



# GROUNDWATER OVERVIEW

Making the invisible visible



Produced by IGRAC (International Groundwater Resources Assessment Centre), 2018

In cooperation with UNESCO-IHP, IAH, IWMI and with contributions of many UN Water Members and Partners



IGRAC facilitates and promotes international sharing of information and knowledge required for sustainable groundwater resources development and management worldwide.

IGRAC is the UNESCO global groundwater centre, it works closely with WMO and IAH and it is supported by the Government of The Netherlands.



**'Groundwater Overview: Making the invisible visible'** is a UN-Water category III publication



#### **DISCLAIMER**

This overview is based on information either obtained from UN Water Members and Partners or available at their websites.

The views and opinions expressed herein do not necessarily reflect those of the Members and Partners of UN-Water.



# GROUNDWATER OVERVIEW

## Making the invisible visible

Globally, invisible groundwater resources are under increasing pressure due to human activities and climate change. Our response to this pressure is often not adequate, also due to limited awareness of the importance of groundwater resources. This Groundwater Overview is prepared to showcase the essentials and the credentials of groundwater, placed within the broad spectrum of UN-Water Member's and Partner's activities. It is meant to inform about groundwater-related activities, to enhance knowledge exchange and collaboration, and to raise awareness about our most important hidden resource: groundwater.





## ABBREVIATIONS

<b>AIDA</b>	International Association for Water Law	<b>IWMI</b>	International Water Management Institute
<b>AMR</b>	Antimicrobial Resistance	<b>IWRA</b>	International Water Resources Association
<b>ANBO</b>	African Network of Basin Organizations	<b>IWRM</b>	Integrated Water Resources Management
<b>BGR</b>	German Federal Institute for Geoscience and Natural Resources	<b>MAR</b>	Managed Aquifer Recharge
<b>BRAC</b>	Building Resources Across Communities	<b>MEAs</b>	Multilateral Environmental Agreements
<b>CAD-CZM</b>	Coastal Aquifer Dynamics and Coastal Zone Management	<b>NGO</b>	Non-governmental organisation
<b>CAWST</b>	Centre for Affordable Water and Sanitation Technology	<b>NSAS</b>	Nubian Sandstone Aquifer System
<b>CBD</b>	Convention on Biological Diversity	<b>NTD</b>	Neglected Tropical Diseases
<b>CC</b>	Climate change	<b>NWSAS</b>	North-Western Sahara Aquifer System
<b>CGIAR</b>	Consultative Group for International Agricultural Research	<b>OHCHR</b>	Office of the High Commissioner for Human Rights
<b>CI</b>	Conservation International	<b>PSI</b>	Public services international
<b>ECHO</b>	Extended Continental-scale Hydro-economic Optimization	<b>SAP</b>	Strategic Action Programme
<b>ECLAC</b>	Economic Commission for Latin America and the Caribbean	<b>SDGs</b>	Sustainable Development Goals
<b>EU</b>	European Union	<b>SIDS</b>	Small Islands Developing States
<b>FAO</b>	Food and Agriculture Organization	<b>SIWI</b>	Stockholm International Water Institute
<b>GEF</b>	Global Environmental Facility	<b>TBAs</b>	Transboundary Aquifers
<b>GEMS Water</b>	Global Environment Monitoring System for freshwater	<b>UN</b>	United Nations
<b>GGIS</b>	Global Groundwater Information System	<b>UN ESCAP</b>	United Nations Economic and Social Commission for Asia and the Pacific
<b>GGMN</b>	Global Groundwater Monitoring Network	<b>UN ISDR</b>	United Nations Office for Disaster Risk Reduction
<b>GIS</b>	Geographic Information System	<b>UNCCD</b>	United Nations Convention to Combat Desertification
<b>GRAPHIC</b>	Groundwater Resources Assessment under the Pressures of Humanity and Climate Change	<b>UNCTAD</b>	United Nations Conference on Trade and Development
<b>GRIPP</b>	Groundwater Solutions Initiative for Policy and Practice	<b>UNDP</b>	United Nations Development Programme
<b>GroundwatCH</b>	International Joint Master Programme in Groundwater and Global Change	<b>UNECA</b>	United Nations Economic Commission for Africa
<b>GW</b>	Groundwater	<b>UNECE</b>	United Nations Economic Commission for Europe
<b>GWP</b>	Global Water Partnership	<b>UNEP</b>	UN Environment
<b>HQ</b>	Headquarters	<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>HWRP</b>	Hydrology and Water Resources Programme	<b>UNESCWA</b>	United Nations Economic and Social Commission for Western Asia
<b>IAEA</b>	International Atomic Energy Agency	<b>UN-Habitat</b>	United Nations Human Settlements Programme
<b>IAH</b>	International Association of Hydrogeologists	<b>UNHCR</b>	Office of the United Nations High Commissioner for Refugees
<b>IAHR</b>	International Association for Hydro-Environment Engineering and Research	<b>UNICEF</b>	United Nations Children's Fund
<b>IAHS</b>	International Association of Hydrological Sciences	<b>UNIDO</b>	United Nations Industrial Development Organization
<b>IAHS-ICGW</b>	IAHS International Commission on Groundwater	<b>UNITAR</b>	United Nations Institute for Training and Research
<b>ICID</b>	International Commission on Irrigation and Drainage	<b>UNU</b>	United Nations University
<b>IFAD</b>	International Fund for Agriculture Development	<b>UNU-FLORES</b>	Institute for Integrated Management of Material Fluxes and of Resources
<b>IGRAC</b>	International Groundwater Resources Assessment Centre	<b>UNU-INWEH</b>	Institute for Water, Environment and Health
<b>IHP</b>	International Hydrological Programme	<b>UNWTO</b>	World Tourism Organization
<b>IIASA</b>	International Institute for Applied Systems Analysis	<b>WACDEP</b>	Water, Climate, and Development
<b>IISD</b>	International Institute for Sustainable Development	<b>WASH</b>	Water, Sanitation and Hygiene
<b>ILO</b>	International Labour Organization	<b>WAT</b>	IIASA Water Program
<b>ISARM</b>	Internationally Shared Aquifer Resources Management	<b>WCCE</b>	World Council of Civil Engineers
<b>IUCN</b>	International Union for Conservation of Nature	<b>WFP</b>	World Food Programme
<b>IUGG</b>	Union of Geodesy and Geophysics	<b>WfWP</b>	Women for Water Partnership
<b>IWA</b>	International Water Association	<b>WHO</b>	World Health Organization
<b>IWAVE</b>	IAEA Water Availability Enhancement Project	<b>WHYCOS</b>	World Hydrological Cycle Observing System
		<b>WLE</b>	Water, Land and Ecosystems
		<b>WMO</b>	World Meteorological Organization
		<b>WRI</b>	World Resources Institute
		<b>WTD</b>	World Tourism Day
		<b>WWAP</b>	World Water Assessment Programme
		<b>WWF</b>	World Wildlife Fund



# GROUNDWATER OVERVIEW

## Rationale

United Nations agencies and programmes, together with their international partners, deal with many issues that involve groundwater: from wetlands to food production, from sanitation to climate change. Due to diversity and complexity of issues, it is often difficult to recognize a role of groundwater and adequately incorporate it in a decision-making process. Understanding complementarities with other issues and using groundwater experience gained elsewhere is not easy either.

This overview is therefore:

- to inform about groundwater-related activities of UN entities and their partners,
- to enhance knowledge exchange and collaboration, and
- to raise awareness about groundwater, making the invisible visible.

Groundwater provides almost half of all drinking water worldwide, about 40% of water for irrigated agriculture and about 1/3 of water supply required for industry. It sustains ecosystems, maintains the baseflow of rivers and prevents land subsidence and seawater intrusion. Groundwater is an important part of climate change adaptation and is often a solution for people without access to safe water. Despite these impressive figures, invisible groundwater is out of sight and out of mind for most people.

Human activities (including population- and wealth growth) and climate variability are increasing pressure on groundwater resources; consequently, pollution and over-extraction problems are regularly reported in many parts of the world. Regardless of their importance and of evident threats - we still do not know sufficient about a state and current trends of the World's groundwater resources.

This Groundwater Overview showcases the essentials and the credentials of groundwater, placed within the broad spectrum

of UN-Water member's and partner's activities. The overview presents some interesting facts and figures, revealing diversities, resemblances and complementarities in groundwater-related activities within the UN-Water community. Outlining who is doing what - when it comes to groundwater - helps to better understand connections of groundwater with health, migrations, tourisms, biodiversity, and many other vital segments of our lives. In that way, the overview might also serve as incentive to take joint actions across the (organisational, sectoral, administrative...) borders, making the invisible groundwater a bit more visible.

## How this overview is prepared

The overview is based on survey that consisted of three main steps: a desktop study, an enquiry and the final analysis/synthesis. In the desktop study, we checked how often groundwater was mentioned on about 70 websites of UN-Water members and partners and in which context, in terms of topics (issues) and activities. Eventually, the lists of groundwater-related topics and activities were organically developed and subdivided in a several main categories. These lists, coming from practice, do not resemble completely the lists from textbooks, but we preserved them as such as much as possible.

For each organisation a summary sheet ("Groundwater Profile") was prepared, describing its core business and the link with groundwater, identified topics and activities, possible examples and a few questions. Although almost no connection with (ground)water was found on 11 websites, the profiles were prepared and sent to everyone from the UN-Water contact list (65 organisations), requesting confirmation/improvements of initial groundwater profiles.

In total 33 organisations reacted, three of them confirming no specific relation with groundwater. Hence, the reaction from 30 organisations was used for analysis of topics and activities, as presented in continuation of this chapter. Subsequently, groundwater topics and provided groundwater profiles are presented in this overview. The overview rounds off with a

## GROUNDWATER IN THE SDGs

Groundwater is a key resource for achievement of the UN Sustainable Development Agenda for 2030 — but is still weakly conceptualised in the SDG (Sustainable Development Goal) 6 indicators or insufficiently known to provide a reliable indicator value. Professional assessment of groundwater status, trends and risks is required to interpret the state/condition of the groundwater resources, whose sustainability is essential for achievement of SDG-6 Targets.

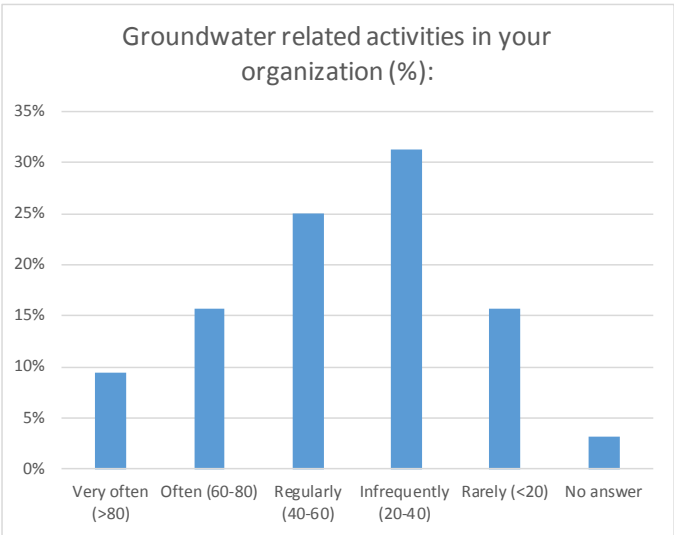
Beside SDG-6, groundwater directly contributes to poverty eradication (Goal 1), food security (Goal 2), gender equality (Goal 5), sustainability of cities and human settlement (Goal 11), combating climate change (Goal 13) and protecting terrestrial ecosystems (Goal 15).



brief accounting of organisations which did not respond to the enquiry but -according to available info – still deal with groundwater specifically. Hopefully they will see the added value of this overview as well and join for a possible update. For the colleagues that already contributed and made this overview possible: many thanks!

### Who works with groundwater?

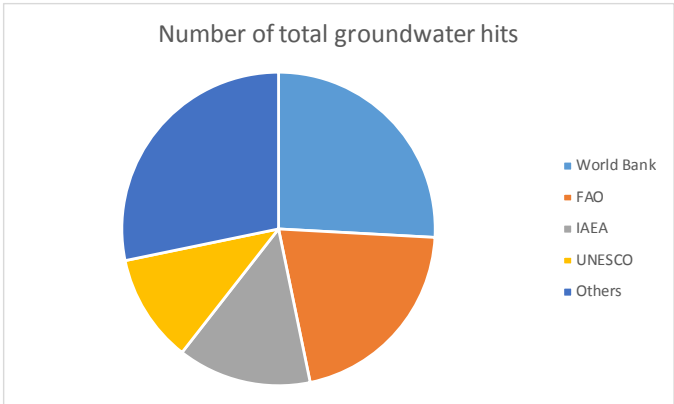
About 45 UN Water members and partners address in their work groundwater specifically; some of them occasionally, others very frequently.



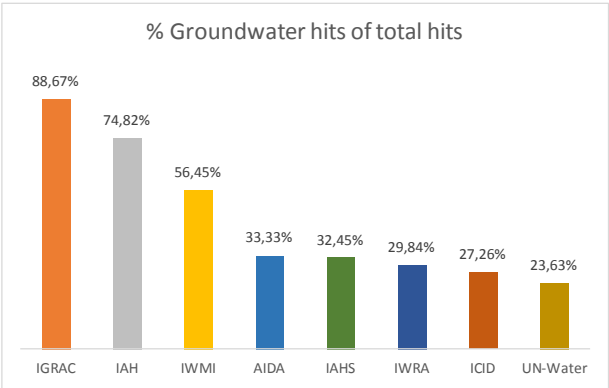
*"Groundwater issues are a fundamental of our members' work and implicitly a huge part of our activities/processess"*  
 - Aquafed -

*"Understanding and protecting groundwater is our 'raison d'être'"*  
 - IAH -

Looking solely at the websites and counting groundwater hits (i.e. a number of pages and documents containing a search term "groundwater"), groundwater is distinctively present at the World Bank, FAO, IAEA and UNESCO.



However, if we look at the percentage of groundwater hits of the total website hits, IGRAC, IAH and IWMI score the highest. Obviously, groundwater is the core business of these organisations, where World Bank, FAO, IAEA and UNESCO deal with many other issues/topics besides groundwater.



The number of hits is naturally only an indication in which the size and the kind of organisation play an important role; this also because some organisations – for various reasons - publish on their websites numerous documents produced elsewhere, others less, or not at all. In any case, there are more than 300.000 groundwater-related pages and documents that UN-Water Members and Partners placed on their websites. But in which context?

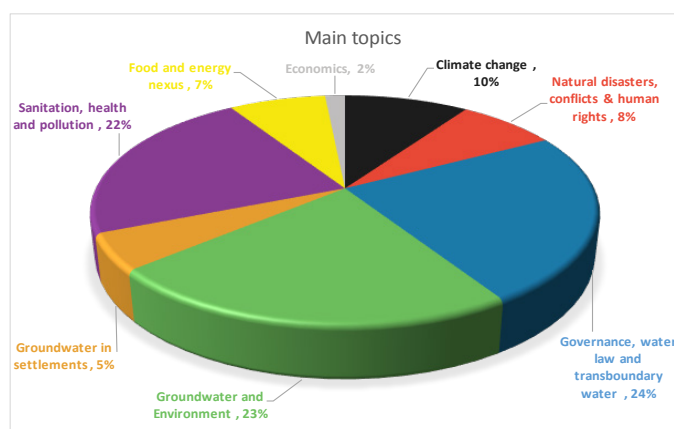
### Topics: groundwater in context of ...

The topic list (page 6) contains all groundwater-related topics found in the desk-top study, complemented with a few topics suggested by respondents to the enquiry. After some consistency and terminological improvement, in total 64 topics were listed and subsequently divided into eight groups – the Main Topics. This division is relative but it reflects the best the listed topics, even though some of them (e.g. contamination control, groundwater security, etc.) appear, or could appear, in more groups.

The topics and the count of their appearance in various activities of responding organisations are presented around the circle on the next page. SDGs, groundwater quality and adaptation to climate change are addressed the most often, but the difference with the following group (droughts, IWRM, human right to safe drinking water) is not large. Further decrease of the topic appearance is almost linear.

Although adaptation to climate change and droughts are counted frequently, grouped Climate Change topic is not prominent among the Main Topics. However, Groundwater and Environment, one of three the most addressed main topics, contains five time more individual topics than the Climate Change. On the other hand, diversification/elaboration of topics could also be a reflection of increased attention and intensified activities.

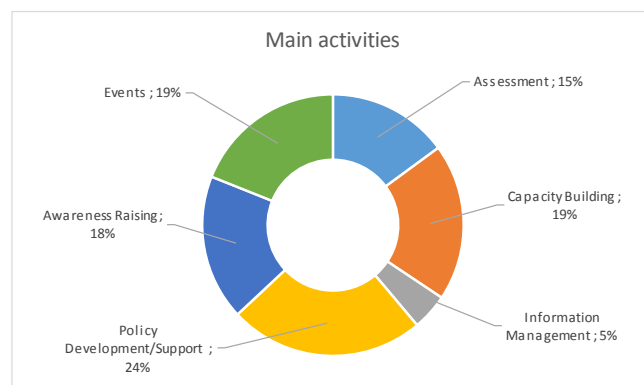




### Activities that involve groundwater

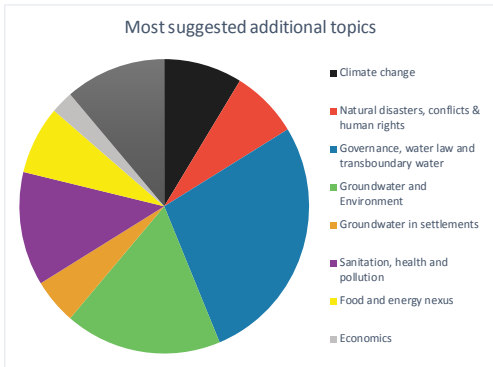
Activity list was prepared in the same organic manner as the topic list. Eventually it contained 44 activities (or activity products). Among the individual activities, seminars/webinars, expert- & intragovernmental meetings and guidelines &

manuals are the most common one. Likewise topics, the activities were grouped in Main Activities. Six of them, with only exception of information management, are carried out with similar rate (15-25% of total). It appears that the UN organisations and their partners are (when it comes to groundwater) the most often engaged in policy development/support.



## Where does groundwater need more attention?

According to the enquiry outcomes, adaptation to climate change and governance need the additional attention at most. After grouping the topics, Governance (water law and transboundary waters) remains the Main Topic to be additionally addressed. Among activities, Policy development/

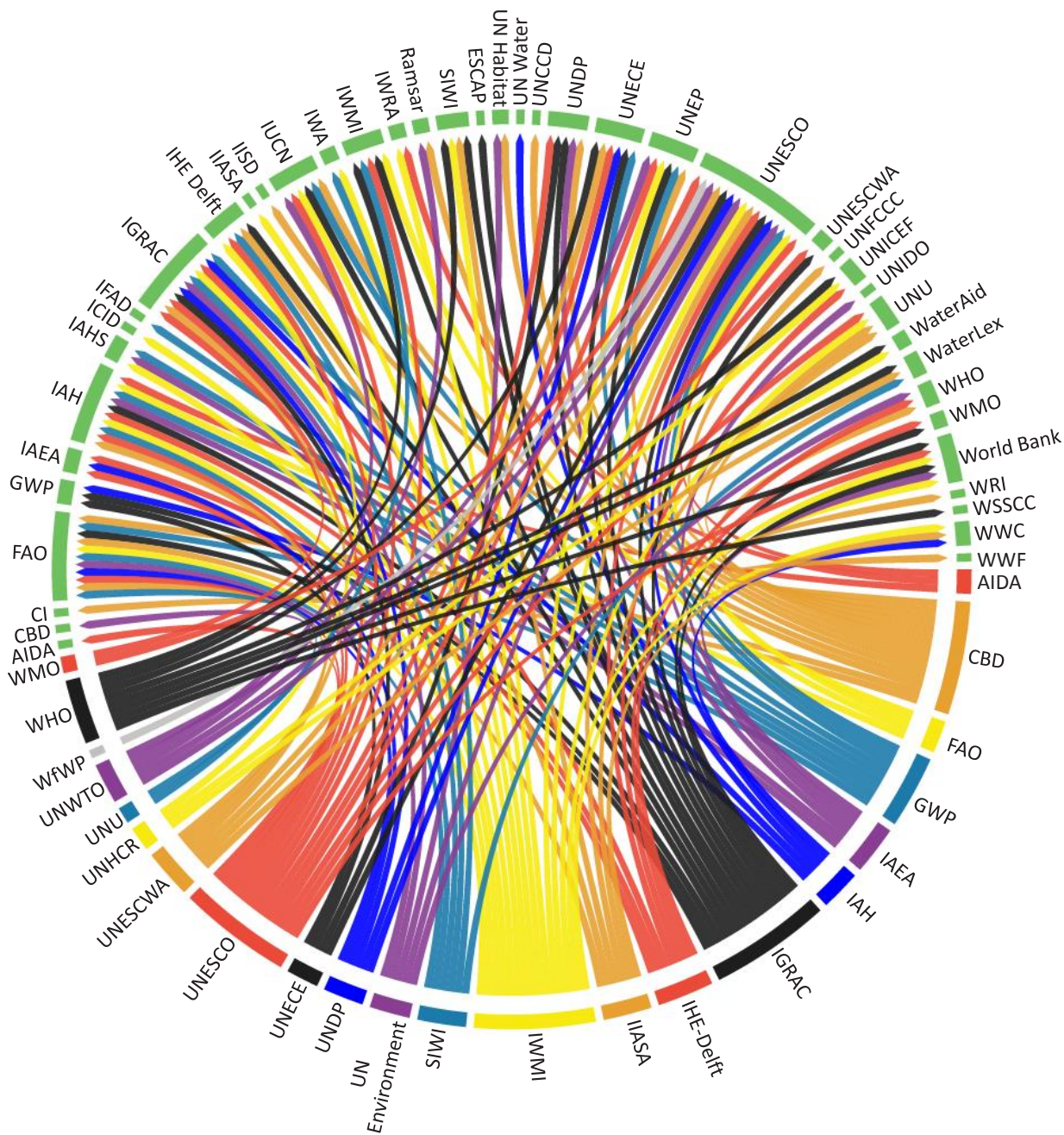


Support is not only the most frequent current Main Activity but desired one a well!

## Collaboration on groundwater issues

Most of the respondents indicated collaboration on groundwater issues with other UN-Water members and partners. Several respondents did not answer on this question at all, and two answered that they collaborate with everyone (which sounds nice and very unlikely).

It the figure below, 41 organisations that were indicated as collaborators on groundwater-related topics are located at the upper – green – perimeter of the circle. UNESCO, IGRAC, FAO and IAH are indicated the most often (by 21 responding organisations that populate lower part of the circle). It seems that collaboration on groundwater issues is quite diverse and wide-ranging (see further in groundwater topics - page 7).





## What else we learned/confirmed from the enquiry?

According to enquiry, the 2/3 of organisations addresses groundwater also as the main topic in their activities (and not only as a part of IWRM/water cycle/climate change or similar).

*"Transboundary aquifers, impact of climate change on groundwater and groundwater monitoring are the core of the ISARM, GRAPHIC and GGMN programmes"*

- UNESCO-IHP -

For about 2/3 of organisations it does make a difference whether the groundwater or surface water is available/used as a water source.

*"Specific risks associated with the Water Source are taken into consideration in Water Safety Plans – and more recently climate resilient water safety plans"*

- WHO -

The willingness to fully include groundwater in activities is present, but since invisible groundwater needs more attention (and resources) it can be easily "overlooked".

*"Groundwater is often forgotten with such a focus on surface waters"*

- GWP -

Data availability/accessibility is reported as the biggest challenge/gap when incorporating the groundwater in organisation's activities.

*"Working with countries in GEMS Water on water quality monitoring and the world water quality assessment includes where possible (which is still limited) groundwater"*

- UN Environment -

## So how can we improve integration and visibility of groundwater?

A few dozens of suggestions were received from our colleagues/respondents to the enquiry, many thanks! A small selection:

- Stress that the invisible character of groundwater does not easily lend itself to inform policy and therefore needs constant increased attention.
- Raise attention to groundwater in a context of relevant societal/environmental issues and in an integrated manner.
- Link groundwater to SDG monitoring and reporting.
- Develop joint inter-agency projects and activities on groundwater.

And we should also:

- Capitalise on recent water issues e.g. Cape Town
- Have an International Groundwater Day (there is for everything else).

## Concluding remarks

Building a case for invisible groundwater remains a very challenging task. We need to step up our efforts to:

- Improve the knowledge on groundwater resources, especially their status/change.
- Improve information and knowledge sharing: climate change and human impact on groundwater resources do not stop at administrative borders.
- Use contemporary, interactive information management systems as an enabling environment for international cooperation.
- Raise awareness on manifold Value of Groundwater, using customised approaches and tools (social media, serious gaming, etc.) for various target groups.

Effective monitoring, informed interpretation/assessment and confidence building are important for management of any resource. When resource is invisible, like groundwater, these tasks are even more challenging, asking for additional attention of the international community.



## NATURAL DISASTERS, CONFLICTS & HUMAN RIGHTS

## GROUNDWATER IN SETTLEMENTS

## CLIMATE CHANGE

- Droughts
- Climate change
- Salinisation
- Desertification

- Groundwater management for refugee camps
- Groundwater hazards (caused by construction)
- Human right to safe drinking water
- Human right to water
- Uranium in groundwater
- Land and soil degradation
- Human security
- Gender
- Sharing knowledge

- Urban development & urban water management
- Sustainable cities
- Rural development
- Satellite data
- Coastal aquifers

## FOOD & ENERGY NEXUS

- Energy
- Food production and security
- Irrigation
- Nexus water-energy-food

## ECONOMICS

- Economics
- Economic impact of CC on water
- Groundwater economics (value of groundwater)
- Water accounting

# MAIN TOPICS

## SANITATION, HEALTH & POLLUTION

- Arsenic (contamination/removal)
- Chloride in groundwater
- Coastal aquifers
- Contamination control
- Groundwater management for refugee camps
- Groundwater risk (groundwater quality)
- Groundwater treatment
- Human right to safe drinking water
- Iron concentration
- Pollution (nitrate)
- Pollution (by pesticides and fertilizers)
- Recycling wastewater
- Salinisation
- Selenium in groundwater
- Sulfate in groundwater
- Uranium in groundwater
- WASH
- Water quality

## GOVERNANCE, WATER LAW, TRANSBOUNDARY WATER

- (Model provisions) Transboundary groundwaters
- Diplomacy / Governance (water convention)
- Groundwater law
- (Ground)water security
- Groundwater management
- SIDS
- Transboundary aquifers
- Governance
- Groundwater mapping
- IWRM
- Water accounting
- SDGs

## GROUNDWATER & ENVIRONMENT

- Contamination control
- Rainwater harvesting
- Ammonia in groundwater
- Aquifer recharge
- Biodiversity and Eco-systems
- Freshwater conservation
- Depletion
- Drainage
- Groundwater assessment
- Groundwater hydraulics
- MAR
- Isotope groundwater
- Karst
- Iron concentration
- Water quality
- Water risk / stress
- Groundwater replenishment through reforestation
- Groundwater/surface water
- Modelling
- Soil borings and sampling
- Sulfate in groundwater
- Drylands





# GROUNDWATER TOPICS





CLIMATE CHANGE

As the world's largest distributed store of fresh water, groundwater plays a central part in sustaining ecosystems and enabling human adaptation to climate variability and change. Aquifers have a buffering capacity and they are naturally more resistant to external impact than surface waters. Since variability of surface water availability is increasing due to climate change, strategic importance of aquifers for water and food security is clearly growing.



TOPICS	ORGANISATIONS
Droughts	<div><div>AquaFed</div><div>Convention on Biological Diversity</div><div>Food and Agriculture Organization of the United Nations</div><div>Global Water Partnership</div><div>IAEA</div><div>IHE DELFT</div><div>International Institute for Applied Systems Analysis</div><div>IWMI</div><div>United Nations Convention to Combat Desertification</div><div>UNEP</div><div>UNITED NATIONS UNIVERSITY</div><div>WFP</div><div>WWF</div></div>
Adaptation to climate change	<div><div>AquaFed</div><div>Convention on Biological Diversity</div><div>Global Water Partnership</div><div>IAEA</div><div>IAGRAC</div><div>IUGG</div><div>IWMI</div><div>SIWI</div><div>UNECE</div><div>UNHCR</div><div>United Nations University</div><div>UNWTO</div><div>World Health Organization</div><div>WWF</div></div>
Salinization	<div><div>IAEA</div><div>IAGRAC</div><div>IHE DELFT</div><div>International Institute for Applied Systems Analysis</div><div>IRC</div><div>IWMI</div><div>UNHCR</div></div>
Desertification	<div><div>Convention on Biological Diversity</div><div>Food and Agriculture Organization of the United Nations</div><div>IAEA</div><div>United Nations Convention to Combat Desertification</div><div>UNEP</div><div>UNITED NATIONS UNIVERSITY</div></div>

NATURAL DISASTERS, CONFLICTS & HUMAN RIGHTS

Aquifers can substitute affected drinking water supplies in time after catastrophic events, such as tsunamis. Relief organisations need to know about availability of groundwater for water supply when settling displaced communities (after natural disasters and/or conflicts). Finally, groundwater is often a possible solution for the people without access to safe drinking water (still more than 600 million!).

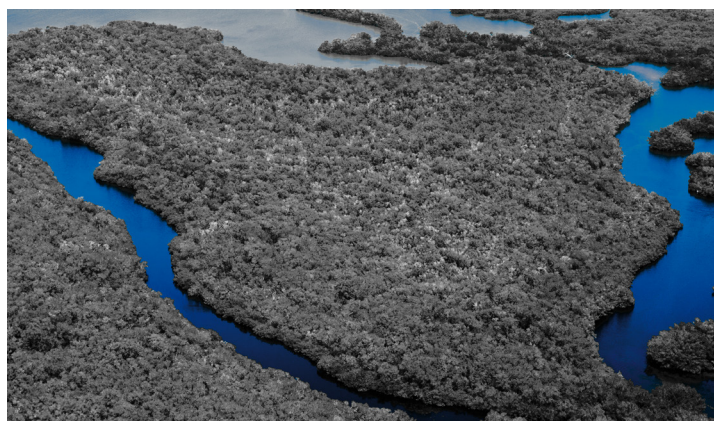
TOPICS	ORGANISATIONS
Human right to safe drinking water	<div><div>AquaFed</div><div>SIWI</div><div>UNHCR</div><div>WFP</div></div>
Human right to water	<div><div>AquaFed</div><div>IAEA</div><div>IWMI</div><div>SIWI</div><div>UNHCR</div><div>WFP</div></div>
Groundwater security	<div><div>AquaFed</div><div>Global Water Partnership</div><div>IAEA</div><div>IUGG</div><div>IWMI</div><div>SIWI</div><div>UNHCR</div><div>United Nations University</div><div>WWF</div></div>
Uranium in groundwater	<div><div>IAEA</div></div>
Land and soil degradation	<div><div>Convention on Biological Diversity</div><div>IAEA</div><div>IUGG</div><div>IWMI</div><div>United Nations Convention to Combat Desertification</div><div>UNITED NATIONS UNIVERSITY</div></div>
Groundwater management for refugee camps	<div><div>UNHCR</div></div>
Gender	<div><div>AquaFed</div><div>IWMI</div><div>SIWI</div><div>United Nations Convention to Combat Desertification</div><div>UNEP</div><div>United Nations University</div><div>WFP</div><div>WWF</div><div>UNHCR</div></div>












































































































































## GOVERNANCE, WATER LAW & TRANSBOUNDARY WATER

Groundwater is a common-pool resource and is often utilized at an individual level regardless of overall impact on the aquifer because neither use nor impact are necessarily immediately visible.

























































































































This becomes even more complex when aquifers cross state or national borders (the most of large aquifers in the world are transboundary). Therefore, aquifers need to be governed through a process of shared responsibility and participation, information availability and transparency, and rule of law. Otherwise, mining and polluting of groundwater will continue.



TOPICS	ORGANISATIONS
Diplomacy / Governance (water convention)	       
Groundwater law	         
(Ground)water security	        
Groundwater management	         
SIDS	        
Transboundary aquifers	                 
Governance	                     
Groundwater mapping	           
IWRM	                    
Water accounting	                 

GROUNDWATER & ENVIRONMENT

Various kinds of ecosystems depend on groundwater: aquatic (wetlands, rivers and lakes receiving groundwater), terrestrial (with phreatophyte vegetation, either shallow-rooted in alluvial settings or deep-rooted in arid zones) and even subterranean (in limestone formations with karstic caverns). Accordingly, groundwater is an essential part of any ecosystem-based adaptation measure, green infrastructure or a nature-based solution.

TOPICS	ORGANISATIONS
Biodiversity and Ecosystems	       
Freshwater conservation	     
Aquifer recharge	          
Depletion	       
Groundwater assessment	       
Rainwater harvesting	     
MAR	      
Isotope hydrology	    
Karst aquifers	       
Contamination control	      
Iron concentration	
Ammonia in groundwater	
Groundwater quality	          
Water risk / stress	        
Groundwater replenishment through reforestation	
Groundwater/surface water	       
Modelling	       
Soil borings and sampling	    
Drylands	 



Groundwater is the main source of water supply in many cities around the world (Mexico City, Kabul, Dakar, etc.) and increasingly under a pressure due to continuous urbanisation, climate change and inadequate water management; for example, groundwater depletion and land subsidence are serious problems in many South Asian cities and elsewhere. The pumping rates in the megacities need to be reduced and compensated by urban rainwater harvesting, rural-urban water transfers, aquifer recharge with wastewater and similar measures.







































































































































TOPICS	ORGANISATIONS
Urban development & water management	Global Water Partnership, IAEA, IAH, IUGG, IASO, IHE Delft, IASA, IWM, SIWI
Sustainable cities	Global Water Partnership, IAH, IASA, IWM, SIWI, ESCAP
Rural development	IWM, ESCAP, Women for Water Partnership
Coastal aquifers	Convention on Biological Diversity, IAEA, IAH, IUGG, IASO, IHE Delft, WWF



## SANITATION, HEALTH & POLLUTION

Water-related disease remains one of the major health concerns in the world. The improvement of groundwater quality control, in conjunction with improvement in sanitation and personal hygiene is the main strategy to reduce water-related disease. Groundwater can be polluted from agriculture, sanitation, industry and mining, landfills and waste disposals, traffic and transport and also from chemical processes with geological environment. Regular groundwater monitoring, vulnerability assessment, protection from point-source and diffuse pollution, and pollutant removal, are some of necessary actions in preserving and improving groundwater quality and our health.

TOPICS	ORGANISATIONS
Arsenic (contamination/removal)	         
Chloride in groundwater	     
Coastal aquifers	        
Contamination control	       
Groundwater management for refugee camps	  
Groundwater risk (groundwater quality)	           
Groundwater treatment	        
Human right to safe drinking water	        
Iron concentration	  
Pollution (nitrate)	       
Pollution (by pesticides and fertilizers)	          
Recycling wastewater	      
Salinization	       
Selenium/sulphate in groundwater	
Uranium in groundwater	 
WASH	      
Waste water and contamination	        
Groundwater quality	         



FOOD AND ENERGY NEXUS

About 2/3 of all abstracted groundwater is used in agriculture. Global food production is increasingly relying on groundwater over-abstraction (depletion) whereas groundwater depletion eventually leads to decline of food production.

About 1/4 of the energy used globally is spent on food production and supply, including groundwater pumping. Deep aquifers, as a potential source and a sink for heat, can play much more prominent role in the provision of renewable geothermal energy.



TOPICS	ORGANISATIONS
Energy	<div><div>AquaFed</div><div> </div><div> </div></div>
Food security	<div><div>AquaFed</div><div> Food and Agriculture Organization of the United Nations</div><div> Global Water Partnership</div><div> IAEA</div><div> IUGG</div><div> International Institute for Applied Systems Analysis</div></div> <div><div> </div><div> UNITED NATIONS ESCAP</div><div> United Nations Convention to Combat Desertification</div><div> WOMEN FOR WATER PARTNERSHIP</div></div>
Irrigation	<div><div>AquaFed</div><div> Food and Agriculture Organization of the United Nations</div><div> Global Water Partnership</div><div> IAEA</div><div> IUGG</div><div> </div></div> <div><div> United Nations Convention to Combat Desertification</div><div> WOMEN FOR WATER PARTNERSHIP</div></div>
Nexus water-energy-food	<div><div>AquaFed</div><div> Food and Agriculture Organization of the United Nations</div><div> IAEA</div><div> IUGG</div><div>  UNITED NATIONS ESCAP</div></div> <div><div> UNECE</div><div> ECLAC</div><div> UNITED NATIONS UNIVERSITY</div></div>



ECONOMICS

Groundwater resources are extensively used in production processes by large international companies all over the world. Accordingly, international investors need to share broader societal and environmental costs of groundwater. Understanding value of groundwater would be (next to regulations and public-relations) an additional incentive for investors and asset managers to engage, leading eventually to investment risk reduction.

TOPICS	ORGANISATIONS
Economics	<div><div>AquaFed</div><div></div></div>
Economic impact of climate change on water	<div><div>AquaFed</div><div> Convention on Biological Diversity</div><div></div></div>
Groundwater economics (value of groundwater'	<div><div>AquaFed</div><div> igrac</div><div></div></div>





# GROUNDWATER PROFILES







## UN-WATER PARTNER

HQ: Rome, Italy

Website: [www.aida-waterlaw.org](http://www.aida-waterlaw.org)

AIDA is an NGO with the purpose of fostering the evolution, study, understanding and application of water law, national and international, with a view to raising awareness, and the knowledge and practice, of this field of the law of natural resources.

## AIDA &amp; GROUNDWATER

AIDA deals with water resources law, which encompasses surface water and groundwater, either from an undifferentiated perspective or taken separately, depending on the law of the land.



## EXAMPLES OF AIDA'S GROUNDWATER ACTIVITIES

AIDA co-organized with IWRA the webinar “Legal mechanisms for water resources in practice” in 2017 (accessible at <https://www.iwra.org/water-lawwebinar/>) where one of the five addressed themes included the law of transboundary aquifers. Moreover, the policy brief on “Legal mechanisms for water resources in practice, IWRA Policy Brief No.7 (August 2017) covers, in particular and among others, transboundary aquifer cooperation.

AIDA organized the online Training Course on “The ‘Greening’ of Water Law: Implementing environment-friendly principles in contemporary water treaties and laws” (available at <https://e-learning.informea.org>). The course focuses on the implementation of international principles for sustainable water management through the lens of the Multilateral Environmental Agreements (MEAs). The training programme is organized into five modules, and it includes one given over to the law governing the protection of groundwater systems.



## GROUNDWATER TOPICS

*Governance, water law and transboundary water*

- Diplomacy / Governance - water convention •
- Groundwater law •
- Transboundary aquifers •
- Governance •

## MAIN ACTIVITIES

- Capacity building •
- Policy development/support •
- Events •



AquaFed is the international federation of private water operators. AquaFed members are based across the world, working with local, regional and national governments to ensure people in cities and settlements have access to water and sanitation services.

## AQUAFED & GROUNDWATER

### GROUNDWATER TOPICS

#### *Climate Change*

- Droughts

#### *Natural disasters, conflicts & human rights*

- Human right to safe drinking water
- Human right to water
- Groundwater security
- Gender

#### *Governance, water law and transboundary water*

- Diplomacy / governance (water convention)
- Governance
- SDGs

#### *Sanitation, health and pollution*

- Groundwater risk (groundwater quality)
- Human right to safe drinking water
- Pollution (by pesticides and fertilizers)
- Groundwater quality

#### *Food and energy nexus*

- Energy
- Food security
- Irrigation
- Nexus water-energy-food

#### *Economics*

- Economics
- Economic impact of climate change on water
- Groundwater economics (value of groundwater)

The protection of the quantity and quality of groundwater sources is essential to AquaFed's members because of the nature of their work.



### EXAMPLES OF AQUAFED'S GROUNDWATER ACTIVITIES

AquaFed has always campaigned for access to safe drinking water to be a human right since groundwater sources are a fundamental component of delivering this right. In this sense, AquaFed have worked in advising and representing members on key policy changes and developments related to groundwater, for instance the EU Drinking Water Directive and the Water Framework Directive.

### MAIN ACTIVITIES

- Assessment
- Policy development/support
- Awareness raising
- Events



HQ: Montreal, Canada  
Website: [www.cbd.int](http://www.cbd.int)

UN-WATER MEMBER

CBD is a multilateral treaty with three main goals: the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of benefits emerging from genetic resources. The Secretariat of the CBD was established to support the goals of the Convention.

## CBD & GROUNDWATER

### GROUNDWATER TOPICS

#### Climate Change

- Droughts
- Adaptation to climate change
- Desertification

#### Natural disasters, conflicts & human rights

- Land and soil degradation

#### Governance, water law and transboundary water

- SDGs

#### Groundwater and Environment

- Biodiversity and ecosystems
- Freshwater conservation
- Aquifer recharge
- Depletion
- Water risk / stress
- Groundwater replenishment through reforestation
- Groundwater/surface water
- Drylands

#### Groundwater in settlements

- Coastal Aquifers

#### Sanitation, health and pollution

- Coastal aquifers

#### Economics

- Economic impact of climate change on water

The threats to the biological diversity of inland waters, including groundwater, are addressed through a series of broad-based policies under the CBD's Inland Waters Biodiversity programme of work and through practical guides to Biodiversity.

### EXAMPLES OF CBD'S GROUNDWATER ACTIVITIES

For example, The CBD's Conference of the Parties expresses its concern that the limits of sustainability of both surface water and groundwater resources have already been reached or surpassed in many regions. Further the Conference of the Parties encourages Parties, other Governments and relevant organizations to reinforce capacity for the implementation of the programme of work by:



- Further incorporating biodiversity considerations into integrated water resources management and related approaches and considering the interactions between, and inter-connectivity of, the different ecosystems that regulate surface, groundwater and coastal water resources; and
- Preventing unsustainable use of groundwater.

Groundwater is addressed in [Good Practice Guide](#) series on:

- Drinking water, biodiversity and development; and
- Pastoralism, Nature Conservation and Development.

### MAIN ACTIVITIES

- Assessment
- Information management
- Policy development/support
- Events

A GOOD PRACTICE GUIDE

### DRINKING WATER, BIODIVERSITY and DEVELOPMENT





## UN-WATER MEMBER

HQ: Rome, Italy

Website: [www.fao.org](http://www.fao.org)

The Food and Agriculture Organization of the United Nations (FAO) is a specialized agency of the United Nations that leads international efforts to eradicate hunger, food insecurity and malnutrition; to fight poverty and drive forward of economic and social progress for all; and to ensure the sustainable management and use of natural resources, including groundwater resources. FAO acts as a neutral forum where countries meet as equals to negotiate agreements and debate policy.

## FAO & GROUNDWATER

The Land and Water Division of FAO works to promote coherent approaches to sustainable land and water management and governance.

As part of this work, it led the Global Groundwater Governance project, a global partnership programme between UNESCO-IHP, the International Association of Hydrogeologists (IAH), the World Bank, the Global Environment Facility (GEF) and FAO.



The programme produced several key documents, most notably a global vision and the Global Framework of Action for Groundwater Governance, outlining a set of principles for policies, legislation, regulations and customary practices.

Groundwater Governance project website: [www.groundwatergovernance.org](http://www.groundwatergovernance.org)

### EXAMPLES OF FAO'S GROUNDWATER ACTIVITIES

FAO has now using the Global Framework of Action at aquifer level in three countries – Morocco, Tunisia and Jordan – supporting local stakeholders to improve groundwater governance. The work started with a diagnostic study to better understand the hydrogeological and governance context and to identify more specific activities to more directly involve water users in decisions made around the use of the respective aquifers.



At the same time, FAO is working to improve data and monitoring of water efficiency, productivity and sustainability through remote sensing, and to provide policy support, for example through the Regional Collaboration Platform on Water Scarcity, and on topics, such as the use of solar-powered irrigation, particularly when it comes to groundwater user. Finally, FAO works on projects, like its response programme to El Nino-driven emergencies to protect food and nutrition security.



## GROUNDWATER TOPICS

### *Climate change*

- Droughts •
- Desertification •

### *Governance, water law and transboundary water*

- Diplomacy / Governance - water convention •
- Groundwater law •
- IWRM •
- Water accounting •
- SDGs •

### *Groundwater and environment*

- Water risk / stress •

### *Sanitation, health and pollution*

- Pollution by pesticides and fertilizers •

### *Food and energy nexus*

- Food security •
- Irrigation •
- Nexus water-energy-food •

## MAIN ACTIVITIES

- Assessment •
- Capacity building •
- Information management •
- Policy development-support •
- Awareness raising •
- Events •

HQ: Stockholm, Sweden

Website: [www.gwp.org](http://www.gwp.org)

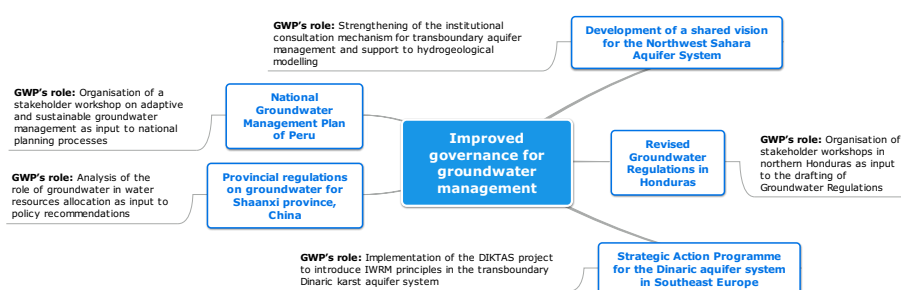
**UN-WATER PARTNER**

GWP is a global action network, multi-stakeholder platform open to all organizations involved in water resources management: developed and developing country government institutions, agencies of the United Nations, bi- and multi-lateral development banks, professional associations, research institutions, non-governmental organizations, and the private sector. GWP's action network provides knowledge and builds capacity to advance governance and management of water resources at all levels: global, regional, national and local.

## GWP & GROUNDWATER

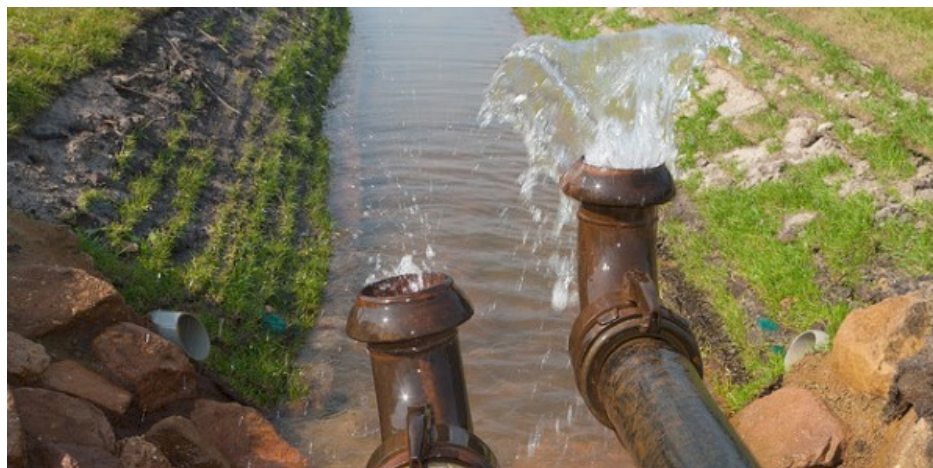
Utilizing its multi-stakeholder platform, GWP engages with issues around groundwater as an integral part of integrated water resources management (IWRM) and good water governance. This is reflected in some of their activities, as the GWP's WACDEP (Water, Climate and Development) programme for a nexus assessment and development of a shared vision for the North-Western Sahara Aquifer System (NWSAS).

Examples of how GWP has supported more sustainable groundwater management



### EXAMPLES OF GWP'S GROUNDWATER ACTIVITIES

GWP has 87 Country Water Partnerships that provide a neutral, multi-stakeholder platform for facilitating improvements in the way water and resources are managed, including groundwater. One example is GWP China, which carried out a series of activities including surveys, dialogues, research, studies and workshops to assist the formulation of provincial regulations on groundwater in Shaanxi Province in 2016. Another case is GWP-Peru, which by contributing both a study and a workshop on groundwater helped formulate the National Groundwater Management Plan (2013), which led to a regulatory framework for groundwater in Peru in 2015.



### GROUNDWATER TOPICS

#### Climate change

- Droughts
- Adaptation to climate change

#### Natural disasters, conflicts & human rights

- Groundwater security

#### Governance, water law and transboundary water

- Diplomacy / governance - water convention
- Groundwater management
- Transboundary aquifers
- Governance IWRM
- Water accounting

#### Groundwater and environment

- Freshwater conservation

#### Groundwater in settlements

- Urban development & water management
- Sustainable cities

#### Food and energy nexus

- Food security
- Irrigation

#### Economics

- Economic impact of climate change on water

### MAIN ACTIVITIES

- Assessment
- Policy development-support
- Events





## UN-WATER MEMBER

HQ: Vienna, Austria

Website: [www.iaea.org](http://www.iaea.org)

IAEA is an international organization that serves as an intergovernmental forum for scientific and technical co-operation in the nuclear field and peaceful uses of nuclear science and technology.

## IAEA &amp; GROUNDWATER

## GROUNDWATER TOPICS

**Climate Change**

- Droughts
- Adaptation to climate change
- Salinization
- Desertification

**Natural disasters, conflicts & human rights**

- Human right to water
- Groundwater security
- Uranium in groundwater
- Land and soil degradation

**Governance, water law and transboundary water**

- Groundwater security
- Groundwater management
- SIDS
- Transboundary aquifers
- Governance
- Groundwater mapping
- IWRM
- SDGs

**Groundwater and Environment**

- Freshwater conservation
- Aquifer recharge
- Depletion
- Groundwater assessment
- Rainwater harvesting
- MAR
- Isotope hydrology
- Karst aquifers
- Contamination control
- Iron concentration

- Groundwater quality
- Groundwater/surface water
- Modelling

**Sanitation, health and pollution**

- Arsenic contamination/removal
- Coastal aquifers
- Contamination control
- Groundwater quality risk
- Groundwater treatment
- Pollution - nitrate
- Pollution - pesticides and fertilizers
- Recycling wastewater
- Salinization
- Uranium in groundwater
- Groundwater quality

**Groundwater in settlements**

- Urban development & water management
- Coastal aquifers

**Food and energy nexus**

- Food security
- Irrigation
- Nexus water-energy-food

The overarching theme of IAEA's water resources program is to develop scientifically sound hydrological information to support Member State policies for sustainable use and management of water resources, particularly groundwater, and adaptation to climate change. IAEA counts with about 50 technical cooperation projects mainly assessing/mapping groundwater resources using isotopes as tracers of water source and movement.

## EXAMPLES OF IAEA'S GROUNDWATER ACTIVITIES

## IAEA Water Availability Enhancement Project (IWAVE)



The IWAVE project assists Member States in conducting a comprehensive assessment of water resources at national scale, leading to the establishment of water policies for a more rational allocation of surface- and groundwater resources.

The project brings together the principal stakeholders in each country to identify gaps in current hydrological information, understanding, and relevant capacity through seminars and workshops, and field studies. Action plans to fill identified gaps and dissemination of results have been implemented in the Philippines, Oman and Costa Rica, and are currently underway in several African and Latin American countries.

## Assessment and Modeling of the Nubian Aquifer

A numerical model of groundwater flow in the Nubian Aquifer system – shared by Egypt, Libya, Sudan and Chad – was developed within an IAEA/UNDP/GEF co-funded project. This comprehensive model used all existing isotope and hydrogeologic data with extensive input from the four countries sharing the aquifer. Results of the model provided a sound understanding of the current and future effects of aquifer development in Egypt and Libya and a mechanism for future cooperation.

## Assessment and mitigation of arsenic poisoning of groundwater in Bangladesh

The IAEA in cooperation with The World Bank assisted Bangladesh to find and supply safe drinking water. Back in 2005, The IAEA helped conduct an isotope investigation of groundwater in Chapai Nawabganj to identify an arsenic-free aquifer in the eastern part of the village with a different source of recharge than the arsenic-contaminated aquifer in the western part of the village. These results led to a fresh review of the geologic and hydrologic data, optimizing multi-million-dollar investments for alternative supply options.



## MAIN ACTIVITIES

- Assessment
- Capacity building
- Information management
- Policy development-support
- Awareness raising
- Events



**IAH**

**INTERNATIONAL ASSOCIATION OF HYDROGEOLOGISTS**

HQ: Reading, United Kingdom

Website: [www.iah.org](http://www.iah.org)

**UN-WATER PARTNER**

IAH is a scientific and educational charitable organization for scientists, engineers, water managers and other professionals working in the fields of groundwater resource planning, management and protection. Its mission is to further the understanding, wise use and protection of groundwater resources throughout the world.

## IAH & GROUNDWATER

### GROUNDWATER TOPICS

#### *Climate Change*

- Adaptation to climate change

#### *Governance, water law and trans-boundary water*

- Transboundary aquifers

#### *Groundwater and Environment*

- Biodiversity and Ecosystems
- Freshwater conservation
- Aquifer recharge
- Karst aquifers

#### *Groundwater in settlements*

- Sustainable cities

#### *Food and energy nexus*

- Energy

### MAIN ACTIVITIES

- Capacity building
- Information management
- Policy development/support
- Awareness raising
- Events

IAH's National Chapters are a valuable means of bringing scientific, professional and social benefits to their members and community, and also enable the Association to promote sound and sustainable groundwater use at a country and regional level. Many run training courses and conferences and each year a National Chapter organises and hosts an Annual Congress.

### EXAMPLES OF IAH'S GROUNDWATER ACTIVITIES



IAH's Commission and Networks contribute to the science of groundwater and undertake outreach, education and training. They run sessions at IAH congresses, co-convene technical meetings and field excursions with other societies, host workshops and training courses and prepare educational and outreach publications. They also support IAH Executive and Council in influencing global groundwater policy.

IAH publishes two book series and a scientific journal, all containing essential material for individuals undertaking groundwater-related research, work and study. IAH's Hydrogeology Journal is a premier journal for groundwater professionals, with eight issues totalling around 1650 pages per year. IAH books have the common purpose of spreading the science and knowledge of hydrogeology and are products arising from IAH's congresses and meetings, its commissions and networks, as well as a variety of other sources.



#### **Commissions IAH**

- Commission on Groundwater and Climate Change
- Commission on Groundwater and Energy
- Commission on Groundwater Outreach
- Commission on Karst Hydrogeology
- Commission on Managing Aquifer Recharge
- Commission on Mineral and Thermal Waters
- Commission on Regional Groundwater Flow
- Commission on Transboundary Aquifers



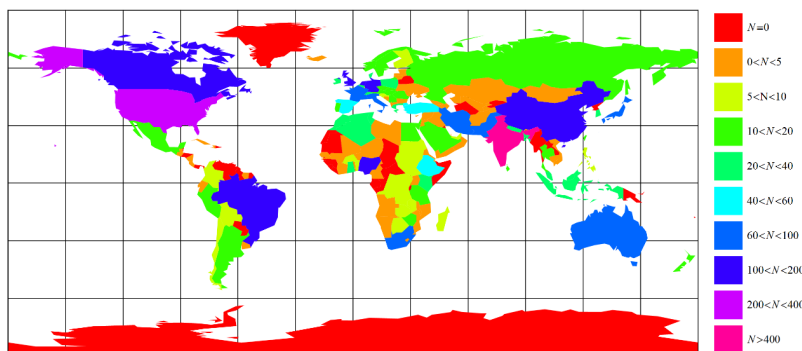
#### **Networks**

- Burdon Groundwater Network for International Development
- Early Career Hydrogeologists' Network
- Network for Coastal Aquifer Dynamics and Coastal Zone Management (CAD-CZM)
- Network on Fractured Rock Hydrogeology
- Network on Groundwater and Ecosystems
- Urban Groundwater Network



IAHS is a non-profit international non-governmental scientific organization and one of the eight associations that comprise the International Union of Geodesy and Geophysics (IUGG). Among its main objectives it is to study the hydrological cycle and the hydrological aspects of the use and management of water resources, and to provide a firm scientific basis for the optimal utilization of water resources systems, including the transfer of knowledge on planning, engineering, management and economic aspects of applied hydrology.

## IAHS & GROUNDWATER



IAHS-ICGW (International Commission on Groundwater) is responsible for the development of the science of groundwater hydrology, including the scientific basis for groundwater resource assessment and groundwater management, and for helping to bridge the gap between science and practice. It organizes and sponsors significant international and regional symposia and working groups to develop reports which focus on new and important aspects of hydrogeology.



### GROUNDWATER TOPICS

#### *Climate change*

- Droughts •
- Adaptation to climate change •

#### *Natural disasters, conflicts & human rights*

- Groundwater security •
- Land and soil degradation •

#### *Governance, water law and transboundary water*

- Groundwater management •
- Groundwater mapping •
- SDGs •

#### *Groundwater and environment*

- Aquifer recharge •
- Depletion •
- Isotope hydrology •
- Karst aquifers •
- Contamination control •
- Groundwater quality •
- Water risk / stress •
- Modelling •
- Soil borings and sampling •

#### *Groundwater in settlements*

- Urban development & water management •
- Coastal aquifers •

#### *Sanitation, health and pollution*

- Arsenic contamination/removal •
- Chloride in groundwater •
- Coastal aquifers •
- Contamination control •
- Groundwater quality risk •
- Groundwater treatment •
- Pollution - nitrate •
- Pollution - pesticides and fertilizers •
- Salinization •
- Waste water and contamination •
- Groundwater quality •

#### *Food and energy nexus*

- Food security •
- Irrigation •
- Nexus water-energy-food •

### MAIN ACTIVITIES

- Assessment •
- Capacity building •
- Policy development-support •
- Events •



# IGRAC

## INTERNATIONAL GROUNDWATER RESOURCES ASSESSMENT CENTRE

HQ: Delft, The Netherlands

Website: [www.un-igrac.org](http://www.un-igrac.org)

UN-WATER PARTNER

IGRAC (International Groundwater Resources Assessment Centre) facilitates and promotes international sharing of information and knowledge required for sustainable groundwater resources development and management worldwide.

Since 2003, IGRAC provides an independent content and process support, focusing particularly on transboundary aquifer assessment and groundwater monitoring.

## IGRAC & GROUNDWATER

### GROUNDWATER TOPICS

#### Climate Change

- Adaptation to climate change
- Salinization

#### Governance, water law and transboundary water

- Groundwater management
- SIDS
- Transboundary aquifers
- Governance
- SDGs

#### Groundwater and Environment

- Biodiversity and Ecosystems
- Aquifer recharge
- Groundwater assessment
- MAR
- Karst aquifers

#### Sanitation, health and pollution

- Arsenic (contamination/removal)

#### Economics

- Groundwater economics (value of groundwater)

### MAIN ACTIVITIES

- Assessment
- Capacity building
- Information management
- Policy development/support
- Awareness raising
- Events

### Monitoring

Global Groundwater Monitoring Network (GGMN) programme is initiated by IGRAC to improve quality and accessibility of groundwater monitoring information and hence the knowledge on the state of groundwater resources.



### Transboundary Groundwaters

Political, institutional, socio-economic, cultural and other differences among countries make the assessment and management of internationally shared aquifers challenging.



The major transboundary aquifer assessment activities at IGRAC are carried out within the framework of UNESCO-led ISARM - the Internationally Shared Aquifer Resource Management programme ([www.isarm.org](http://www.isarm.org)).

That includes execution of projects (e.g. GEF TWAP, GGRETA, GEF DIKTAS and IW-LEARN), development of an assessment methodology and a regular update of the Transboundary Aquifers of the World map.

### Global Groundwater Information System

GGIS is an interactive, web-based portal to groundwater-related information and knowledge: [www.un-igrac.org/ggis](http://www.un-igrac.org/ggis).

The main purpose of the system is to assist in collection and analysis of information on groundwater resources and sharing it among groundwater experts, decision-makers and general public.

GGIS contains a number of portals developed for a certain topic (e.g. managed aquifer recharge) or a region (e.g. Southern Africa).





## UN-WATER PARTNER

HQ: Delft, The Netherlands  
Website: [www.un-ihe.org](http://www.un-ihe.org)

IHE Delft Institute for Water Education is the largest international graduate water education facility in the world and is based in Delft, the Netherlands.

## IHE DELFT & GROUNDWATER

IHE Delft coordinates an International Joint Master Programme in Groundwater and Global Change (GroundwatCH) and carries out research for development projects in groundwater resources assessment and management.

### GROUNDWATER TOPICS

#### *Climate change*

- Droughts •
- Adaptation to climate change •
- Salinization •

#### *Governance, water law and transboundary water*

- Groundwater security •
- Groundwater management •
- Governance •
- Groundwater mapping •
- Water accounting •
- SDGs •

#### *Groundwater and environment*

- Biodiversity and ecosystems •
- Aquifer recharge •
- Groundwater assessment •
- MAR •
- Isotope hydrology •
- Contamination control •
- Groundwater quality •
- Groundwater/surface water •
- Modelling •

#### *Groundwater in settlements*

- Urban development & water management •
- Coastal aquifers •

#### *Sanitation, health and pollution*

- Chloride in groundwater •
- Coastal aquifers •
- Contamination control •
- Groundwater quality risk •
- Groundwater treatment •
- Pollution - nitrate •
- Pollution - pesticides and fertilizers •
- Salinization •
- Waste water and contamination •
- Groundwater quality •

### MAIN ACTIVITIES

- Assessment •
- Capacity building •
- Policy development-support •
- Awareness raising •
- Events •



Home The programme Admission and Application Career and Students



Fieldtrip in Amsterdam

“ Study the interactions between groundwater, surface water, climate and global change

### EXAMPLES OF IHE DELFT'S GROUNDWATER ACTIVITIES

GroundwatCH ([www.groundwatermaster.org](http://www.groundwatermaster.org)) offers a distinctive curriculum built on hydro(geo)logy, climatology, impacts and adaptation, within a framework of human pressures and global change.



In a development project “Mitigating groundwater SALINity impacts for IMPROVED water security in coastal areas under socio-economic and climate change”, IHE Delft works together with the local partners in three different settings in three countries towards assessing, monitoring and simulating the impacts of groundwater salinization, and

finding feasible adaptation solutions, both currently and under future climate and socio-economic change.

Presence of elevated fluoride levels in groundwater used as a drinking water imposes a serious public health threat. Under the Bongo (Ghana) defluoridation project IHE Delft, in cooperation with local and Dutch partners is verifying an innovative fluoride removal technology under field conditions.



IIASA is an international scientific institute that conducts policy-oriented research into the critical issues of global environmental, economic, technological, and social change. IIASA mission is to provide insights and guidance to policymakers worldwide by finding solutions to global and universal problems through applied systems analysis in order to improve human and social wellbeing and protect the environment.

## IIASA & GROUNDWATER

### GROUNDWATER TOPICS

#### Climate Change

- Droughts
- Adaptation to climate change
- Salinization

#### Governance, water law and transboundary water

- (Ground)water security
- Groundwater management
- Transboundary aquifers
- IWRM
- SDGs

#### Groundwater and Environment

- Aquifer recharge
- Depletion
- Groundwater assessment
- Groundwater quality
- Water risk / stress
- Groundwater/surface water
- Modelling

#### Groundwater in settlements

- Urban development & water management
- Sustainable cities

#### Sanitation, health and pollution

- Groundwater risk (groundwater quality)

#### Food and energy nexus

- Food security

### MAIN ACTIVITIES

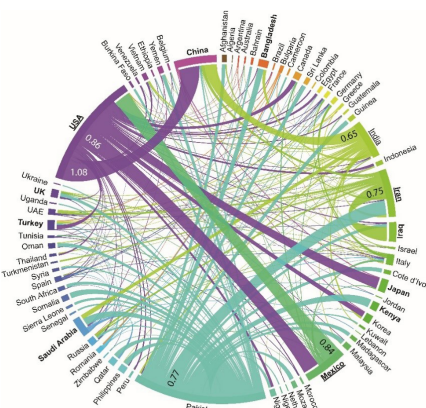
- Assessment
- Capacity building
- Information management
- Policy development/support
- Awareness raising
- Events

### Groundwater depletion driven by international food trade

Together with University College London, IIASA Water Team has quantified that approximately eleven per cent of non-renewable groundwater use for irrigation is embedded in international food trade, of which two-thirds are exported by Pakistan, the USA and India alone. These results could help to improve the sustainability of global food production and groundwater resource management by identifying priority regions and agricultural products at risk as well as the end consumers of these products.

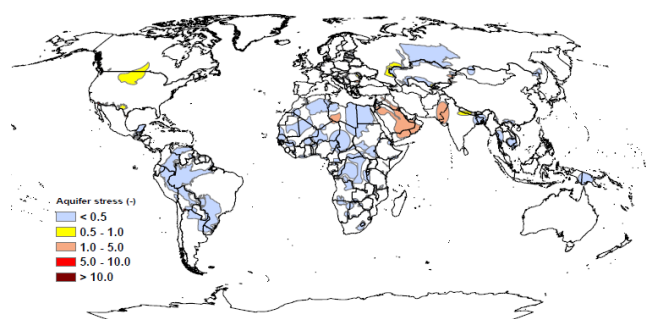
### A continental-scale hydro-economic model for exploring solutions for groundwater sustainability

IIASA Water (WAT) Program leads a model development of a new bottom-up, large-scale hydro-economic model, Extended Continental-scale Hydro-economic Optimization (ECHO), that works at a sub-basin scale over a continent. The strength of ECHO is the opportunity for integrating a detailed representation of local hydrological and technological constraints with regional and global policies, and accounting for the feedbacks between water, energy and agricultural sectors. ECHO has been applied over Africa as a case study with the aim of demonstrating the benefits of this integrated hydro-economic modeling framework to explore the investment options to reduce groundwater depletion.



### Transboundary groundwater sustainability

Together with IGRAC, IIASA team provided a first quantitative assessment of Transboundary Aquifers (TBAs) worldwide (in 2010) with an aquifer stress indicator over the period 1960–2010 using groundwater abstraction, groundwater recharge, and groundwater contribution to environment flow. The results reveal that 8% of TBAs worldwide are currently stressed due to human overexploitation.





## UN-WATER PARTNER

HQ: The Hague, The Netherlands

Website: [www.ircwash.org](http://www.ircwash.org)

IRC is an international think-and-do tank that works with governments, NGOs, entrepreneurs and people around the world to find long-term solutions to the global crisis in water, sanitation and hygiene services.

## IRC &amp; GROUNDWATER

The BRAC WASH programme, established in 2006 under the supervision of IRC and BRAC, has supported more than 37 million people in Bangladesh to access hygienic household sanitation working through Village WASH Committees, cluster meetings and household visits, as well as work in schools. A second phase of this project, the BRAC Environmental WASH programme for 2016-2020 (BRAC WASH II), is planned as a gradual expansion in scope beyond WASH towards water security and from rural areas towards low income small towns, urban areas and coastal areas. One of its specific areas of intervention is sanitation in areas with high groundwater tables.



The project ASTRA (Aiding Sustainable Water Technology Realization in Arsenic contaminated Areas of Bangladesh), developed in the framework of the BRAC WASH II programme, is a decision-support tool to aid the identification of potentially appropriate drinking water methods for arsenic- and salt-mitigation in Bangladesh. One of its major outputs is the sourcebook "Bangladeshi arsenic- and salt-mitigation sourcebook and decision-support tool: final report" (2015), which presents 26 technical solutions that can either treat or circumvent arsenic- or salt-contaminated water sources. Among the outlined mitigation routes, targeting arsenic- or salt-free groundwater, and treating arsenic- or salt contaminated groundwater are included.



## GROUNDWATER TOPICS

*Climate change*

Salinization •

*Groundwater and environment*

Modelling •

*Sanitation, health and pollution*

Arsenic contamination / removal •

WASH •

## MAIN ACTIVITIES

Capacity building •

Awareness raising •

The International Water Management Institute (IWMI) is a non-profit, scientific research organization focusing on the sustainable use of water and land resources in developing countries. Headquartered in Colombo, Sri Lanka, with regional offices across Asia and Africa, IWMI is a CGIAR Research Center and leads the CGIAR Research Program on Water, Land and Ecosystems (WLE).

## IWMI & GROUNDWATER

### GROUNDWATER TOPICS

#### Climate Change

- Droughts
- Adaptation to climate change
- Salinization

#### Natural disasters, conflicts & human rights

- Human right to water
- Groundwater security
- Land and soil degradation
- Gender

#### Governance, water law and trans-boundary water

- Diplomacy / Governance (water convention)
- Groundwater law
- (Ground)water security
- Groundwater management
- Transboundary aquifers
- Governance
- Groundwater mapping
- IWRM
- Water accounting
- SDGs

#### Groundwater and Environment

- Biodiversity and Ecosystems
- Aquifer recharge
- Depletion
- Groundwater assessment
- MAR
- Isotope hydrology
- Karst aquifers
- Contamination control
- Groundwater quality
- Water risk / stress
- Groundwater/surface water
- Modelling
- Soil borings and sampling

#### Groundwater in settlements

- Urban development & water management
- Sustainable cities
- Rural development

#### Sanitation, health and pollution

- Arsenic (contamination/removal)
- Chloride in groundwater
- Coastal aquifers
- Contamination control
- Groundwater risk (groundwater quality)
- Groundwater treatment
- Pollution (nitrate)
- Pollution (by pesticides and fertilizers)
- Recycling wastewater
- Salinization
- Waste water and contamination
- Groundwater quality

#### Food and energy nexus

- Energy
- Food security
- Irrigation
- Nexus water-energy-food

#### Economics

- Groundwater economics (value of groundwater)

IWMI's focus within groundwater is on sustainable development, use and management of groundwater resources to enhance livelihoods, food security, climate resilience and economic growth. IWMI informs, engages and influences thinking on groundwater and produces innovative research, policy advice, data and collaborative partnerships on groundwater.



### EXAMPLES OF IWMI'S GROUNDWATER ACTIVITIES

IWMI leads and coordinates the Groundwater Solutions Initiative for Policy and Practice (GRIPP). GRIPP has about 30 international partners, many of which are members and partners of UN-Water (UNESCO, World Bank, UNU, IAH, IGRAC, and IUCN). GRIPP plays a critical role in advocating for sustainable groundwater management, policy development, networking and lesson sharing, and identifying and upscaling workable solutions to groundwater challenges.



**GRIPP**

GROUNDWATER SOLUTIONS  
INITIATIVE FOR  
POLICY AND PRACTICE

### MAIN ACTIVITIES

- Assessment
- Capacity building
- Information management
- Policy development/support
- Awareness raising
- Events



SIWI is a policy institute that seeks to leverage knowledge and convening power to strengthen water governance for a just, prosperous, and sustainable future, through i.a. cooperation over shared waters and contribution to integrated, transparent and participatory processes.

## SIWI & GROUNDWATER

SIWI works with groundwater through the UPGro programme, with focus on urban poor aspects; and as an integrated part of projects on sustainable textiles production and the forests and water-nexus.

### EXAMPLES OF SIWI'S GROUNDWATER ACTIVITIES



Groundwater contamination and over-abstraction, impacts on domestic use (human right to safe drinking water) and food production are topics indirectly dealt with in the research project 'Global textile trade and local impacts on life and water: New technical requirements and initiatives for sustainable textiles'

The Swedish Water House Department of SIWI works with raising awareness about groundwater in engagement and dialogues with Swedish stakeholders and connecting them to international networks such as the FAO Forest and Water Network. Among its activities, it organises seminars and has a Cluster Group on Water in transforming landscapes.



### GROUNDWATER TOPICS

#### *Climate change*

- Adaptation to climate change •

#### *Natural disasters, conflicts & human rights*

- Human right to safe drinking water •
- Human right to water •
- Groundwater security •
- Gender •

#### *Governance, water law and transboundary water*

- (Diplomacy / Governance (water convention •
- Groundwater law •
- Groundwater security) •
- Groundwater management •
- Transboundary aquifers •
- Governance •
- IWRM •
- SDGs •

#### *Groundwater and environment*

- Aquifer recharge •
- Depletion •
- MAR •
- Contamination control •
- Groundwater quality •
- Water risk / stress •

#### *Groundwater in settlements*

- Urban development & water management •
- Sustainable cities •

#### *Sanitation, health and pollution*

- Contamination control •
- (Groundwater risk (groundwater quality •
- Groundwater treatment •
- Human right to safe drinking water •
- Recycling wastewater •
- Waste water and contamination •
- Groundwater quality •

#### *Food and energy nexus*

- Food security •
- Irrigation •

### MAIN ACTIVITIES

- Assessment •
- Capacity building •
- Policy development-support •
- Awareness raising •
- Events •

UN ECLAC is one of the five regional commissions of the United Nations to encourage economic cooperation. It was founded with the purpose of contributing to the economic development of Latin America. Its goal is promoting economic and social development through regional and sub regional cooperation and integration.

## UN ECLAC & GROUNDWATER

### GROUNDWATER TOPICS

#### Governance, water law and transboundary water

- Groundwater law
- IWRM
- SDGs

#### Food and energy nexus

- Nexus water-energy-food

#### Economics

- Economic impact of climate change on water

UN ECLAC is engaged in research and technical advisory assistance in water management, particularly in water law and regulations, including the groundwater aspect. The main contributions to groundwater management are summarized in:

- Miguel Solanes (2003), *“Groundwaters: regulatory needs”*, Circular of the Network for Cooperation in Integrated Water Resource Management for Sustainable Development in Latin America and the Caribbean. (This document is also available in Spanish)



### MAIN ACTIVITIES

- Assessment
- Capacity building
- Information management
- Policy development/support
- Awareness raising
- Events





## UN-WATER MEMBER

HQ: Nairobi, Kenya

Website: [www.unenvironment.org](http://www.unenvironment.org)

UN Environment is an agency that promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system, and serves as an authoritative advocate for the global environment both in the General Assembly and any relevant scale of collaboration with member states.

## UN ENVIRONMENT & GROUNDWATER

Groundwater is a central to UN Environment in terms of quality and quantity reflecting natural contamination and anthropogenic pollution as well as climate change.

### EXAMPLES OF UN ENVIRONMENT'S GROUNDWATER ACTIVITIES

Groundwater it is a focal area in the Global Environment Monitoring System GEMS/Water Programme in UN Environment.

Groundwater is critical in the World Water Quality Assessment and needs to be looked at particular in contexts of the nexus, climate change, equity and conflict and peace namely also in transboundary systems. Also to be considered is groundwater pollution by pathogen and chemical due to wastewater or pit latrine leakages, the dumping of chemical and hazardous wastes, landfills. As such groundwater reflects in all aspects of the current UN Environment Freshwater Strategy

UN Environment is the custodian for three of the indicators in Sustainable Development Goal 6, all of which include groundwater:

- Indicator 6.3.2: Proportion of bodies of water with good ambient water quality
- Indicator 6.5.1: Degree of integrated water resources management implementation
- Indicator 6.6.1: Change in the extent of water-related ecosystems over time

A global data drive was conducted in 2017, with varying levels of data (and numbers of reporting countries) captured for each of these three indicators. The information on groundwater was, unfortunately, quite low. UN Environment is interested in augmenting country reported data with more information, for example through the potential use of Earth observations.



Figure 2 — Core priorities of UN Environment Freshwater Strategy

### GROUNDWATER TOPICS

#### Climate change

- Adaptation to climate change

#### Natural disasters, conflicts & human rights

- Human right to safe drinking water
- Human right to water
- Groundwater security
- Gender

#### Governance, water law and transboundary water

- Diplomacy / Governance - water convention
- Groundwater law
- Transboundary aquifers

#### Sanitation, health and pollution

- Recycling wastewater

### MAIN ACTIVITIES

- Assessment
- Capacity building

**UN-WATER MEMBER**

HQ: Bangkok, Thailand  
 Website: [www.unescap.org](http://www.unescap.org)

ESCAP, one of the five regional economic and social commissions of the United Nations, is committed to a resilient Asia and the Pacific founded on shared prosperity, social equity and sustainability. ESCAP works to overcome some of the region's greatest challenges by providing results oriented projects, technical assistance and capacity building to member States in multiple areas including environment and development.

**UN ESCAP & GROUNDWATER**

ESCAP is engaged in groundwater issues mostly through follow-up and review of SDG 6 on water and sanitation as agreed at the Asia Pacific Forum on Sustainable Development. UN-Water Regional Knowledge Hub and ESCAP SDG HelpDesk are part of these activities. ESCAP also supports Urban Water Cycle Management where groundwater plays an important role.



Groundwater is included in E-learning Material, Technical Guidance, Assessment Reports (e.g. ESCAP Status Report on the Water-Energy-Food Security Nexus in the Asia Pacific Region), Case studies (e.g. Good Practices on Strategic Planning and Management of Water Resources In Asia And The Pacific) and Capacity building activities (e.g. Training Workshop on Addressing Disaster Risks Specific to South and South-West Asia).

**GROUNDWATER TOPICS***Governance, water law and transboundary water*

- IWRM •
- SDGs •

*Groundwater and environment*

- Aquifer recharge •
- Depletion •
- MAR •
- Contamination control •
- Groundwater quality •
- Water risk / stress •

*Groundwater in settlements*

- Urban development & water management •
- Sustainable cities •
- Rural development •

*Sanitation, health and pollution*

- Human right to safe drinking water •
- Recycling wastewater •

*Food and energy nexus*

- Energy •
- Food security •
- Nexus water-energy-food •

*Other*

- Integrated water policy development and monitoring •

**MAIN ACTIVITIES**

- Assessment •
- Capacity building •
- Information management •
- Policy development-support •
- Awareness raising •
- Events •





The United Nations Global Compact is a voluntary initiative based on CEO commitments to implement universal sustainability principles and to undertake partnerships in support of UN goals. The UN Global Compact is the world's largest corporate sustainability initiative, with more than 12,000 corporate participants and stakeholders from more than 140 countries.

## UN GLOBAL COMPACT & GROUNDWATER

### GROUNDWATER TOPICS

#### Sanitation, health and pollution

- Groundwater risk (groundwater quality)

#### Economics

- Economics

### MAIN ACTIVITIES

- Assessment
- Capacity building
- Information management
- Policy development/support
- Awareness raising

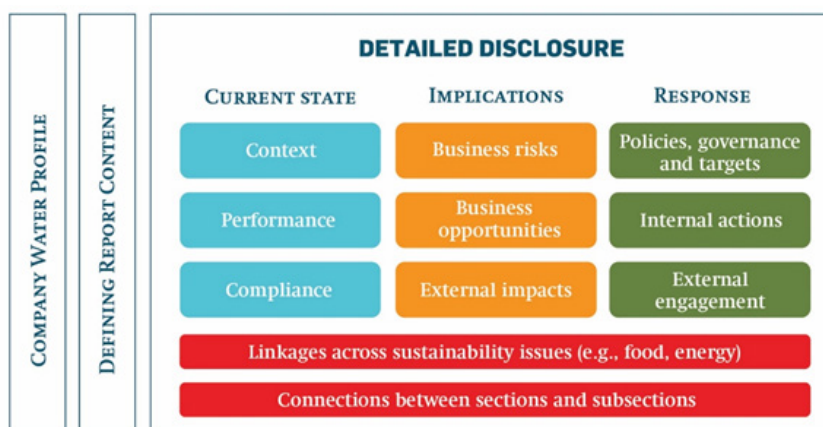
In order to increase engagement of international business community in water and sanitation, a “CEO Water Mandate” <https://ceowatermandate.org> initiative was launched in 2007 by the UN Secretary-General and the UN Global Compact, implemented in partnership with the Pacific Institute. The CEO Water Mandate mobilizes business leaders to advance water stewardship, sanitation, and the Sustainable Development Goals – in partnership with the United Nations, governments, peers, civil society, and others.



Water Action Hub

### EXAMPLES OF UN GLOBAL COMPACT GROUNDWATER ACTIVITIES

- In the framework of CEO Water Mandate a number of guidelines (such as on Corporate Water Disclosure) and tools (mostly for Water Risk Assessment) have been developed, to be implemented through corporate water stewardship. Although groundwater needs more adequate (re)presentation in tools, guidelines and programmes, the water stewardship is a proper context to engage companies in water management, at various scales.
- As a part of Water Stewardship Toolbox, the CEO Water Mandate has created a repository of Case Studies and Reports relevant for understanding of groundwater by risk analysts and asset managers.



HQ: Bonn, Germany

Website: [www.unccd.int](http://www.unccd.int)

UN-WATER MEMBER

Established in 1994, UNCCD is the only legally binding international agreement on land issues. The Convention promotes good land stewardship. Its 196 Parties aim, through partnerships, to implement the Convention and achieve the Sustainable Development Goals. The end goal is to protect our land, from over-use and drought, so it can continue to provide us all with food, water and energy.

## UNCCD & GROUNDWATER

### GROUNDWATER TOPICS

#### *Climate Change*

- Droughts
- Desertification

#### *Natural disasters, conflicts & human rights*

- Land and soil degradation
- Gender

#### *Groundwater and Environment*

- Rainwater harvesting
- Soil borings and sampling
- Drylands

#### *Food and energy nexus*

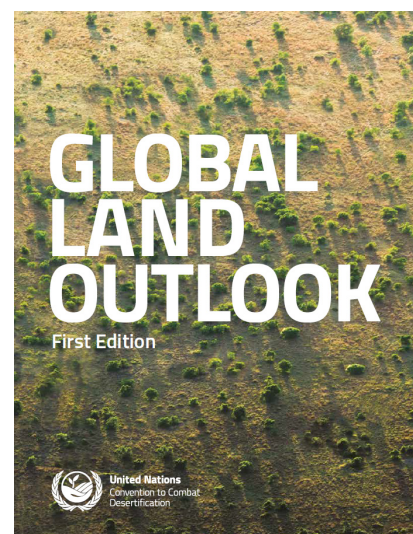
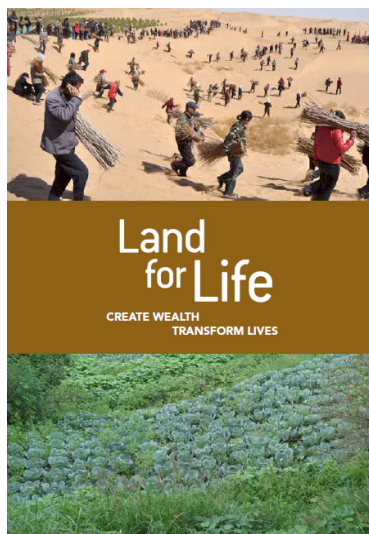
- Food security
- Irrigation



UNCCD promotes courses about groundwater, publishes news and articles in the Knowledge Hub and advertises “marketplace” opportunities about learning, funding, and jobs (also related to groundwater). It contributes to publications (e.g. World Atlas of Desertification) and organizes workshops and UNCCD Scientific Conferences, with topics related to groundwater.

### MAIN ACTIVITIES

- Assessment
- Capacity building
- Information management
- Policy development/support
- Awareness raising
- Events







### UN-WATER MEMBER

HQ: New York, USA  
Website: [www.undp.org](http://www.undp.org)

UNDP is a global development network of the United Nations working in about 170 countries and territories, helping to achieve the eradication of poverty, and the reduction of inequalities and exclusion. It helps countries to develop policies, leadership skills, partnering abilities, institutional capabilities and build resilience in order to sustain development results.

## UNDP & GROUNDWATER

In implementing the GEF (Global Environment Facility) programme, UNDP plays the primary role in ensuring the development and management of capacity building programs and technical assistance projects.

### EXAMPLES OF UNDP'S GROUNDWATER ACTIVITIES

With relation to groundwater, UNDP collaborate with GEF in multiple projects, as:

- Enhancing conjunctive management of surface and groundwater resources in selected transboundary aquifers: Case study for selected shared groundwater bodies in the Nile Basin
- GEF International Waters: Learning Exchange And Resources Network (IW:LEARN)
- Strengthening the institutional capacity of African Network of Basin Organization - ANBO, contributing to the improved transboundary water governance in Africa
- Enabling implementation of the Regional SAP for the rational and equitable management of the Nubian Sandstone Aquifer System – NSAS
- Fostering multi-country cooperation over conjunctive surface and groundwater management in the Bug and Neman Transboundary River Basins and the underlying aquifer systems
- Implementation of the SAP of the Dinaric Karst Aquifer System: Improving Groundwater Governance and Sustainability of Related Ecosystems



### GROUNDWATER TOPICS

#### *Natural disasters, conflicts & human rights*

- Gender

#### *Governance, water law and transboundary water*

- Diplomacy / Governance
- Groundwater law
- Transboundary aquifers
- IWRM
- SDGss

#### *Groundwater and environment*

- Groundwater assessment
- Karst aquifers
- Groundwater/surface water

### MAIN ACTIVITIES

- Assessment
- Events



## UN-WATER MEMBER

HQ: Geneva, Switzerland

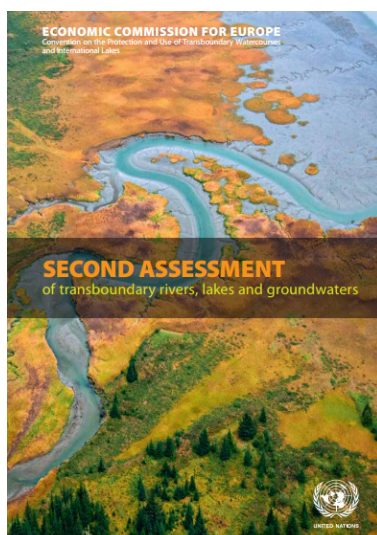
Website: [www.unece.org](http://www.unece.org)

UNECE is one of the five regional commissions of the United Nations to encourage economic cooperation, with the aim of promoting pan-European economic integration. As a multilateral platform, UNECE facilitates greater economic integration and cooperation among its member countries and promotes sustainable development and economic prosperity.

## UNECE & GROUNDWATER

UNECE host the secretariat of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, which provides a legal and institutional framework for sustainable management of transboundary waters, covering both surface waters and groundwaters, which is open for accession to all UN Member States. The Protocol on Water and Health to the Water Convention has an overall goal of protecting human health and well-being by better management of water resources in the pan-European region.

Under the Water Convention, groundwater related aspects are usually integrated into activities, including workshops, guidance materials and covered in assessments of transboundary waters, although groundwater specific activities have also been carried out (e.g. development of Model Provisions on Transboundary Groundwaters). The first inventory of transboundary groundwaters in Europe (1999) was carried out in the framework of the Water Convention. The following assessments (2007 and 2011) included the internationally shared aquifer of Caucasus and Central Asia as well. In the framework of the Protocol on Health, the Parties set targets and a time-frame for their achievement. Protection and sustainable use of groundwater resources is an important part of work under both instruments.



## GROUNDWATER TOPICS

### *Governance, water law and transboundary water*

- Diplomacy / Governance •
- Groundwater law •
- SIDS •
- Transboundary aquifers •

## MAIN ACTIVITIES

- Assessment •
- Capacity building •
- Policy development-support •
- Awareness raising •
- Events •





UNESCO is a specialized agency of the United Nations with the purpose of contributing to peace and security by promoting international collaboration through educational, scientific and cultural reforms, in order to increase universal respect for justice, the rule of law, and human rights.

## UNESCO & GROUNDWATER

### GROUNDWATER TOPICS

#### Climate Change

- Adaptation to climate change

#### Natural disasters, conflicts & human rights

- Gender

#### Governance, water law and transboundary water

- Diplomacy / Governance
- Groundwater law
- SIDS
- Transboundary aquifers
- Governance
- Groundwater mapping
- IWRM
- SDGs

#### Groundwater and Environment

- Aquifer recharge
- Groundwater assessment
- Karst aquifers

#### Sanitation, health and pollution

- Coastal aquifers
- Groundwater quality

#### Food and energy nexus

- Nexus water-energy-food

### MAIN ACTIVITIES

- Assessment
- Capacity building
- Information management
- Policy development/support
- Awareness raising
- Events

### INTERNATIONAL HYDROLOGICAL PROGRAMME (UNESCO-IHP)



Groundwater-related activities are executed in the framework of its International Hydrological Programme (UNESCO-IHP), with a dedicated Theme for 2014-2021: "Groundwater in a changing environment". Focal areas of this Theme are sustainable management of groundwater resources, groundwater and climate change, groundwater quality, aquifer recharge and transboundary aquifers. UNESCO-IHP has several long-term groundwater activities, such as:

- ISARM (International Shared Aquifer Resources Management) Programme serves as umbrella for all transboundary aquifers projects and activities (<https://isarm.org>)
- GRAPHIC is dedicated to Groundwater Resources Assessment under the Pressures of Humanity and Climate Change (<http://www.graphicnetwork.net>)
- GGMN is the Global Groundwater Monitoring Network set up to improve quality and accessibility of groundwater monitoring information (<https://www.un-igrac.org/ggmn>)

### WORLD WATER ASSESSMENT PROGRAMME (WWAP)



The World Water Assessment Programme (WWAP), a part of the UNESCO Water Family, provides information and data about groundwater status, use, management and governance at global level in its yearly World Water Development Reports and UN Water flagship publications. WWAP also supports the integration of gender considerations in groundwater governance and policies, and apply sex-disaggregated (ground)water data collection and analysis and gender-sensitive indicators.



ESCWA is one of the five Regional Commissions of the United Nations System, which aim to encourage the achievement of internationally agreed development goals at the regional and subregional levels. To achieve these objectives, Regional Commissions promote multilateral dialogue, knowledge sharing and networking and promote intra-regional and inter-regional cooperation for sustainable development.

## UNESCWA & GROUNDWATER

### GROUNDWATER TOPICS

#### Climate Change

- Adaptation to climate change
- Desertification

#### Governance, water law and transboundary water

- Diplomacy / Governance (water convention)
- (Ground)water security
- Transboundary aquifers
- Groundwater mapping
- IWRM

#### Groundwater and Environment

- Rainwater harvesting
- MAR

#### Groundwater in settlements

- Sustainable cities

#### Sanitation, health and pollution

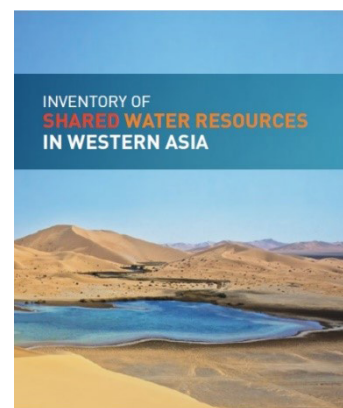
- Groundwater risk (groundwater quality)
- Human right to safe drinking water
- Waste water and contamination

#### Food and energy nexus

- Nexus water-energy-food

ESCWA supports Arab States improve groundwater resource management by providing scientific assessments, knowledge resources and fostering regional dialogue on groundwater within the context of shared water resources management, integrated water resources management, the water-energy-food nexus, and climate change with the aim of achieving sustainable development goals. ESCWA supports intergovernmental dialogue and capacity building under the auspices of the Arab Ministerial Water Council on shared surface and groundwater resource.

ESCWA collaborated with BGR (German Federal Institute for Geosciences and Natural Resources) to prepare an Inventory of Shared Water Resources in Western Asia, which features 17 chapters dedicated to a shared groundwater resource in the region. The report is available on a dedicated website where each chapter can be individually accessed ([www.waterinventory.org](http://www.waterinventory.org)).



ESCWA has been supporting the Arab Ministerial Water Council to conduct intergovernmental consultations and dialogues on shared surface and groundwater resources since 2009. This has entailed organizing one to two intergovernmental and expert-level dialogues per year, in cooperation with the League of Arab States.



### MAIN ACTIVITIES

- Assessment
- Capacity building
- Information management
- Policy development/support
- Awareness raising
- Events





UN-WATER MEMBER

HQ: Geneva, Switzerland  
Website: [www.unhcr.org](http://www.unhcr.org)

UNHCR is a United Nations programme with the mandate to protect refugees, forcibly displaced communities and stateless people, and assist in their voluntary repatriation, local integration or resettlement to a third country. To fulfil its mandate UNHCR works with national government and other partners to ensure the sustainable provision of water to refugees. In many contexts this includes the management of groundwater resources. UNHCR is organising trainings/workshops (like Sustainable Groundwater Management for Refugee Camps in Kenya) and provides supporting technical material (e.g. Sample Drilling Contract and Specifications for Refugee Settings).

UNHCR & GROUNDWATER

A rapid groundwater potential mapping technique has been developed and applied in Bidibidi-Rhino area (Northern Uganda), combining satellite imagery, geological maps and fracture analysis, as well as morphological analysis combined with assessment of potential groundwater recharge patterns. The aim is guiding drillers/hydrogeologists and planners together to identify the most appropriate locations for well siting (positions to carry out geophysical investigations).



UNHCR has been conducting geophysical and hydrogeological studies of the aquifers on the Teknaf peninsula, Bangladesh to respond to the influx of almost 1M Rohingya refugees.

UNHCR is working with its implementing partners to maintain GIS portal with a database of over 11,200 water points from 27 countries including information on various fields: safe yield, static and dynamic water levels, water quality parameters (conductivity, turbidity, arsenic, nitrates), and pump test results.



GROUNDWATER TOPICS

*Climate change*

- Adaptation to climate change •
- Salinization •

*Natural disasters, conflicts & human rights*

- Human right to safe drinking water •
- Human right to water •
- Groundwater security •
- Groundwater management for refugee camps •
- Gender •

*Governance, water law and transboundary water*

- Groundwater management •
- Governance •
- Groundwater mapping •
- IWRM •
- SDGs •

*Groundwater and environment*

- Groundwater assessment •
- Rainwater harvesting •
- Groundwater quality •
- Groundwater/surface water •
- Modelling •
- Soil borings and sampling •

*Sanitation, health and pollution*

- Arsenic contamination/removal •
- Groundwater management for refugee camps •
- (Groundwater risk (groundwater quality •
- Groundwater treatment •
- Human right to safe drinking water •
- Iron concentration •
- (Pollution (nitrate •
- (Pollution (by pesticides and fertilizers •
- Salinization •
- WASH •
- Waste water and contamination •
- Groundwater quality •

MAIN ACTIVITIES

- Assessment •
- Capacity building •
- Policy development-support •
- Awareness raising •
- Events •

## UN-WATER MEMBER

Website: [www.unu.edu](http://www.unu.edu)

UNU is a global think tank and postgraduate teaching organization. The mission of the UN University is to contribute, through collaborative research and education, to efforts to resolve the pressing global problems of human survival, development and welfare that are the concern of the United Nations, its Peoples and Member States. Among UNU institutes, UNU-FLORES and UNU-INWEH have strongest connections with groundwater.

## UNU & GROUNDWATER

### UNU-FLORES

UNU-FLORES (Institute for Integrated Management of Material Fluxes and of Resources) develops strategies to resolve pressing problems in the sustainable use and integrated management of environmental resources, particularly water, soil and waste. The institute addresses groundwater as a part of problem solving in projects such as:



UNITED NATIONS  
UNIVERSITY

**UNU-FLORES**

Institute for Integrated Management  
of Material Fluxes and of Resources

- **'Integrated evaluation of wastewater irrigation for sustainable agriculture and groundwater development'**. This ongoing project in South Asia aims at identifying efficient scenarios for wastewater irrigation management that support sustainable agriculture and groundwater development.
- **'Understanding water quality indicators and their application'** is an ongoing research project. The project is about quantity and diversity of water quality indicators in standards and guidelines versus the need for those by practitioners (also useful for the SDG monitoring process).

### UNU-INWEH

UNU-INWEH (Institute for Water, Environment and Health) examines: i) the role of groundwater – particularly deep groundwater and off-shore aquifers – as a source of unconventional / additional water supply in water scarce areas; ii) how accelerated managed aquifer recharge can help alleviate the damages from both floods and droughts – at the Basin scale; iii) the effectiveness of past interventions into treatment of arsenic-contaminated groundwater and iv) the role that groundwater plays in supporting various water-related SDG targets. Most of the projects of UNU-INWEH have elements of groundwater implicitly, such as:



UNITED NATIONS  
UNIVERSITY

**UNU-INWEH**

Institute for Water,  
Environment and Health

- **'Managing Water-related health risks'**, which works on arsenic in groundwater (assessment of effectiveness of past interventions).
- **'Managing water resources variability and risks for increased resilience'**, which has a plan to work on underground storage as a means to reduce damages of both floods and droughts.

### GROUNDWATER TOPICS

#### *Climate change*

- Droughts
- Adaptation to climate change
- Desertification

#### *Natural disasters, conflicts & human rights*

- Groundwater security
- Land and soil degradation

#### *Governance, water law and transboundary water*

- Groundwater security
- Groundwater management
- Transboundary aquifers
- Governance
- IWRM
- SDGs

#### *Groundwater and environment*

- Biodiversity and Ecosystems
- Freshwater conservation
- Aquifer recharge
- Groundwater assessment
- MAR
- Contamination control
- Groundwater quality
- Water risk / stress
- Groundwater/surface water

#### *Sanitation, health and pollution*

- Arsenic contamination/removal
- Contamination control
- Groundwater quality risk
- Recycling wastewater
- Waste water and contamination

#### *Food and energy nexus*

- Nexus water-energy-food
- Food security
- Irrigation

### MAIN ACTIVITIES

- Assessment
- Capacity building
- Information management
- Policy development/support
- Awareness raising
- Events



UNWTO is the United Nations agency responsible for the promotion of responsible, sustainable and universally accessible tourism. It promotes tourism as a driver of economic growth, inclusive development and environmental sustainability and offers leadership and support to the sector in advancing knowledge and tourism policies worldwide.

## UNWTO & GROUNDWATER

### GROUNDWATER TOPICS

#### Climate Change

- Adaptation to climate change

#### Governance, water law and transboundary water

- SDGs

#### Groundwater and Environment

- Biodiversity and Ecosystems

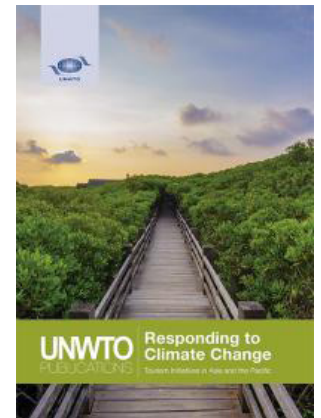
World Tourism Day 27 Sept 2013



Protecting our Common Future

A central aspect of sustainability is the management of the world's resources. Thus, sustainable tourism development and operation fosters the responsible use of renewable and non-renewable resources, such as water, whether groundwater or surface water. Among others, UNWTO's focus is on governance, monitoring and resource management within the framework of the sustainable development of tourism.

In support of United Nations International Year of Water Cooperation, World Tourism Day (WTD) 2013, held annually on 27 September, was held under the theme Tourism and Water: Protecting our Common Future. The theme highlighted tourism's role in water access and shined a spotlight on the actions taken by the sector in order to contribute to a more sustainable water future, as well as the challenges ahead. The official celebrations included a Think Tank on the 2013 theme with the participation of top experts and policy makers in the field of tourism and water.



### MAIN ACTIVITIES

- Assessment
- Capacity building
- Events



Water.org is an U.S.-based nonprofit developmental aid organization. Its goal is to facilitate universal access to safe drinking water and sanitation through affordable financing to the Base of the Economic Pyramid. Through its WaterCredit programme, Water.org collaborates with local financial and non-financial institutions to provide small, affordable loans and expert resources to achieve household water and sanitation.

## WATER.ORG & GROUNDWATER

### GROUNDWATER TOPICS

#### *Natural disasters, conflicts & human rights*

- Human right to safe drinking water

#### *Sanitation, health and pollution*

- Groundwater risk (groundwater quality)
- Human right to safe drinking water
- WASH

### MAIN ACTIVITIES

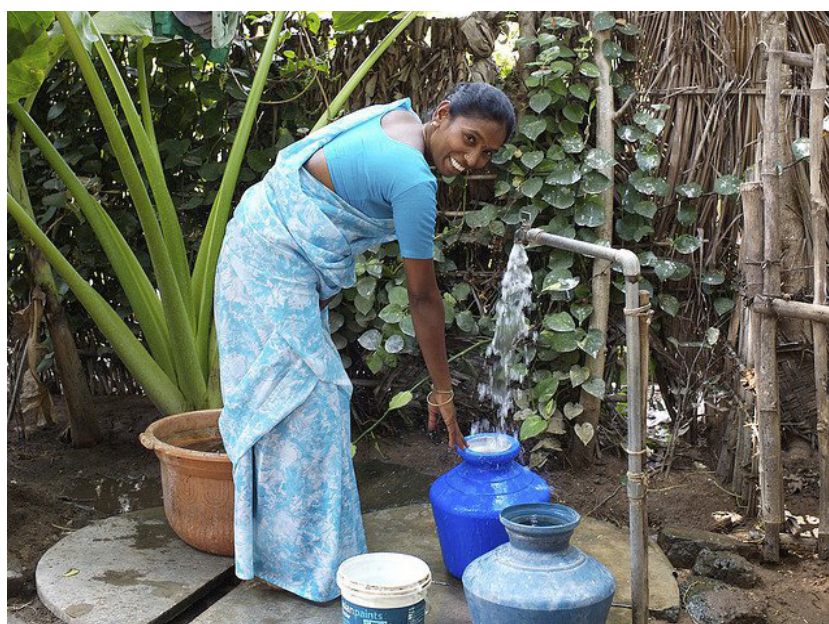
- Assessment
- Capacity building
- Policy development/support
- Awareness raising

Water.org believes that at least half of the people in need of safe water and sanitation can acquire sustained access by taking out small loans to build or tap into existing infrastructure. The primary goal of our efforts is for water and sanitation finance to be increased, globally. We know mobilizing domestic resources for access is a powerful financial mechanism that governments can work into their financing strategies for achieving universal access. Without reliable sources of water, of which groundwater is a major component, there is no sustainable supply, and costs will move beyond the reach of the poor.



WaterCredit borrowers often take loans for piped water connections to afford connecting to municipal supplies. In India, the cost of a permit is often more than the cash reserves of a low-income household. Small regular payments, however, can enable those who previously lacked access to bring water to their doorstep.

Without access to safe and reliable sources of water, people are forced to collect water from the nearest available source, which is often contaminated and located at a distance from where they live.





## UN-WATER PARTNER

HQ: The Hague, The Netherlands

Website: [www.womenforwater.org](http://www.womenforwater.org)

WfWP is a partnership of women's organizations and networks, uniting women leadership in around 134 predominantly low and middle-income countries around the world. All 27 member organizations are rooted in society and are active in the areas of water and sanitation, sustainable development, women's participation and empowerment. WfWP positions women as active leaders, partners, experts and agents of change in water.

## WFWP &amp; GROUNDWATER

Most members of WfWP carry out projects in the field of SDG 6. For these members, groundwater is often the main source of water.

## EXAMPLES OF WFWP'S GROUNDWATER ACTIVITIES

Tegemeo Women Group, a member of WfWP, located high up in the Pare Mountains in Northern Tanzania faced an acute shortage of safe water for a long time. Five gravity flow schemes, with groundwater collected from remote perennial springs, solved the problem and changed the lives of the women.



NetWwater, a member of WfWP in Sri Lanka, carries out a project: Adaptation to climate change for women in community based organizations "Jalavahini". Droughts resulting in lack of groundwater are amongst others combated with simple irrigation techniques using buried pots, drip lines made of empty bottles and saline tubes, simulating expensive drip irrigation systems.



## GROUNDWATER TOPICS

*Climate change*

- Droughts •
- Adaptation to climate change •

*Natural disasters, conflicts & human rights*

- Human right to safe drinking water •
- Human right to water •
- Gender •

*Governance, water law and transboundary water*

- Diplomacy / Governance - water convention •
- Governance •
- IWRM •
- SDGs •

*Groundwater and environment*

- Rainwater harvesting •

*Groundwater in settlements*

- Urban development & water management •
- Rural development •

*Sanitation, health and pollution*

- Chloride in groundwater •
- Contamination control •
- Human right to safe drinking water •
- Pollution by pesticides and fertilizers •
- WASH •

*Food and energy nexus*

- Food security •
- Irrigation •

## MAIN ACTIVITIES

- Assessment •
- Capacity building •
- Information management •
- Policy development/support •
- Awareness raising •
- Events •

## UN-WATER MEMBER

HQ: Geneva, Switzerland

Website: [www.who.int](http://www.who.int)

WHO is the directing and coordinating authority on international health within the United Nation's system. It works side by side with governments and other partners to ensure the highest attainable level of health for all people.

## WHO & GROUNDWATER

The WHO Water Sanitation, Hygiene and Health unit monitors WASH burden of disease, access and enabling environment under the SDGs, provides global evidence based norms on water quality (drinking water, wastewater use, recreational water and sanitation) and strengthens WASH service delivery in health sector interventions (NTD, Nutrition, Health facilities, AMR and outbreak response).

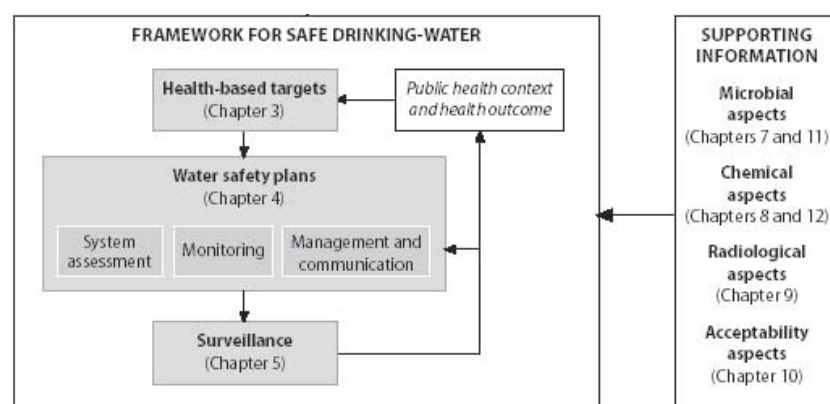
### EXAMPLES OF WHO'S GROUNDWATER ACTIVITIES

WHO's comprehensive Guidelines for drinking water quality and supporting publication (e.g. WSPs) cover groundwater – especially as it relates to source water protection.

WHO has produced groundwater specific scientific books – “**Protecting Groundwater for Health**”

[http://www.who.int/water\\_sanitation\\_health/publications/protecting\\_groundwater/en/](http://www.who.int/water_sanitation_health/publications/protecting_groundwater/en/)

WHO has been active for many years on Nitrate, Fluoride and Arsenic in groundwater globally (especially arsenic in Bangladesh) and produced comprehensive reports available via the WHO website.



### GROUNDWATER TOPICS

#### Climate change

- Adaptation to climate change •

#### Natural disasters, conflicts & human rights

- Human right to safe drinking water •

#### Governance, water law and transboundary water

- SDGs •

#### Groundwater and environment

- Ammonia in groundwater •

#### Sanitation, health and pollution

- Arsenic contamination/removal •
- Chloride in groundwater •
- Coastal aquifers •
- Contamination control •
- Groundwater management for refugee camps •
- Groundwater quality risk •
- Groundwater treatment •
- Human right to safe drinking water •
- Iron concentration •
- Pollution - nitrate •
- Pollution by pesticides and fertilizers •
- Recycling wastewater •
- Salinization •
- Selenium in groundwater •
- Sulphate in groundwater •
- Uranium in groundwater •
- WASH •
- Waste water and contamination •
- Groundwater quality •

### MAIN ACTIVITIES

- Assessment •
- Capacity building •
- Policy development/support •
- Awareness raising •
- Events •





# WMO

## WORLD METEOROLOGICAL ORGANIZATION

HQ: Geneva, Switzerland

Website: [www.wmo.int](http://www.wmo.int)

UN-WATER MEMBER

WMO is the UN system's authoritative voice on the state and behaviour of the Earth's atmosphere, its interaction with the land and oceans, the weather and climate it produces and the resulting distribution of water resources. WMO's Hydrology and Water Resources Programme (HWRP) is concerned with the assessment of the quantity and quality of water resources, both surface and groundwater, in order to meet the needs of society, to permit informed water resources management, mitigation of water-related hazards, and to maintain or enhance the condition of the global environment.

## WMO & GROUNDWATER

### GROUNDWATER TOPICS

#### Climate Change

- Droughts
- Adaptation to climate change

#### Natural disasters, conflicts & human rights

- Groundwater security

#### Governance, water law and transboundary water

- SIDS
- Governance
- IWRM
- SDGs

#### Groundwater and Environment

- Biodiversity and Ecosystems

#### Groundwater in settlements

- Sustainable cities

#### Food and energy nexus

- Nexus water-energy-food

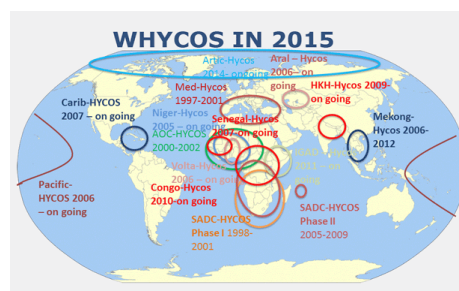
### MAIN ACTIVITIES

- Assessment
- Capacity building
- Information management
- Policy development/support

WHYCOS (World Hydrological Cycle Observing System) projects aim at improving the capacity of National Hydrological Services to collect, analyze, archive and manage hydrological data and to produce water related information meeting the knowledge requirements of stakeholders. In this framework, automatic multi-parameter sensors for groundwater monitoring (depth of water table, and basic physio-chemical parameters) have been installed.

Among others, capacity building on groundwater is concentrated at small Island Developing States (SIDS) groundwater, often from very shallow aquifers, represents the main source of water supply. Extreme hydro-meteorological events as well as the natural climatic variability and socio-economic change affect groundwater resources and their impacts needs to be assessed and forecast.

For example, a workshop has been co-organized with IGRAC in 2016 to review the state of groundwater resources and monitoring in the Pacific SIDS, identify critical challenges and development needs and possible solutions in the context of SDGs.



Groundwater issues are addressed in WMO technical publications: a general introduction to groundwater hydrology, methods of observation and modelling is provided in the Guide to Hydrological Practices (WMO No. 168) while more detail on specific topics are dealt

with in other in other publications such as the Flood Management Tool Series.



HQ: Washington, USA

Website: [www.worldbank.org](http://www.worldbank.org)

UN-WATER MEMBER

The World Bank is an international financial institution that provides loans to countries of the world for capital programs. It comprises two institutions: the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA). Together, IBRD and IDA provide financing, policy advice, and technical assistance to governments of developing countries. IDA focuses on the world's poorest countries, while IBRD assists middle-income and creditworthy poorer countries.

## WORLD BANK & GROUNDWATER

### GROUNDWATER TOPICS

#### Climate Change

- Droughts
- Adaptation to climate change

#### Governance, water law and transboundary water

- Groundwater management
- Governance
- IWRM

#### Groundwater in settlements

- Urban development & water management
- Rural development

#### Food and energy nexus

- Irrigation

#### Economics

- Economics

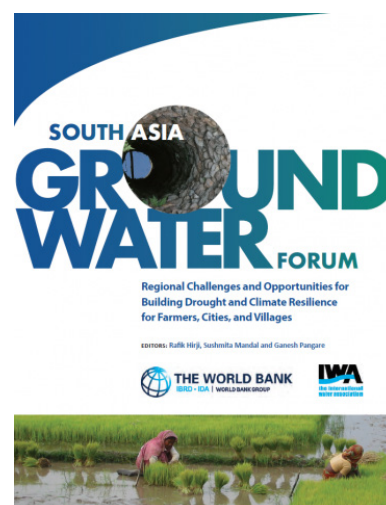
The World Bank addresses various groundwater topics including quality, governance, rural and urban development, climate change, IWRM, groundwater economics, and irrigation, among others. Some examples are provided below.

In close cooperation with the World Bank, Southern African Development Community (SADC) recently established the Groundwater Management Institute (GMI) as a regional center of excellence for the sustainable management of groundwater.

World Bank was one of the executing partners of the 'GEF project Groundwater Governance - A Global Framework for Action' (2011-2016)

[www.groundwatergovernance.org](http://www.groundwatergovernance.org).

'Water and Climate Change: Impacts on Groundwater Resources and Adaptation Options' has been prepared as a special paper for the World Bank flagship on Climate Change and Water. It summarizes a comprehensive report that: (a) characterizes the impact of current and projected hydrologic variability and Climate Change on groundwater, (b) develops a Methodology for Assessing Vulnerability and Risk in Groundwater Dependent Water Systems to Hydrological Variability and Climate Change and (c) presents four developed nation case studies from Australia, Europe, or the United States.



'The Full Economic Cost of Groundwater Extraction' is a Policy Research Working Paper containing an analytical framework for describing the characteristics of economically efficient groundwater management plans, and includes a discussion of electricity pricing modification to improve efficiency in both power and water use.

In the period of 2000-2010, the Groundwater Management Advisory Team (GW-MATE) provided an original and very valuable contribution to the understanding of groundwater in general, including mitigation of groundwater-related problems and sustainable groundwater use. As a part of the Water Partnership Program, GW-MATE produced Briefing Notes, Case Profiles and Strategic Overview Series

(see <https://www.un-igrac.org/special-project/gw-mate>).

### MAIN ACTIVITIES

- Assessment
- Capacity building
- Information management
- Policy development-support
- Awareness raising
- Events

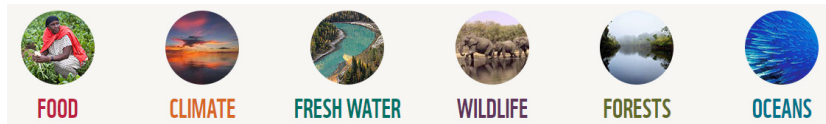




WWF is an international non-governmental organization working in the field of the wilderness preservation, and the reduction of human impact on the environment.

## WWF & GROUNDWATER

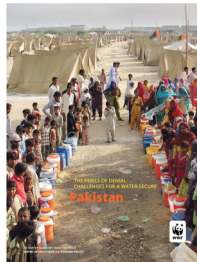
The entire WWF Network focuses on six major goals - forests, oceans, wildlife, food, climate & energy, and freshwater - and three key drivers of environmental problems – markets, finance and governance. Together with existing and new partners, WWF drives powerful and influential partnerships, innovative solutions, sustainable financing, in-depth monitoring and large-scale mobilization of people.



### EXAMPLES OF WWF'S GROUNDWATER ACTIVITIES

The perils of denial: challenges for a water-secure Pakistan.

A WWF publication about Pakistan's water security crisis and its serious social and economic repercussions.



### GROUNDWATER TOPICS

#### *Climate change*

- Droughts •
- Adaptation to climate change •

#### *Natural disasters, conflicts & human rights*

- Groundwater security •

#### *Governance, water law and transboundary water*

- Diplomacy / governance - water convention •
- Groundwater security •
- Governance •
- Groundwater mapping •

#### *Groundwater and Environment*

- Biodiversity and ecosystems •
- Depletion •
- Karst Aquifers •
- Groundwater quality •
- Water risk / stress •

#### *Groundwater in settlements*

- Coastal Aquifers •

#### *Sanitation, health and pollution*

- Pollution by pesticides and fertilizers •

### MAIN ACTIVITIES

- Assessment •
- Capacity building •
- Policy development-support •
- Awareness raising •





## CAWST

CENTRE FOR AFFORDABLE WATER AND SANITATION TECHNOLOGY

HQ: Calgary, Canada  
Website: [www.cawst.org](http://www.cawst.org)

UN-WATER PARTNER

CAWST is a Canadian charity and licensed engineering firm, which teaches people how to get safe drinking water, sanitation and hygiene in their own homes, using simple, affordable technologies.

Among others, CAWST produced several technical briefs addressing the topic of groundwater contamination. For instance, the Siting Latrines Technical Brief with the aim of helping project implementers and latrine builders understand the most important factors for siting latrines, including reducing the risk of groundwater contamination. Another one is the Latrines in Challenging Environments brief, including the design of a latrine in places with high groundwater table.

## Conservation International



UN-WATER PARTNER

HQ: Arlington, USA  
Website: [www.conservation.org](http://www.conservation.org)

Conservation International is an American nonprofit environmental organization. Building upon a strong foundation of science, partnership and field demonstration, CI empowers societies to responsibly and sustainably care for nature and global biodiversity, for the well-being of humanity.

One of CI activities is publishing policy papers, like 'Lightening the Lode: A Guide to Responsible Large-scale Mining' and 'Reinventing the Well: Approaches to Minimizing the Environmental and Social Impact of Oil Development in the Tropics'. In both, the risk of groundwater contamination is addressed.



Supported by  
Spain Water  
and IWHR, China

## IAHR

INTERNATIONAL ASSOCIATION FOR HYDRO-ENVIRONMENT ENGINEERING AND RESEARCH

Website: [www.iahr.org](http://www.iahr.org)

UN-WATER PARTNER

IAHR is a worldwide independent organization of engineers and water specialists working in fields related to the hydro-environmental sciences and their practical application. IAHR stimulates and promotes both research and its application, and by so doing strives to contribute to sustainable development, the optimization of world water resources management and industrial flow processes.

The research agenda of IAHR's Groundwater Hydraulics and Management Committee includes among others the topics of groundwater management, groundwater monitoring, groundwater remediation, exchange with surface water and flow modelling.

## ICID

INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE



UN-WATER PARTNER

HQ: New Delhi, India  
Website: [www.icid.org](http://www.icid.org)

ICID is a scientific, technical, international non-profit professional network of experts from across the world in the field of irrigation, drainage, and flood management. ICID mission is to promote sustainable agriculture water management to achieve water secure world free of poverty and hunger through sustainable rural development.

The 2nd World Irrigation Forum in Chang Mai, Thailand, organized by ICID, included the groundwater in relation with agriculture. In the ICID journal on Irrigation and Drainage, thematic papers on this topic are published as well.



**IFAD**  
**INTERNATIONAL FUND FOR AGRICULTURE DEVELOPMENT**



**UN-WATER MEMBER**

HQ: Rome, Italy  
Website: [www.ifad.org](http://www.ifad.org)

IFAD is an international financial institution and a specialized agency of the United Nations that is dedicated to eradicating rural poverty in developing countries.

IFAD works in multiple projects related with the topic of groundwater. For example, in the project Promoting Resilience in Desert Environments (PRIDE), IFAD is exploring the feasibility of investing in renewable energy to pump groundwater in reclaimed land and ease the burden on the declining fossil fuel reserves in Egypt.



**IISD**  
**INTERNATIONAL INSTITUTE FOR SUSTAINABLE DEVELOPMENT**

HQ: Winnipeg, Canada  
Website: [www.iisd.org](http://www.iisd.org)

**UN-WATER PARTNER**

IISD is an independent, non-profit organization that provides practical solutions to the challenge of integrating environmental and social priorities with economic development. Its mission is to promote human development and environmental sustainability.

IISD produces assessment reports, case studies, position papers, and a series of commentaries, among others. The topics of groundwater is addressed for instance in the IISD commentary Prioritizing “No Significant Harm” over “Reasonable and Equitable” in Governance of Aquifers.

**ILO**  
**INTERNATIONAL LABOUR ORGANIZATION**



**UN-WATER MEMBER**

HQ: Geneva, Switzerland  
Website: [www.ilo.org](http://www.ilo.org)

ILO is a tripartite UN agency that brings together governments, employers and workers of 187 Member States. Its main objective is to promote rights at work, encourage decent employment opportunities, enhance social protection and strengthen dialogue on work-related issues.

ILO has produced an advocacy material to support Green Jobs that minimize pollution and protect and restore ecosystems, including remediation of contaminated soil and groundwater.

**IUCN**  
**INTERNATIONAL UNION FOR CONSERVATION OF NATURE**

HQ: Gland, Switzerland  
Website: [www.iucn.org](http://www.iucn.org)

**UN-WATER PARTNER**

IUCN is a membership Union uniquely composed of both government and civil society organizations. It provides public, private and non-governmental organizations with the knowledge and tools that enable human progress, economic development and nature conservation to take place together.

The IUCN Water and Nature Initiative (WANI) has worked with more than 80 partner organizations across the world to demonstrate water management that supports healthy rivers and communities. Part of it is SPRING: managing groundwater sustainably, a guide through technical challenges of groundwater drilling, economic analysis and effective community arrangements.

**IWA****INTERNATIONAL WATER ASSOCIATION****HQ:** London, UK**Website:** [www.iwa-network.org](http://www.iwa-network.org)**UN-WATER PARTNER**

IWA is a non-profit organization and knowledge hub for the water sector. IWA mission is to serve as a worldwide network for water professionals and to advance standards and best practices in sustainable water management.

The Groundwater Management and Remediation Specialist Group provides a unique forum within IWA to address the full range of scientific, technological, managerial and regulatory policy issues emerged over the last two decades in many countries regarding protection, remediation and use of groundwater resource.

**IWRA****INTERNATIONAL WATER RESOURCES ASSOCIATION****UN-WATER PARTNER****HQ:** Nanterre, France**Website:** [www.iwra.org](http://www.iwra.org)

IWRA is an international network of multidisciplinary experts on water resources which facilitates global knowledge sharing of water resources information across disciplines and geographies. It is a non-profit, non-governmental organization, with the purpose of improving the management of water resources.

Since 1973, every three years IWRA organizes a congress on advanced water resources knowledge, policy and management around the world. The World Water Congress "Bridging Science and Policy" held in 2017 in Cancun, Mexico, included a special session on Transboundary Water Resources, Surface water and Groundwater Assessment and Management along the Canada-US and Mexico-US borders in North America.

**OHCHR****OFFICE OF THE HIGH COMMISSIONER FOR HUMAN RIGHTS****HQ:** Geneva, Switzerland**Website:** [www.ohchr.org](http://www.ohchr.org)**UN-WATER MEMBER**

OHCHR is a United Nations agency that promotes and protects the human rights guaranteed under international law. OHCHR provides a forum for identifying, highlighting and developing responses to human rights challenges, and act as the principal focal point of human rights research, education, public information, and advocacy activities in the United Nations System.

OHCHR published a white paper Climate Change and the Human Rights to Water and Sanitation, addressing quality problems through groundwater pollution and changing groundwater levels.

**PSI****PUBLIC SERVICES INTERNATIONAL****UN-WATER PARTNER****HQ:** Geneva, Switzerland**Website:** [www.world-psi.org](http://www.world-psi.org)

Public Services International is a global trade union federation representing 20 million workers in 154 countries. PSI represents workers in social services, health care, municipal services, central government and public utilities, and is dedicated to promoting quality public services in every part of the world.

PSI report 'Conflicts, companies, human rights and water - A critical review of local corporate practices and global corporate initiatives' (2012) includes case studies related to groundwater depletion, groundwater risk and human right to safe drinking water.





## RAMSAR

### CONVENTION OF WETLANDS

HQ: Gland, Switzerland  
Website: [www.ramsar.org](http://www.ramsar.org)

UN-WATER PARTNER

The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

Ramsar produced the document 'Guidelines for the management of groundwater to maintain wetland ecological character' in 2005, with the objective of providing general guidance to assist Contracting Parties to understand the interaction between wetlands and groundwater and to develop strategies for impact assessment and sustainable groundwater management in wetlands.

## UN-HABITAT

UNITED NATIONS HUMAN SETTLEMENTS PROGRAMME



UN-WATER MEMBER

HQ: Nairobi, Kenya  
Website: [www.unhabitat.org](http://www.unhabitat.org)

UN-Habitat is a United Nations agency with the mission of promoting socially and environmentally sustainable human settlements development and the achievement of adequate shelter for all.

UN-Habitat hosts URBAN GATEWAY, an online community to help cities and urban practitioners across the world unite to share knowledge and take action for sustainable cities in a rapidly urbanizing world. In this platform, news and assessment reports about the state of groundwater over the world are shared.

UN Habitat produces the series 'Climate Change Vulnerability Assessments' with the objective of estimating the local area vulnerability to potential climate change impacts and providing a context for local government decision makers to develop local climate change adaptation and mitigation plans. Some of the groundwater related topics addressed in these assessment reports are groundwater depletion and coastal aquifers.



## UNISDR

### UNITED NATIONS OFFICE FOR DISASTER RISK REDUCTION

HQ: Geneva, Switzerland  
Website: [www.unisdr.org](http://www.unisdr.org)

UN-WATER MEMBER

UNISDR is a secretariat of the United Nations dedicated to facilitate the implementation of the International Strategy for Disaster Reduction. It coordinates disaster reduction activities among the United Nations and regional organizations, and activities in socio-economic and humanitarian fields.

UN ISDR collaborated in the second phase of the UNESCO-IHP project Groundwater in Emergency Situations (GWES) together with UNESCO International Centre for Water Hazard and Risk Management (ICHARM).

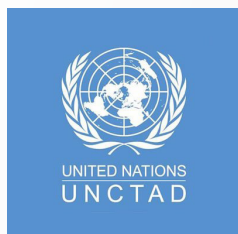
**UN-WATER MEMBER**

HQ: Geneva, Switzerland

Website: [www.unwater.org](http://www.unwater.org)

UN-Water coordinates the efforts of UN entities and international organizations working on water and sanitation issues. One of its key objectives is to provide coherent and reliable data and information on key water trends and management issues. UN-Water informs policy processes by identifying emerging issues and developing effective, collaborative responses.

UN-Water publishes information on water facts including groundwater in a context of climate change, transboundary cooperation and groundwater quality, among others. UN-Water is coordinating Integrated Monitoring Initiative for SDG 6 that includes groundwater in many of SDG6 targets and indicators (e.g. 6.3.2 on ambient water quality, 6.4.2 on water stress and 6.5.2 on transboundary cooperation).

**UNCTAD****UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT**

HQ: Geneva, Switzerland

Website: [www.unctad.org](http://www.unctad.org)**UN-WATER MEMBER**

UNCTAD is a permanent UN intergovernmental body that supports developing countries to access the benefits of a globalized economy more fairly and effectively, by proving analysis, facilitating consensus-building, and offering technical assistance.

UNCTAD shares reports and presentations (own and from external sources) in which topics as diplomacy, governance and food security are addressed in relation to groundwater.

**UNECA**United Nations  
Economic Commission for Africa**UNITED NATIONS ECONOMIC COMMISSION FOR AFRICA****UN-WATER MEMBER**

HQ: Addis Ababa, Ethiopia

Website: [www.uneca.org](http://www.uneca.org)

UNECA is one of the five regional commissions of the United Nations to encourage economic cooperation. Its mandate is to promote the economic and social development of its member States, foster intra-regional integration, and promote international cooperation for Africa's development.

UNECA was involved in publishing of several publications which (also) address groundwater, mainly case studies on various subjects, from inclusive green growth to disaster risk reduction.

**UNICEF****UNITED NATIONS INTERNATIONAL CHILDREN'S EMERGENCY FUND**

HQ: New York, USA

Website: [www.unicef.org](http://www.unicef.org)**UN-WATER MEMBER**

UNICEF is a United Nations program that provides humanitarian and developmental assistance to children and mothers in 190 countries and territories. UNICEF promotes the rights and wellbeing of every child, focusing special effort on reaching the most vulnerable and excluded children.

One of their contribution in the field of groundwater is the publication 'Professional Water Well Drilling: A UNICEF Guidance Note, Cost Effective Boreholes Partnership of the Rural Water Supply Network' (2016), produced by UNICEF and Skat Foundation (available from [www.unicef.org](http://www.unicef.org) and [www.rural-water-supply.net](http://www.rural-water-supply.net)). Its aim is that UNICEF staff and partners who manage or support water well drilling programmes understand what professional groundwater development means and incorporate good practices into programmes and advocacy.

HQ: Vienna, Austria

Website: [www.unido.org](http://www.unido.org)

**UN-WATER MEMBER**

UNIDO is the specialized agency of the United Nations that promotes industrial development for poverty reduction, inclusive globalization and environmental sustainability.

UNIDO, together with the Government of Bangladesh and with the support of the United Nations Trust Fund for Human Security (UNTFHS), has implemented a project to remove arsenic from groundwater in Hajiganj and Shahrasti (Bangladesh, 2006-2008). Another project is the 'Horlivka Chemical Plant remediation', with the aim of assisting the Government of Ukraine to urgently, comprehensively and safely address the issue of toxic pollution and its human health effects caused by the presence of TNT at the Horlivka Chemical Plant, stored in flooded underground tanks leaking into soil and groundwater.

## UNITAR

UNITED NATIONS INSTITUTE FOR TRAINING AND RESEARCH



**UN-WATER MEMBER**

HQ: Geneva, Switzerland

Website: [www.unitar.org](http://www.unitar.org)

UNITAR is a training arm of the United Nations, and has the mandate to enhance the effectiveness of the UN through diplomatic training, and to increase the impact of national actions through public awareness-raising, education and training of public policy officials.

UNITAR organized an online course 'Law of Transboundary Aquifers' with the objective of providing advanced knowledge of the key legal aspects governing the management and the protection of groundwater resources.



## WaterAid

HQ: London, UK

Website: [www.wateraid.org](http://www.wateraid.org)

**UN-WATER PARTNER**

WaterAid is an international organization whose mission is to improve access to clean water, sanitation and hygiene for the poorest and most marginalized people. WaterAid provides clean water, decent toilets and hygiene knowledge to people who don't yet have access to them. WaterAid addresses the topic of groundwater in different ways:

- Through assessment reports, as 'Rainwater harvesting for recharging shallow groundwater'
- Groundwater Quality Information Sheets: prepared for each country in which WaterAid works, with the aim of identifying inorganic constituents of significant risk to health that may occur in groundwater in the country in question.
- Groundwater Information Sheets: prepared in relation to specific human activities of significant concern for the management of groundwater resources and protection of groundwater quality, with the aim of summarizing the characteristics of each activity, describe the risk of each one impacting on groundwater, the possible approaches to their investigation and potential methods of control, mitigation or restoration.



## UN-WATER PARTNER

HQ: Geneva, Switzerland  
Website: [www.waterlex.org](http://www.waterlex.org)

WaterLex is an international non-governmental organization that contributes to sustainable water governance and management through a cycle of research, knowledge training and legal products. Its mission is to secure the human rights to water and sanitation through law and policy reform.

WaterLex produced reports as 'National Human Rights Institutions and Water Governance Compilation Of Good Practices', 'The Human Rights to Water And Sanitation In Courts Worldwide A Selection Of National, Regional And International Case Law' and 'Sustainable Sanitation Systems: Health, Environment and Governance Challenges', which included case studies involving groundwater pollution and over pumping.



## WCCE WORLD COUNCIL OF CIVIL ENGINEERS

HQ: Madrid, Spain  
Website: [www.wcce.biz](http://www.wcce.biz)

## UN-WATER PARTNER

WCCE is constituted as an international non-governmental organization, with the purpose of creating and foster a global platform of civil engineering organizations and particulars, and a forum for the exchange of professional best practices, skills, knowledge, technology and information across the globe addressing the needs and concerns of civil engineers.

WCCE produces the Journal of Applied Water Engineering and Research (JAWER) which includes papers and practical case studies on all aspects of hydro-environmental engineering and research, including groundwater within an engineering context.

## WFP

### WORLD FOOD PROGRAMME



## UN-WATER MEMBER

HQ: Rome, Italy  
Website: [www.wfp.org](http://www.wfp.org)

WFP is the food-assistance branch of the United Nations and the world's largest humanitarian organization addressing hunger and promoting food security. WFP delivers food assistance in emergencies and works with communities to improve nutrition and build resilience.

Regarding its relation to groundwater, WFP supports activities that construct and maintain wells to conserve groundwater and rainwater, as it was done for vulnerable rural and remote Bedouin communities in Egypt.



## WORLD RESOURCES INSTITUTE

## WRI WORLD RESOURCES INSTITUTE

HQ: Washington, USA  
Website: [www.wri.org](http://www.wri.org)

## UN-WATER PARTNER

WRI is a global research non-profit organization that spans more than 50 countries. WRI's mission is to promote environmental sustainability, economic opportunity, and human health and well-being. Its work focuses on six critical issues at the intersection of environment and development: climate, energy, food, forests, water, and cities and transport.

WRI launched in 2013 the Water Risk Atlas, which is part of Aqueduct, an online platform to visualise, map and analyze current and future strain on global water resources. A component of groundwater stress is included. Another similar platform is The India Water Tool, including groundwater availability and groundwater quality standards.



## GROUNDWATER OVERVIEW: MAKING THE INVISIBLE VISIBLE

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Globally, invisible groundwater resources are under increasing pressure due to human activities and climate change. Our response to this pressure is often not adequate, also due to limited awareness of the importance of groundwater resources. This Groundwater Overview is prepared to showcase the essentials and the credentials of groundwater, placed within the broad spectrum of UN-Water Member's and Partner's activities. It is meant to inform about groundwater-related activities, to enhance knowledge exchange and collaboration, and to raise awareness about our most important hidden resource: groundwater.



UN WATER