

# **Initiatives towards sustainable groundwater management**

Data, tools and methodologies for integrated water  
resources management

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*G-WADI Global Conference*

*"G-WADI more than a decade enhancing water  
and sustainable development for arid regions"*

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*Beijing - China*

# Why is information important?

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You can't **manage**  
what you don't **measure**.

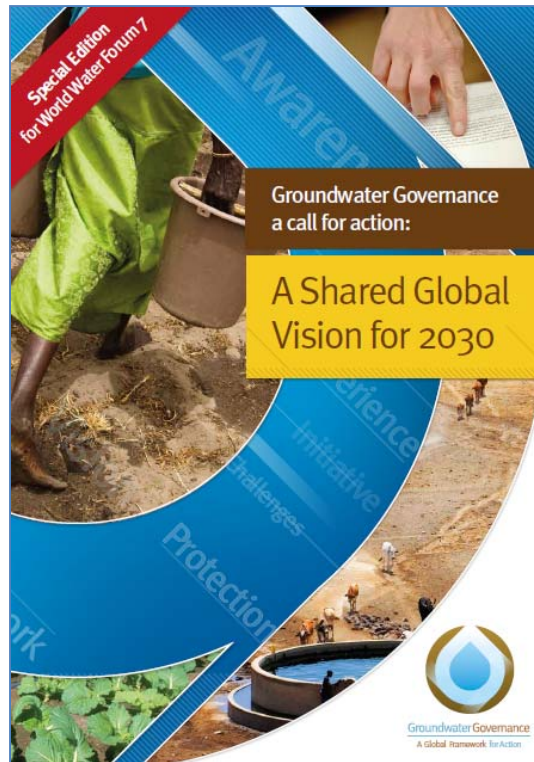
**Information is key to sustainable  
management of groundwater resources!**



# Groundwater governance



GEF Groundwater Governance Programme  
[www.groundwatergovernance.org](http://www.groundwatergovernance.org)



## Groundwater governance – a definition

Groundwater governance comprises the promotion of **responsible collective action** to ensure control, protection and socially-sustainable utilisation of groundwater resources and aquifer systems for the **benefit of humankind and dependent ecosystems**. This action is facilitated by an enabling framework and guiding principles.

# Groundwater governance

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Groundwater governance has four components

- An effective and articulate **legal and regulatory framework**
- **accurate and widely-shared knowledge** of the groundwater systems concerned, together with awareness of the sustainability challenges
- an **institutional framework** characterized by leadership, sound organizations and sufficient capacity, **permanent stakeholder engagement**, and working mechanisms to coordinate between groundwater and other sectors
- **policies, plans**, finances and incentive structures aligned with society's goals

# Tools for sharing data and knowledge & enhance stakeholders engagement

## Global Groundwater Monitoring Network

GGMN is a **participative**, web-containing **measurements** and based **network of networks**, **aggregated** estimations



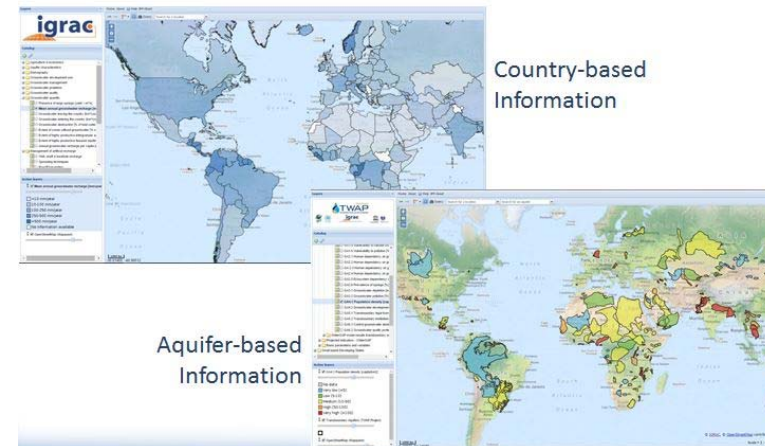
GGMN People Network



GGMN Portal

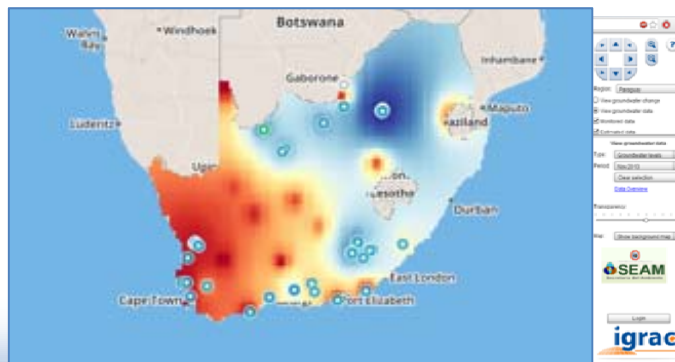


## Global Groundwater Information System



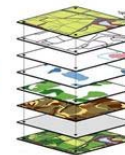
## GGMN Portal: Storage, Processing, Visualisation

Spatial Interpolation, aggregation and time series analysis

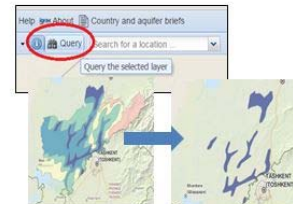


## GGIS - Functionalities

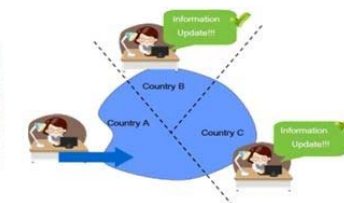
Generate new information by making overlays of thematic maps



Use of WMS - Web Mapping Service



Analyze data by using filters / queries





# Global Groundwater Information System

## Themes



### Transboundary groundwater

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



### Global Country Data

The modules within the Global Country Data section provide information on country level rather than aquifer level. The Global Overview provides a...



### Project Related Information

Within several projects, IGRAC has not only contributed to the groundwater assessment, but also provided a project Information Management System (IMS...



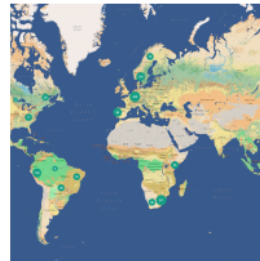
### Managed Aquifer Recharge

To increase its availability and facilitate continuous update, the global MAR inventory is made available free of charge on a web-based GIS platform...



### Small Islands

Small Island Developing States (SIDS) have special physical, demographic and economic features. Their very reduced areas, shortage of natural...



### Groundwater monitoring

Groundwater resources are vital for drinking water supply, irrigation, the sustainability of wetlands and rivers as well as many other important...



### Meta Information Module

documents, people and organizations



International Groundwater Resources Assessment Centre

<https://ggis.un-igrac.org>

# TWAP TBAs in numbers

## Global Inventory :

199 Aquifers (mostly > 5000 km<sup>2</sup>)

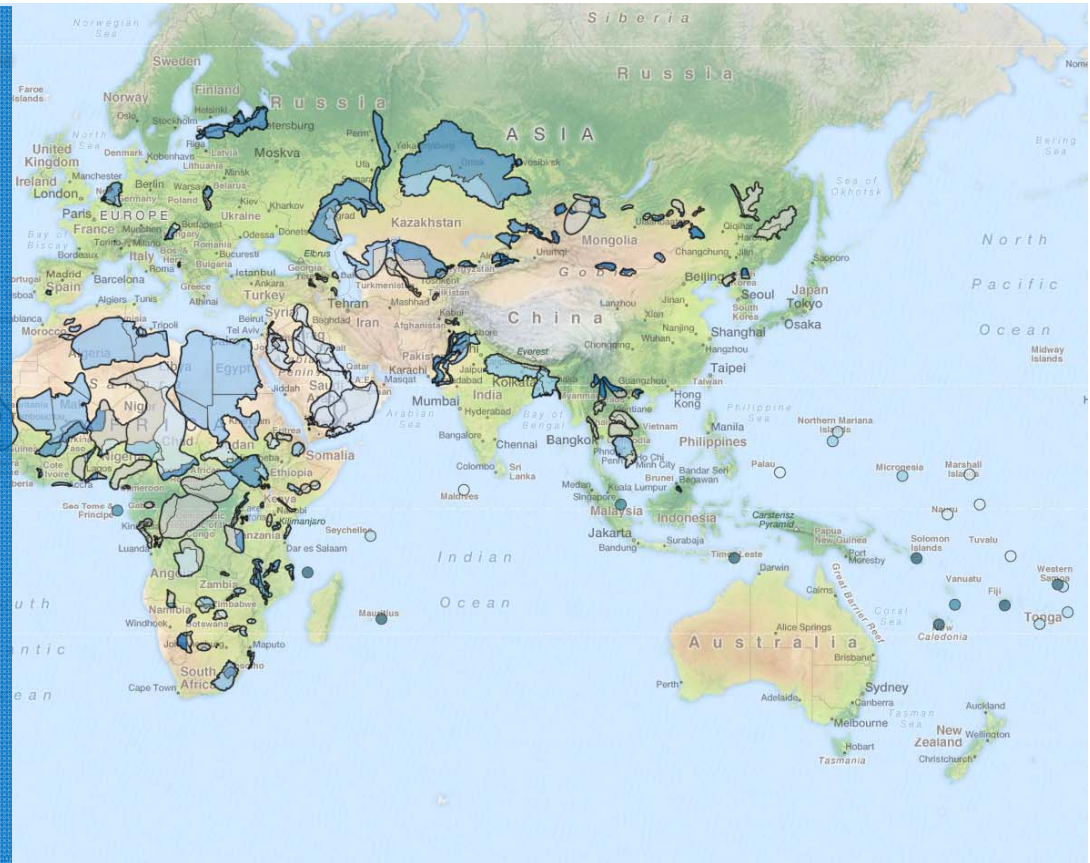
502 Country segments

126 Countries

+ 200 Experts from 76 countries  
contributed

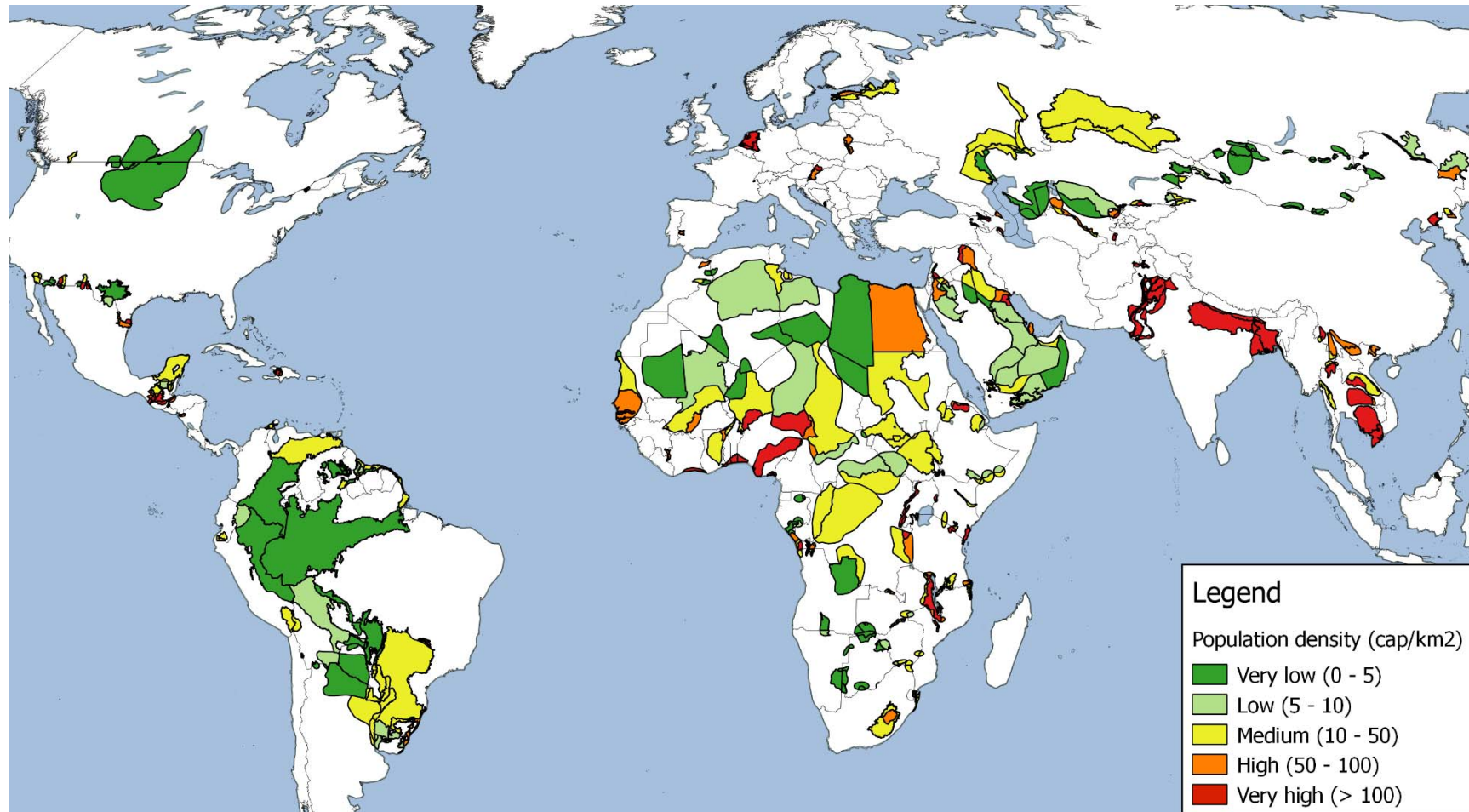
## WaterGAP model study:

91 Aquifers (TBAs > 20,000 km<sup>2</sup>)



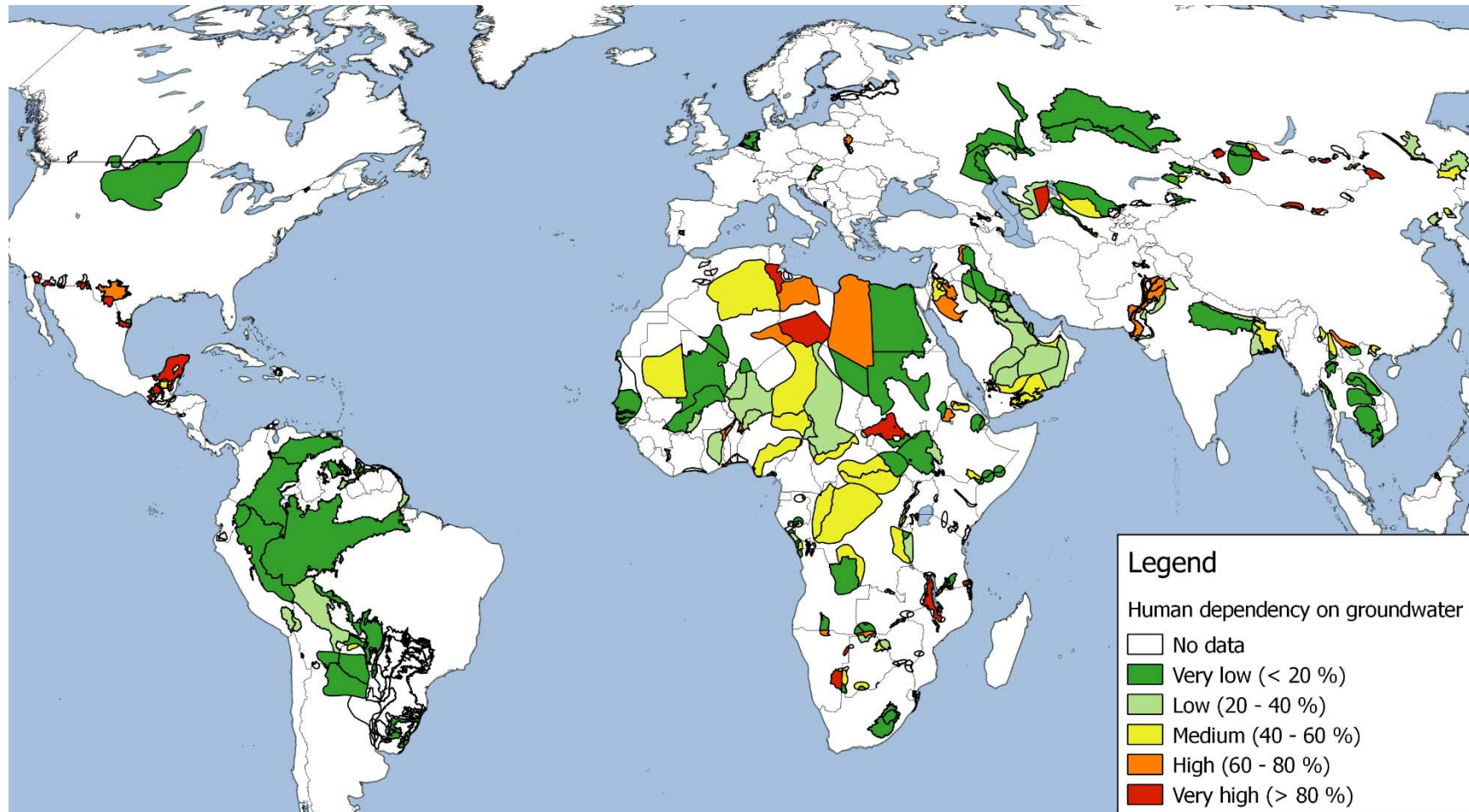


# Indicators: Population density

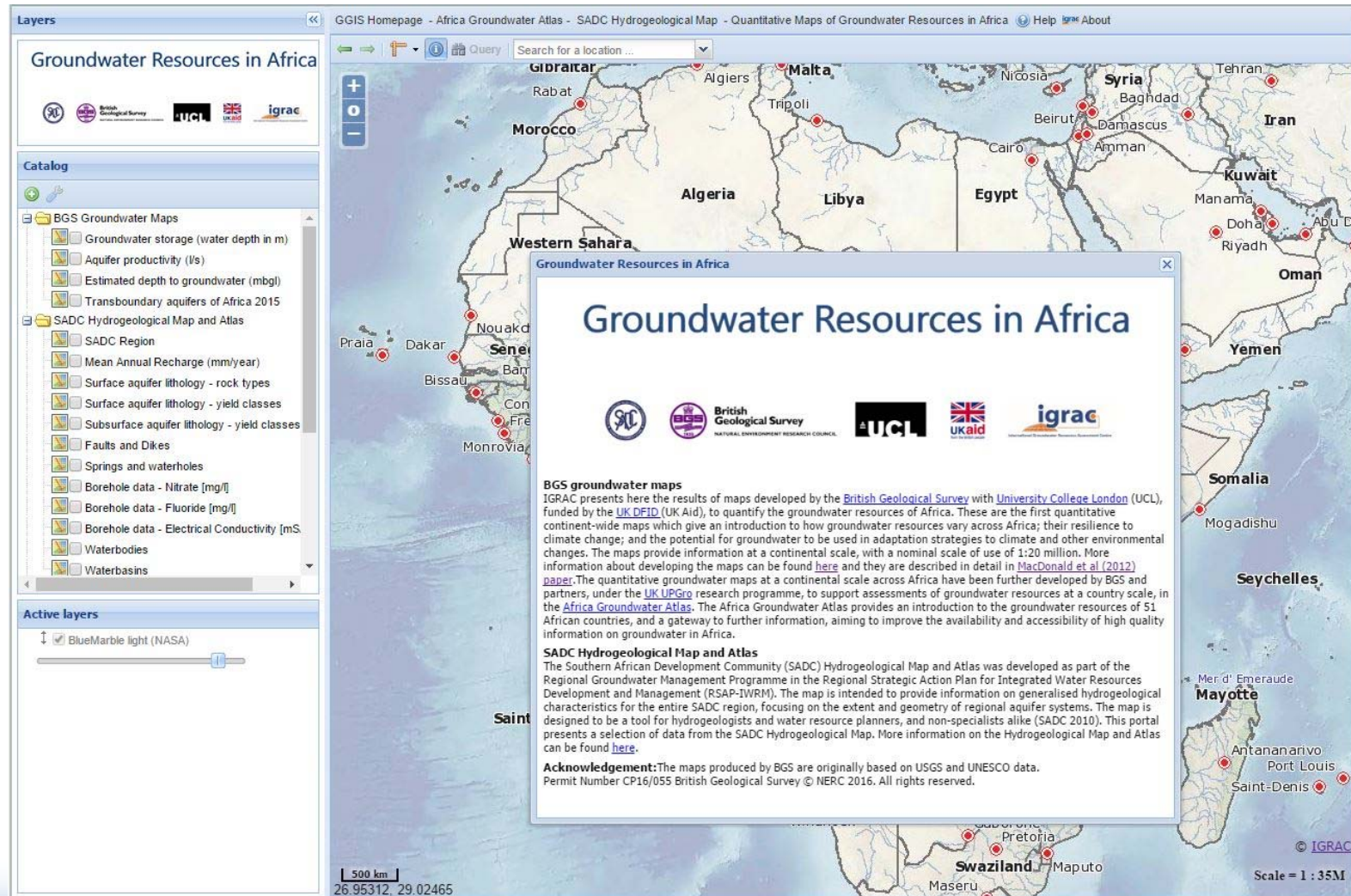




# Indicators: Human dependency on groundwater



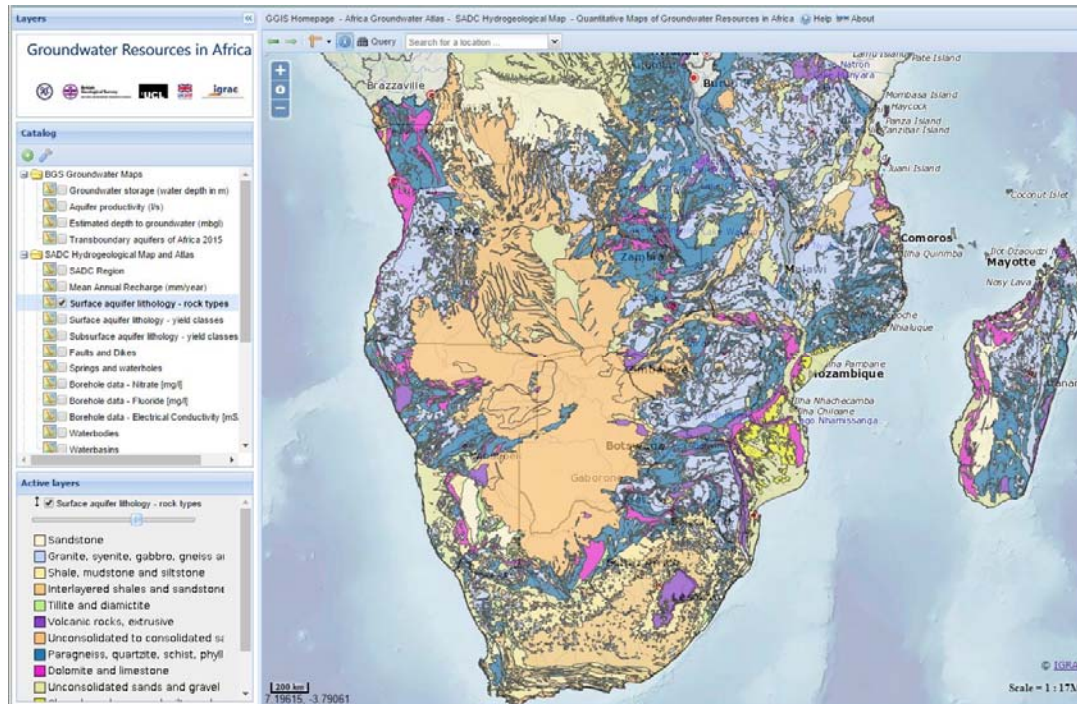
# Groundwater resources in Africa



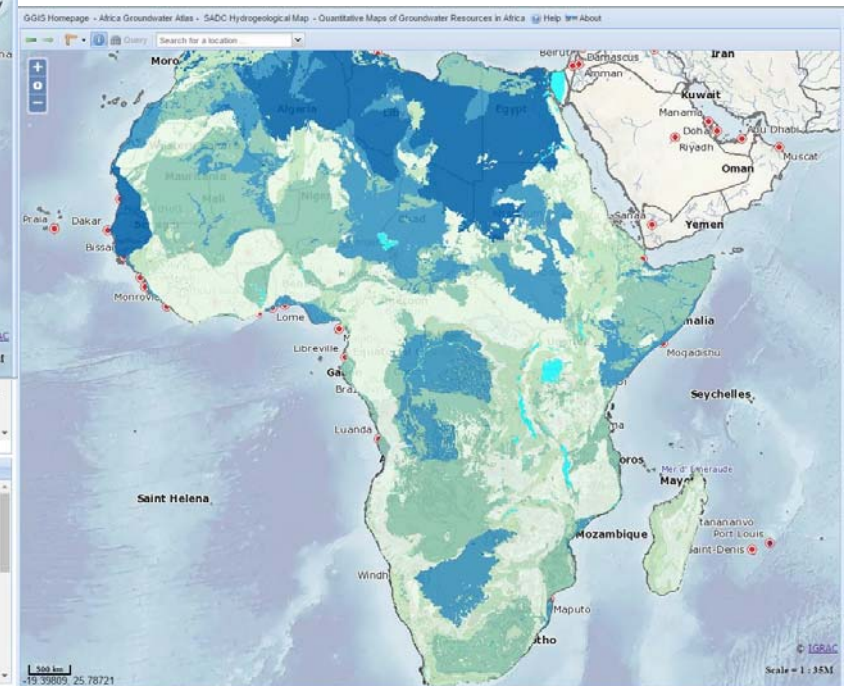


# Groundwater resources in Africa

## BGS Groundwater maps Groundwater storage



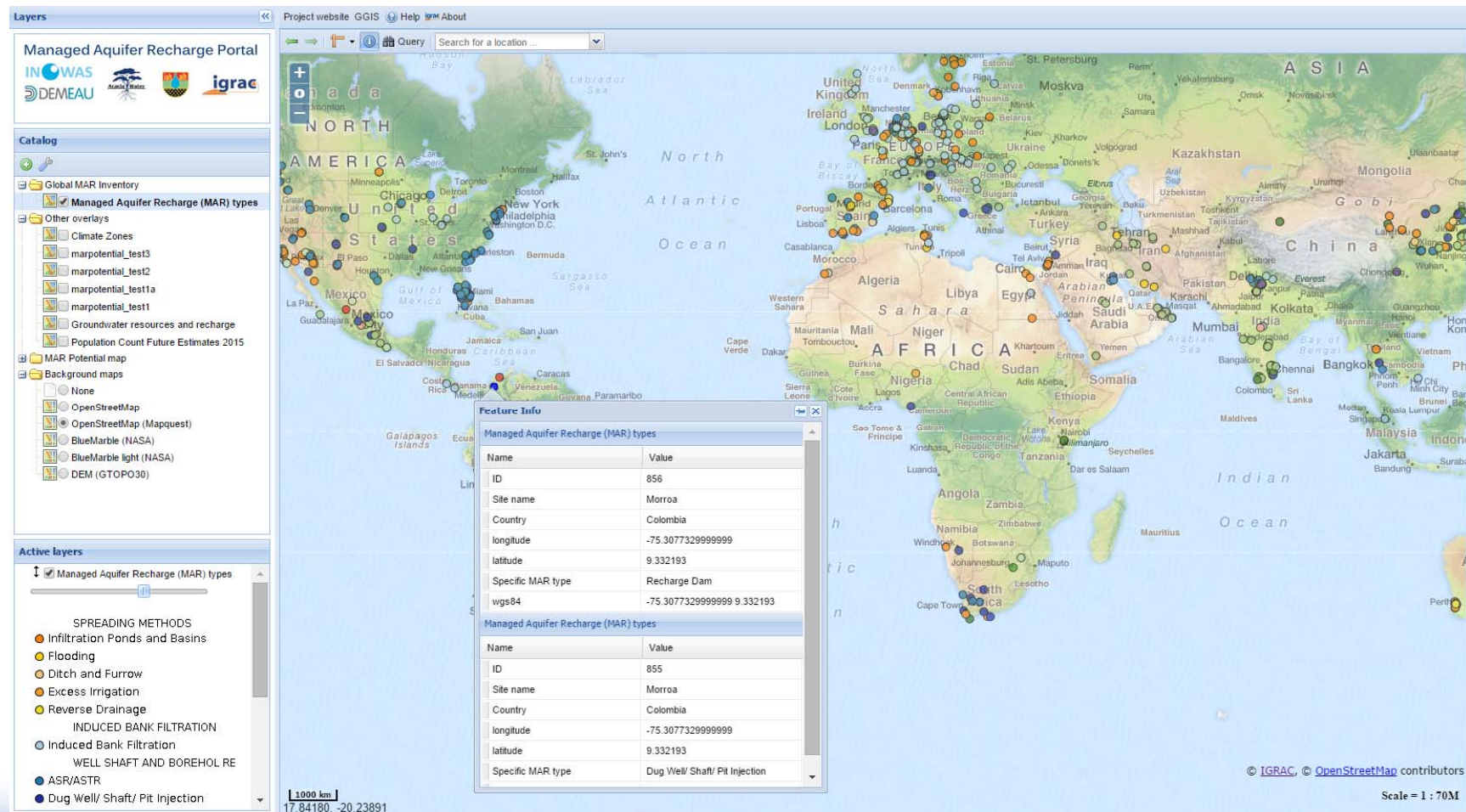
SADC hydrogeological maps  
Lithology map



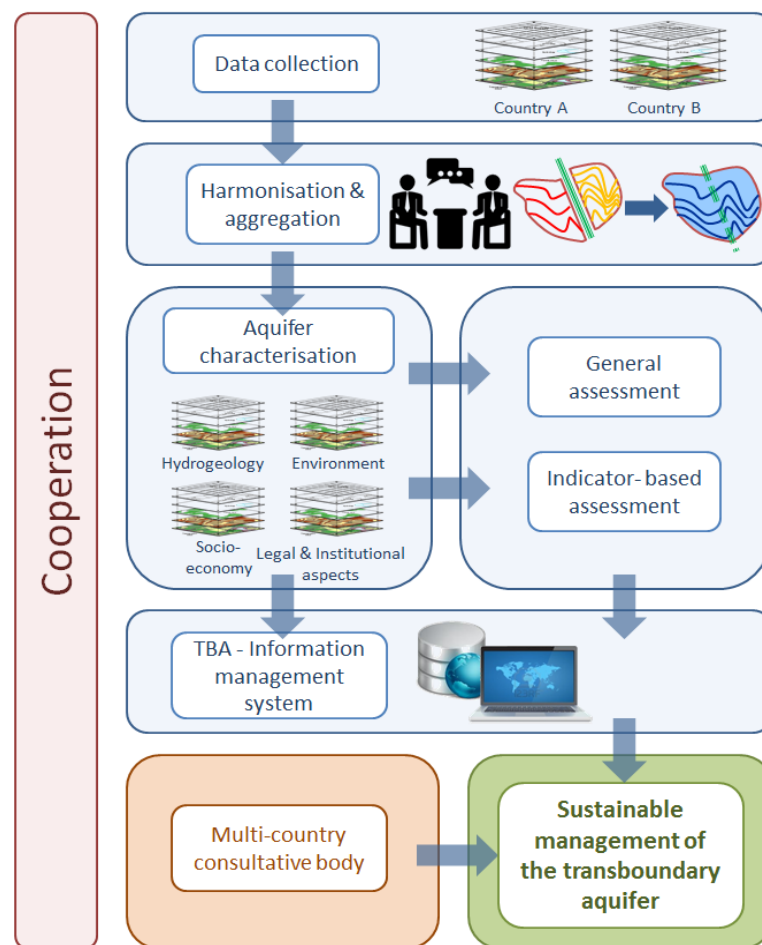


# MAR Portal

- Global MAR Inventory of locations where MAR techniques have been applied



# Methodology for transboundary aquifer assessment



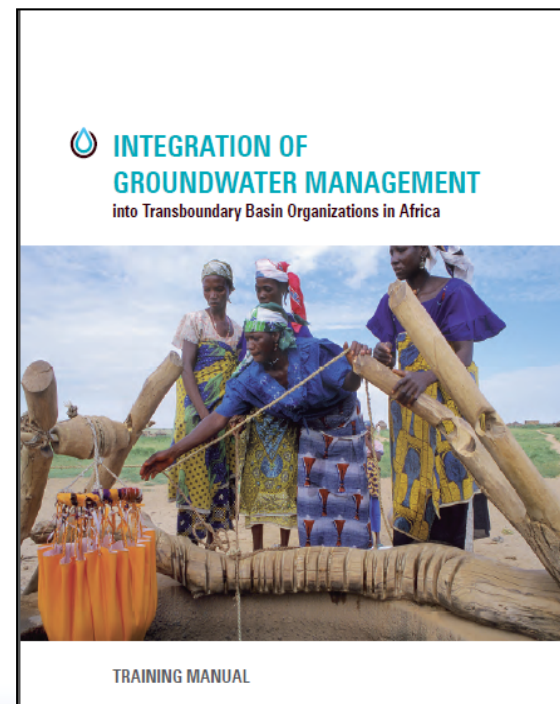
# 10 core indicators from the TBA methodology

Thematic cluster	Core Indicators
QUANTITY	<ul style="list-style-type: none"><li>• Groundwater recharge depth</li><li>• Groundwater depletion</li></ul>
QUALITY	<ul style="list-style-type: none"><li>• Groundwater natural background quality</li><li>• Groundwater pollution</li></ul>
SOCIO-ECONOMIC	<ul style="list-style-type: none"><li>• Population density</li><li>• Renewable groundwater per capita</li><li>• Human dependence on groundwater</li><li>• Groundwater development stress</li></ul>
GROUNDWATER GOVERNANCE	<ul style="list-style-type: none"><li>• Transboundary legal framework</li><li>• Transboundary institutional framework</li></ul>



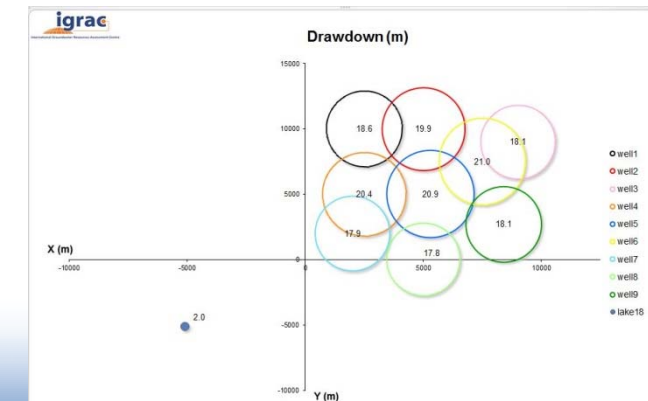
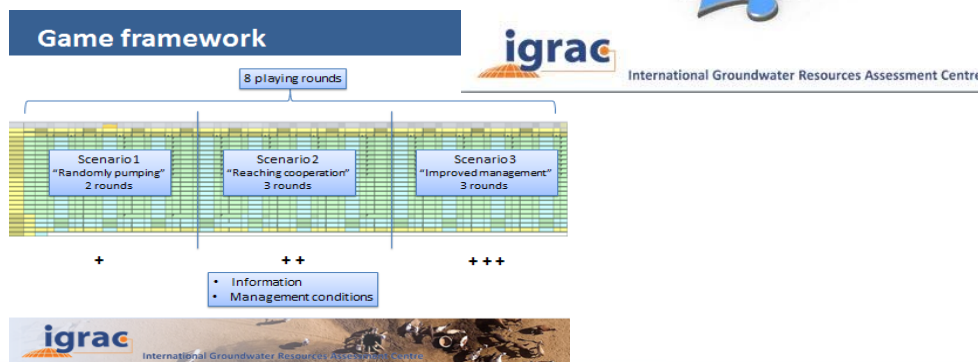
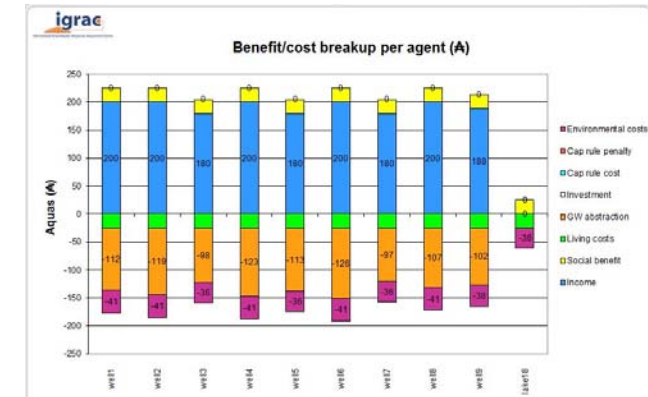
# Capacity building & knowledge sharing

- Advanced Groundwater monitoring training in cooperation with UNESCO-IHE
- Course on Groundwater in River Basin Organizations



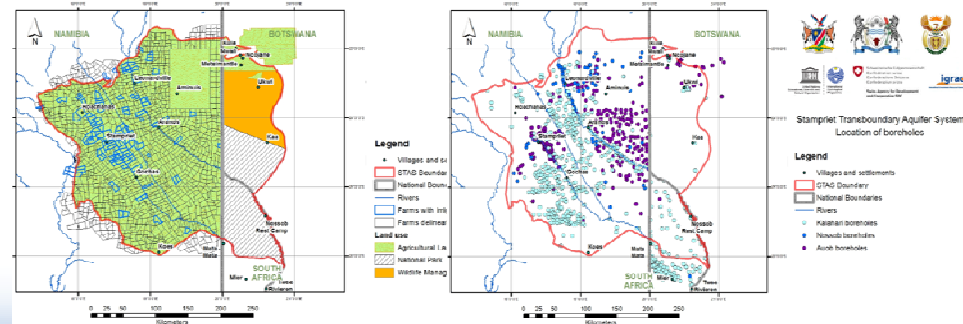
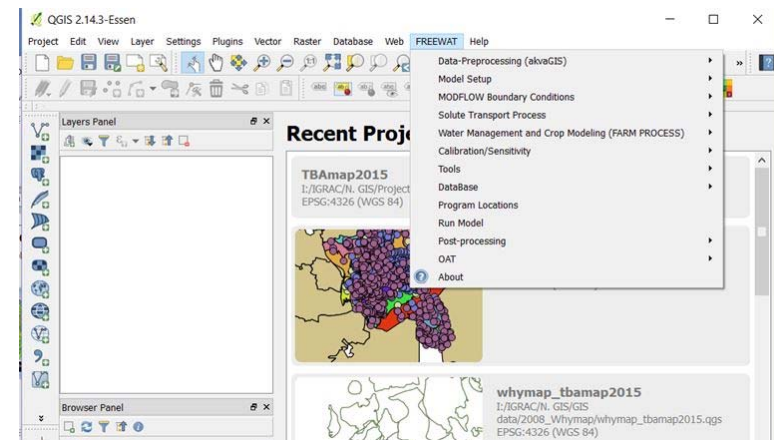
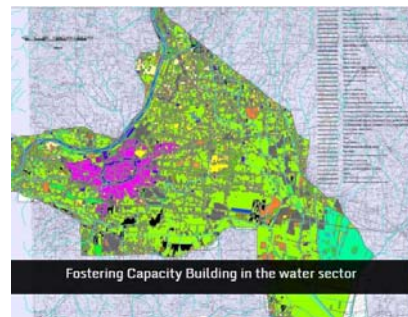
# Capacity building & knowledge sharing

- Groundwater Serious Game – tool to open up the discussion on management of shared resources



# Capacity building & knowledge sharing

- Groundwater modelling tools integrated in QGIS – FREEWAT – Free and Open Source Water Management





# Project overview

- **ISARM** – Internationally Shared Aquifer Resources Management



- **TWAP** – Transboundary Water Assessment Program



- **DIKTAS** – Karst Aquifers in Balkan



- **GGRETA** with 3 case study (Pretashkent, Stampriet Trifinio)



- **GROFUTURES** project in Sub-Saharan Africa (UPGRO)



- **FREEWAT** project H2020



- **Transboundary Aquifers of the World Map**



- **Assessment Methodology**



# *Thank you for your attention!*



International Groundwater Resources Assessment Centre

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United Nations  
Educational, Scientific and  
Cultural Organization



International  
Hydrological  
Programme



World Meteorological  
Organization



Government of  
The Netherlands

# Information exchange in the Law of TBAs

## UN Draft articles on the Law of Transboundary Aquifers

### Article 8 - Regular exchange of data and information

1. ... aquifer States shall, on a regular basis, exchange readily available data and information on the condition of their transboundary aquifers.....
2. ....aquifer States concerned shall employ their best efforts to collect and generate more complete data and information ..... They shall take such action individually or jointly and, where appropriate, together with or through international organizations.
3. ...
4. Aquifer States shall, where appropriate, employ their best efforts to collect and process data and information in a manner that facilitates their utilization by the other aquifer States to which such data and information are communicated.