Initiatives towards sustainable groundwater management

Data, tools and methodologies for integrated water resources management

Daniela Benedicto van Dalen,

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Why is information important?

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

Information is key to sustainable management of groundwater resources!
Groundwater governance

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 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-based network of networks, containing measurements and aggregated estimations.

GGMN Portal: Storage, Processing, Visualisation
Spatial interpolation, aggregation and time series analysis

Global Groundwater Information System
Country-based Information
Aquifer-based Information

GGIS - Functionalities
- Generate new information by making overlays of thematic maps
- Use of WMS - Web Mapping Service
- Analyse 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

https://ggis.un-igrac.org
Global Inventory:

199 Aquifers (mostly > 5000 km²)

502 Country segments

126 Countries

+ 200 Experts from 76 countries contributed

WaterGAP model study:

91 Aquifers (TBAs > 20,000 km²)
Indicators: Population density

Legend
- Very low (0 - 5)
- Low (5 - 10)
- Medium (10 - 50)
- High (50 - 100)
- Very high (> 100)
Indicators: Human dependency on groundwater
Groundwater resources in Africa

Groundwater Resources in Africa

Catalog

- BGS Groundwater Maps
  - Groundwater storage (water depth in m)
  - Aquifer productivity (in)
  - Estimated depth to groundwater (mdag)
  - Transboundary aquifers of Africa 2015
  - SADC Hydrogeological Map and Atlas
    - SADC Region
    - Mean Annual Discharge (mm/year)
    - Surface aquifer thickness - rock types
    - Surface aquifer thickness - yield classes
    - Faults and Dikes
    - Springs and waterfalls
    - Boresite data - 4km (kmsq)
    - Boresite data - Fluorescence (kmsq)
    - Boresite data - Electrical Conductivity (kmsq)
    - Waterbodies
    - Waterways

Active layers

- Blended visible light (NASA)

Groundwater Resources in Africa

BGS groundwater maps

BGS presents here the results of maps developed by the British Geological Survey with University College London (UCL), funded by the UK DECC, to quantify the groundwater resources of Africa. These are the first quantitative continental-scale maps which give an introduction to how groundwater resources vary across Africa; their resilience to climate change; and the potential for groundwater to be used in adaptation strategies to climate and other environmental changes. The maps provide information at a continental scale, with a nominal scale of use of 1:20 million. More information about developing the maps can be found here and are described in detail in Howarth et al. (2013).

The quantitative groundwater maps at a continental scale across Africa have been further developed by IGRAC and partners, under the UN/ISDR research programme, in support assessments of groundwater resources at a country scale, in the Africa Groundwater Atlas. The Africa Groundwater Atlas provides an introduction to the groundwater resources of 31 African countries, and a gateway for further information, aiming to improve the availability and accessibility of high-quality information on groundwater in Africa.

SADC Hydrogeological Map and Atlas

The Southern Africa Development Community (SADC) Hydrogeological Map and Atlas was developed as part of the Regional Groundwater Management Programme (RGMP) in the Regional Strategic Action Plan for Integrated Water Resources Development and Management (RIWARM). The map is intended to provide information on generalised hydrogeological characteristics for the entire SADC region, focusing on the extent and geometry of regional aquifer systems. The map is designed to be a tool for hydrologists and water resource planners, and non-specialists alike (SADC 2013). This portal presents a selection of data from the SADC Hydrogeological Map. More information on the Hydrogeological Map and Atlas can be found here.

Acknowledgements

The maps produced by BGS are originally based on USGS and UNESCO data. Permit Number CP16/003 British Geological Survey © NERC 2016. All rights reserved.
Groundwater resources in Africa

SADC hydrogeological maps
Lithology map

BGS Groundwater maps
Groundwater storage

International Groundwater Resources Assessment Centre
MAR Portal

- Global MAR Inventory of locations where MAR techniques have been applied
Methodology for transboundary aquifer assessment

Cooperation

Data collection

Harmonisation & aggregation

Aquifer characterisation

General assessment

Indicator-based assessment

TBA - Information management system

Sustainable management of the transboundary aquifer

Multi-country consultative body

Country A

Country B

Hydrogeology

Environment

Socio-economy

Legal & institutional aspects

Draft Version

September 2015

Guidelines for Multidisciplinary Assessment of Transboundary Aquifers

IGRAC

International Groundwater Resources Assessment Centre
10 core indicators from the TBA methodology

<table>
<thead>
<tr>
<th>Thematic cluster</th>
<th>Core Indicators</th>
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| QUANTITY                  | • Groundwater recharge depth  
|                           | • Groundwater depletion                                                        |
| QUALITY                   | • Groundwater natural background quality  
|                           | • Groundwater pollution                                                        |
| SOCIO-ECONOMIC            | • Population density  
|                           | • Renewable groundwater per capita  
|                           | • Human dependence on groundwater  
|                           | • Groundwater development stress                                                |
| GROUNDWATER GOVERNANCE    | • Transboundary legal framework  
|                           | • Transboundary institutional framework                                          |
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!

Daniela Benedicto van Dalen
daniela.benedicto@un-igrac.org
www.un-igrac.org
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.