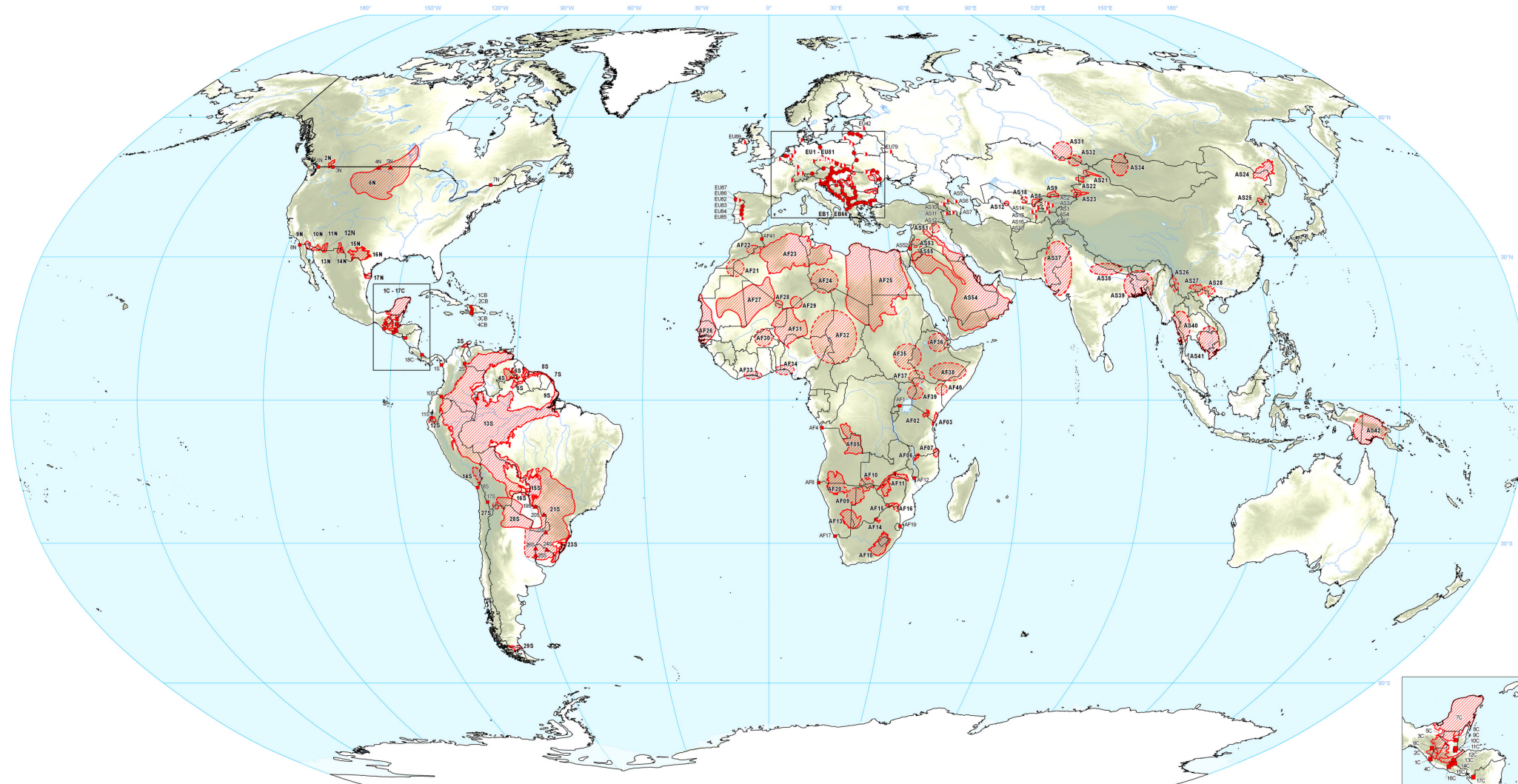


Transboundary Aquifers of the World - Update 2009 -



Legend

Transboundary Aquifers

Aquifer occurrence and extent

- AF21 aquifer extent
- confirmed boundary
- - - approximate boundary
- small aquifer(s) with confirmed boundary
- ▲ superimposed aquifers

Aquifer occurrence

- aquifer confirmed by all countries involved
- aquifer confirmed by at least one country

Geographic elements

- political borders
- lakes
- rivers

Elevation

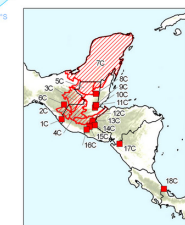
- ~ 8 km
- ~ 0 km (sea level)

Prepared by
IGRAC
Editor in chief: Neno Kukuric
Cartographic editing/GIS: Cheryl van Kempen, Josef Reckman

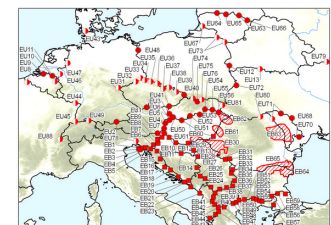
Base maps
Country borders: <http://thematicmapping.org>
Rivers and lakes: ESRI (2009)
Elevation: Amante, C. and B. V. Eakins, ETOPO1
1-Arc-Minute Global Relief Model: Procedures,
Data Sources and Analysis, National Geophysical
Data Center, NESDIS, NOAA, U.S. Department of
Commerce, Boulder, CO, August 2008.

Map projection
Robinson projection, geographic coordinates,
spheroid WGS84, longitude of central meridian 0°.

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Scale 1 : 25 000 000
Central America



Scale 1 : 25 000 000
Europe

Special Edition
for the 5th World Water Forum,
Istanbul, March 2009

Scale 1 : 50 000 000

TRANSBOUNDARY AQUIFERS OF THE WORLD

UPDATE 2009 - 1:50 000 000

Special Edition for the 5th World Water Forum, Istanbul

March 2009

TRANSBOUNDARY AQUIFER ACTIVITIES AT IGRA

The assessment of global groundwater resources is one of the core activities of the International Groundwater Resources Assessment Centre (IGRAC)...

Transboundary aquifers activities at IGRA are carried out in the framework of the ISARM programme, an UNESCO-led multi-agency global initiative for identification, assessment and sound management of internationally-shared groundwater resources.

In the framework of the GEF (Global Environment Facility) UN LEARN project, IGRA set up an international forum on transboundary aquifers, compiled groundwater information from various GEF UN projects and conducted a workshop on transboundary aquifers at the GEF UN conference in Cape Town in 2007.

IGRAC assisted the UN International Law Commission in preparing draft articles for the first global legal agreement on transboundary groundwater.

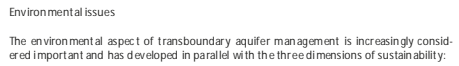
IGRAC assisted the UN International Law Commission in preparing draft articles for the first global legal agreement on transboundary groundwater.

ing hydrogeologically complex formations. Additionally, aquifer-sharing states may come up with various delineation criteria, suggesting for instance hydrological, geological or hydrogeological characteristics as a basis for delineation.

The second group of activities (classification, diagnostic analysis and zoning) provides the stakeholders with information necessary for decision-making...

Finally, data harmonisation and information management are essentially technical activities related to harmonisation of formats, classifications, terminologies, reference systems and levels, software and hardware specifics...

IGRAC assisted the UN International Law Commission in preparing draft articles for the first global legal agreement on transboundary groundwater.



- In the first dimension, the environmental aspect is strongly connected with groundwater resources depletion and the dilemma of compromising the use for future generations...

Externalities are often indirect and hidden and it is therefore hard to determine who caused them, and to what extent. Furthermore, it is often difficult if not impossible to express externalities in monetary terms.

Although hard to answer, these questions show that an inventory of groundwater use, allocation, priorities, valuation and externalities should be standard part of a TBA socio-economic analysis.

Institutional settings

Organisational settings of groundwater management range from state-planned management to collective actions at grass-root level.

Institutionalising transboundary groundwater management is an ongoing process of social learning. It is generally recommended to start this process at a low-profile and low-risk level.

Institutional instruments may be regulatory (like licensing, allocation and property right, laws and binding agreements and policies), economic (subsidies, tradable groundwater use and pollution rights, pricing of groundwater and electricity) or advisory (enabling access to information, expertise, funding and creating awareness, trainings and non-binding agreements).

There is no unique and sharply defined form an institutional structure should take to best facilitate transboundary aquifer management.

It is often said that the large number and dispersed nature of groundwater users complicate monitoring of groundwater use and rule compliance.

MAP COMPILATION AND LABELLING

The map presented here brings together information provided by various organisations and projects dealing with transboundary aquifer assessment and/or management at regional and continental scales.

The guiding principle during the compilation of this TBA map was to stay as close as possible to the information provided by the original sources, while presenting the information as appropriately as possible for the chosen scale of the map.

The TBA map shows aquifer extent (if known), for aquifers with an area larger than 6000 km². Smaller aquifers are represented with squares.

Quite limited information is available on extent of TBAs for some parts of Europe and Asia. Small filled or half-filled circles are used to depict aquifers whose extent is not known.

Table with 3 columns: Information sources, Region, and Source. Lists various geographical regions and their corresponding data sources.

Table with 3 columns: No., Aquifer name, Sharing countries, IGRAC Area (km²), and IGRAC Area (Mha). Lists 238 numbered aquifers and their global distribution.

Table with 3 columns: No., Aquifer name, Sharing countries, IGRAC Area (km²), and IGRAC Area (Mha). Continuation of aquifer list from 239 to 484.

Aquifers do not cross the borders; they were there before the borders (Ester Havranek-Sláglá, 1948 - 2008)

ABOUT THIS MAP

This map is about transboundary aquifers (TBAs). It shows the present state of information regarding the occurrence and extent of TBAs world-wide.

Globally, the vast majority of countries share (individual) aquifers (and/or aquifer systems) with their neighbours.

Cooperation and information exchange among aquifer-sharing States is a prerequisite for appropriate TBA assessment and management.

The back side of the map contains an overview of the main TBAs aspects and the outline of a general assessment methodology.



Developing a framework for closer bi-national cooperation

Region: Americas Countries: Mexico and the USA Aquifers: Santa Cruz (N12) & San Pedro (N13)

High urban growth rates, declining water tables, contamination and an arid environment along the US-Mexico border have made groundwater management an emerging concern for policy-makers in both countries.

Initiator: US Congress - Transboundary Aquifer Assessment Act of 2006 Activity: Four transboundary basins and their associated aquifers are identified for prioritized assessment...

Initiator: US-Mexico Transboundary Aquifer Assessment Program (TAAP) Activity: Through TAAP proposals, water managers and scientists will be able to work towards bi-national priority setting...

Initiator: Internationally Shared Aquifer Resources Management (ISARM) Activity: The Arizona-Sonora portion of the TAAP was recently designated an ISARM case study...

Source: Ms. Sharon Magdal, University of Arizona

From inventory to assessment and management

Region: South Eastern Europe (SEE) Aquifers: All aquifers in the region (EB1 to EB65)

Transboundary aquifer resources play a major role in SEE as sources of freshwater.

Initiator: INWEG and INWEB at the Aristotle University of Thessaloniki, in cooperation with United Nations Economic Commission for Europe (UNECE).

Activity: Inventory of transboundary aquifers in the region

Inventory identified 65 transboundary aquifers in the region, distinguishing two main types: karst aquifers ranging from a few tens to hundreds of square kilometres and alluvial aquifers with greater areal extent.

Initiator: UNECO and GEF Activity: DKTAS (Dinaric Karst Transboundary Aquifer System) project

The project aims to develop a sustainable, integrated management methodology for regional transboundary karst aquifers with the Dinaric Karst Aquifer System as a test case.

Source: UNECO/INWEG, 2007. http://www.inwega.org Source: DKTAS Project 2009: http://dnr.icim.net

Developing a proposal for transboundary groundwater assessment in Southern Africa

Region: Southern Africa Countries: Botswana, Namibia and South Africa Aquifers: Stampriet Kalahari / Karoo (A113)

The Stampriet Kalahari/Karoo Artesian Basin is situated in arid and semi-arid parts of Southern Africa (Kalahari Desert). Total aquifer area in Namibia, Botswana and South Africa is estimated at 146 000 km².

Initiator: ORASEM - Orange-Senqu River Basin Commission (ORASECOM) Activity: In July 2007 a decision was taken to carry out a pilot study of the Stampriet Kalahari/Karoo Artesian Basin.

The major issue for all three countries is to obtain a proper understanding of the resource potential of the aquifer and to establish a sound international water management policy.

Source: Kirchner J., 2008. Stampriet Kalahari/Karoo Aquifer Study along the Namibia-Botswana-South Africa Boundary Area, Draft Project Proposal, SACD

Monitoring for environmental protection

Region: East Asia Countries: China and Russia Aquifer: Helongjiang (A524)

The total area of Middle Helongjiang-Amur river basin amounts to 100 000 km². The Chinese part, called the Sarjanyng plain, has an area of 45 000 km² while the Russian part covers 55 000 km².

Initiator: UNWEP Activity: Joint monitoring program

The groundwater resources of Helongjiang-Amur river basin were evaluated by each country separately, according to their own national standards and methods.

Source: Zehnborg, H. et al. 2006. Transboundary Aquifers in Asia with Special Emphasis to China, UNESCO.

International legal framework

Legal agreements among aquifer-sharing States are usually a part of their institutional arrangements. International laws, protocols and guidelines can be very instrumental in specification of content of legal agreements among two or more states.

All aquifers on the map are presented with a label. For the aquifers of the Americas, labels are exactly the same as used by the Organization of American States (OAS).

References Blum, E., Hollingworth, B. Xu, Y., Nel, M., Mahed, G. & Solomon, H., Protocol for the Assessment of the Status of Sustainable Utilization and Management of Groundwater Resources...

The ILC transmitted the draft articles to the UN General Assembly with the following recommendation:

- To adopt a resolution taking note of the draft articles on the law of transboundary aquifers and to annex these articles to the resolution;

The UN General Assembly adopted on 11 December 2008 the Resolution A/RES/63/124 on the law of transboundary aquifers.

Developing a framework for closer bi-national cooperation

Region: North-Germ any/Neth of the Danube Countries: Germany, Poland, Lithuania, Latvia, Belarus, Estonia, Denmark, Germany, France, Germany, Switzerland

High urban growth rates, declining water tables, contamination and an arid environment along the US-Mexico border have made groundwater management an emerging concern for policy-makers in both countries.

Initiator: US Congress - Transboundary Aquifer Assessment Act of 2006 Activity: Four transboundary basins and their associated aquifers are identified for prioritized assessment...

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Source: UNECO/INWEG, 2007. http://www.inwega.org Source: DKTAS Project 2009: http://dnr.icim.net

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