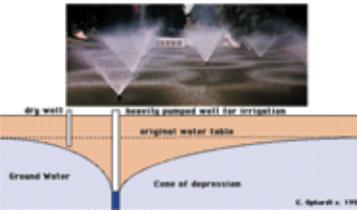


The Invisible Resource Transboundary Aquifers: an Opportunity for International Cooperation*

Groundwater constitutes over 98 percent of the total amount of global freshwater on the planet. It is stored in aquifers located at different depths — from shallow, unconfined aquifers only a few meters deep to confined systems at depths of up to several kilometers. Groundwater is found almost everywhere, in humid as well as arid and semi-arid areas. Some of the world's largest groundwater reserves are located deep under the Sahara and have accumulated from past periods when conditions were more humid.

In Latin America and the Caribbean, groundwater is a vital resource, increasingly playing a strategic role in sustainable development. This role will increase even further in years to come, as water scarcity and increased climatic fluctuations and variability become major global concerns. The Guarani Aquifer System (GAS), for example, constitutes one of the largest reservoirs of groundwater in

EFFECTS OF GROUND WATER "MINING"



Approximately one third of the total water used in arid and semi-arid regions of Latin America comes from groundwater. It provides a major percentage of the drinking supplies and many aquifers are currently being over-exploited. Groundwater is being "mined" beyond the recharge capacity of the aquifers.

AQUIFERS

Aquifers are bodies of permeable rocks where significant quantities of groundwater are stored. They can be open to the surface environment (unconfined), only partially connected to the surface (confined), or totally unconnected (fossil). In natural conditions, aquifers, unconfined and/or confined, are in perfect hydrologic balance with the surface environment. Outflows, such as springs and surface streams, and water-bodies are in equilibrium with inflows from rain-water infiltration in their recharge areas. The quality of the contained water is often very good and can be directly used for human supply. Aquifers are, however, extremely fragile systems. Once depleted or polluted, they may take centuries to recover.

tions, uncontrolled exploitation, and contamination of water sources. In Central, Northern, and Northwestern Mexico, in the Northeastern areas of Brazil, and in the Small Island Developing States of the Caribbean, groundwater is an important source of water to meet human consumption needs. In the state of São Paulo in Brazil, estimates are that 60 percent of urban centers are served totally or partially by groundwater sources — supplying a population of 5.5 million people.

the world, with an area of 1.2 million km² and an estimated storage capacity of 40,000 km³. Nonetheless, the Guarani Aquifer is being threatened by uncontrolled pollution in its extraction and recharge areas.

Groundwater is increasingly at risk at the local level, due to such factors as ever-increasing water-demand of urban mega-conglomera-

In the Americas in general, many of the problems affecting groundwater relate to lack of information. Information, vital to water management, is usually fragmented or unavailable outside of the academic world. The lack of coherent, systematic information affects the political and public perception of this precious but invisible resource, limiting the understanding of its importance to food security and poverty alleviation. This generally translates into fragmented policies and no long-term management strategies.

Notwithstanding these impediments, there is cause for optimism. The scientific and technological basis for groundwater management is available, and improving. Groundwater-related sciences have advanced a general understanding of groundwater systems, allowing for the identification and development of sustainable exploitation strategies. The extension and geometry of aquifers and of their recharge areas can be easily delineated; volumes of stored water can be determined. The physical and chemical characteristics of the stored water, including the tracing of contaminants and their movements, as well as the recharge rate, can be estimated and monitored. More and more Latin American countries are taking into account the scientific advances in the formation of their regulatory frameworks and their strategies for managing water resources, reflecting a desire to face groundwater issues in a more consistent and integrated manner. Moreover, the awareness among citizens and stake-holders continues to grow — thanks to media coverage, public policy programs, and the many educational and

* By Michela Miletto, Senior Environmental Specialist and Roberto Kirchheim, Guarani Project Manager, General Secretariat of the Organization of American States, Unit for Sustainable Development and Environment, with inputs from OAS/USDE staff: Jorge Rucks (Division Chief for South and Central America), Enrique Bello (Assistant Division Chief), Nelson da Franca Ribeiro dos Anjos (General Coordinator for the UNESCO/OAS ISARM Americas Programme). For further information, please email mmiletto@oas.org, sag@sg-guarani.org.

diffusion efforts of national institutions. Due to the increase in public awareness, civil society not only wants to know about these resources and be considered in decision-making, they also demand to be involved in decisions about its current and future use.

Many of the major aquifers in the world are shared between two or more countries. As in any transboundary resource, management of these aquifers could prove a daunting challenge, as it requires collaboration among various levels of land/water management institutions within a country and among the different countries involved. This challenge is compounded by the fact that there are no international conventions specifically addressing transboundary aquifers.¹ Despite the absence of a clear legal framework, in recent years groundwaters have received greater attention in the international community (World Summit on Sustainable Development, Johannesburg, 2002; 3rd World Water Forum, Kyoto, 2003). Moreover, the United Nations International Law Commission (UN ILC) has designated a special sub-committee to review existing laws regarding shared natural resources, with special attention to transboundary aquifers. Similarly, UNESCO is assisting the UN ILC to draft several articles that might form the core of a future convention on transboundary aquifers and their management.

Transboundary aquifers also present opportunities for regional integration and collaboration, including anticipating and avoiding conflicts and competition among water users and preserving the health of water ecosystems and the many services they provide.

OAS AND GROUNDWATERS: EXAMPLES OF REGIONAL COLLABORATION

The Organization of American States (OAS) promotes multi-country resource management, including international groundwater. The OAS

INTEGRATED WATER RESOURCES MANAGEMENT

In 2002, the international community met in Johannesburg at the World Summit on Sustainable Development. One of the key directives of the WSSD Plan of Implementation calls for the development of Integrated Water Resources Management: “The IWRM approach seeks to address a country’s key water related problems – water for health, for food, for energy, for environment – more effectively than it is possible using traditional approaches. It seeks to avoid the lives lost, the money wasted, and the natural capital depleted because of fragmented decision making about developing and managing water resources that did not take into account the larger ramifications of sectoral actions. It aims to ensure that current demand of water is met without jeopardizing the ability of future generations to meet theirs.” (GWP 2004, <http://www.gwpforum.org>)



assists Member States in the efforts to integrate and establish common approaches to implement joint water resources management, including transboundary aquifers. The Sustainable Development and Environment Unit (USDE) plays a leading role in leveraging cooperation among countries, bilateral and multi-lateral donors, International Financing Institutions (IFIs), and the science community, and in executing projects aimed at the application of Integrated Water Resources Management (IWRM) principles and schemes. In particular, the OAS is committed to the full integration of groundwater into land-water resources management and to advancing the sustainable use of America’s numerous transboundary aquifers.

The Project “Framework for the Management of the Water Resources of the La Plata River Basin,” being carried out by the Governments of Argentina, Bolivia, Brazil, Paraguay, and Uruguay seeks to identify joint management priorities and to establish a framework to adapt to increasing risks of major floods and droughts (El Niño events), as well as to prevent contamination from excessive sediment loads in the Plata estuary (see Map above). The project is being supported by the United Nations Environment Program (UNEP) and OAS/USDE, with financial assistance from the Global Environment Facility (GEF). As part of this effort, special funds have been obtained from the Ministry of Environment of Italy to develop a component dedicated to the “Toba -Yrenda’- Chaco Tarijeño Transboundary Aquifer”, located beneath a semi-arid area of the

1. Groundwaters are somewhat marginally included under the term “Watercourse” in the not yet ratified 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses (<http://www.un.org/law/ilc/texts/nonnav.htm>). The Convention defines Watercourse as “a system of surface water and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus”. A previous failed effort, the Bellagio Treaty ([www.ana.gov.br/guarani/gestaio/tratados/The%20Bellagio%20Draft%20Treaty%20\(ingles\).pdf](http://www.ana.gov.br/guarani/gestaio/tratados/The%20Bellagio%20Draft%20Treaty%20(ingles).pdf)) was specifically intended to regulate transboundary groundwaters. While the treaty was never adopted and ratified, its principles nevertheless give some guidance to the international community.

Plata Basin affected by climatic fluctuations and extreme droughts and floods. The joint management of these shared groundwaters will be a strategic component of the overall Plata Basin Management context. Another example of regional collaboration is the Guarani Aquifer System (SAG) Project, the first project in the Americas focusing on transboundary aquifers and one of the first multi-country initiatives being undertaken worldwide. The project continues to attract the attention of the global community as a model of international cooperation towards sustainable water management.

The project is an initiative of the Governments of Argentina, Brazil, Paraguay, and Uruguay, carried out with the collaboration of the World Bank and OAS/USDE; it seeks to delineate and implement a common institutional framework for managing and preserving the Guarani Aquifer for current and future generations. The project is of a preventive nature and focuses on (1) the expansion and consolidation of the current knowledge base, (2) the joint development and implementation of a Guarani Aquifer Management Framework, (3) public participation through an appropriate information and institutional framework, (4) monitoring and evaluation, and (5) implementation of measures to deal with non-point sources of pollution.

Specific funds have been allocated in the Guarani Aquifer Project for strengthening national institutions responsible for groundwater management and for supporting public participation and environmental education initiatives at the regional and local levels. A University Fund finances academic groups investigating particular aspects of the project.

Four Pilot Projects have been designed to prevent the aquifer from being polluted and over-exploited in critical areas like those of the aquifer recharge and discharge. The Pilot Projects promote and support stakeholder and community participation.

OAS/USDE, together with UNESCO's International Hydrologic Programme (IHP), is also helping to coordinate the development and implementation of the "Internationally Shared (Transboundary) Aquifer Resources Management Programme" (ISARM)² in the Americas, which aims to improve the understanding and communication/sharing of scientific, socio-economic, legal, institutional, and environmental issues related to the management of transboundary aquifers.

The UNESCO ISARM Program is expected to culminate in 2006 with the publication of an Inventory of the Transboundary Aquifer Systems of the world, which will be the first effort at a global level to analyze and systematically archive transboundary groundwater data. The Program will also finalize the development of a "Toolkit Package,"

In 2002, the UNESCO and OAS jointly launched the ISARM-Americas Programme, the regional initiative for the American hemisphere, at the International Association of Hydrogeologists / Asociacion Latinoamericana de Hidrogeologia Subterranea para el Desarrollo (IAH/ALHSUD) Congress in Mar del Plata, Argentina.

provide recommendations on best approaches for transboundary groundwater resources management, present lessons learnt from case studies, and propose best practices and guidelines. It will foster the achievement of a common decisional platform by the countries that share transboundary aquifers, including scientific, legal, institutional, socio-economic, and environmental aspects.

RECOGNIZING AMERICAN TRANSBOUNDARY AQUIFERS

Since 2003, OAS/USDE has been working with the American countries to coordinate the exchange of scientific and policy information, in order to assess the prevalence of transboundary aquifers. This cooperation will lead to the creation of a UNESCO/OAS Transboundary Aquifer Inventory for the Americas, as well as identify critical cases for pilot demonstrations. A network of technical experts and decision-makers, selected in each country, has been established to facilitate the dialogue among the Member States. To date, 24 countries of the western hemisphere, including the Dominican Republic and Haiti for the Caribbean islands, are actively participating in the Programme, generating and exchanging data.

The map below shows a preliminary inventory. As of May 2004, 59 transboundary aquifers have been identified in the Americas, 35 located in South America, 13 in Central America, 8 in North America (U.S.A.-Mexico border only), and 3 in the Caribbean (between the Dominican Republic and Haiti). Although the countries have not reported conflicts involving transboundary aquifers, they have highlighted a series of concerns that, in the medium to long term, could result in excessive pressures on the resources. OAS is currently gather-



2. ISARM - Internationally Shared (Transboundary) Aquifer Resources Management — is a world-wide Programme endorsed by the Intergovernmental Council of the UNESCO International Hydrological Programme (IHP) in June, 2000. This multidisciplinary initiative operates through a joint coordination committee of experts from UNESCO-IHP, International Association of Hydrogeologists (IAH), Food and Agriculture Organization (FAO) and United Nations Economic Commission for Europe (UNECE), and aims at improving the understanding and communication/sharing of scientific, socio-economic, legal, institutional and environmental issues related to the management of transboundary aquifers. <http://www.unesco.org/water/ihp>.

POTENTIAL CASE STUDY TRANSBOUNDARY AQUIFERS	
TOBA – YRENDA – CHACO TARIJEÑO AQUIFER (Argentina – Bolivia – Paraguay)	ARTIBONITO AND MASACRE AQUIFERS (Dominican Rep. – Haiti)
CUCUTA – SAN ANTONIO AQUIFER (Colombia – Venezuela)	PANTANAL AQUIFER (Brazil – Bolivia)
OSTUA-METAPAN AQUIFER (El Salvador – Guatemala)	SIXAOLA AQUIFER (Panama – Costa Rica)
CIUDAD JUAREZ – EL PASO AQUIFER (Mexico – USA)	SALTO – SALTO CHICO AQUIFER (Argentina – Uruguay)
MACHALA – TUMBES AQUIFER (Ecuador – Peru)	

ing information regarding national policy and regulations on groundwater, international agreements on water resources among neighboring countries, and on the role of water-related institutions at a national, federal, or local level.³

As part of the UNESCO/OAS ISARM Americas Program activities, nine transboundary aquifers have been identified as potential case studies (Table above). These aquifers have been selected on the basis of their relevance to environmental and hydro-geological characteristics, as well as their socio-economic and legal aspects. Additional criteria were adopted to take into account the wishes of neighboring countries to cooperate through the sharing of information and development of joint management systems.

At present, two priority case studies have been considered for pilot-projects and agreed upon: the Artibonito and Masacre Aquifers, shared by Haiti and the Dominican Republic, and the “Toba -Yrenda- Chaco Tarijeño Transboundary Aquifer”, shared amongst Argentina, Bolivia, and Paraguay.

The Artibonito and Masacre Aquifers are a key water resource that, if exploited in a sustainable way, could alleviate the high levels of poverty (80-90 percent of the Haitian population) and health uncertainty in the two countries, both highly vulnerable to natural hazards.

The “Toba -Yrenda- Chaco Tarijeño Transboundary Aquifer” will be addressed within the context of the Plata basin (see above). The pilot-projects will provide a comprehensive understanding of the aquifer, as well as guidance for the actions to be taken in other aquifers with similar characteristics in order to establish more sustainable management mechanisms.

3. [http:// www.oas.org/usde](http://www.oas.org/usde).

FUTURE ACTIONS: PLATFORMS FOR JOINING FORCES

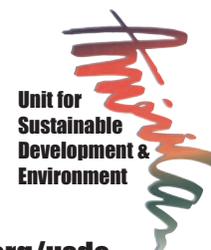
In recent years, progress in understanding and managing groundwater resources in a sustainable way has increased. Progress by a number of organizations and networks, from UNESCO to the GEF, from scientific bodies to the Global Water Partnership, continue to be made. However, challenges remain in shaping a groundwater agenda for the Americas. The OAS continues its efforts and partnerships, through projects and capacity-building, to help member countries ensure that groundwater is a pivotal part of integrated water resource management strategies. This includes identifying best practices that link the management of surface waters with groundwaters. Opportunities to enhance the policy profile of groundwater management are being pursued on a number of fronts.

Through collaborative efforts with IHP (UNESCO’s inter-governmental scientific co-operative programme), OAS/USDE will continue to support member States in the preparation and implementation of multi-national initiatives related to water resources, including groundwater. Also, through the Inter-American Water Resources Network (for which the OAS/USDE acts as the secretariat), practical lessons in groundwater management and sustainability will be identified and exchanged. The Fifth Inter-American Dialogue, to be held in Jamaica in 2005, presents a further opportunity to share scientific, management, legal, and other experiences. Also in 2005, the OAS itself, through its summit preparatory process, will host a high-level meeting to address sustainable development, during which groundwater management will receive attention.

For further information, please contact Michela Miletto (mmiletto@oas.org) in the Unit For Sustainable Development and Environment of the General Secretariat of the Organization of American States (OAS/USDE; <http://www.oas.org/usde>).

This USDE Policy Brief series provides a forum for discussion on issues pertaining to sustainable development to help transfer good practices and lessons learned from project design and implementation. This is the third in a series that includes topics on:

- Water Resources Management
- Biodiversity Conservation
- Environmental Assessments of Trade
- Renewable Energy
- Natural Hazard Mitigation



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