



ORGANIZATION  
OF AMERICAN STATES



INTERNATIONAL  
HYDROLOGICAL PROGRAMME

**UNESCO/OAS ISARM Americas Programme  
TRANSBOUNDARY AQUIFERS OF THE AMERICAS**

**1<sup>ST</sup> COORDINATION WORKSHOP**

**Montevideo, Uruguay**

**September 24<sup>th</sup>-25<sup>th</sup> 2003**

**FINAL REPORT**

Washington, D.C.

*With the support of Deltamerica Project*



**UNESCO/OAS ISARM AMERICAS PROGRAMME (Internationally Shared  
Aquifer Resources Management) FIRST COORDINATION WORKSHOP  
Montevideo, September 24<sup>th</sup>-25<sup>th</sup>, 2003**

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## LIST OF ACRONYMS

<b>ALHSUD</b>	Asociación Latinoamericana de Hidrología Subterránea para el Desarrollo
<b>DELTAMERICA</b>	Preparation and Execution of Diffusion Mechanisms on Experiences and Lessons Learned from the Transboundary Water Resources Integrated Management in the Americas / Preparación y Ejecución de Mecanismos de Difusión de Experiencias y Lecciones Aprendidas en la Gestión Integrada de Recursos Hídricos Transfronterizos en las Américas
<b>FAO</b>	Food and Agriculture Organization/Organización de las Naciones Unidas para Agricultura y Alimentos (United Nations/Naciones Unidas)
<b>FEMCIDI</b>	Special Multilateral Fund of the Inter-American Council for Integral Development/Fondo Especial Multilateral del Consejo Interamericano para el Desarrollo Integral
<b>GAS/SAG</b>	Guarani Aquifer System/Sistema Acuífero Guaraní
<b>GEF/ FMAM</b>	Global Environment Facility/Fondo para el Medio Ambiente Mundial
<b>GS/OAS/SG/OEA</b>	General Secretariat of the Organization of American States/Secretaría General de la Organización de Estados Americanos
<b>IAH/AIH</b>	International Association of Hydrogeologists/Asociación Internacional de Hidrogeólogos
<b>IBRD/BIRD</b>	Interamerican Bank for Reconstruction and Development/Banco Interamericano de Reconstrucción y Desarrollo
<b>IBWC/CILA</b>	International Boundary and Water Commission/Comisión Internacional de Límites y Aguas
<b>IHP/PHI</b>	International Hydrological Programme/Programa Hidrológico Internacional
<b>ISARM</b>	Internationally Shared Aquifer Resources Management/Gestión de los Recursos Acuíferos Internacionalmente Compartidos
<b>IWAC</b>	International Water Assessment Centre (UN/ECE Collaborating Centre)
<b>IWRN/RIRH</b>	Interamerican Water Resources Network/Red Interamericana de Recursos Hídricos
<b>MERCOSUR</b>	Mercado Común Sudamericano
<b>NC/CN</b>	National Coordinator/Coordinador Nacional
<b>OAS/OEA</b>	Organization of American States/Organización de Estados Americanos
<b>PNUMA/UNEP</b>	United Nations Environmental Program / Programa de las Naciones Unidas para el Medio Ambiente
<b>RIZA</b>	Rijksinstituut voor Integraal Zoetwaterbeheer en Afvalwaterbehandeling (Inland Water Management and Waste Water Treatment)
<b>ROSTLAC/ORTAC</b>	Regional Office of Science and Technology for Latin America and the Caribbean/ Oficina Regional de la UNESCO para Ciencia y Tecnología en América Latina y el Caribe (UNESCO)
<b>TA</b>	Transboundary Aquifer
<b>TARM</b>	Transboundary Aquifer Resources Management
<b>UN/ECE</b>	United Nations Economic Commission for Europe
<b>UNESCO</b>	United Nations Educational Scientific and Cultural Organization/Organización de las Naciones Unidas para la Educación, Ciencia y Cultura
<b>USDE/UDSMA</b>	Unit for Sustainable Development and Environment/Unidad de Desarrollo Sostenible y Medio Ambiente
<b>WGMA</b>	Working Group on Monitoring and Assessment

## **INTRODUCTION**

### **Background**

The UNESCO/OAS ISARM-Americas Programme results from the joint effort by UNESCO-IHP and USDE/OAS to set up the ISARM Programme, as part of the worldwide ISARM Programme. This regional initiative was launched at the IAH-ALHSUD Congress in 2002 in Mar del Plata, Argentina; at this event Mr. Nelson da Franca Ribeiro dos Anjos was appointed as General Coordinator for the Americas.

The Internationally Shared Aquifer Resources Management - ISARM Programme aims at improving understanding of scientific, socio-economic, legal institutional and environmental issues related to the management of transboundary aquifers. The Programme operates through a joint coordination committee of experts from UNESCO-IHP, IAH, FAO and UNECE.

As the leading agency in coordinating the UNESCO/OAS ISARM-Americas Programme, OAS has focused its efforts on helping American countries become involved in carrying out the programme's tasks. Among the most important steps of the programme is the collection of data on transboundary aquifers. Through preliminary questionnaires sent to the countries, the two organizations have assessed the prevalence of transboundary aquifers in the Western Hemisphere in order to identify critical case studies while creating a comprehensive Transboundary Aquifer Inventory of the Americas.

The IWRN (Interamerican Water Resources Network) and IHP (International Hydrological Programme) Focal Points readily collaborated with the UNESCO/OAS ISARM Americas Programme and selected the ISARM National Coordinators among the groundwater experts of their countries. The ISARM National Coordinators collected a huge amount of data on the country transboundary aquifers and sent them to OAS headquarters.

The Isarm Americas initiative and its launching at the Workshop counted with the financial support, the IWRN Focal Points participation and the presentation of experiences on transboundary aquifers management of the DELTAMERICA Project (IWRN, GEF, UNEP, OAS).

## **Montevideo Workshop**

On September 24<sup>th</sup> - 25<sup>th</sup> 2003, the first UNESCO/OAS ISARM-Americas Workshop was held in Montevideo, Uruguay. The Workshop was realized in coordination with the DELTAMERICA Project (IWRN, GEF, UNEP, OAS) Workshop on the Exchange of Experiences on Transboundary Waters Management in the Southern Cone.

Participation in the Workshop was strong: twenty countries were represented, including Haiti and the Dominican Republic from the Caribbean.

Presentations provided a broad overview of what is known about groundwater shared by American countries. The National Coordinators related the hydro-geological characteristics of transboundary aquifers, various water-land use situations, the socio-economic problems related to water, and current water legislation. Concerns over the inadequate use and protection of aquifers and the increasing demand for water in the Americas were raised during the discussions. Representatives of various American countries at the meeting outlined special needs of their countries.

The workshop provided an ideal forum for Member States to plan actions in the framework of the UNESCO/OAS ISARM-Americas Programme. Cited, too, were the benefits of such workshops in the exchange of information and the exploration of sharing of strategies and financial supports.

One of the most important results achieved in the meeting was the identification of nine transboundary aquifers as possible case studies. The aquifers were selected on the basis of their hydro-geological characteristics, amount of information, agreements among country representatives, and other criteria. Priority case studies will be implemented following the ISARM methodology; they will provide a comprehensive understanding of the aquifers as well as guidance for the actions to be taken in other aquifers with similar characteristics and the adoption of the more appropriate sustainable management mechanisms.

The U.S. International Boundary Water Commission offered to host the UNESCO/OAS ISARM-Americas Programme II Workshop at the IBWC facilities in El Paso, which will be held in November 2004. The U.S. and Mexican representatives welcomed the opportunity to present the Hueco-Bolson case study, a transboundary aquifer shared between the U.S.A. and Mexico.

## **Acknowledgements**

The UNESCO/OAS ISARM-Americas team wishes to thank:

- MERCOSUR Headquarters for making their facilities available for the event;
- Minister of Transportation and Public Works of the Republic of Uruguay, Engr. Lucio Cáceres Behrens, for the support expressed during the Workshop inauguration;
- UNESCO-ROSTLAC and OAS-Uruguay staff for their tremendous help with organization before and during the workshop, coordinated by Maria Donoso and Roberto Casaña respectively;
- The Deltamerica Project for the support, and the IWRN and IHP Focal Points of the American countries for their efforts in starting the ISARM activities at a national level;
- ISARM-Americas National Coordinators for their essential contribution to accomplish the Programme tasks;
- USDE staff assistants in the GS/OAS Headquarters-Washington D.C., for the constant and untiring support in organizing the workshop and divulging Programme information and news to the countries.

## 1. WELCOME TO PARTICIPANTS AND WORKSHOP AGENDA

The Workshop on “Transboundary Aquifers of the Americas” started with a Welcome Ceremony hosted in the MERCOSUR building in Montevideo on the 24<sup>th</sup> of September, 2003.

Members of the Panel were: Engr. **Lucio Cáceres Behrens**, Minister of Transportation and Public Works for the Republic of Uruguay, Mrs. **Maria Concepción Donoso**, UNESCO/ROSTLAC Regional Hydrologist and Environmental Sciences and Water Resource Programs Specialist, Mr. **Shammy Puri**, ISARM President of the Transboundary Aquifer Resources Management Commission (TARM) of the International Association of Hydrogeologists (IAH), Mr. **Nelson da Franca dos Anjos**, OAS/USDE Principal Water Resources Specialist and General Coordinator for the UNESCO/OAS ISARM Américas Programme, Mr. **Roberto Luis Casañas**, Director of the OAS National Office in Uruguay.

Mrs. **Donoso**, inaugurating the workshop, thanked the participants and pointed out that UNESCO and OAS, notwithstanding their different roles in the region - the first focused on the scientific and educational support, the latter on multi-country projects management - had now joined in the implementation of the ISARM-Americas Programme.

Mrs. Donoso finally encouraged the countries to coordinate their efforts through the development of joint projects.

Mr. **Shammy Puri** underlined the global context of ISARM Americas. Mr. Puri noted the large participation at the event, which confirmed the success of the Programme in the Americas, as well as the impressive quantity and quality of the data provided by the countries through the Preliminary Questionnaire on Transboundary Aquifers.



**Photo 1.** Welcome Ceremony Panel





**Photo 2.** OAS and UNESCO-IHP Workshop organizers and invited speakers



**Photo 3.** ISARM Americas National Coordinators

Mr. **Nelson da Franca dos Anjos** thanked the UNESCO/OAS ISARM-Americas team, namely Mrs. **Alice Aureli**, IHP Hydrologist of UNESCO-Paris, Mrs. **Maria Concepción Donoso**, Mr. **Shammy Puri**, Mrs. **Michela Miletto**, USDE/OAS Senior Environmental Specialist and Mr. **Jorge Rucks**, USDE/OAS Chief of South America Geographic Area.

According to Mr. da Franca, ISARM-Americas represents the natural follow-up of the Hydrogeological Map of South America and of the Hydrogeological Atlas of the Caribbean, which was the first attempt to harmonize hydrogeological information on a continental scale in Latin America.

Mr. da Franca expressed his satisfaction for the participation of almost twenty countries at the event, the first success of the programme. He also pointed out that one goal of ISARM-Americas is to promote a better scientific understanding of transboundary aquifers as a mean to set up their sustainable management. He finally mentioned the example of the Guarani, the aquifer system shared among Argentina, Brasil, Paraguay and Uruguay, where a multi-country project funded by GEF, IBRD, OAS and the countries involved, is underway.

As a conclusion to the Welcome Ceremony, the Minister of Transportation and Public Works, Mr. **Lucio Caceres Behrens**, pointed out the importance of transboundary aquifers within the framework of integrated sustainable basin managements. He thanked UNESCO and the OAS for focusing the workshop on this issue, in particular during the International Year of Freshwater. The Minister concluded by wishing the countries a successful and fruitful effort during the two-days workshop.

At the end of the Ceremony, the participants approved the Agenda of the Workshop (Appendix 1). The list of participants, invited speakers and observers is shown in Appendix 2.

## **2. INTERNATIONAL AGENCY PRESENTATIONS**

The workshop activities started with the presentations of the invited experts. The lectures were aimed at offering the participants a general and updated overview of the existing information on transboundary aquifers as a possible starting point for discussion. The topic was analyzed from different perspectives, including a summary of the worldwide ISARM activities, the legal and institutional aspects, socio-economic and risk assessments, and examples of aquifer monitoring and assessment guidelines and database systems.

The ISARM Coordinator for IAH **Shammy Puri** started the section presenting a thorough “*Summary of the world wide activities of ISARM and update on recent developments*”, in which he suggested interesting key points as possible subjects for discussion at the workshop.

Puri outlined the necessity of having reliable access to water, which is fundamental to human and environmental security, even in the face of increasing water and health demand in the world, and explained the main indicators of water poverty index, like per capita resources, access to water, water use, etc.

He then reported a brief history of the actions UNESCO and IAH undertook in order to promote awareness of the transboundary nature of many aquifers in the world, until the establishment of the ISARM Programme.

Puri presented the recent developments of ISARM at the global level, among others, he mentioned the Beirut workshop on legal framework for shared groundwater development, the creation of the Africa ISARM Centre, the approval of the Iullemeden ISARM case study with GEF financing, and the preparation of the World Hydrogeological Map.

In conclusion, Mr. Puri proposed some next steps for the development of the ISARM Americas Programme to be discussed during the workshop, suggesting the production of an inventory and preliminary documentation during the first stage, detailed analyses and development of management approaches in the second stage and, finally, the implementation of case-studies in the last phase.

The General Secretary of the Guarani Aquifer Project **Luiz Amore** presented, as an example of an on-going, sustainable management of transboundary aquifer, the Guarani Project, a multilateral project funded by GEF, IBRD, OAS and the countries involved: Argentina, Brazil, Paraguay and Uruguay.

He started his presentation, "*The Guarani Project: Management Processes*", with the description of the Guarani hydrogeological characteristics and of the legal and institutional situation existing in the four countries before the project.

He then detailed the different preparation phases, explaining the operational structure and the responsible institutions, the problems faced during the implementation process, the on-going actions and the expected outcomes.

Amore outlined that the project challenges are related to the set up of local managements, suitable to the groundwater nature and extension, as well as to the development of sound transboundary management, with low transaction costs.

He finally emphasized the necessity of implementing groundwater management tools focused on the specific country's needs, which include financial mechanisms for investment sustainability, and the feasibility of technical continuity through alliance with MERCOSUR.

**Geo Arnold**, from the Rijksinstituut voor Integraal Zoetwaterbeheer en Afvalwaterbehandeling - RIZA (Institute for Inland Water Management and Waste Water Treatment), The Netherlands, as Groundwater Programme Coordinator for the International Water Assessment Centre IWAC - UNECE Collaborating Centre, presented the activities undertaken in Europe in relation to the European transboundary groundwaters ("*ISARM Europe – Transboundary Groundwater Guidance*").

Arnold explained the organizational structure of the UNECE's Working Group on Monitoring and Assessment - WGMA, and his mandate in relation to the 1992 UNECE Water Convention. The mandate is mainly focused on giving guidance to the EC-countries in the implementation of the Convention, through methodological and institutional supports and coordination of activities.

The WGMA carried out the "Guidelines on Monitoring and Assessment of Transboundary Groundwaters", a framework document drawn on studies of current monitoring and assessment practices and on the results of sub-projects. It consists of four supporting technical reports, namely, that relate to the inventory of transboundary groundwaters, the use of indicators, application of models and state of the art on monitoring and assessment of groundwaters.

The inventory, based on questionnaire responses from the ECE countries, gives information on the characteristics of the aquifers, the monitoring activities, the water uses and problems, and the institutional and international aspects related to their management in the EC region.

According to Arnold, the Inventory is an important support document, nonetheless some deficiencies were found due to scarce flexibility of the questions, comparison of data, no consistency in labeling aquifers, wide range of scale and symbols used in the maps, etc.

He then detailed the distinct phases of the monitoring cycle, which is a sequence of related activities that starts with the definition of the information needs and ends with the utilization of the information product, and the arrangements for co-operation with institutions and their responsibilities. He explained the last phase of the activities, that is, the implementation of the guidelines through pilot projects, and he referred to the pilot programme and its objectives, and the criteria for selection.

Arnold finally talked about the UNECE co-operation with ISARM, active since March 2000. The co-

operation is based on the implementation of the groundwater guidelines and it aims at exchanging the knowledge and experiences with respect to the inventory of transboundary groundwaters in Europe and at promoting the setting up of training and exchange of information with the other regions of the world.

**Bo Appelgren**, UNESCO consultant for the ISARM Programme, analyzed the transboundary aquifer topic from a socio-economic and risk assessment perspective and presented the Iullemeden Project, a Transboundary sub-Saharan Aquifer shared among Nigeria, Niger and Mali (*“Iullemeden Project: Socioeconomic and Risk Assessment”*).

Appelgren outlined the importance of focusing on risk and uncertainty management, taking into account the political and economic realities of the countries and the perspectives of individual political economies. He also pointed out that a risk and uncertainty-based management approach coincides with, but also differs in, its essentials and practices, from an unrestricted, and therefore non-achievable commitment provided under the "principles of precaution and preventive action".

According to Appelgren, consistent and coherent actions have to be undertaken on the different continents and representative case studies have to be identified and compiled as important references. These regional strategies and actions are among the main scopes of the global ISARM Programme.

He then explained how the implementation of effective groundwater management is based on the country societies' recognition; transboundary hydrological risk-based management should point towards joint-risk management of the water resources among countries, and focus on recognizing different types of risk and uncertainty and feasible sustainable development. Natural resources management planned to jointly address inter-linked environmental threats to water and land resources should take into account growing international pressures and water conflicts related to the shared aquifer (water and land) resources, as well as mitigate land degradation risk over large land areas, combating desertification and climate desiccation and preserving vulnerable dry land ecosystems.

The Iullemeden Aquifer Project, funded by GEF, is an example of action-orientation, joint multi-risk and uncertainty based management implementation. It focuses on protecting the recharge (Nigeria and Mali) and the humid zones areas of the region, identifying joint mechanisms and framework for risk/uncertainty and on promoting management awareness and communication and dissemination of project data.

Appelgren closed his presentation mentioning the expected outcomes of the Iullemeden Project, mainly related to the set up of a strategy for effective management implementation focused on risk and coping with uncertainty, in the frame of the international priorities.

**Stefano Burchi**, Senior Legal Officer of FAO Legal Office - Development Law Service, in his presentation *“Legal and Institutional Aspects”* offered an overview of the activities carried out by FAO on shared groundwater issues.

An interesting activity is the survey, review and analysis of bi- and multi-lateral treaties and agreements that cover surface water and groundwater, as well as interstate agreements of federal countries relevant to groundwater, from 1980 onwards.

According to Burchi, almost 100 agreements of different types have been gathered to date, referring to both surface water and groundwater, or to one of them only. The review also includes environmental treaties and conventions extending to freshwater resources in general or groundwater only.

In the survey, more detailed information has been recorded with regard to groundwater only, e.g. the type of groundwater, the main provisions and principles, the interested joint institutions, etc. Another on-going activity is the review and analysis of international laws related to shared groundwater resources, aimed at determining the current state of the law and the shortcomings from legal and hydrogeological perspectives, and at defining the agenda for the future. Burchi closed his presentation explaining the legal technical assistance that FAO provides to the countries sharing aquifers; he mentioned some examples like the project funded and executed by FAO (2001-2002) on the Northern Sahara Aquifer System (SASS) shared among Algeria, Lybia and Tunisia and the GEF-FAO project on the Iullemeden Aquifer located in Mali, Niger and Nigeria.

**Luis Vives**, Vice-Director of the Unit of Hydrology of the “Instituto de Llanuras de Argentina”, closed the lectures with his final presentation of the “*Aquifer Database system*”.

In his presentation he pointed out that the major problem in information management is the difficulty of knowledge transfer, mainly due to cumbersome access, low quality information and different standards application. According to Vives, the solution may be envisaged as the capability to store, organize and exploit the information in order to facilitate the transfer and encourage public participation.

He showed an example of a flexible database system, developed to support hydrogeologic information management of the aquifers. The proposed system supports different types of information: numerical, alphanumeric, images, texts, videos etc.

The information exploitation is via the internet, so that the website can be fed by the same user. Users can be members or public.

Vives closed his presentation showing an application of the system, carried out to support and manage the hydrogeological information of the Arroyo del Azul Basin, a watershed located in the Buenos Aires province, Argentina.

### **3. COUNTRY PRESENTATIONS**

The National Coordinators - NCs of the ISARM Americas Programme were invited to present the available information on the transboundary aquifers of their countries. During the previous months the NCs who attended the Montevideo event had already produced a huge amount of work, gathering and compiling data in order to accomplish the first task of the Programme and send the Preliminary Questionnaire on Transboundary Aquifers (Table 3) to the UNESCO/OEA working team. The UNESCO/OEA team assembled the questionnaires and maps in a summary report (Book of Documents <sup>1</sup>) distributed to the participants during the workshop.

A list of transboundary aquifers identified by the countries during this first survey is shown in Table 1 and 2 and their approximate location is shown in Figures 1, 2 and 3.

All Country representatives made their presentations the first day (September 24th) after the lectures of the invited speakers, with the exception of the NC from Colombia, who did it the next day.

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<sup>1</sup> For a complete review of the country TA information, see the Book of Documents distributed during the Workshop.

The presentations were characterized by the quantity and quality of the data and by the clarity of the expositions. They provided an overview of knowledge on internationally shared groundwater within the countries in the Americas from the point of view of the hydrogeological characteristics of the aquifers, as well as of the water/land use and over-use.

As a result, several problems common to many of the countries arose, among which are:

- lack of aquifer definition in terms of boundaries and volume
- lack of water-levels and water-quality monitoring
- rigid information management by the institutions
- increase of water demand due to population growth and economic expansion
- poverty and health problems associated with inadequate water resources management
- irrational water use and lack of institutional preparedness for groundwater management
- lack of water legislation
- poor environmental education
- lack of financial resources

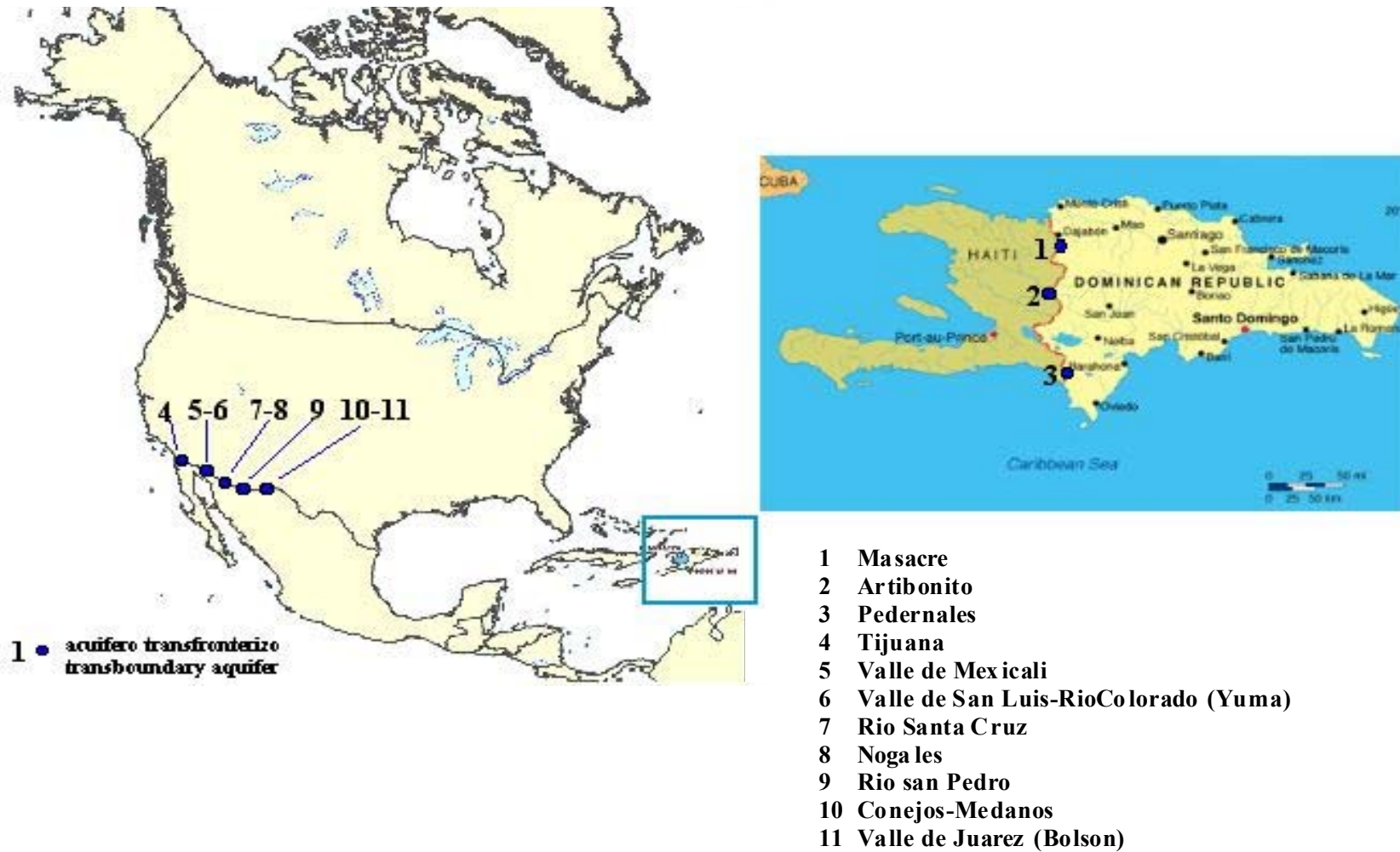
The list of the country representatives' names is as follows:

<b>Argentina</b>	Ofelia Tujchneider
<b>Bolivia</b>	Rodolfo Huaranca Olivera
<b>Brazil</b>	Julio Tadeo Silva Kettelhut
<b>Colombia</b>	Hebert Gonzalo Rivera
<b>Costa Rica</b>	Rodrigo Calvo Porras
<b>Chile</b>	Jaime Muñoz Rodriguez
<b>Ecuador</b>	Napoleón Burbano
<b>El Salvador</b>	Celina Mena
<b>Estados Unidos de N.A.</b>	John Klein, Jim Stefanov
<b>Guatemala</b>	Pedro Augusto Tax Tzoc
<b>Haití</b>	Yvelt Chery
<b>México</b>	Luis Antonio Rascón Mendoza
<b>Panamá</b>	Yamil Danel Sánchez Peña
<b>Paraguay</b>	Elena Benitez
<b>Perú</b>	Edwin Zenteno Tupiño
<b>República Dominicana</b>	José Francisco Febrillet
<b>Uruguay</b>	Alejandro Arcelus
<b>Venezuela</b>	Fernando Decarli Rodriguez

**Table 1.** Matrix of the countries and transboundary aquifers identified in North and Central America, and in the Caribbean

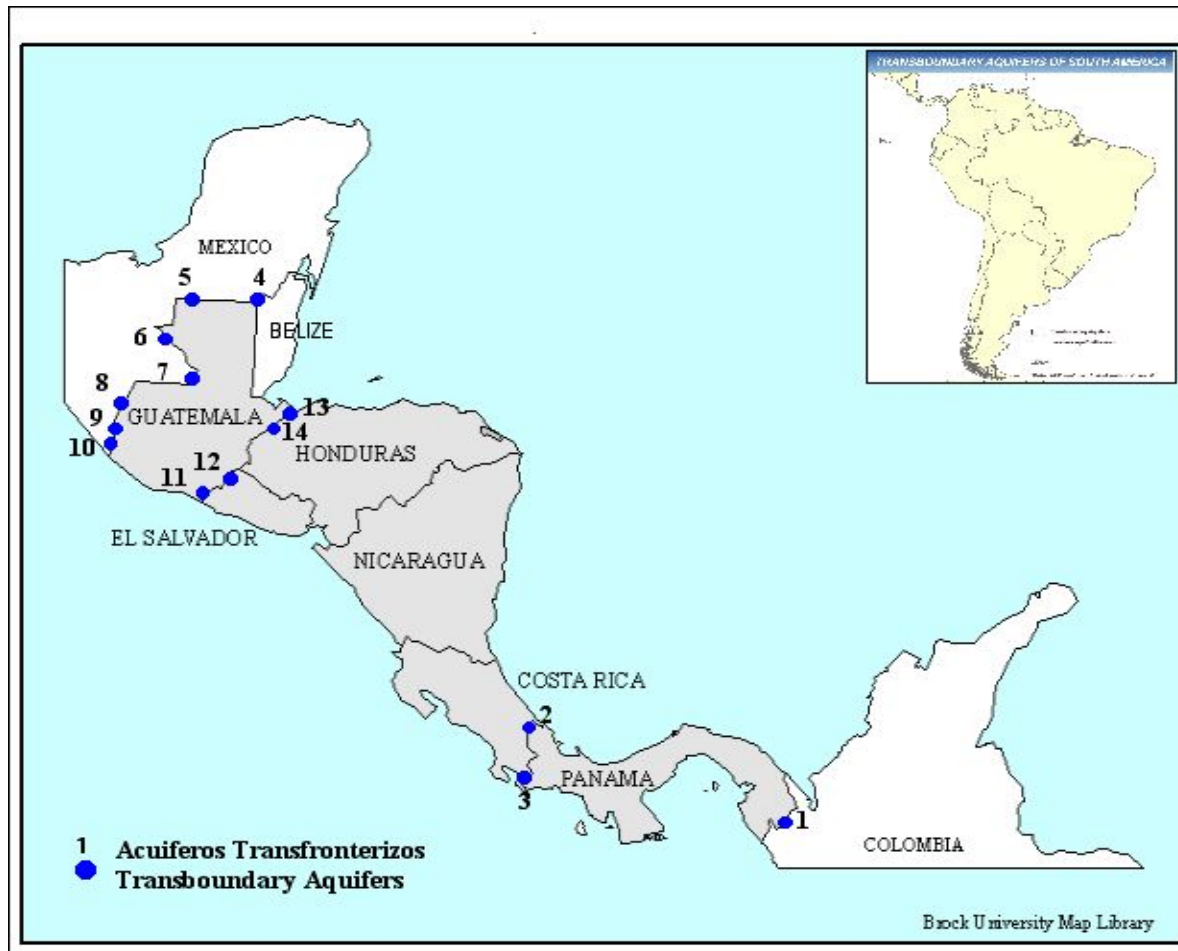
	CAN	USA	MEX	GUA	BEL	HON	ELS	NIC	CSR	PAN	CO	HAI	RD
<b>CANADA</b>													
<b>USA</b>	Great Lakes												
<b>MÉXICO</b>		Rio Tijuana Mexicali Rio Colorado Sonoyta/Pto Penasco Rio Sta Cruz Rio San Pedro Conejos-Medanos Valle Juarez/Bolson Nogales											
<b>GUATEMALA</b>			Hondo-San Pedro San Pedro Usumacinta Chixoy-Xaclbal Selegua-Cuilco Coatan-Alto Suchiate Bajo Suchiate		Hondo-San Pedro	Motagua Norte Motagua Sur Ostua Metapan	Bajo Paz AltoPazOstua						
<b>BELIZE</b>													
<b>HONDURAS</b>													
<b>EL SALVADOR</b>				Chinamas/Ahuachapan Río Paz Atiquizaya/Chalchuapa									
<b>NICARÁGUA</b>													
<b>COSTA RICA</b>										Sixaola			
<b>PANAMÁ</b>									Sixaola Coto		Jurado'		
<b>HAITI</b>													
<b>REPÚBLICA DOMINICANA</b>												Artibonito Pedernales Masacre	

**Figure 1.** Approximate location of North-American and Caribbean transboundary aquifers





**Figure 2.** Approximate location of Central American transboundary aquifers



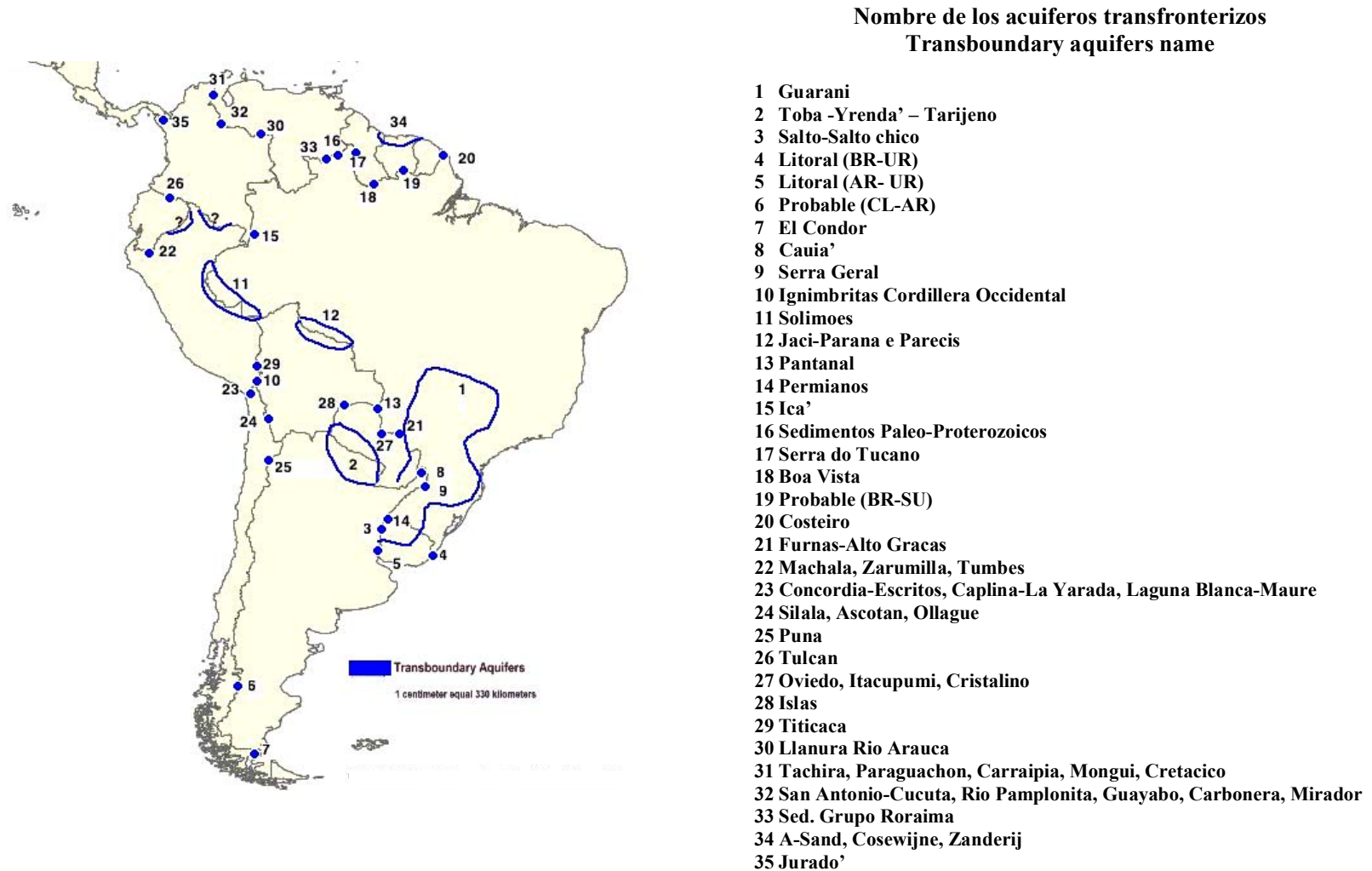
**Nombre de los acuíferos transfronterizos**  
**Transboundary aquifers name**

- 1 Jurado'
- 2 Sixaola
- 3 Coto
- 4 Hondo – San Pedro
- 5 San Pedro
- 6 Usumacinta
- 7 Chixoy-Xaclbal
- 8 Selegua- Cuilco
- 9 Coatan – Suchiate
- 10 Bajo Suchiate
- 11 Bajo Paz
- 12 Alto Paz-Ostua
- 13 Motagua Norte
- 14 Motagua Sur

**Table 2.** Matrix of the countries and transboundary aquifers identified in South America

	BR	AR	UY	PY	CL	BO	PE	EC	CO	VE	GY	SE	GF
BRASIL		Guarani Serra Geral Caiuá [Yrendá/Toba] Permiano	Guarani Serra Geral Caiuá Permianos Litorâneo	Guarani Toba Fm Pantanal Permianos Furnas e Alto Gracas Serra Geral Caiuá		Solimões Jací-Paraná e Parecis Fm Pantanal	Solimões		Iça Solimões	Sed. Paleo- proterozoicos	Boa Vista Fm Serra do Tucano Sed. Paleo- proterozoicos	S/denom.	Costeiro
ARGENTINA	Guarani Yrendá'/Toba [Serra Geral] [Caiuá]		Guarani Salto-Salto Chico Litoral	Guarani Yrendá'/Toba	El Condor Puna? Sur 40lat?	Yrendá'/Toba							
URUGUAY	Guarani Chuy	Guarani Litoral UY		Guarani									
PARAGUAY	Guarani Cristalino Itapucumí Oviedo	Guarani Yrendá/Toba	Guarani			Islas Yrendá							
CHILE						Silala Ascotán Ollague	Escritos-Concordia (Yarada)						
BOLIVIA		Chaco Tarijeno (Toba/Yrendá')		ChacoTarijeno (Toba/Yrendá')	Silala Ignimbrítico Cord. Oeste		Ignimbrítico Cord. Oeste						
PERU					Yarada Caplina	Titicaca		Zarumilla Tumbes					
ECUADOR							Machala		Tulcán				
COLOMBIA										Llanura Rio Arauca fm Guayabo Rio Pamplonita fm Carbonera fm Mirador fm Monguí Cretácico			
VENEZUELA	Sed. Grupo Roraima								Táchira Carraípea-Paraguachón San Antonio-Cucuta Llanura Rio Arauca				
GUYANA													
SURINAME											A-sand Coesewijne Zanderij		Zanderij
GUYANA FRANCESA													

**Figure 3.** Approximate location of South-American transboundary aquifers



#### **4. FUTURE ACTIONS AND RECCOMENDATIONS**

The last day of the workshop (September 25<sup>th</sup>, 2003) was devoted to discuss some key issues on the UNESCO/OAS ISARM Americas Transboundary Aquifers Inventory development as well as to plan future actions for the implementation of possible Case Studies on transboundary aquifers of particular interest and priority.

Discussion mainly focused on five points:

- 1. Completion of the information on the transboundary aquifers already identified and assessment of other possible aquifers.**
- 2. Cross-checking of the information provided by the countries that share aquifers.**
- 3. Selection of transboundary aquifer case-studies on the basis of the hydro-geological characteristics, amount of information, agreements among country representatives, and other criteria.**
- 4. Identification of external financial sources (FEMCIDI-OAS, UNESCO Participation Programme, etc.).**
- 5. Establishment of communication mechanisms and exchange of information among countries.**

Participants also discussed the priority tasks to be developed in the near future; the UNESCO/OAS team proposed a " Schedule of Proposed Activities" (Table 7), that was unanimously accepted.

Mr. Da Franca, Mrs. Donoso and Mr. Puri alternatively lead the group discussion.

##### **1 - Completion of the information on the transboundary aquifers already identified and assessment of other possible aquifers.**

At the end of May 2003, the "Preliminary Questionnaire on Transboundary Aquifers" (Table 3) was distributed to the countries; the ISARM NCs filled them up with the country transboundary aquifer data. The Preliminary Questionnaire, consisting of basic information requirements, was targeted to obtain a general check of the existing knowledge over transboundary groundwater in the countries.

As a follow up of this activity the UNESCO/OAS team encouraged the participants to prepare a more detailed questionnaire in order to achieve a deeper knowledge on the American transboundary aquifers.

The participants discussed the Questionnaire adopted in Europe (Table 4), and partially modified it taking into account the lessons learnt in the European experience (G.Arnold,UNECE).

The ISARM Americas National Coordinators provided many suggestions and new inputs to the European Questionnaire, among others:

- To refer the transboundary aquifer to the geographic and fisiographic area;
- To relate the aquifer to the hydrologic basin;
- To locate the recharge area;
- To add the current relevant environmental aspects as well as potential future risks;
- To list water- related problems that could be solved through sustainable management (i.e. using socio-economic parameters, indicators of water poverty index, etc.);
- To indicate the present water-land uses as well as those foreseen for the future;
- To refer to potential water demand and future perspectives;
- To inform on the existing international agreements, the participating institutions and the present national legislation;
- To inform on the aquifer management structure (e.g. integrated water basin management, exchange mechanisms among the countries sharing the resource, etc.).

The countries and the UNESCO/OAS ISARM Americas Programme Team agreed to adopt the European Questionnaire, modified and integrated with the suggestions raised during the workshop (Table 5).

**Table 3.** Preliminary Questionnaire on Transboundary Aquifers of the Americas sent to the NCs in May 2003.

**ISARM Americas Preliminary Questionnaire on Transboundary Aquifers**

Country:	
Name of the Transboundary Aquifer (the name under which it is recognized in the area)	
Country or countries which share this aquifer:	
Approximate location of the aquifer within the map enclosed as annex (please indicate what hydrographic basin it belongs to, state, province, department or any other detail that could be useful for location purposes):	
Main geologic/hydrogeologic formations with a brief lithologic description and to which geologic period of time they belong to:	
What are the main technical documents that are available about the aquifer? Are there maps available as well? On what scale?	
Where are these available documents?	
What are the main hydrogeological data available on this aquifer besides the above indicated?	
Prepared by: Complete address:	Date:.....
Please send the complete Questionnaire to:	General Coordinator ISARM Americas: <a href="mailto:nelsonf@codevasf.gov.br">nelsonf@codevasf.gov.br</a> CC. to: <a href="mailto:mmiletto@oas.org">mmiletto@oas.org</a> ; <a href="mailto:a.aureli@unesco.org">a.aureli@unesco.org</a> ; <a href="mailto:shammypuri@aol.com">shammypuri@aol.com</a> ; <a href="mailto:jrucks@oas.org">jrucks@oas.org</a>

**Table 4.** Questionnaire on Transboundary Aquifers used in Europe

**Questionnaire on Transboundary Aquifers in Europe**

<b>Transboundary aquifer data</b>	<b>Country A</b>		<b>Country B</b>	
Aquifer type Shared international boundary length (km) Flow across boundary (Mm <sup>3</sup> /yr) Gradient across boundary				
Areal extent (km <sup>2</sup> ) Geological symbols on map Abstractions (Mm <sup>3</sup> /yr) Other impacts: quantity Other impacts: quality Level changes (m/yr) Main utilization Quality trends				
<b>Monitoring data: Quantity</b>				
No. of monitoring stations Frequency of measurements Specific distributions				
<b>Monitoring data: Quality</b>				
No. monitoring sites Frequency of measurements Specific distributions Determinants: Major ions Heavy metals Pesticides Nitrogen compounds Industrial organic compounds				
Formal agreements ratified? Informal agreement/conventions? Key institutions				
Questionnaire completed by	Country A	Name		Institution and Address
	Country B	Name		Institution and Address
Please send complete questionnaire to				

**Table 5.** New Questionnaire on Transboundary Aquifers of the Americas, prepared during the Workshop (Montevideo, 2003).

**Questionnaire on Transboundary Aquifers of the Americas**

**Part A - Geological and hydrogeological information of the aquifer**

<b>REQUESTED INFORMATION</b>	<b>COUNTRY A:</b>	<b>COUNTRY B:</b>
Transboundary aquifer name		
Aquifer ubication		
Geological characteristics		
Hydrogeological characteristics		
Flow across boundary (Mm <sup>3</sup> /yr) (volume, direction)		
Recharge area		
Hydraulic gradient across boundary		
Areal extent (km <sup>2</sup> )		
Abstraction (Mm <sup>3</sup> /yr)		
Water table changes (m/yr)		
Relevant environmental aspects: 2) Current situation quantity quality 2) Potential risk assessment		
Main uses: 2) Current use 2) Foreseen water demand		



**Part B - monitoring data: water levels table and water quality**

Number of wells for water-levels monitoring		
Frequency of water-levels measurements		
Ubication (map)		
Number of wells for water-quality monitoring		
Frequency of water-quality measurements		
Wells ubication (map)		
Measured parameters:		
Additional information		

**Part C - Legal and institutional aspects, water resources management**

International agreements existing			
Participating Institutions			
Current national legislation:			
Integrated Aquifer Management?			
Questionnaire completed by	<b>Country A</b>	<b>Name:</b>	<b>Institution and contact details</b>
	<b>Country B</b>	<b>Name:</b>	<b>Institution and contact details</b>

## **2 - Cross-checking of the information provided by the countries that share transboundary aquifers.**

The UNESCO/OAS team encouraged the countries that share the same aquifer to jointly develop the Questionnaire in order to: i) promote the exchange of information, ii) compare and organize data, iii) identify gaps in scientific and technical knowledge and iv) promote preliminary studies and data collection.

The National Coordinators expressed their interest in initiating the contacts with the neighboring countries; time was given to facilitate the exchange among countries for identifying common interests and priorities and establishing preliminary agreements.

## **3 - Identification of transboundary aquifer case-studies**

The UNESCO/OAS team proposed identifying a preliminary group of transboundary aquifers eligible for key case-studies, on the basis of the amount of scientific information and/or of the type of agreement among the countries already available (e.g. countries which have already established agreements or have developed joint investigations, etc.).

The team explained that the identification of case studies is a continuing process in the ISARM framework; such process must maintain the regional perspective of the Programme and give the countries the time to coordinate their efforts.

The country representatives agreed with the case-studies requirements but pointed out the need of further data collection and investigations; they organized working groups to coordinate proposals with neighboring countries.

The countries proposed nine transboundary aquifer case-studies, providing detailed technical information and outlining problems, existing and foreseen.

Table 6 shows the Transboundary Aquifer case-study list, with the characteristics of the aquifers and of the areas where they are located.

**Table 6.** List of Transboundary Aquifer Case-Studies proposed by the NCs.

<p><b>TOBA-YRENDIA- CHACO TARIJEÑO AQUIFER</b> (ARGENTINA - BOLIVIA - PARAGUAY)</p> <ul style="list-style-type: none"> <li>• Large indigenous population – water scarcity (water quality) Paraguay, Bolivia, Argentina</li> <li>• Agriculture: large uncultivated areas (Bolivia)</li> <li>• Poverty / Development (Paraguay, Bolivia/ Argentina – in some areas)</li> <li>• Semi arid region (Paraguay, Bolivia)</li> <li>• Population in recharge area: villages with a population of 10-5mil inhabitants, Bolivia</li> <li>• Some developed areas: Argentina</li> <li>• Need to carry out further studies (Argentina)</li> <li>• Recharge areas in Argentina and/or Bolivia ?</li> <li>• Water cost: \$2,00m<sup>3</sup></li> <li>• Institutions who manage the aquifers:</li> <li>• Argentina: County administration</li> <li>• Bolivia: municipal authorities</li> <li>• Paraguay: Environmental Agency</li> </ul>	<p><b>ARTIBONITO AND MASACRE AQUIFERS</b> (DOMINICANA REP.- HAITÍ)</p> <ul style="list-style-type: none"> <li>• high levels of poverty (80%, 90% of population): no water, no power.</li> <li>• Only dirt roads</li> <li>• Quality and quantity</li> <li>• Scarce rainfall</li> <li>• INDRHI (Dom. Rep.)</li> <li>• Servicio Nacional de Rec. Hidr. (Haiti)</li> <li>• Recharge areas in both countries.</li> <li>• Small handmade wells supply the rural population</li> <li>• Largely populated area on the Haitian side</li> </ul>
<p><b>CUCUTA-SAN ANTONIO AQUIFER</b> (COLOMBIA - VENEZUELA)</p> <ul style="list-style-type: none"> <li>• Dinamic area along the border</li> <li>• scarce rainfall</li> <li>• no integrated management for exploitation (Ve)</li> <li>• geothermal springs (60<sup>a</sup>) Ve</li> <li>• population of 300 thousand people</li> <li>• Environment Ministry and local companies within the Environment Ministry (Ve)</li> <li>• Corponor and IDEAM (Co)</li> <li>• Agricultural development (Ve y Co)</li> <li>• Water quality: local contamination</li> <li>• Recharge areas in both countries.</li> <li>• Aquifer exploitation could provide economic growth</li> </ul>	<p><b>PANTANAL AQUIFER</b> (BRAZIL - BOLÍVIA)</p> <ul style="list-style-type: none"> <li>• Little information available (Br, unknown in Bo)</li> <li>• Important ecological area (biodiversity), Pa</li> <li>• Conflictive agriculture border</li> <li>• Indigenous population (Bo, Br)</li> <li>• Mining exploitation</li> <li>• Aquifer supplies some cities (Br)</li> <li>• Cultivated areas (Bo, Pa)</li> <li>• Protected wetlands (río APA, Pa)</li> <li>• SRH MMA (Br)</li> <li>• Municipal authorities (Bo)</li> <li>• See TOBA (Py) (municipal authorities)</li> <li>• Recharge area is unknown</li> </ul>
<p><b>OSTUA-METAPAN AQUIFER</b> (EL SALVADOR - GUATEMALA - HONDURAS)</p> <ul style="list-style-type: none"> <li>• Scarce rainfall (ES)</li> <li>• Potential climate change-related natural hazards (ES)</li> <li>• precarious socio-economic conditions (ES)</li> <li>• agriculture (ES)</li> <li>• Land Planning Agency (ES)</li> <li>• Municipality (Gu), INSIVUHME</li> <li>• Recharge area in Guatemala</li> <li>• Agreements among the three countries on surface water management</li> <li>• Water Resources Management Strategic Plan for this area</li> <li>• On-going studies in Guatemala</li> </ul>	<p><b>SIXAOLA AQUIFER</b> (PANAMÁ – COSTA RICA)</p> <ul style="list-style-type: none"> <li>• Important area for the BMC</li> <li>• High poverty in both countries</li> <li>• Race diversity</li> <li>• Hydroelectric and turistic potential</li> <li>• Recharge areas:80% in CR</li> <li>• Bananas production (Pma)</li> <li>• Subsistence agriculture (CR)</li> <li>• AyA (CR)</li> <li>• IDAAN, Health Ministry, Water Resources Service</li> </ul>

<p><b>CIUDAD JUÁREZ – EL PASO AQUIFER (MÉXICO - USA)</b></p> <ul style="list-style-type: none"> <li>• Aquifer supplies El Paso &amp; Ciudad Juárez – 2 million inhabitants (URBAN USE)</li> <li>• Population is expected to double in ten years (Mx)</li> <li>• Agriculture (Mx)</li> <li>• Arid zone</li> <li>• Over exploited aquifer</li> <li>• Recharge = 10% of extraction (over exploitation and poor water quality)</li> <li>• Transboundary flow has changed (nowadays toward the center of exploitation)</li> <li>• There are joint studies and research in Mx and USA (assessment, consumption, models)</li> <li>• There are formal binational agreements for binational studies.</li> <li>• Target: prolonged exploitation by means of efficient use and conservation practices</li> <li>• USA: the exploitation decreased</li> <li>• In the last years Mx has accomplished with the water demand while it maintained constant the extraction volumes.</li> <li>• Treatment plant that reinjects into the tertiary aquifer (USA)</li> <li>• Both Mx and U.S. search alternative sources for supply (Mx y USA)</li> <li>• Wells protection programs</li> <li>• CNA (Mx), government, local stakeholders in irrigation districts</li> <li>• USA: private owners, operating agencies</li> <li>• Mx: Research is supported by government International Borders and Water Commission (Mx and USA)</li> <li>• Water cost: \$2 - \$10 m<sup>3</sup> (Mx)</li> <li>• Local subsidence due to overexploitation</li> <li>• Recharge areas in both countries</li> </ul>	<p><b>SALTO – SALTO CHICO AQUIFER (ARGENTINA – URUGUAY)</b></p> <ul style="list-style-type: none"> <li>• Unclear if/how it's transboundary</li> <li>• Country interest in establishing sustainable joint management</li> <li>• It overlies the GAS</li> <li>• extraction for consumption (shallow aquifer)</li> <li>• no thermal water</li> <li>• intense agricultural practice - rice, citrus (Ar, Uy)</li> <li>• recharge areas in UY? Ar?</li> <li>• Need to better know the connection between recharge areas and aquifer</li> <li>• Several wells</li> <li>• Dirección Nac. Hidrograf. (UY)</li> <li>• It supplies several cities (AR)</li> <li>• Over-exploitation (AR), poor water quality due to scarce wells maintenance (abandoned wells are used like waste-sites)</li> <li>• Dir Hidr. de la Prov. , municipality, private consortiums</li> </ul>
<p><b>MACHALA-TUMBES AQUIFER (ECUADOR - PERÚ)</b></p> <ul style="list-style-type: none"> <li>• Desert and bush vegetation to the south (Ec)</li> <li>• Bananas production zone to the north (Ec)</li> <li>• goat livestock (Ec)</li> <li>• Exploitation of the aquifer could mitigate/stop desertification processes and provide agricultural development (Ec, Pe)</li> <li>• Area of high poverty levels (Ec, Pe)</li> <li>• PREDESUR, Co Na Re.Hidr.) (Ec)</li> <li>• Intendencia de Rec. Hidr. (Pe)</li> <li>• Recharge area in Ec</li> <li>• Arid zone (months during the year in which there is no water for population) (Pe)</li> </ul>	<p><b>GREAT LAKES AQUIFER REGION (USA-CANADA)</b></p>

#### **4 - Identification of financing external resources**

Possible external resources of financing as well as leading agencies and technical support providers were identified; financing mechanisms and processes for the TA case-study implementation were also discussed.

**UNESCO** and **OAS** informed on the type of funds available through these organizations and the application procedures.

**Roberto Casañas**, Director of OAS/Uruguay, explained the characteristics, the eligibility criteria and the requested modalities for FEMCIDI-OAS funds (Special Multilateral Fund of the Inter-American Council for Integral Development). Among the 8 thematic areas of the fund, two seem to be best suited for multi-country proposals addressing the management and development of transboundary aquifers: the “Sustainable Development and Environment” area and the “Science and Technology” area. In view of the large number of proposals presented by the countries, the selection process is thorough and lengthy (two years approximately).

**Maria Donoso**, UNESCO regional hydrologist, outlined the modalities for accessing funds of the Participation Programme of UNESCO. The Programme funds research projects submitted by the countries (three for each country) up to a value of US\$ 35,000. The next submission deadline is March 2004.

**Bo Appelgren**, consultant for UNESCO, mentioned the GEF as a possible funding source, pointing out the types of eligible projects, the selection criteria, and the need for co-financing from countries and other donors.

#### **5 - Establishment of communication mechanisms and exchange of information among countries**

It was agreed to create a data bank and a mechanism for exchanges among the ISARM-Americas National Coordinators and with UNESCO-OEA. These two agencies were given the task of identifying ways to implement this recommendation, including the urgent establishment of an ISARM-Americas website where all generated information would be posted.

#### **Schedule of Proposed Activities**

Finally, a Schedule of Proposed Activities (Table 7) was agreed upon the UNESCO/OAS team and the country representatives.

## SCHEDULE OF PROPOSED ACTIVITIES

Actions	2003	2004				2005			
	4°trimester	1°trimester	2°trimester	3°trimester	4°trimester	1°trimester	2°trimester	3°trimester	4°trimester
1. Completion of the information collection at country level	=====								
2. Consolidation of multi-national information	=====	=====	=====	-----	-----				
3. Case-studies identification	===	=====	==X==	=====	=====	=====	=====	=====	=====
4. Identification and management of financing sources		-----	-----	=====	=====	=X=====	=====	=====	=====
5. Exchange information mechanisms: a) preparation	=====	=====							
b) follow-up			=====	=====	=====	=====	=====	=====	=====
6. Case-studies implementation and execution	=====	=====	=====	==X==	=====	=====	=====	=====	=====
7. El Paso workshop				=					

**Table 7.** Schedule of Proposed Activities to be carried out by 2005.

### 5. WORKSHOP CONCLUSIONS

It was agreed to send a Final Report and the documents produced during the Workshop to the country representatives and to the invited speakers who participated at the meeting.

The UNESCO/OAS team announced that the U.S. representatives had offered the International Boundary and Water Commission - IBWC facilities in El Paso, Texas, to host the Second Workshop of the UNESCO/OAS ISARM Americas Programme, which will be held in November 2004.

The UNESCO/OAS team congratulated the countries for their active participation and for the success of the event; they pointed out the relevant outcomes and advances of the Programme achieved during the two-day workshop.

The country representatives thanked UNESCO and OAS for the excellent workshop organization and for giving new perspectives and challenges at the regional level; they also thanked the invited experts for their relevant contributions.

**UNESCO/OAS ISARM AMERICAS PROGRAMME  
FIRST COORDINATION WORKSHOP  
(Transboundary Aquifers of the Americas)**

**Montevideo, September 24<sup>th</sup>- 25<sup>th</sup> , 2003**

**Workshop Agenda**





**TALLER/WORKSHOP**  
**ACUÍFEROS TRANSFRONTERIZOS DE LAS AMÉRICAS**  
**PROGRAMA UNESCO/OEA ISARM AMÉRICAS**

TRANSBOUNDARY AQUIFERS OF THE AMERICAS  
 UNESCO/OAS ISARM AMERICAS



**MONTEVIDEO, URUGUAY**

**24-25 SETIEMBRE 2003/SEPTEMBER 24<sup>TH</sup>-25<sup>TH</sup> 2003**

**AGENDA**

**24 DE SEPTIEMBRE/SEPTEMBER 24<sup>TH</sup>**

EN  
COLABORACIÓN  
CON:

09:00-09:30H / 09:00-09:30 AM **BIENVENIDA A LOS PARTICIPANTES/WELCOME TO THE PARTICIPANTS**  
 •MARÍA DONOSO – HIDRÓLOGA REGIONAL – UNESCO/ROSTLAC  
 •SHAMMY PURI – ISARM IAH COORDINATOR  
 •NELSON DA FRANCA RIBEIRO DOS ANJOS – COORDINADOR GENERAL PROGRAMA UNESCO/OEA ISARM AMERICAS  
 •ING. LUCIO CÁCERES – MINISTRO DE TRANSPORTE Y OBRAS PÚBLICAS



09:30-09:50H / 09:30-09:50 AM **RESUMEN DE LAS ACTIVIDADES DE ISARM A NIVEL MUNDIAL, ACTUALIZACIÓN DE AVANCES RECIENTES/SUMMARY OF WORLD WIDE ACTIVITIES OF ISARM, UPDATE ON RECENT DEVELOPMENTS - SHAMMY PURI, ISARM IAH COORDINATOR**

09:50-10:05H / 09:50-10:05 AM **PROYECTO GUARANÍ: PROCESOS DE GESTIÓN/GUARANÍ PROJECT: MANAGEMENT PROCESS – LUIZ AMORE, GUARANI PROJECT**



10:05-11:05H / 10:05-11:05 AM **•ISARM EUROPA – ORIENTACIONES PARA AGUAS SUBTERRÁNEAS TRANSFRONTERIZAS/ISARM EUROPE – TRANSBOUNDARY GROUNDWATER GUIDANCES – GEO ARNOLD, UNECE**

**•PROYECTO IULLEMEDEN : EVALUACIÓN SOCIOECONÓMICA Y DE RIESGO/IULLEMEDEN PROJECT: SOCIOECONOMIC AND RISK ASSESSMENT – BO APPELGREN, ISARM PROJECT IULLEMEDEN**

**•ASPECTOS LEGALES E INSTITUCIONALES/LEGAL AND INSTITUTIONAL ASPECTS – STEFANO BURCHI, FAO, ITALY**

**•SISTEMAS DE BASES DE DATOS PARA ACUÍFEROS/AQUIFER DATABASE SYSTEM – LUIS VIVES, INSTITUTO DE HIDROLOGÍA DE LLANURAS, ARGENTINA**

**COFFEE BREAK**

11:05-11:30H / 11:05-11:30 AM

11:30-13:00H / 11:30AM-1:00 PM **PRESENTACIONES DE LOS PAÍSES/COUNTRY PRESENTATIONS ARGENTINA, BELIZE, BOLIVIA, BRAZIL, CANADA Y CHILE Y COLOMBIA**

14:30-17:00H / 2:30-5:00 PM **PRESENTACIONES DE LOS PAÍSES/COUNTRY PRESENTATIONS**  
 •COSTA RICA, ECUADOR, EL SALVADOR, GUATEMALA, GUYANA, HAITÍ, HONDURAS, MÉXICO, NICARAGUA, PANAMÁ

17:00-17:30H / 5:00-5:30 PM

**COFFEE BREAK**

17:30-19:00H / 5:30-7:00 PM **PRESENTACIONES DE LOS PAÍSES/COUNTRY PRESENTATIONS**  
 •PARAGUAY, PERU, REPÚBLICA DOMINICANA, SURINAME, URUGUAY, USA Y VENEZUELA



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**25 DE SEPTIEMBRE/SEPTEMBER 25<sup>TH</sup>**

9:00-10:00H / 9:00-10:00 AM

**RESUMEN CONSOLIDADO DE LAS PRESENTACIONES/SUMMARY OF THE COUNTRY PRESENTATIONS**

10:00-11:00H / 10:00-11:00 AM

**DISCUSIÓN EN GRUPO: ASPECTOS CLAVES EN EL DESARROLLO DEL INVENTARIO DE ISARM AMÉRICA/**GROUP DISCUSSION: KEY ISSUES IN THE DEVELOPMENT OF THE AMERICAS ISARM INVENTORY – **DISCUSIÓN LIDERADA POR MARIA DONOSO/**DISCUSSION LED BY MARIA DONOSO

EN  
COLABORACIÓN  
CON:

11:00-11:30H / 11:00-11:30 AM

11:30-13:00H / 11:30AM-1:00 PM

**DISCUSIÓN EN GRUPO: ASPECTOS LEGALES, SOCIOECONÓMICOS E INSTITUCIONALES QUE AFECTAN A LOS ACUÍFEROS TRANSFRONTERIZOS EN AMÉRICA/**GROUP DISCUSSION: LEGAL, SOCIO-ECONOMIC, INSTITUTIONAL ISSUES THAT AFFECT TRANSBOUNDARY AQUIFERS IN AMERICAS – **DISCUSIÓN LIDERADA POR STEFANO BURCHI/**DISCUSSION LED BY STEFANO BURCHI



14:30-15:00H / 2:30-3:00 PM

**DISCUSIÓN EN GRUPO: SELECCIÓN DE LAS PRESENTACIONES REALIZADAS Y DE LAS DISCUSIONES PREVIAS – CASOS DE ESTUDIO CLAVE – CUYOS RESULTADOS ALIMENTARÁN EL PROGRAMA ISARM/** GROUP DISCUSSION: SELECTION FROM THE PRESENTATIONS MADE AND THE PREVIOUS DISCUSSIONS – KEY CASE STUDIES – WHOSE OUTPUT WILL FEED INTO THE ISARM PROGRAMME – **DISCUSIÓN LIDERADA POR SHAMMY PURI/**DISCUSSION LED BY SHAMMY PURI



15:30-16:30H / 3:30-4:30 PM

**DISCUSIÓN EN GRUPO: FINANCIAMIENTO, SOPORTE TÉCNICO Y AGENCIAS LÍDERES PARA LA IMPLEMENTACIÓN DEL INVENTARIO DE ISARM AMÉRICA Y DE LOS CASOS DE ESTUDIO SELECCIONADOS/** GROUP DISCUSSION: FINANCING, TECHNICAL SUPPORT AND LEAD AGENCIES FOR THE IMPLEMENTATION OF THE AMERICAS ISARM INVENTORY AND THE SELECTED CASE STUDIES - **DISCUSIÓN LIDERADA POR JORGE RUCKS/**DISCUSSION LED BY JORGE RUCKS



16:30-17:00H / 4:30-5:00 PM

**COFFEEBREAK**

17:00-18:00H / 5:00-6:00 PM

**ACCIONES FUTURAS Y CONCLUSIONES DEL TALLER/FUTURE ACTIVITIES AND CLOSING OF THE WORKSHOP**

- SHAMMY PURI – ISARM/IAH COORDINATOR
  - NELSON DA FRANCA RIBEIRO DOS ANJOS – UNESCO/OEA ISARM AMÉRICAS
  - MARIA DONOSO – UNESCO/ROSLAC
-

**UNESCO/OAS ISARM AMERICAS PROGRAMME  
FIRST COORDINATION WORKSHOP  
(Transboundary Aquifers of the Americas)**

**Montevideo, September 24<sup>th</sup>- 25<sup>th</sup> , 2003**

**List of participants,  
invited speakers and observers**

**UNESCO/OAS ISARM AMERICAS PROGRAMME - LIST OF PARTICIPANTS - MONTEVIDEO SEPT. 24TH -25TH 2003**

<b>COUNTRY</b>	<b>NAME</b>	<b>POSITION</b>	<b>INSTITUTION</b>	<b>CODE</b>	<b>TELEPHONE</b>	<b>FAX</b>	<b>E-MAIL</b>
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