Case Study of Transboundary Dispute Resolution: the Guarani Aquifer

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1. Case summary

River basin: Guarani Aquifer (figure 1 and table 1)
Dates of negotiation: 2000 to present
Relevant parties: Argentina, Brazil, Paraguay, Uruguay
Flashpoint: None
Issues: Stated Objectives: Relevant parties to design and implement a coordinated management program for preserving and monitoring the Guarani Aquifer for current and future use.
Criteria for water allocations: None determined
Incentives/linkage: Financial: Protection of aquifer is significantly less costly than remediating a polluted aquifer in the future; Political: None
Breakthroughs: Four countries, along with support from the Global Environment Facility (GEF), agreed on Project for the Environmental Protection and Sustainable Development of the Guarani Aquifer System in 2000
Status: Ongoing design of international Water Management Framework for the Guarani Aquifer

2. Background

The Guarani aquifer is the largest groundwater resource in the world, with 45,000 km^3 of water and a surface area of 1.2 million km^2 (Organization of American States, 2004, p. 1; Valente, 2002, p. 1-2). The transboundary aquifer is shared by Argentina, Brazil, Paraguay and Uruguay. Table 1 illustrates the distribution of the aquifer across the four nations and the relevant uses, environmental issues and information relating to each nation and the aquifer.

3. The problem

The economic and social importance of the Guarani aquifer to the four riparians has spurred concern over the pollution and overexploitation of its groundwater, especially in the context of growing demand for freshwater resources in all four states. While the level of pollution and use has not yet reached critical levels, the potential for future problems in these areas has led to immediate action and cooperation among the four states to develop an aquifer management strategy.

Additionally, the hydrothermal character of certain areas of the aquifer represents a resource for tourism as well as "clean energy" production. Considering all four countries are in the process of economic development, and have also signed the Kyoto Protocol, access to the aquifer for these purposes could also be a source of conflict.

4. Attempts at conflict management

Considering the coordinated efforts of the four nations to implement an aquifer management program before significant problems with pollution and overuse could occur, there has not been any significant conflict over the shared groundwater resource to date. Additionally, these four states have a history of collaboration (for example, the Intergovernmental Committee for the La Plata river basin and the MERCOSUR trade mechanism) rather than conflict in recent decades.

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Table 1: Current knowledge and importance of the Guarani Aquifer in Argentina, Brazil, Uruguay, and Paraguay (Global Environment Facility, 2000, p. 4)

	Argentina	Brazil	Paraguay	Uruguay
Approximate extension of the Guarani Aquifer (km^2)	225,500	839,800	71,700	45,000
Surface of territory occupied by the aquifer (%)	5.9	9.8	17.6	25.3
Characteristics	Supply source	Recharge and supply area	Recharge and supply area	Recharge and supply area
Extent of exploitation	6 deep wells for thermal use; about 100 wells for drinking and irrigation	Between 300 to 500 cities partially or entirely supplied by the Guarani Aquifer	About 200 wells	347 wells for public supply (250), irrigation (90), and thermal tourism (7)
Main environmental issue	1. Potentially uncontrolled drilling and extraction 2. Subject to pollution effects from other countries	1. Point and nonpoint source pollution 2. Uncontrolled drilling and extraction	1. Point and nonpoint source pollution 2. Uncontrolled drilling and extraction 3. Subject to pollution impact from other countries	1. Point and nonpoint source pollution 2. Uncontrolled drilling and extraction 3. Subject to pollution impact from other countries
Level of information	Limited information available	Considerable information available but dispersed in different states and institutions	Limited structured information available	Considerable information available

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Figure 1: Map of the Guarani Aquifer.

In order to prevent conflict in the future over the Guarani aquifer, the four states have been involved in the GEF-funded Project for the Environmental Protection and Sustainable Development of the Guarani Aquifer System. The US$27 Million project ($13M from the GEF and $14M from participating countries, the Organization of American States, and other donors) includes five major areas to address the sustainable management of the aquifer:

(a) Expansion and consolidation of the current knowledge base;
(b) Joint development and implementation of a Guarani Aquifer Management Framework;
(c) Public participation through an appropriate information and institutional framework;
(d) Implementation of measures to deal with non-point source pollution, and
(e) Monitoring and evaluation (Valente, 2002, p. 2; GEF, 2000, p. 7).

The Guarani Aquifer Management Framework is one subsection of the much larger La Plata River Basin Integrated Water Resource Management Program. This program was originally developed to manage the surface waters contained in the La Plata watershed; however, the original program largely ignored the management of any groundwater resources, including the Guarani Aquifer.

5. Outcome

Experts working on the GEF project have until 2007 to develop the plan for all four states to share management of the aquifer. All four states have signed on to the project and participated thus far in the

design of the management and monitoring program for the Guarani aquifer. Other institutions who have participated in the process include: the World Bank (WB), the Global Environmental Facility (GEF), the Organization of American States (OAS), United Nations Environmental Programme (UNEP), United Nations Education, Scientific and Cultural Organization (UNESCO), the International Atomic Energy Association (IAEA) and the German Government (GEF, 2001, p. 7).

The current GEF/WB project will involve three major sectors: sustainable water resource management, transboundary water management and energy use. Sustainable water resource management will largely include institutional arrangements between stakeholders, investments in water infrastructure (for use and monitoring) construction and maintenance, as well as measures for pollution control and prevention (GEF, 2001, p. 2). Transboundary water management will be institutionalized by integrating the management framework for the Guarani Aquifer into the existing framework for the management of the La Plata River basin (Mejia *et al*., 2004, slide 8). Finally, an initial assessment of the potential energy generation capacity (and tourism potential) of the hydrothermal sections of the basin will allow for the creation of a management strategy for energy use (GEF, 2001, p. 2).

So far, initial surveys of the aquifer have given more detailed information relating to the quantity of water, and the geography, distribution and use of the water, giving stakeholders and policymakers a better understanding of how the aquifer will need to be managed. In fact, some "hot spots" of pollution or overuse have been identified, and new management practices have been initiated in these areas. Additionally, the project has succeeded in raising awareness about the aquifer, which has resulted in increased international interest, forums for dialogue and the engagement of universities and NGOs (Mejia *et al.*, 2004, slide 14).

6. Lessons learned

- *Groundwater management needs to be integrated into regional water management strategies and programs.*
  Most of the Integrated Water Resource Management (IWRM) program in the region had been devoted to surface waters, largely ignoring one of the largest underground freshwater resources in the world.
- *In order to manage a transboundary aquifer effectively, it requires coordinated collaboration, cooperation and communication between national and sub-national governments, as well as the private sector, international organizations and local civil society.*
  With an integrated management strategy that affects international politics, economics, the environment and social well-being, it is necessary to include all stakeholders in the process from design to implementation to maintenance, in order for the program to be effective and sustainable. There needs to be a broad understanding of a common goal and a clear strategy and methodology to achieve that goal.

7. Creative outcomes resulting from resolution process

The foresight with which the four basin states are using to plan the use of the Guarani Aquifer System has lead to holistic, sustainable management plans that include public participation and education and are based on preventative actions.

8. Timeline

- 1969 Plata Basin Framework Agreement
- 1981 MERCOSUR Common Market Agreement
- 1991 GEF gives birth to an experimental task force aimed at the preservation and sustainable management of the Guarani Aquifer
- December 1999 Sao Paolo Workshop discuss use and protection of aquifer by the state
- January/February 2000 Stakeholder workshop at Foz de Iguazu for an endorsement of a project concept

note by central and state government representatives, university researchers, NGOs, municipalities and international organizations (OAS, IICA)

- 2002 to 2004 Regular meetings between stakeholders relating to the ongoing design of the integrated management and monitoring framework for the Guarani Aquifer. Final plan is scheduled to be finished by 2007
- May 2003 All four basin states signed the “Environmental Protection and Sustainable Development of the Guarani Aquifer System” agreement

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