



## CASE STUDY

# Transboundary: Groundwater management issues for Guarani aquifer



## Summary

The quality of groundwater recharging the Guarani aquifer is threatened in some areas by rapid land-use changes, and locally by rapid urbanisation. Action was taken by the World Bank through a GEF-funded project on the 'Sustainable Development & Environmental Protection of the Guarani Aquifer', which included scientific studies, institutional provisions and transboundary groundwater management. This case study reinforces the lesson to 'think globally but act locally'.

## Background

The Guarani Aquifer is a huge system of Triassic-Jurassic sandstones (mainly of Aeolian origin) underlying more than 1 million km<sup>2</sup> of Brazil (62% of area), Paraguay Uruguay & Argentina – with around 30,000 km<sup>3</sup> of fresh groundwater in storage, a current rate of exploitation of just over 1 km<sup>3</sup>/a (94% in Brazil) and major potential for municipal and industrial water-supply, supplementary irrigation and hydrogeothermal resources (reaching 40-60 C in its more deeply-confined sections).

There are estimated to be around 2,000 operating deep production boreholes. Some are capable of producing more than 500 m<sup>3</sup>/hr but less when only the 'overflow yield' is utilized – and as regards actual average abstraction less than 20% of the total are producing more than 100 m<sup>3</sup>/hr. The extensive area underlain by the SAG has a present population of about 15 million (although including large cities in its proximity this figure increases to about 90 million), a mainly sub-tropical climate, and abundant (but often polluted) surface water resources which experience occasional droughts. Thus the need for reliable potable water-supply sources and industrial supplies (of low-treatment cost) is likely to grow significantly, especially in some climate-change scenarios (which imply increased water demand due to ambient temperature increase and more frequent and intense surface-water

droughts).

The quality of groundwater recharging the aquifer is threatened in some areas by rapid land-use changes (from natural forest to arable soya-bean cultivation), and locally by rapid urbanisation – but only very locally are there indications of excessive groundwater abstraction (eg. Ribeirao Preto-Brazil) or transboundary groundwater resource or quality dimensions (eg. Rivera-Uruguay/Santana do Livramento-Brazil, Ponta Pora-Brazil/Pedro-Juan Caballero (Paraguay), Concordia (Argentina)-Salto (Uruguay)).

## **Actions taken**

During 2003-08 the World Bank mobilised and executed a GEF-funded international project on the 'Sustainable Development & Environmental Protection of the Guarani Aquifer', implemented by the OAS and the respective governments, with the support of the IAEA and BGR-Germany. Throughout

implementation of the GEF-Program there was consensus among countries on developing a coordinated legal framework and harmonizing their laws regarding groundwater resource management, whilst recognizing national differences and peculiarities. Significant efforts were made by the GEF-Program to remedy deficiencies in groundwater regulations and or tools, such that all four 'Guarani countries' have shown important advances. In addition, 7 Brazilian States and 3 Argentinian Provinces have made specific Guarani Aquifer management provisions, and resolutions on SAG protection by the Rio Pardo Basin Committee (CBRP) in Brazil have prompted deliberations on groundwater restriction areas by the São Paulo State Water Resources Council. Five pilot experiences of advancing SAG groundwater management and protection are reported which cover a representative range of resource management and quality protection issues, and are attempting to identify problem-specific and scale-specific solutions, capable of being implemented by appropriate local institutional agreements.

In addition to extensive collaborative scientific studies of aquifer characteristics and behaviour, and a systematic and critical review of the national/state level institutional and legal provisions for groundwater management (both in a local and transboundary context), the project featured a number of international transboundary groundwater management pilot projects which through 'local champions' addressed the issue of stakeholder mobilization on integrated water and land use management.

## **Outcomes**

The main institutional advances generated by the GEF-Program in respect of groundwater management. The legal basis for 'local commission work' emanates from state or provincial responsibility for water management in general, and groundwater management in particular. The GEF-Program has demonstrated, through its pilot projects, how local management should be setup, and also provided several useful management tools (such as information systems, practical guidelines, etc). It has also helped to strengthen the institutional nucleus for future local management and it is now in the countries own interest to build upon this. Moreover, as seen in Concordia-Salto, Rivera-Santana do Livramento, Riberão Preto and Itapúa, the involvement of national and state/provincial governments has been essential to achieve progress. at local level

## **Lessons Learned**

In very large groundwater systems like the Guarani Aquifer, it is essential to 'think globally but act locally' (redefine institutional responsibilities and legal powers as necessary) if progress on practical groundwater resource management and quality protection is to be achieved.

The interface between groundwater interests and land-use planning (both urban in terms of establishing protected wellfields and rural in the sense of influencing the drivers on agricultural cropping) still requires considerable further work.

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**Supporting Materials**

[The World Bank](#)

[Transboundary: Groundwater management issues for Guarani aquifer](#)

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