



Towards the joint-management of transboundary groundwaters: Hydrogeology and the Guaraní Aquifer System

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This article explores the role of hydrogeology in the emergence of management policies for the Guaraní Aquifer system, a vast transboundary groundwater reservoir shared by Argentina, Brazil, Paraguay, and Uruguay. It finds that the emergence of knowledge about the resources, which came concomitant with processes of democratization in the region and the constitution of new knowledge networks, fostered the political process that ultimately led to the implementation of joint management policies for the transboundary groundwaters.

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In stark contrast to other international waters such as shared rivers or lakes, transboundary groundwaters are rarely co-managed. The management of groundwater aquifers depends on scientific knowledge, which is often unavailable, and is always influenced by a multiplicity of localized challenges that often preclude the straightforward implementation of generic regulatory mechanisms. Drawing from historical documents and interviews with management experts, scientists and socio-economic stakeholders, this research examines the roles of science and scientific cooperation in the process that led to the creation of co-management instruments for one of the largest transboundary groundwater basins in the world: the Guaraní Aquifer System shared by Argentina, Brazil, Paraguay, and Uruguay (see Footnote 1). This analytical

Towards the joint-management of transboundary groundwaters: Hydrogeology and the Guaraní Aquifer System

approach purposefully sidesteps standard discussions about geopolitical differences or the incompatibility of institutional settings to explain the development of governance systems; instead, it seeks answers in the process that led to the emergence of hydrogeological knowledge and its influence on policy.



Figure 1. Guaraní Aquifer System. Source: Adapted from OAS (2009), p. 53.

Historically, water resources shared by the riparian countries of the Río de La Plata Basin were proxies for the geopolitical competition existing between the countries. The States saw the waters of the shared basin as means both to fulfill their economic development plans and to demarcate their sovereign spaces. In

that context, scientific research dedicated to the study of shared water resources was compartmentalized in each nation and guided by the development projects of the governments. The vast majority of academic institutions were funded and organized by the State: the formal recognition of scientific disciplines in regional universities directly depended on the decisions of the national Ministries of Education. The academic departments in the regional universities located along the La Plata basin were funded and organized for the training of experts and the production of the knowledge deemed necessary for the construction and maintenance of large infrastructure projects in the area. Under this framework, not all scientific disciplines received equal official support. Hydrogeology studies, which are dedicated to the understanding of groundwaters and aquifers, were considered subordinate to other canonical disciplines such as Hydrology and Geology and thus were allocated fewer economic and institutional resources. The region produced few experts and academic studies in the field of Hydrogeology. During the nineteen-eighties, however, regional democratization processes and the consequent freedom of academic institutions from strict governmental control fostered the creation of new academic departments. The process fuelled the

Towards the joint-management of transboundary groundwaters: Hydrogeology and the Guaraní Aquifer System

significant increase in the number of hydrogeology experts and the study of the region's aquifers and groundwater resources.

Interest in Hydrogeology grew concomitant to the increasing demand for the resources in the region. Groundwaters progressively became a crucial component of diverse economic activities – i.e., the supply of freshwater for urban consumption in southern Brazil, crop irrigation in Paraguay, and thermal tourism operations in Argentina and Uruguay – which were threatened by the slow yet noticeable quantitative and qualitative deterioration of the resources. Better general knowledge of the resources revealed the transboundary impact of the unregulated proliferation of groundwater wells, the contamination of recharge zones, and the lack of proper well-drilling standards. In that context, the discovery of the Guaraní Aquifer System reflected not just the verification of hydrologic connections existing between known local aquifers, but also denoted the consolidation of Hydrogeology in the regional academic institutions and the constitution of new regional knowledge networks. Theorizing the existence of the Guaraní Aquifer System, hydrogeologists suggested that the regional aquifers were part of an interconnected system. Such an approach was instrumental to the regional hydrogeologists' ongoing struggle

for recognition and resources within regional academic institutions. The scale and, thus, geostrategic importance of the transboundary aquifer, supported the capture of new economic resources from international agencies dedicated to funding research about shared natural resources, as well as the hydrogeologists' claim for recognition.

Moreover, scientific research on regional groundwater resources fuelled explicit calls for internationally-coordinated political action. The regional scale of the aquifer system catalyzed the recognition of the potential geostrategic value of the resources and prompted the involvement of public officials. Driven by the demands of regional scientists and local stakeholders, but reflective of the strategic interest of the national governments, the transboundary groundwaters entered the political agenda. The countries engaged in a process of multi-lateral cooperation and established a project – co-financed by the Global Environment Facility – for the assessment of the resources and the established regulatory frameworks in the year 2000. The initiative produced a knowledge base for the development of policies aimed at the protection and sustainable management of the aquifer system. The international cooperation project concluded in 2009 with the production of a strategic action plan,

Towards the joint-management of transboundary groundwaters: Hydrogeology and the Guaraní Aquifer System

which facilitated the development of concrete management policies at the local, regional and national levels. Information gathered through the cooperation process was centralized in a system of geographic information publicly accessible and made available for decision-makers. On this basis, local level stakeholders implemented new well drilling standards, determined minimum buffer zones between wells, and protected vulnerable recharge areas. The action plan also led to the signature of a multi-lateral framework agreement in 2010, which outlined general non-binding principles for future transboundary groundwater governance in the region. The agreement emphasized the countries' inalienable sovereignty over the resource and enshrined reciprocal no-harm and sustainability as guiding principles for the future exploitation of the resources.

The process that led to the creation of the governance instruments for the management and sustainable exploitation of the Guaraní

Aquifer System is indicative of the many political roles of scientific knowledge. Information about transboundary groundwaters was simultaneously instrumental to the introduction of the resources in the political agenda and the political negotiation of concrete management provisions. The process of political recognition of the resources was inseparable from the emergence of new theories about the aquifer system's geographical scale and from the struggles for disciplinary recognition led by the regional scientists. Official negotiations about the 'new' shared resources – the waters stored in the Guaraní Aquifer System – resulted from the mobilization and interest of actors who, historically, had been marginal in regional politics. Instead of being designed and directed exclusively according to the preferences of State agents, the governance of the aquifer system was fostered by subsidiary political authorities and non-state actors: expert networks and international organizations.

Footnotes

1. Located under the Paraná, Uruguay and Paraguay River basins, the Guaraní Aquifer System extends over one million square kilometers and is a significant renewable source of safe fresh water in the region. The aquifer system occupies 8.1% of the territory of Argentina, 8.1% of Brazil, 21.5% of Paraguay, and 19.5% of that of Uruguay.

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Towards the joint-management of transboundary groundwaters: Hydrogeology and the Guaraní Aquifer System

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Martin Walter is currently in the final stages of a dual doctoral program at Northwestern University and the Institut d'Etudes Politiques de Paris. His research deals with the socio-political intricacies of implementing projects for the protection and sustainable development of the environment; it focuses on the history and politics surrounding the emergence of water governance systems and, in particular, policies for the management of transboundary groundwaters. In addition to his academic activities, the author also conducts research for the United Nations Environment Programme (Regional Office for North America) and for independent professional consultancy projects.

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