MANAGING THE HIDDEN SIDE OF HIDROLOGICAL CICLE, THE INTERNATIONAL LAW OF TRANSBOUNDAY AQUIFERS AND THE AGREEMENT ON THE GUARANI AQUIFER

Pilar Carolina Villar[1]

1. Introduction

The increased use of groundwater in several parts of the world calls attention to the degradation risk of the aquifers and the lack of experience in their management. If the challenge last century was to regulate the use of superficial waters, in the present one it is to consolidate this regulation to avoid a water crisis and include the slower and more hidden hydrologic-cycle dimension: groundwater and aquifers.

Groundwater management requires the articulation of several agencies and players. In the case of transboundary aquifers, such as the Guarani Aquifer that extends through Argentina, Brazil, Paraguay and Uruguay, the institutional design is much more complex, since its management depends on the cooperation of international, national, regional and local levels. Groundwater policies are just begging in the four countries and face difficulties to be implemented.

The celebration of an international agreement between those countries is a great move towards the management of transboundary aquifers. The Agreement on the Guarani Aquifer was the first agreement for transboundary groundwater developed under the influence of the United Nations Resolution 63/124 – The Law of transboundary aquifers and the only one established without problems, tensions or conflicts for the aquifer use. .

This paper aims to analyze the legal and geopolitical context that prompted the signing of the Agreement on the Guarani Aquifer and evaluate its potential for preventing future conflicts and deepening cooperation among the countries overlying the Guarani Aquifer. The research was made through the qualitative analyses of primary and secondary sources, including the results of the Guarani Aquifer Project, MERCOSUR documents, international rules related to water resources, the Agreement on the Guarani Aquifer, and the existing literature on the subject.

This paper is organized into five sections. Section 2 contextualize the groundwater situation and the case of Guarani Aquifer System (GAS).. Section 3 discusses the various projects that contributed to promoting knowledge about the aquifer and cooperation. Section 4 addresses international water law pertaining to transboundary aquifers and section 5 analyses the Agreement on the Guarani Aquifer. Finally, Section 6 presents conclusions and recommendations.

2. Groundwater situation and the Guarani Aquifer System Cooperation (GAS)

The intensive use of groundwater is a phenomenon that started from the second half of the XX century and is capable of significantly changing the hydrologic cycle (Fornés et al. 2005). The increased extraction is caused by several causes: the degradation of superficial waters, the perception of the superior quality of groundwater,

[1] PhD student from São Paulo University Environmental Sciences Post-Graduate Program. E-mail: pcvillar@usp.br

its availability in arid and semi-arid areas, its use for irrigation[2], advances in drilling techniques and the low price of energy to pump these resources. The groundwater exploitation allowed for social-economic shifts (Jarvis 2010), but it also generated aquifer over-exploitation, contamination and salinization risks. The impacts on these resources tends to get worse due to the climate-change phenomenon (Loáiciga 2003).

Several scholars explain the increase in groundwater exploitation considering its common-pool-resource nature (Feitelson 2006**,** Gunn 2009, Jarvis 2010), which refers to "a natural or man-made resource system that is sufficiently large as to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use" (Ostrom 1990, p. 30). Anyone that has the financial and technical means (Moech, 2004) is stimulated to exploit them, as long as, "the marginal value product of the water is greater or equal to the marginal pumping costs" (Feitelson 2006, p. 320). This characteristic produces externalities because the water pumped is no longer available to others and decreases the aquifer levels for everyone. Also, individual contamination impairs all groundwater users (Palma 2003). The hidden character of these waters and its intrinsic relation with water, added to the right to ownership, make their extraction exclusion and control more difficult. Parallel to this, only through science is it possible to check the characteristics of the aquifers and the externalities generated.

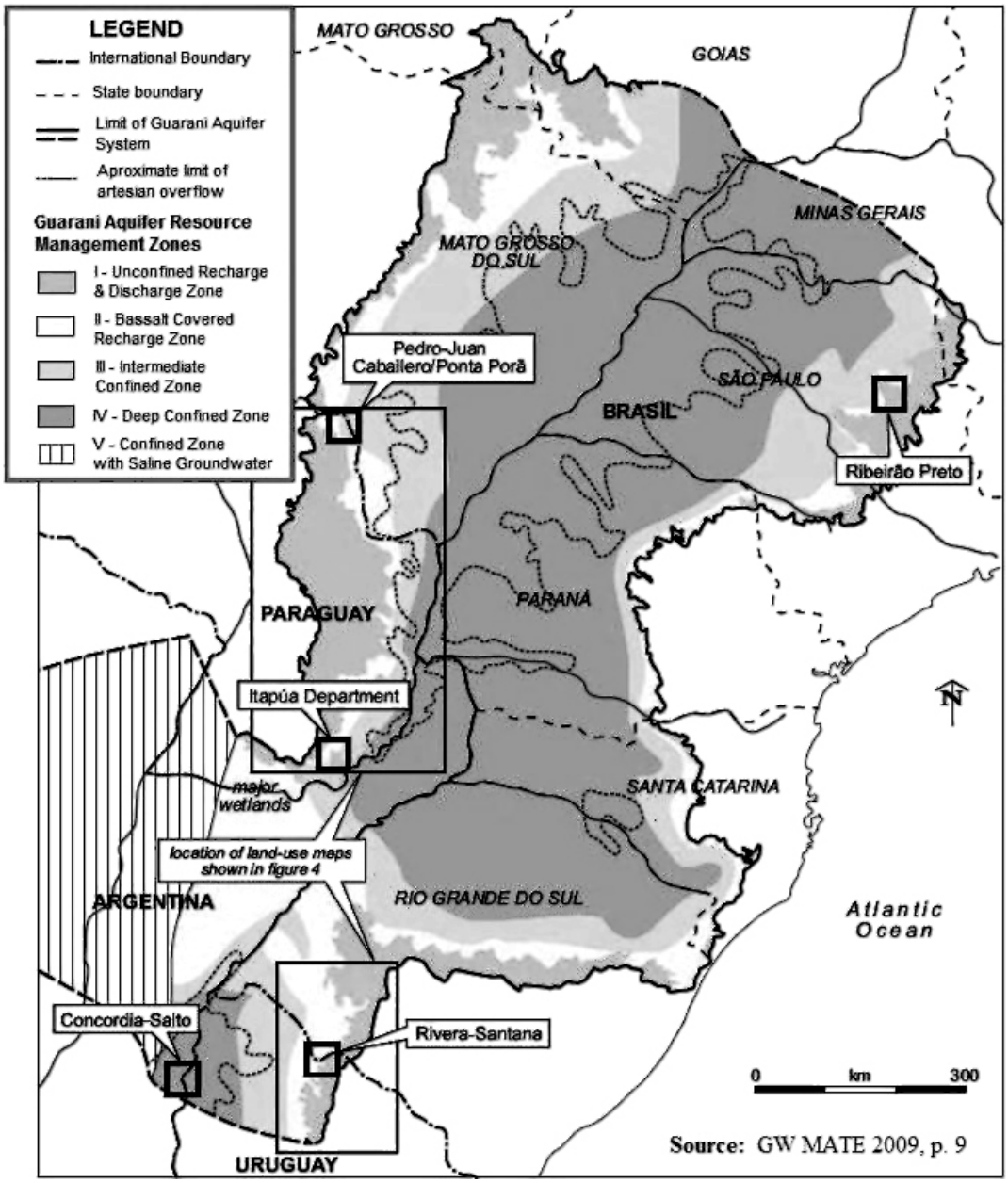
Groundwater has been subjected to serious degradation through overuse or contamination all over the world. This is a classic example of what Hardin (1968) called the tragedy of the commons, which results from a conflict between collective and individual interests. Generally, the possible solutions for this dilemma focus in the follow strategies: a) privatizing the commons (individual management); b) regulation by an external government agency (state-level management); and c) collective agreements among local resource users (local level management) (Laver 1984, Ostrom 1990). Several institutional arrangements may be built based on these strategies and used for the management of the common-pool resources (Sick 2002).

Empirical studies show that the most successful management experiences were those where the resource was restricted to the national limits and managed by small to relatively large groups counting on the support of nested institutions at varying scales (Ostrom et al. 1999). Environmental goods require collective action and cooperation and that also applies to transboundary water resources, although the process is more complex. Managing the hydrological cycle in an integrated perspective demands the co-ordination of a range of existing social, administrative, economic, and political boundaries (Sick 2002)

Guarani Aquifer is a transboundary aquifer which requires international cooperation to be managed. International institutions, projects or agreements may influence the countries positively in managing groundwater (Bernauer, 1995). The Guarani Aquifer System has been the subject of international cooperation projects which contribute to transform it in the only transboundary aquifer in Latin America that has a treaty signed between the countries through which it extends. Figure 1 shows that this aquifers is located in the South American mid-eastern between 12º and 35º south latitude and 47º and 65º west longitude, in the Paraná Sedimentary Geological Basin.

[2] According Llamas and Martınez-Santos (2005) the use of groundwater generated a silent revolution in the rural area. This phenomenon means the action of millions of independent farmers in arid and semi-arid countries, who implemented the necessary means to irrigate their land with groundwater without governmental participation on these groundwater developments.

Figure 1: Guarani Aquifer System – Management Zones



The Guarani Aquifer System covers a geographical area of 1,100,000 km^2 (GW MATE 2009) which reveals a great management challenge. The average thickness of the aquifer is 250 meters and the volume of water is estimated to be 30,000 km^3 (GW MATE 2009). The quality of water is good, with low rates of mineralization in most places (OAS 2009, GW MATE 2009). The ages of the water varies. In the areas of confinement, the residence time may exceed 10,000 years (OAS 2009, GW MATE 2009).

Studies in the region contributed to improve the understanding of the aquifer in relation to its dynamics, recharge areas, and future transboundary problems. According GW MATE (2009), the aquifer could be divided in four areas of management, based on their hydrogeological characteristics: I – non confined recharge and discharge zone; II – recharge zone covered by basalt; III – intermediate non-confined zone; IV – deep confined zone; and V confined zone with saline groundwater.

This zoning seeks to identify which areas are most vulnerable and enable the pursuit of appropriate management strategies in relation to the particularities of each one. The non-confined recharge and discharge zone (zone I) is the main source of aquifer recharge and the most vulnerable to contamination. The recharge zone covered by basalt (zone II) is overlain by very thick and fractured basalt, which allows the recharge, but in a lower capacity than that of zone I (GW MATE 2009). In the confined zones (intermediate, deep, and with high level of salinity) there is no significant recharge and the extraction of groundwater results in mining the aquifer because there is no water replacement. In contrast, in those areas the aquifer is protected from anthropogenic pollution (OAS, 2009, GW MATE 2009).

International cooperation in the Guarani Aquifer System prior to the Agreement on the Guarani Aquifer

The invisibility of groundwater makes its management a challenge anywhere in the world. The definition of a policy for the aquifers depends on the existence of a database with its hydrogeological characteristics, the volumes extracted, user register and the activities performed in the aquifer area. In the case of the transboundary aquifers, the cross-boundary circumstances require joint management (Feitelson, 2006), either in the exchange of information, shared monitoring or harmonization of the Aquifer States' water policies. The users will only have a sustainable use of their part of the aquifer if the other users do the same (Feitelson, 2006).

Groundwater international cooperation in Latin America started in the sphere of the epistemic communities from the South-Cone universities and has motivated the insertion of international organizations and States in the process of managing transboundary aquifers.

The first joint effort was the *Proyecto Sostenible del Acuífero Botucatu*[3](1995), sponsored by the *International Development Research Centre* (IDRC - Canada), which intended to integrate private and governmental institutions in order to establish legal mechanisms and joint measures to manage the aquifer[4] (Borghetti *et al.* 2004). Another cooperation project idealize to improve the research on the aquifer was a partnership between the following universities: *Universidad Nacional del Litoral* and *Universidad de Buenos Aires*, both from Argentina, and *Universidad de la República*, from Uruguay[5] (Borghetti *et al*. 2004). Paradiplomacy also contributed to a deeper knowledge of the Guarani Aquifer and the strengthening of its management. The international agreement signed in 2001 between the Environment Department of the state of São Paulo (Brazil) and the Environment, Public Health and Consumer Protection Department of the state

[3] Acuífero Botucatu is one of the Guarani Aquifer System geological formations. The denomination Guarani Aquifer was approved by Argentina, Brazil, Paraguay, and Uruguay only in May 1996, and intended to include all the different geological formations that are part of the system as well as honor the Guarani indigenous peoples who live in the area (BORGHETTI et al., 2004)

[4] Some of the contributions of this project include: The Technical Scientific Journey on the Management of the Botucatu International Aquifer (1995), the International Workshop on the MERCOSUR Giant Aquifer, and the drafting of the first scientific-technical base of the Aquifer under the Geological Basin of Paraná (Borghetti *et al.* 2004).

[5]Subsequently, the results of technical cooperation and exchange of researchers from Argentina and Uruguay were published in the book "Acuíferos Regionales en America Latina. Sistema Acuífero Guaraní. Montano, J.; et al.; 1998. Acuíferos regionales en América Latina sistema acuífero Guaraní. Uruguay: Universidad Nacional del Litoral Santa Fe.

of Bavaria (Germany), established a Technical Cooperation Agreement[6] (Villar and Ribeiro 2009).

The most important initiative in the region was the Environmental Protection and Sustainable Development of the Guarani Aquifer System Project (also known as the Guarani Aquifer System Project). This project was the result of cooperation between the four countries and several international agencies, including the Global Environment Facility (GEF), the World Bank (WB), the Organization of American States (OAS), the Dutch and German Governments, and the International Atomic Energy Agency (OAS 2005, 2009). The six-year project (2003-2009) significantly increased knowledge about the GAS's characteristics and removed the aquifer from anonymity within the four countries. main objective was to support countries "*to elaborate and implement a shared institutional, legal and technical framework to preserve and manage the Guarani Aquifer System (GAS) for the current and future generations"* (OAS 2005, p. 1).

The conclusions of the studies pointed to an aquifer without transboundary conflicts, a flow of recharge limited to the borders, and that the nature of any problems was basically local. In the final document, there are no conflicts over water use among the overlying states, cases of overexploitation or contamination were few and localized, and potential sources of conflict were restricted to border areas, which represent a small portion of the aquifer (OAS 2009, GW MATE 2009). Despite the transboundary nature of the Guarani Aquifer System, the project conclusions based on the four pilot projects developed[7] emphasize that the appropriate scale to manage the Guarani Aquifer System is the local one.

The project conclusions bet on a 'bottom-up' approach. The peculiarities in the SAG make of the local level an important player in the management of these waters, especially in face of the absence of significant transboundary conflicts, the number of stakeholders involved and the variability of its hydro-geologic characteristics.

National and international scales constitute fundamental elements conditioning local decision-making and have a major role in determining the success or failure of local water politics (Pomeroy et. al. 2001). The management of a transboundary aquifer requires the establishment of joint cooperation schemes with a multi-sectorial, multidisciplinary and multi-player approach. The Guarani Aquifer requires cooperative management between the several levels and players

The convergence of national and international people and funds stimulated scientific production and called social attention to the theme. The social, academic and international pressure created a favorable environment for the execution of an international agreement between the Guarani Aquifer countries and the establishment of specific policies in these countries.

In addition, joint efforts promoted by the Guarani Aquifer Project reverberated within MERCOSUR, whose instruments dedicated to environmental issues were used to broaden the debate on the management of the Guarani Aquifer. The first MERCOSUR initiative to formulate a shared management model to Guarani was the establishment of

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[6] This project culminated in a joint project called Pilot System of Information for Environmental Management of Groundwater Resources in the Outcrop Area of the Guarani Aquifer System in the State of Sao Paulo[6].

[7] The pilot projects developed in the Guarani Aquifer area were: a) Concordia (Argentina) / Salto (Uruguay), b) Rivera (Uruguay) / Santana do Livramento (Brazil), c) Encarnación - Cuidad del Este - Caaguazú (Paraguay) and d) Ribeirão Preto (Brazil). The first two sought a better understanding of issues linked to the management of transboundary groundwater and the others sought the development of management strategies within a groundwater vulnerability context (presence of recharge areas, contamination or overexploitation risk).

an Ad-Hoc High Level Group in 2004. The main objective of this group was to formulate a draft Agreement between the Parties concerning the Guarani Aquifer (GMC Decision nº 25/04 and nº 48/04). Unfortunately, it has not progressed due to the difficulty of reaching a consensus on the dispute settlement system (Síndico 2010). These difficulties were aggravated by the conflicts between Argentina e Uruguay regarding the installation of two paper mills on the Uruguay River

During this conflict, the MERCOSUR Parliament proposed to the Common Market Council many actions related to the Guarani Aquifer. The first one was the formation of a commission to study, analyze, and compare each country's water-resource legislation which aimed to recommend to the national governments modifications to their internal systems (October/2007) and to develop a landmark Agreement on the cooperation for the sustainable management of the Guarani Aquifer system (2008). Moreover, it was suggested the creation of a regional Research and Development Institute for groundwater and aquifer protection (INRA MERCOSUR - Mercosul/PM/SO/REC. 25/2009), as well as the implementation of a transitional project following the conclusion of the Guarani Aquifer Project (VILLAR, 2010). Unfortunately none of these initiatives has prospered.

In August 2010, during the XXXIX Meeting of the Common Market Council and the Summit of Presidents of the member states of MERCOSUR and Associated States, Argentina, Brazil, Paraguay, and Uruguay signed the Agreement on the Guarani Aquifer. Although the MERCOSUR event served as a meeting location to sign the Guarani Agreement, it was developed outside the structure of the MERCOSUR organization (Villar and Ribeiro, 2011). It is speculated that the rejection of the MERCOSUR structure was motivated by the failure of this institution in addressing the Pulp Mills conflict and its intention of including new members, which could interfere with the aquifer'management.

4. The International Law of Transboundary Aquifers

For too long groundwater was not considered a priority in international law. According to McCaffrey, "*The law of international groundwater may only be said to be, at best, in the embryonic stages of development*" (2001, p. 433). Groundwater resources were addressed indirectly or incidentally as part of surface water, or were simply not mentioned (Mechlem 2003, 2009).

The first legal instrument to mention them was the 1966 Helsinki Rules[8] promoted by the International Law Association (ILA). For many years, this model served as the main instrument representing customary law for shared fresh waters (Salman 2007). The concept of international drainage basin adopted in the Helsinki Rules included groundwater. However, the peculiarities of these waters demanded that the ILA complement the theme through the 1986 Seoul Rules. Another contribution of this organization are the 2004 Berlin Rules,[9] which revised the legal model of fresh water to include all waters (national and transboundary) and incorporated the products of various fields of international law of recent decades - humanitarian law, human rights, and environmental law (Dellapenna 2006). This document established a specific

[8]Helsinki Rules, 1966. Available from: http://www.colsan.edu.mx/investigacion/aguaysociedad /proyectofrontera/Helsinki%20Rules%201966.pdf [Accessed April 2010].

[9] Berlin Rules, 2004. Available from: http://www.cawater-info.net/library/eng/l/berlin_rules.pdf. [Accessed April 2010]

chapter on groundwater. Although the ILA rules have no formal status under international law, it may be argued that they are important and influential instruments in the development of customary international water law (Eckstein and Eckstein 2003)

In 1997, the United Nations General Assembly adopted the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses. This convention was the result of a long process (McCaffrey 2001), representing the first and only legitimate instrument for countries for the management of shared freshwater (Eckstein and Eckstein 2003). Unfortunately it has not yet entered into force[10].

Unlike the Helsinki rules, the Convention departs from the idea of drainage basin and adopts the concept of watercourse, define in article 2 as:

> *(a) "Watercourse" means a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus;*
>
> *(b) "International watercourse" means a watercourse, parts of which are situated in different States;*

The definition of watercourse expressively includes groundwater, which transforms these waters into a subject of international law. However there are limitations, as Eckstein (2005, p.5) states: the Convention is restricted to those aquifers that: a) are physically part of a system of surface and groundwater; b) are part of a unitary whole; c) normally flow to a terminus that is common with the hydraulically linked surface water, and d) have parts of the system located in different states.

The requirement to include groundwater within the scope of the Watercourses Convention, and the related limitations, cause a number of problems. Aquifers can be hydraulically connected to more than one river basin and normally do not flow to a common terminus like rivers. Strata peculiarities allow groundwater to flow in different directions[11] (sea or other river basins). Also, in many cases, aquifers may not be connected with surface water. Accordingly, the Convention excludes important types of aquifers as those without recharge and those that are supplied solely by rainfall (Mechlem 2003; Eckstein 2005). Due to the complexity of the subject, the ILC intentionally left non-recharging aquifers out of the Convention and preferred to adopt the Resolution on Confined Transboundary Groundwaters,[12] which refers to groundwater resources that are not related to surface waters (Mechlem 2003).

The Guarani Aquifer itself would be excluded by the definition of watercourse considering that except for the areas of recharge, the aquifer is confined by a basaltic layer that hampers any hydraulic connection with surface waters. If the challenge of the last century was to seek to regulate the use of shared surface water, the one of the current century is to consolidate these regulations in order to avoid a water crisis and

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[10] According to Article 36, the Convention needs 35 signatories to enter into force. For up to date information see: http://untreaty.un.org/.

[11] The case of groundwater in the Danube basin is a good example. While most of the groundwater in the basin flows parallel to the river toward the Black Sea, a small portion flows in a different direction and serves as the source of the river Aach, which is located in the Rhine basin. For more information see Mechlem 2003.

[12] Many authors criticize this denomination since confinement is a hydraulic state and is not related to the characteristic of being connect or related to surface waters. The correct term would be non-recharging aquifers.

add a new dimension to the hydrological cycle: groundwater and transboundary aquifers.

The limitations of international law on transboundary aquifers have prompted the International Law Commission of the United Nations to prepare a project on the topic, which was approved on December 11, 2008, by the U.N. General Assembly, with the title of Resolution 63/124 - The law of transboundary aquifers.[13] The approval of Resolution 63/124 symbolizes that the international community recognizes the importance of transboundary aquifers and the need to regulate their use and protection. Although it has no binding legal effect, it represents the first instrument legitimized by the UN General Assembly that is devoted to transboundary aquifers (McCaffrey, 2001).

The draft articles contained in the Resolution cover all types of aquifers and considerably broadens the scope of international standards for fresh waters within the United Nations. According to Article 1 of the document, the draft articles apply to:

a) utilization of transboundary aquifers or aquifer systems;
b) other activities that have or may have an impact on aquifers or aquifer systems
c) measures for the protection, preservation and management of aquifers or aquifer systems

Paragraphs "a" and "c", though limited, were already grounded in the UN Water Convention. The novelty lies in subparagraph "b", which may imply a control of land use, somehow aligning itself with the positioning of the 2004 Berlin Rules (Laborde 2010).

The main purpose of this resolution is to encourage states to include transboundary aquifers in their agendas and to establish bilateral and regional agreements on the subject. This resolution has contributed, in terms of political and technical incentives, to the signing of the Agreement on the Guarani Aquifer (Síndico 2010). That occurred shortly after the adoption of Resolution 63/124, on August 2, 2010, under the auspices of the Resolution, the Declarations of the principal global environmental instruments (Stockholm, Rio de Janeiro and Johannesburg), the River Plate Basin Treaty and the Framework Agreement on the Environment in MERCOSUR, when Argentina, Brazil, Paraguay and Uruguay signed the Agreement on the Guarani Aquifer.[14]

5. The agreement on the Guarani Aquifer

Normally, scientific literature suggesting that conflicts generate cooperation among States (Wolf 2007, Zeitoun and Mirumachi 2008). Such arguments fit the few existing examples of cooperation among countries over transboundary aquifers: (a) the Convention relative à la protection, à l'utilization, à la réalimentation et au suivi de la nappe souterraine Franco-Swiss du Genevois, signed in 2008 by France and Switzerland (replacing the previous agreement of 1977); (b) two technical cooperation agreements for monitoring and exchanging data related to the Program of Development of a

[13]The U.N. Resolution 63/124 is available on the Official Documents System of the United Nations website at: http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N08/478/23/PDF/N0847823.pdf?OpenElement

[14] The full text of the Guarani Aquifer Agreement is available at the Brazilian International Affairs Minister: http://www.itamaraty.gov.br/sala-de-imprensa/notas-a-imprensa/acordo-sobre-o-aquifero-guarani.

Regional Strategy for Utilization of the Nubian Sandstone Aquifer System[15]; (c) and a technical cooperation agreement for the establishment of a consultative mechanism for the Aquifer System of northwestern Sahara[16] (Burchi and Mechlem 2004).

All of these agreements came into existence because of the need to reverse a situation of high likelihood of conflict. That was not the case with the Guarani Aquifer where the promulgation of the Agreement did not occur as a result of tensions over transboundary groundwater resources. It is speculated that this signing was stimulated by three main events: a) the end of the Guarani Aquifer project, which had provided an important technical foundation, b) the presentation of Resolution 63/124 on the Law of Transboundary Aquifers by the UN General Assembly, and c) the International Court of Justice decision of April 2010 in the case of the pulp mills in the Uruguay River between Uruguay and Argentina (Síndico 2010).

The first article of the Guarani Agreement states:

> *"The Guarani Aquifer System is a transboundary water resource that integrates the sovereign territorial area of Argentina, the Federative Republic of Brazil, the Republic of Paraguay and the Eastern Republic of Uruguay, which are the only holders of this resource and will henceforth be called 'Parties'."*

This treaty sets out the main guidelines of Resolution 63/124 of the United Nations especially in relation to the principles expressed: sovereignty, equitable and reasonable use of water resources, the obligation not to cause harm, cooperation, and exchange of data and information.

The Agreement reaffirmed the sovereignty of the overlaying states over the aquifer on several occasions. Sovereign territorial domain of the Guarani Aquifer is mentioned in arts.1º and 2º, while sovereign right over natural resources is set out in article 3º, which states:

> *The parties exercise, in their respective territories, the sovereign right to promote the management, monitoring, and sustainable use of water resources of the Guarani Aquifer System and will utilize these resources based on the criteria of rational and sustainable use, and respecting the obligation not to cause appreciable harm to the other Parties or the environment*

This article clearly provides that each country is responsible for managing their portion of the aquifer based on its own public policy, and sets standards for the use and protection of the aquifer. Some scholars argue that this principle merely restates the well-established principle of international law and ensure safeguards for the aquifers, thus preventing the aquifer from being considered as a "*common good of mankind similar to the status of a common heritage of mankind***"** like the deep seabed, outer space, or Antarctica (Laborde 2010, p.3). Other authors view it with surprise and suspicion, contending that the reaffirmation of the sovereignty principle is inconsistent with the spirit of cooperation and equitable use (McCaffrey 2009, McIntyre 2010).

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[15] Programme for the Development of a Regional Strategy for the Utilization of the Nubian Sandstone Aquifer System was established between Chad, Egypt, Libia, and Sudan. Agreement No 1 - Terms of Reference for the Monitoring and Exchange of Groundwater Information of the Nubian Sandstone Aquifer System; Agreement No 2 - Terms of Reference for Monitoring and Data Sharing sign in Tripoli, on 5th October 2000.

[16] Establishment of a Consultation Mechanism for the Northwestern Sahara Aquifer System (SASS) signed between Algeria, Libya, and Tunisia at the end of 2002 and beginning of 2003.

The Agreement follows the main principles and obligations of international law: the equitable use of water resources, the obligation not to cause harm, and international cooperation, which includes the exchange of technical information about the aquifer, notification of activities that can cause harm to the parties, and obligation to mitigate negative impacts. In this sense article 5 states that the Parties to the Guarani Aquifer System should act in conformity with applicable international law principles and rules if there is a possibility that actions, studies, or works within their territory could have effects beyond the national borders (Villar and Ribeiro, 2011).

The principle of equitable use of water resources is affirmed in articles 3º and 4º and the obligation not to cause harm appears in articles 3º, 6º, and 7º. In relation to article 3º, it is noteworthy that these principles appear to limit the Parties sovereign rights related to the Guarani Aquifer System. Each State is responsible for promoting the management, monitoring, and sustainable use of the aquifer, but each also has to consider the rational and sustainable use of the aquifer and the obligation not to cause harm (Villar and Ribeiro, 2011).

Cooperation is one of the strong points of the Agreement and appears in many articles, such as 8º, 9º, 10, 12, 13, and 14. These statements of cooperation foresee the need for information exchange about water resources utilizations, the duty of prior notification, and the right to seek additional information. Also they foresee the establishment and development of joint projects and cooperation programs for technical, scientific, and management aspects (Villar and Ribeiro, 2011).

One of the Agreement's weaknesses is that there are no provisions in the document of a specific plan for the protection of recharge areas or for the extraction of non-renewable Guarani waters. Article 14 makes a vague allusion to "*identify critical areas, particularly in border areas that require specific treatment measures.*" The recharge areas could fall into that category, however, the focus of Article 14 seems to be to identify areas that require measures to restrict or control rather than the design of a policy based on precaution and prevention.

Article 15 provides that the cooperation process will be under the responsibility of a Commission formed by the four parties and institutionalized in the mold of Article IV of the River Plate Basin Treaty, which states:

> *Notwithstanding the provisions within each country, there will be cooperation bodies and advisory committees of the Government, namely Commissions or National Secretariats, formed in accordance with the Joint Declaration of Buenos Aires. Commissions or Secretariats may establish bilateral contacts, always obeying the criteria and standards of the countries concerned and keeping it properly informed, when appropriate, the Intergovernmental Coordinating Committee.*

Thus, Article 15 of the Agreement provides that :

> *A Commission composed of the four states party to the agreement will coordinate and cooperate amongst themselves to fulfill the principles and objectives of this Agreement. The committee will promulgate its own regulations.*

When implemented, this Commission would be the first to address the issue of transboundary aquifers in the region and in Latin America. At present, it is still not possible to determine the future and scope of this commission. The countries have yet to institute it and endow it with its statutes, powers, membership, and budget. Although

they already have several international bodies for the management of surface water resources,[17] whose cooperation promotion scope varies, this Commission would be the first to deal specifically with groundwater, featuring a new form of cooperation in South America. The Commission is a key component to the cooperation process whose success depends on how it will be structured and how it will be supported by the member states (Villar and Ribeiro, 2011).

The resolution of disputes, under articles 16, 17, 18, and 19, will take place through direct negotiations of the countries, which are obligated to inform the Commission mentioned in Article 15. The role of this Commission is to recommend and give advice to the countries. In accordance with Article 17, if the states fail to reach an understanding, they can request the Commission's recommendations or refer the dispute to arbitration, which will be defined later in an Additional Protocol. The Agreement opted for a new arbitral procedure to be set, and ignored the one provided by MERCOSUR through the Protocol of Olivos which has already structured an arbitration process.

The analysis of the agreement reveals its fragility, since the cooperation mechanisms are limited and require regulation in the national and international spheres. Its main message is that despite a few joint actions, each country will be responsible for managing and exploiting the Aquifer in its territory. The countries adopted an innovating posture when they signed an agreement within a precaution/prevention context; nevertheless, they simultaneously maintain a conservative position with regards to the agreement content. In face of the absence of conflicts over and degradation of the aquifer, there are no problems to accept the philosophy defined by the UNDP (2006, p. 228), "cooperation [over transboundary waters] need not always be deep … Indeed, given the different strategic, political and economic contexts in international basins, it makes sense to promote and support cooperation of any sort, no matter how slight".

The negotiation of an international agreement happens in two complementary spheres: the international and the national. In the international sphere, the States are the main players; nevertheless, the results of the negotiations must be incorporated and accepted by the national sphere (Feitelson 2006). The emphasis on the sovereignty, the subjection of the management to the national jurisdiction and the exclusion of the controversial points facilitate the social consent of the nationals, which is essential for the ratification of the agreement and implementation of joint projects. Cooperation is a process, the countries' conservative posture may be justified as a way to allow for a faster acceptance of the agreement and gradually make it more ambitious.

The application of national and international standards depends on the countries' institutional capacity to mobilize the several players involved in the policy established (Feitelson 2006). In the national jurisdiction, the management of the aquifer is influenced by several players and legal standards, since the aquifer goes beyond the administrative limits of several federative states and provinces, including several municipalities and a great number of users (irrigation, public supply, thermal tourism, the industry). The next session will analyze how the groundwater management has been dealt with in Brazil.

[17]Binational Commission for the development of the Bermejo River Basin and Rio Grande de Tarija; Tri-National Commission for the Development of the Pilcomayo River Basin; Binational Commission Bridge Colonia Buenos Aires (COBAICO); Administrative Commission of the Río de la Plata (CARP); Intergovernmental Coordinating Committee Countries of the Plata Basin (CIC); Salto Grande Technical Mixed Commission (CTMSG); and the Administrative Commission of the River Uruguay (CARU).

6. Conclusions

In analyzing the agreement structure, it is possible to say that the Agreement represents the intention of Parties to construct a new paradigm in the sense that it takes place in the absence of groundwater conflict. It is the first time that transboundary groundwater is considered in a preventive/precautionary context. However, to be really implemented, the preventive and precautionary nature of the Agreement requires domestic and international regulations. The lack of precise cooperation arrangements or an information exchange process challenges the Agreement's efficiency. Another problem relies on the fact that the recharge areas, which are the most likely areas to face conflict, are not regulated and there are no strategies for the mining of the aquifer. Finally, if conflicts were to emerge someday, the Agreement may face difficulties in addressing them due to the absence of a solid dispute settlement system.

Because of these issues, the Guarani Aquifer Commission will play a central role in guiding the cooperation process and implementing the Agreement. However, it is still unclear how this commission will be structured by the four countries. The success of the Agreement lies mainly in the ability of this Commission to articulate the transboundary groundwater issues.

7. References

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