Revista Brasileira de Política Internacional
ISSN: 0034-7329
secretaria@ibri-rbpi.org
Instituto Brasileiro de Relações Internacionais
Brasil

Villar, Pilar Carolina
International cooperation on transboundary aquifers in South America and the Guarani Aquifer case
Revista Brasileira de Política Internacional, vol. 59, núm. 1, 2016, pp. 1-20
Instituto Brasileiro de Relações Internacionais
Brasília, Brasil

RBPI

Revista Brasileira de Política Internacional

ISSN 1983-3121

http://www.rbpi.info

International cooperation on transboundary aquifers in South America and the Guarani Aquifer case

DOI: http://dx.doi.org/10.1590/0034-7329201600107

Rev. Bras. Polít. Int., 59(1): e007, 2016

Pilar Carolina Villar
Universidade Federal de São Paulo, Departamento de Ciências do Mar, Santos – SP, Brazil (pcvillar@gmail.com).

ORCID ID: orcid.org/0000-0002-7222-1609

Abstract

International cooperation on groundwater takes many forms. The mobilization of different actors helps to promote cooperation initiatives in South America, where the most well known case is the Guarani Aquifer System (GAS). This article intends to analyze how international actors have motivated cooperation on transboundary aquifers and its repercussions in South America, especially in the case of the GAS.

Keywords: transboundary aquifers; international cooperation; Guarani aquifer; South America; water governance.

Received: February 5, 2016
Accepted: June 14, 2016

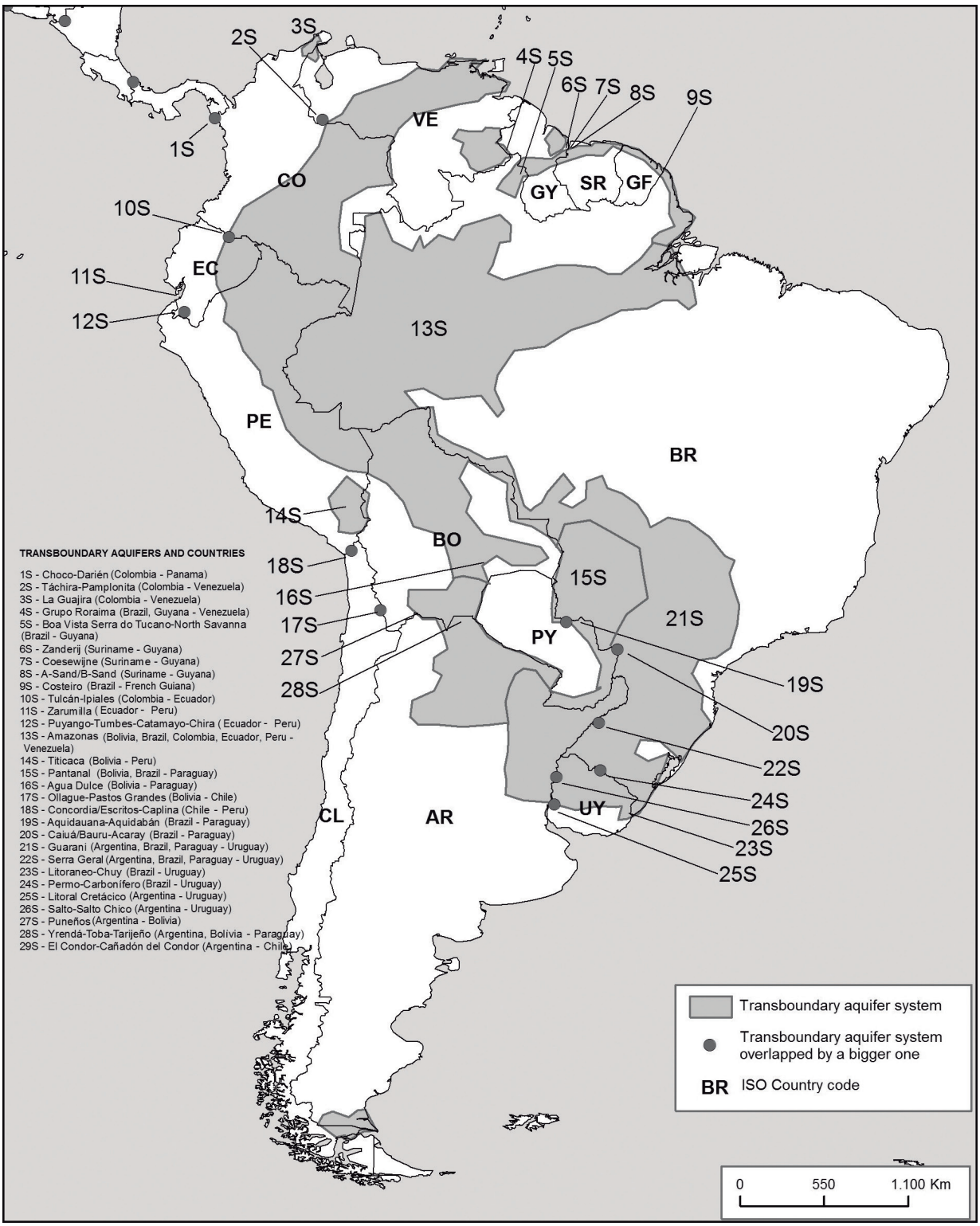
Introduction

Transboundary aquifer systems can be found all around the world, even in arid and semi-arid zones. However, international cooperation in the field of groundwater is still incipient. The International Groundwater Resources Assessment Centre (IGRAC) has identified 592 transboundary aquifers (including 226 transboundary 'groundwater bodies' as defined in the European Union Water Framework Directive) (IGRAC 2015). As figure 1 shows, in South America there are 29 transboundary aquifers, most of them with limited information and knowledge about their real dimensions, geological characteristics, water reserves, exploitation rates and their role in regional development (UNESCO/OEA/ISARM AMERICAS 2007).

Although South America has a high availability of surface water, groundwater guarantees about 40% to 60% of the countries' water demand (UNESCO/OEA/ISARM AMERICAS 2007). Its importance contrasts with its precarious management; a phenomenon the literature calls hydroschizophrenia (JARVIS et al 2005). There is only one international agreement in the

region that deals specifically with groundwater: the Agreement on the Guarani Aquifer[1], which was signed in 2010 by Argentina, Bolivia, Brazil and Paraguay, but has not entered into force.

Figure 1: Transboundary Aquifers in South America



Elaborated by the author.
Source: Villar 2015, p. 61.

1 An unofficial English translation of the treaty can be found at: http://www.internationalwaterlaw.org/documents/regionaldocs/Guarani_Aquifer_Agreement-English.pdf.

The lack of knowledge and the difficulties of managing a hidden resource can be a force to promote groundwater international cooperation (GUN 2007). Since 2000, epistemic community[2] and international actors have created agencies and programs, promoted technical capacity or developed joint projects specific to groundwater that are helping South American countries to include aquifers in joint cooperation initiatives. In this sense, international cooperation can be understand as an open and nonlinear process that occurs gradually and under the influence of domestic and international factors (O'Neill, Balsiger and VanDeveer 2004). It is considered an open process because the joint action to promote groundwater governance goes beyond the classical international actors, comprising for example nongovernmental organization and the epistemic community. Also it is a nonlinear process due to the fact that the established goals are subject to progress, setbacks and stagnation. Finally, cooperation levels and arrangements are influenced and can be explained by how national and international actors were organized (SANT'ANNA, 2009).

So, this article intends to analyze how the international scenario has prompted groundwater cooperation in South America and how it contributed to the Guarani Aquifer case. The paper consists of four sections. The first section exposes the challenges of transboundary aquifer cooperation. The second section discusses how international actors have encouraged cooperation and its effects in South America. The third presents the GAS cooperation process, which represented the most developed groundwater experience in the region. Finally, conclusions are presented. The methodology is based on the qualitative analysis of specialized literature, documents from international organizations, international treaties and information on UN-Water and MERCOSUR web sites.

Transboundary aquifers as a matter of international relations

Traditionally, waters that "transit from one State territory to another or extend over the territories of several States" are considered shared resources (Barberis 1986, p. 23). There is no legal definition for this concept which is used to classify those resources to national jurisdiction whose use and protection are conditioned by certain norms of international law (Caubet 2006).

Surface waters crossing countries' boundaries are considered shared resources. This understanding was based on a historical process that gained support with the definition of "international rivers" established in the Final Act of the Congress of Vienna of 1815 and has been consolidated with the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (hereinafter the "1992 Helsinki Convention"*)* by the United Nations Economic Commission for Europe (UNECE), and the United Nations Convention on the Law of the Non-navigational Uses of International Watercourses (1997), hereinafter the "UN

2 Haas (1992, p. 3) defined an epistemic community as "a network of professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue-are".

Watercourse Convention". Also it has been reaffirmed by the International Court of Justice on different occasions, like the Gabčíkovo-Nagymaros case or the Uruguay River Pulp Mills case.

On the other hand, the legal characterization of groundwater or aquifers as shared resources is recent and controversial. Groundwater only became the object of international law in the nineties and, even then, with limitations pointed out by many authors (Eckstein and Eckstein 2005; McIntyre 2010; McCaffrey 2011; Villar 2015).

The 1992 Helsinki Convention[3] included "ground waters" in the concept of transboundary water which was defined as "any surface or ground waters which mark, cross or are located on boundaries between two or more States [...]" (art.1º, 1). Although this broad definition is capable of including all types of aquifers in its scope, this formal inclusion has not generated any practical effect on the actions of States. The difficulties involved in addressing this matter have been recognized since 2009 by the Meeting of the Parties which entrusted the Legal Board and the Working Group on Integrated Water Resources Management to jointly prepare studies concerning the application of the Convention principles to groundwater/aquifers[4]. Those studies culminated in the edition of the Model Provisions on Transboundary Groundwaters (UNECE 2014).

The UN Watercourse Convention, which entered into force on August 17, 2014, as its name indicates focuses on surface waters (McCaffrey 2011). Despite this, "ground waters" were included in the concept of watercourse which "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" (art. 2º, a). This definition did not consider the specific characteristics of aquifers and is restricted to groundwater that: "(1) is physically part of a system of surface and ground waters; (2) is part of a unitary whole; (3) normally flow to a terminus that is common with the hydraulically linked surface water; and (4) has parts located in different states" (Eckstein 2005, p. 5).

So the Convention excluded important types of aquifers. For example, aquifers without recharge, like confined aquifers or the ones in which climate conditions impair the recharge due to the absence of rain. In the case of confined aquifers, the International Law Commission (ILC) Resolution on Confined Transboundary Groundwater (1994) recognized the need to elaborate specific rules, although it expressed the convenience of applying the principles of the UN Watercourse Convention to them (Mechlen 2009).

In addition, it is uncertain how international law deals with aquifers that do not flow to a common terminus or are hydraulically connected to more than one river basin. Strata peculiarities allow groundwater to flow in different directions (to the sea or other river basins). Even though the word "normally" was added precisely to consider this kind of situation, some questions remain: To which international watercourse should groundwater with different flows be allocated? Should it be divided proportionally according the water contribution to each river

3 Originally, this Convention was a regional instrument for countries that were part of the UNECE. In 2003, the parties amended it to allow all member of the United Nations to join it. This amendment entered into force on February 6, 2013.

4 More information on the UNECE site at: http://www.unece.org/env/water/groundwaters_activ.html

or, since there is no common terminus, should it be excluded from the scope of the convention? (Eckstein and Eckstein 2005; Mechlem 2009).

Resolution 63/124 (2008) approved by the United Nations General Assembly (UNGA) was intended to clarify the principles and obligations related to transboundary groundwaters/aquifers in international water law, however it created significant controversies. The definition of aquifer classifies not only the groundwater as a shared natural resource but also the geological strata that contains these waters. In international law there is already a consensus that water which crosses two or more countries is a shared resource. However the same does not apply to geological formations, which are not fluid materials, but static ones and considered part of the territorial soil of the State (McIntyre, 2010). Therefore, the inclusion of a static component in this definition could be interpreted as a threat or an interference in the territorial sovereignty of the State, since mineral resources and soil are considered national resources (McCaffrey 2011). This instrument has been reaffirmed by UNGA Resolution 66/104 (2011) and UNGA Resolution 68/118 (2013). States, however, are postponing the transformation of the draft articles into a binding instrument. In 2016 the General Assembly will have another opportunity to decide the fate of the draft articles (Sindico and Hawkins 2015).

None of the South American countries has committed to the water conventions. Nevertheless, Argentina, Brazil, Paraguay and Uruguay have recognized UNGA Resolution 63/124 (2008) in the only specific agreement on groundwater in the region. This experience is particular relevant, considering the lack of international agreements on groundwater. The literature points out that only five initiatives evolved to specific interstate agreements, and not all of them were ratified or implemented (Conti 2013; Villar 2015; Sindico 2015). Those experiences are: a) the Convention on the Protection, Utilization, Recharge and Monitoring of the Franco-Swiss Genevese Aquifer signed between France (the Community of the Annemassienne Region, the Community of the Genevois Rural Districts, and the Rural District of Viry) and Switzerland (the Republic and Canton of Geneva), on December 18, 2007. It entered into force on January 1, 2008 (Cobos 2010); b) the Bamako Declaration of the Ministers in Charge of Water Resources of the Countries Sharing the Iullemeden Aquifer System, signed by Mali, Niger and Nigeria, on June 20, 2009[5], which has not evolved to any further actions; c) the Agreement on the Guarani Aquifer[6] signed on August 2·, 2010, which has not entered into force yet; d) two declarations signed by Algeria, Libya and Tunisia for the Establishment of a Consultation Mechanism for the Northwestern Sahara Aquifer System (December 19 and 20, 2002) and the Permanent Consultation Mechanism for the North-Western Sahara Aquifer System (2006), which started its operations in July, 2008; and e) the Regional Strategic Action Program for the Nubian Aquifer System signed on September 18, 2013, by Chad, Egypt, Libya & Sudan (Stephan 2013).

5 Bamako Declaration of the Ministers in Charge of Water Resources of the Countries Sharing the Iullemeden Aquifer System (Governments of Republic of Mali, Republic of Niger, Federal Republic of Nigeria) (2009) Bamako, Mali. Available at: http://www.internationalwaterlaw.org/documents/regionaldocs/Iullemeden_Bamako_Declaration-2009.pdf.

6 Available at: http://www.itamaraty.gov.br/sala-de-imprensa.

The fragility of international law concerning groundwater and the lack of treaties between States show that aquifers have not been considered a matter of international relations. In practice they have been treated as national resources under national sovereignty. In the best case, groundwater was only mentioned in international water treaties without any detailed provision (Mechlen 2009). Since aquifers are not easily identified as a shared resource, States can explore them without constraints (Hayton and Utton 1989; Eckstein and Eckstein 2005). According to UNESCO/OEA/ISARM Americas (2007), of the 29 transboundary aquifers in South America, 15 require basic information[7]. The lack of data can be an obstacle to constructing common agreements, but it can also be a force to stimulate cooperation between states.

The lack of international initiatives can also be justified by the fact that aquifers cannot be used for navigation, fishing, delimitation of boundaries or energy production which were responsible for causing the main conflicts in the history of international water law (Mechlen 2009). In South America most of water conflicts have arisen due to the construction of infrastructure on rivers, especially hydroelectric plants and navigation works, and to transboundary pollution (Sant'Anna and Villar 2015).

International groundwater tensions focus on its overexploitation and transboundary pollution, which can only be determined with studies and monitoring. There are no conflicts over transboundary aquifers in South America, however most States ignore or have little information about the aquifer's situation. That is a serious problem since aquifer degradation is practically irreversible (Margat and Gun 2013).

Aquifer protection is a great challenge to many countries in South America. Groundwater overexploitation can cause impacts, such as diminishing surface water availability, subsidence or saline intrusion. Overexploitation of the Caplina aquifer by Peru caused saline intrusion and threatens the quality of water in Chile. Aquifers Sand A and B (Guyana and Suriname) and the Guajira aquifer (Colombia and Venezuela) also face problems with saline intrusion (UNESCO/OEA/ISARM AMERICAS 2007).

The pollution of an aquifer can cause the loss of important reserves for present and future generations (Villar 2015). In the case of transboundary aquifers, states need to identify their zones of high vulnerability and take joint protection measures, especially in the boundary areas. The Titicaca aquifer (Bolivia and Peru) for example, is threatened by the contamination of the Titicaca Lake (UNESCO/OEA/ISARM AMERICAS 2007).

The management of fossil aquifers also requires attention. These reserves are not renewable, so their extraction should prioritize long term use and vital human needs. Many South American aquifers are fossil and represent the main or only source of freshwater available to local populations. Sand A and B (Guyana and Suriname), Puneños (Argentina and Bolivia), Concordia/Escritos-Caplina (Chile and Peru) and Ollague-Pastos Grandes (Bolivia and Chile) are examples of fossil aquifers (UNESCO/OEA/ISARM AMERICAS 2007).

7 This is the case of the following aquifers: *Choco-Darién* (1S), *Táchira-Pamplonita* (2S), Grupo Roraima (4S), Boa Vista Serra do Tucano – *North Savanna* (5S), Costeiro (9S), *Tulcán-Ipiales* (10S), *Puyango-Tumbes-Catamayo-Chira* (12S), Amazonas (13S), Titicaca (14S), Pantanal (15S), *Agua Dulce* (16S), *Ollague-Pastos Grandes* (17S), Permo-Carbonífero (24S), *Salto-Salto Chico* (26S), *El Condor-Cañadón del Cóndor* (29S). For further information see: UNESCO/OEA/ISARM AMERICAS 2007.

In this context, international cooperation can be a positive force to promote knowledge of, and public policies on aquifers by supporting agreements to exchange information, to construct and maintain monitoring –well networks, to improve groundwater management or to establish rights and obligations concerning groundwater allocation and protection. In fact the need to promote knowledge about aquifers has boosted the mobilization of different actors dedicated to supporting groundwater governance of the States.

The mobilization of international actors to foster groundwater governance and its effects in South America.

International organizations and the international epistemic community play an important role in including aquifers on the global agenda. As Finnemore (1993, p. 593) explains those actors "contribute to state policy debates in a positive rather than merely a negative and constraining way". In fact, epistemic community with international organizations or funds from the United Nations System have been the main responsible for promoting knowledge and awareness about the need of groundwater protection and cooperation, as well have encourage international joint projects (Souza, Silva and Barbosa 2014).

Concerns over groundwater have been evident since the first international conferences on environment and water in the seventies, as well as in the action of international organizations such as United Nations Development Program (UNDP), United Nations Environment Programme (UNEP); World Health Organization (WHO), Food and Agriculture Organization (FAO), UNESCO, International Atomic Energy Agency (IAEA), and World Meteorological Organization (WMO) (Villar 2015).

In the seventies, the Stockholm Action Plan for the Human Environment (1972) and the Mar del Plata Action Plan (1977) already mentioned the need for groundwater protection measures. Also UNESCO and the International Hydrological Programme (IHP) created a program to design the Hydrogeological Map of South America (1977-1997), with the support of regional experts. In addition, the International Law Commission started its work on the topic "The law of the non-navigational uses of international watercourses" which culminated in the UN Watercourses Convention (Villar 2015).

In the eighties, FAO conducted studies of transboundary groundwater and its legal nature (Barberis 1986). Groundwater was formally included in the concerns of the legal epistemic community and in 1986 the International Law Association (ILA) adopted the Seoul Rules on International Groundwaters, which aimed to regulate transboundary groundwater and complement the Helsinki Rules (1966). Another proposal to promote the development of international groundwater law was the academic initiative called The Bellagio Draft Treaty (1989) (Hayton and Utton 1989).

In the nineties, the International Conference on Water and the Environment (Dublin, 1992) transformed water into one of the priorities on the international agenda and classified it as a

finite and vulnerable resource with economic value. Meanwhile the United Nations Conference on Environment and Development (Rio de Janeiro, 1992) consolidated the idea of sustainable development and embraced the principles of Dublin on the Agenda 21. Progressively, the water debate comprised economic actors like the World Bank, the International Monetary Fund (IMF) and transnational water companies (Amorin 2009). New organizations were created to stimulate water management such as the Global Environment Facility -GEF (1991), the Global Water Partnership – GWP (1996) and World Water Council (1996). Also new spaces of participation have emerged such as the World Water Forum and the Alternative World Water Forum (Ribeiro 2008).

Those years would mark the transition of water management from being a Government duty to being a market problem (Ribeiro 2008; Amorin 2009; Villar 2015). In addition, degradation of water resources was taken to be evidence of a water crisis whose solution demanded integrated water resources management (IWRM) and good water governance (Mollinga 2008). In this context, groundwater has gained importance since it represents the main supply of water available to humanity and a new source of wealth to be exploited.

The importance of water has been reflected in the United Nations System, which has transformed the subcommittee on water resources into a coordinated mechanism known as UN-Water. This mechanism is responsible for conducting the following programs: the World Water Assessment Programme[8] (WWAP); the UN-Water Decade Programme on Capacity Development[9] (UNW-DPC); the UN-Water Decade Programme on Advocacy and Communication (UNW-DPAC)[10]; and the WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation[11]. Transboundary waters are considered a thematic priority area of the United Nations[12], so it has stimulated specific initiatives like the Shared Waters Partnership[13] (SWP) and the Transboundary River Basin Initiative Project (TRIB)[14]. Regional international organizations

8 Under UNESCO's direction, this program has been editing triennial informative publications like Water for People. Water for Life (2003); Water, a Shared Responsibility (2006); Water in a Changing World (2009); Managing Water under Uncertainty and Risk (2012); World Water Development Report 2014 and 2015. In the case of groundwater, there is the report Groundwater and Global Change: Trends, opportunities and challenges. For further information see: http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/.

9 With the end of the International Decade for Action "Water for Life", this program closed its activities on July 31, 2015. It was coordinated by the United Nations University and intended to support the achievement of the Millennium Development Goals (MDGs). For further information see: http://www.unwater.unu.edu/article/read/mission.

10 The program supported the water and sanitation agenda at all levels. More information at: http://www.un.org/waterforlifedecade/what.shtml.

11 This program was implemented and coordinated by WHO and UNICEF. It aims to monitor the expansion of access to water and sanitation. For further information see: http://www.wssinfo.org/.

12 The UN-Water Thematic Priority Area (TPA) on Transboundary Waters " is intended to provide a platform to promote coherence and coordination of activities by UN-Water Members and Partners in the area of transboundary waters". Further information at: http://www.unwater.org/activities/thematic-priority-areas/transboundary-waters/en/. Consulted on: 23/04/2015

13 The Shared Waters Partnership (SWP) promotes cooperative approaches to shared waters. Further information at: http://www.watergovernance.org/sa/node.asp?node=1467.

14 In early 2000, UNDP established a global trust for the implementation of the TRIB Project. Its objective is supporting riparian countries efforts to improve their dialogues on shared rivers and build intra-riparian trust. Further information at: http://www.undp.org/content/undp/en/home/ourwork/environmentandenergy/focus_areas/water_and_ocean_governance/water-supply-and-sanitation/transboundary-river-basin-initiative/.

have also included water among their actions, such as the Organization of American States, which has conducted several projects in South American basins (CIC 2011).

The alliance of international organizations, States, nongovernmental organizations and the epistemic community has gained prominence with the IWRM and governance ideas. So in the late nineties and early 2000s, international actors intensified their efforts to promote groundwater management by creating specific projects or programs for aquifers and by establishing multi-stakeholder partnerships.

Those joint actions have stimulated groundwater cooperation and encouraged States to delineate aquifers and to manage them. Cooperation initiatives have occurred in three ways: a) creation of programs, centers or offices dedicated to researching and studying groundwater; b) execution of specific projects in transboundary aquifers; c) creating training material and instructing personnel (UN/ECE TASK FORCE ON MONITORING & ASSESSMENT, 2000; UNESCO IHP ISARM PROGRAM, 2009; UNESCO-IHP, 2011). Table 1 presents the main research centers dedicated to promoting groundwater knowledge and management, established by international actors.

Table 1: Main international centers for groundwater research and study.

INITIATIVE	INTERNATIONAL ACTORS	OBJECTIVES
Commission for the Geological Map of the World – CGMW (1878)	International Union of Geological Sciences (IUGS); International Union of Geodesy and Geophysics (IUGG); and UNESCO	To design, promote, coordinate, prepare and publish small-scale thematic Earth Science maps.
AQUASTAT (1992)	FAO	To collect, analyze and disseminate information on water resources, uses and management.
World-wide Hydrogeological Mapping and Assessment Programme – WHYMAP (1999)	International Hydrological Programme (IHP); International Geoscience Programme (IGCP); International Association of Hydrogeologists (IAH); CGMW; International Atomic Energy Agency (IAEA); Federal Institute for Geosciences and Natural Resources (BGR).	To systematize groundwater data and provide map information to stimulate discussion on water.
Internationally Shared Aquifer Resources Management – ISARM (2000)	International Association of Hydrogeologists (IAH); UN Food & Agriculture Organization (FAO); UN Economic Commission for Europe (UNECE); Organization of American States (OAS); International Network of Water-Environment Cesnter for the Balkans (INWEB); The Sahara and Sahel Observatory (OSS); UN Economic & Social Commission for West Asia (UNESCWA), University of Dundee; Organization for Security and Cooperation in Europe (OSCE)	To promote global cooperation by establishing a network of experts; generating scientific, legal, socio-economic, institutional and environmental information about aquifers; and identifying potential case studies.

continua...

continuação

INITIATIVE	INTERNATIONAL ACTORS	OBJECTIVES
Groundwater Management Advisory Team – GW-MATE (2000)	World Bank and Global Water Partnership (GWP).	To disseminate knowledge and make recommendations for improving groundwater management, institutional capacities and policies.
Joint International Isotopes in Hydrology Programme (2002)	IHP/UNESCO and IAEA.	To develop isotope techniques, promote a better understanding of hydrological processes and improve groundwater assessment, development and management.
ICQHS stands for International Centre on Qanats and Historic Hydraulic Structures (2003)	UNESCO and the Government of the Islamic Republic of Iran**.**	To gather and transfers knowledge and experiences regarding all aspects of Qanat technology and other historical hydraulic structures
Groundwater Resources Assessment under the Pressures of Humanity and Climate Change **–** GRAPHIC (2004)	UNESCO – IHP.	It improves knowledge about how groundwater interacts within the global water cycle, ecosystems, human activity and climate change.
International Groundwater Resources Assessment Centre – IGRAC (2007).	UNESCO, World Meteorological Organization (WMO), Netherlands Institute of Applied Geosciences and the Government of the Netherlands.	It stimulates knowledge about groundwater by developing a Groundwater Global Information System and establishing groundwater orientations or protocols.
Regional Centre for Shared Aquifer Resouces Management (RCSARM) (2008)	UNESCO and the Great Socialist Popular Lybian Arab Jamahiriya.	It promotes cooperation on research and compilation of case studies on shared groundwater management in Africa and Arab States.

Elaborated by the author.

From all these experiences, it is possible to highlight the ISARM Program which is a partnership between intergovernmental agencies and the international epistemic community (Souza, Silva and Barbosa 2014). This project is coordinated by the IHP – UNESCO and has adopted a two – step methodological approach: first an inventory and diagnosis of the existing internationally shared aquifers; then, considering the results of this investigation, detailed pilot projects and specific actions will be formulated (United Nations System 2001).

ISARM has been acting in America, Asia, Africa, Europe, Asia, the Caucasus and the Middle East. This multi-agency effort suggested 7 potential study cases for transboundary aquifers in the Americas, 3 of which are located in South America: the Yrenda-Toba-Tarijeño aquifer (Paraguay, Argentina and Bolivia); the Pantanal aquifer (Bolivia, Brazil and Paraguay); and the Zarumilla aquifer (Ecuador-Peru)[15]. In 2003, ISARM decided to include the Guarani Aquifer case in its portfolio due to the execution of the Guarani Aquifer System Project shown in table 2. ISARM

15 The other American projects were conducted in the following aquifers: Artibonito/Massacre (Dominican Republic and Haiti); Hueco del Bolsón (Mexico-USA); Ostua-Metapan (El Salvador-Guatemala); and Real-Rio Negro (Honduras-Nicaragua).

and other programs or projects have helped to increase groundwater knowledge in South America. Table 2 shows the most important projects developed in the area and their supporters.

Table 2: International Projects for transboundary aquifers in South America

Projects for Aquifers in South America	Partners	Main Goal
Project for the Implementation of Integrated River Basin Management Practices for the Pantanal and Upper Paraguay River Basin (1999 -2004)	Brazil, National Water Agency (ANA), Global Environmental Facility (GEF); United Nations Environment Programme (UNEP) and the Organization of American States (OAS).	To promote the sustainable development of the Pantanal region as a way to support the priorities identified in the Upper Paraguay Basin Conservation Plan and according to the Strategic Action Programme (UNEP and GEF 2005).
Project for the Characterization of the Zarumilla aquifer and monitoring of water quality carried out with coordination by the Puyango Tumbes Binational Project (2001).	IAEA, Peru and Ecuador	To produce knowledge on the aquifer which included the preparation of a geological and hydrogeological map, as well elaborating a hydrological model for the Zarumilla aquifer (AIEA 2009).
Project for the Integrated Transboundary Water Resources Management in Puyango-Tumbes, Catamayo- Chira and Zarumilla River Basins and Aquifers integrating climate variability concerns (2013)	Ecuador, The National Water Secretariat of Ecuador (SENAGUA) National; Peru; Water Authority of Peru (ANA); United Nations Development Programme (UNDP), GEF, FAO e IUCN	"Strengthening institutional, policy, legal and scientific-technical capacities to implement Integrated Transboundary Water Resources Management in Puyango-Tumbes, Catamayo- Chira and Zarumilla River Basins and Aquifers, integrating climate variability concerns" (GEF 2013, p. 1).
Project for Environmental Protection and Sustainable Development of the Guaraní Aquifer System, also known as Guarani Aquifer System Project (GASP). (2003).	Argentina, Brazil, Paraguay, Uruguay, GEF; IAEA; Germany's Federal Institute for Geosciences and Natural Resources (BGR); OAS, World Bank, Bank Netherlands Water Partnership Program.	To support countries in the elaboration and implementation of a common institutional, legal, and technical framework for the management of the GAS (OAS 2009).
The Framework Program for the Sustainable Management of La Plata Basin's Water Resources with Respect to the Effects of Climate Variability and Change. Component Integrated Management of Groundwater: Sustainable Management of the Yrenda-Toba-Tarijeño Aquifer System (SAYTT)	Argentina, Bolivia, Brazil, Paraguay, and Uruguay, GEF, FONPLATA, CIC, OAS, UNEP and ISARM Americas	To guarantee a sustainable management of the water resources of the SAYTT, assuring the continuity of its replenishment and the maintenance of its water quality, and managing the risks to the aquifer associated with global climate change (CIC 2011).

Elaborated by the author
Source: UNEP and GEF 2005; AIEA 2009; OAS 2009; CIC 2011; GEF 2013.

The first international studies of the Zarumilla aquifer were conducted in 2001 through cooperation between IAEA, Ecuador and Peru. Data produced was intended to support the implementation of a project involving the shared utilization of the Puyango-Tumbes waters (AIEA, 2009). In 2013, GEF approved the execution of the Project for the Integrated Transboundary Water Resources Management in Puyango-Tumbes, Catamayo-Chira and Zarumilla River Basins and Aquifers, integrating climate variability concerns (2013)[16].

The inclusion of the Yrendá Toba Tarijeño aquifer in the ISARM Americas Programme had stimulated the conduction of trinational events and studies aimed at elaborating a work plan to prepare a project that was included as part of the groundwater component of the Framework Program for the Sustainable Management of La Plata Basin's Water Resources with Respect to the Effects of Climate Variability and Change (OEA and UNESCO PHI 2004).

The Pantanal aquifer was partially comprised in the groundwater analysis included in the Project for the Implementation of Integrated River Basin Management Practices for the Pantanal and Upper Paraguay River Basin. This project was restricted to Brazilian territory. Its conclusions, however, recommended a second stage which still has not occurred and should include Bolivia and Paraguay (UNEP and GEF 2005).

From all the experiences mentioned in table 2, the GASP had the biggest repercussion, probably because of the history behind this project, the number of actors engaged in its execution and its evolution to become the first and only groundwater agreement in South America.

The cooperation process on the Guarani Aquifer System (GAS)

GAS covers an area of 1,087,879 km^2 and extends into Argentina, Brazil, Paraguay and Uruguay. It is formed predominantly by "sandy sedimentary rocks of the Paraná Basin (Brazil and Paraguay), the Chaco-Paranaense Basin (Argentina) and the Northern Basin (Uruguay)" (OAS 2009). Most of the aquifer is confined (90%) and the recharge area is only 124,650 km^2. Most of the GAS area is located in Brazil which is the main user of its waters (93.6% of the total amount of water extracted) (OAS 2009; World Bank 2009).

Villar (2015) divides the GAS cooperation process into three different stages. The first one took place in the nineties and was related to epistemic community studies. Since the year 2000, the control of cooperation has transcended from the epistemic community to international organizations and the States. The greatest result of this alliance was the GASP. When it ended, in 2009, a new phase of cooperation started in which States were the main actors and the Agreement on the Guarani Aquifer symbolizes its main accomplishment.

The role of the epistemic community in promoting international cooperation has not been well studied in international relations, however the literature points out its importance in

16 For further information see: GEF 2013.

supporting the decision-making process, developing management systems, exposing risks and influencing state policies (Haas 1992; Finnemore 1993; Roll and Timmerman 2006). Scientists from national universities and institutes represented a leading force in the GAS cooperation process, since they carried out the first studies on the aquifer, discovered its cross-border nature and created the designation Guarani Aquifer which had a higher social appeal than the traditional geological formation names[17]. Thus the epistemic community was responsible for establishing the basis for classifying this aquifer as a shared natural resource and articulated the first efforts to promote this discovery (Borghetti, Borghetti and Rosa Filho 2011). Without this knowledge and mobilization, States would ignore that they shared this aquifer.

Also, scientists' mobilization helped to make connections with international organizations and funds dedicated to water issues. With that, the GAS cooperation expanded beyond the epistemic community and entered into a new stage in which international organizations and States were to play a major role. In this context emerged the GASP, which called the attention of States, society and regional integration organizations to aquifers (Villar and Ribeiro 2011; Villar 2015; Sindico 2015).

GASP conclusions pointed out that it was an aquifer without conflicts and a shared resource with limitations since the "current and potential transboundary effects of the GAS are restricted to a narrow strip of territory of no more than a few dozen kilometers, depending upon locally specific hydrodynamic conditions" (OAS 2009, p. 18). The areas with major risk of conflicts, however, coincide with the recharge areas located on the borders, especially in the region of Mato Grosso do Sul (Brazil) and Paraguay, and the southwest of Rio Grande do Sul (Brazil), Argentina and Uruguay (Borghetti, Borghetti and Rosa Filho 2011, p. 199).

Those joint efforts reverberated in the regional integration organizations like MERCOSUR and PARLASUR. In 2004, MERCOSUR created an Ad Hoc High Level Group, whose goal was to formulate a draft agreement on GAS among the States (GMC Decision nº 25/04 and nº 48/04). In addition, in the last years of GASP, the MERCOSUR Parliament proposed: (i) the formation of a commission to study, analyze and compare each country's water-resource legislation; (ii) an agreement for the common management of the GAS and a transitional project assuring the continuity of the GAS Project structure; and, (iii) the establishment of a regional Research and Development Institute for the Guarani aquifer and other aquifers shared by the states (Villar and Ribeiro, 2011). None of those proposals has prospered.

At the national level, the 2000s have brought with them the drafting of laws and plans for groundwater. For example, Argentina formulated the National Plan for Groundwater (2007); Brazil created several legal acts to include groundwater in water management[18] and launched

17 Guarani aquifer was known by the names of the national geological formations: Pirambóia/Botucatu in Brazil; *Misiones* in Paraguay; *Tacuarembó* in Argentina; and *Buena Vista/Tacuarembó* in Uruguay (Borghetti, Borghetti and Rosa Filho 2011).

18 To illustrate see National Water Resources Council Resolutions nsº 15/2001, 17/2001; 22/2002, 76/2007; 91/2008; 92/2008; 107/2010; e 126/2011 and National Environmental Council Resolution nº 396/2008.

specific programs such as the National Groundwater Agenda[19] and the National Program for Groundwater[20]; Paraguay established a specific law for water resources (Law nº 3.239/2007); Uruguay established a National Water Policy (Law nº 18.610/2009) to complement the Water Code (Decree nº 14.859/1978), created the Guarani Aquifer Management Plan (Decrees nº214/2000, 11/2001 and 295/2001) and established the Commission for the Guarani Aquifer (Decree nº 183/2013) as an advisory organ of the Water Resources Regional Council for the Uruguay River.

With the end of PGAS, the third stage of cooperation began. Based on the knowledge produced, the four countries should have promoted the GAS management. The first step to accomplish that expectation occurred with the signature of the Agreement on the Guarani Aquifer, on August 2, 2010. This agreement represented an important move towards international cooperation on groundwater because it reaffirmed the applicability of international water law principles to aquifers and was the first agreement for transboundary groundwater developed under the influence of the UNGA Resolution 63/124 (2008) (Villar 2015; Sindico 2015). Also it is an example of preventive diplomacy (Villar and Ribeiro, 2009), which is "a concept based on the premise that is easier and cheaper to prevent disputes before they begin" (Priscoli and Wolf 2009, p.28). Transboundary water cooperation usually occurs in a context of water crises, water conflicts or water events such as floods and droughts (Priscoli and Wolf 2009). Thus the fact that GAS States mobilized interests and resources without having a conflict and exclusively for an aquifer has turned it into a unique experience (Villar and Ribeiro 2011).

Table 3 summarizes the five core elements of the Agreement (scope, substantive rules, procedural rules, institutional mechanisms, and dispute settlement), based on Wounter's metodology (2013, p. 19). According to her, the way these elements are established by the agreement "often determines [...] the efficiency of the cooperation" carried out in practice.

19 It is an initiative of the National Water Agency to foster hydrogeological knowledge, technical and management capacity and to develop specific training in groundwater. Available at: http://www2.ana.gov.br/Paginas/projetos/AguasSubterraneas.aspx. Consult on: 23/03/2015.

20 The program is divided into three sub-programs: Extension of hydrogeological knowledge; Development of Institutional and Legal Aspects; and Capacity Building, Communication and Social Mobilization. Available at: http://www.mma.gov.br/index.php/agua/recursos-hidricos. Consult on: 23.5.2015.

Table 3: Summary of the Agreement on the Guarani Aquifer.

Key elements	Agreement on the Guarani Aquifer	Aditional Information
Scope	Preamble Art. 1º – SAG "is a transboundary water resource that integrates the sovereign territories of the Republic of Argentina, the Federative Republic of Brazil, the Republic of Paraguay and the Oriental Republic of Uruguay, which are the sole owners of this resource" (art. 1).	States strongly emphasized their sovereign rights over SAG (articles 1º, 2º e 3º). States considered only the waters to be a transboundary resource, not the geological formation.
Substantive rules	Sovereign territorial control over their respective portions of the SAG (art. 2º). Sovereign right to promote the management, monitoring, and sustainable utilization of the SAG water resources (art. 3º). Equitable and reasonable utilization principle (art. 3º and 4º). Obligation of not causing significant harm to the other Parties or the environment (art. 3º, 6º and 7º). States shall act in agreement with the principles and norms of applicable international law (art. 5º). Cooperation to identify critical areas (art. 14).	The principle of sovereignty was limited by mentioning the principle of equitable and reasonable use and the obligation not to cause harm, as well as by principles and norms of international law.
Procedural rules	Exchange technical information about studies, activities and works (art. 8º). Obligation to inform and exchange data on planned measures that may have transboundary effects on the GAS, including results from an evaluation of environmental effects (art. 5º, 8º and 9º). Duty to provide the appropriate data and information required by other Party, or Parties in the case of planned measures (art. 10). Cooperation programs to extend scientific and technical knowledge over the GAS (art. 12) Identification of critical areas, especially boundary areas (art. 14).	The agreement did not express the obligations of notification and consultation, however those duties are implied in the idea set out in articles 9 and 10.
Institutional mechanisms	Provisions to the GAS Commission (art. 15).	
Dispute settlement	Direct negotiations (art. 16, 17 and 18). Arbitration procedure (art. 19).	The arbitration procedure will be defined in an Additional Protocol (art. 19).

Source: Agreement on the Guarani Aquifer 2010.

As Sindico and Hawkins stated the Guarani aquifer represents "a flexible framework for cooperation" (2015, p. 324). Although most of the provisions are not detailed, it does establish a number of commitments to stimulate cooperation such as: a) States should manage the aquifer in their territories according to international law; b) a transboundary aquifer organization should be created; c) States shall establish an arbitration procedure to resolve disputes in an additional protocol, d) States should implement cooperation programs on groundwater and e) States should identify critical areas, especially boundary areas (Villar and Ribeiro 2011).

Despite the emphasis on the principle of sovereignty, it has been balanced by the international water law principles and the rules of international law (Sindico and Hawkins 2015). Although the four countries have not signed the UN Watercourse Convention, the agreement includes its main principles and obligations, as shown in table 3. The agreement has formed a base to stimulate cooperation but the process seems to be facing a period of stagnation. Five years after its signing, only Argentina and Uruguay have ratified it. The House of Representatives of Paraguay has rejected the agreement and Brazil, the main user of the aquifer, has not ratified it yet. Also there has been no progress in on the part of the Guarani Aquifer Commission. The only positive news is the creation of a Regional Centre for Groundwater Management for Latin America and the Caribbean (CeReGAS) in Uruguay, as a partnership between that country and the IHP/UNESCO. The center might help to restart the cooperation efforts over GAS or stimulate new aquifer initiatives.

Conclusion

Groundwater international cooperation in South America is a phenomenon of the years 2000 which was boosted by the alliance between international organizations and States. The existence of international organizations and groundwater programs has been an important force in stimulating States to address groundwater issues, as well as in constructing the idea of transboundary aquifers as a shared resource.

Of all the transboundary aquifer projects developed in the area, only the Guarani Aquifer case has evolved to an international agreement, which shows that cooperation is based primarily on producing knowledge about groundwater. Given the lack of data on most transboundary aquifers in South America, there is a great potential for international technical cooperation between aquifer States, international organizations and the epistemic community. The improvement of knowledge is a crucial point for the characterization of aquifers as a shared resource and the development of international arrangements. Despite that, the joint data produced would not necessarily be used by States to deepen the process of cooperation started with the other aquifer States and to reach international agreements.

The GAS case has shown that multi-actors partnerships and international projects contributed towards mobilizing States'resources and promoting joint arrangements, even though there are

no conflicts over use. Despite the success of GAS as a technical cooperation example, the long process of the Agreement' ratifications has shown the difficulties of transforming it into a joint groundwater management cooperation example. Even with all international organizations and epistemic community mobilization and information produced, in the end it is up to States to deepen cooperation and to create proper arrangements and institutions to transboundary aquifers.

References

Agencia Internacional de Energia Atomica. *Estudios de Hidrología Isotópica en América Latina 2006*. Viena: OIEA, 2009. Disponível online: http://www-pub.iaea.org/MTCD/publications/PDF/TE_1611s_web.pdf. Acesso: 03/02/2015.

Amorin, João Alberto A. *Direito das Águas: o regime jurídico da água doce no direito internacional e no Direito Brasileiro*. São Paulo: Lex Editora, 2009.

Barberis, Julio A. *International ground water resources law*. Rome*:* Food and Agricultural Organization Legislative Study, 1986.

Borghetti, Nadia Rita B.; Borghetti, José Roberto; Rosa Filho, Ernani Francisco. *A integração das águas: revelando o verdadeiro aquífero Guarani*. Curitiba: Edição da autora, 2011.

Caubet, Christian. Guy. *A água doce nas relações internacionais*. Barueri: Manole, 2006.

Comitê Intergovernamental Coordenador (CIC). *Programa para a gestão sustentável dos recursos hídricos da Bacia do Prata, considerando os efeitos decorrentes da variabilidade e da mudança climática*. Sin ciudad: CIC, 2011. Available at: http://www.cicplata.org/documents/08122011/Cuenca_Portugues. pdf. Consulted on: 3/01/2014.

Conti, Kirstin I. *Listening to a 'silent revolution': Eight factors that can turn up the volume on transboundary aquifer cooperation and governance*. Global Water Forum, Camberra: Australian National Press, 2013.

COBOS, Gabriel de los. "The transboundary aquifer of the Geneva region (Switzerland and France): successfully managed for 30 years by the State of Geneva and French border communities". In: *UNESCO-IAH-UNEP Pre-proceedings – ISARM International Conference Transboundary Aquifers: Challenges and new directions [CD-ROM*]. UNESCO, 6–8 December 2010. Paris: UNESCO.

Eckstein, Yoram; Eckstein, Gabriel E. "Transboundary Aquifers: Conceptual Models for Development of International Law." *Ground water*, v. 3, n. 5 (2005): 679-690.

Eckstein, Gabriel E. "Protecting a hidden treasure: the U.N. International Law Commission and international law of transboundary ground water resources." *Sustainable Development Law & Policy*, v. 5, n. 1 (2005): 5–12.

Finnemore, Martha. "International Organizations as Teachers of Norms: The United Nations Educational, Scientific,and Cutural Organization and Science Policy". *International Organization*, v. 47, n. 4 (1993): 565-597.

GEF. Project Identification Form: Integrated Water Resources Management in the Puyango-Tumbes, Catamayo-Chira and Zarumilla Transboundary Aquifers and River Basins, 2013. Available at: http://iwlearn.net/iw-projects/5284/project_doc/iwrm-puyango-pif/view. Consulted on: 03/10/2015.

Gun, Jac van der. "Sharing Groundwater Information, Knoledege and Experience on a Worldwide Scale." In: *The Agricultural Groundwater Revolution. Opportunities and Threats to Development*, edited by Mark Giordano and Karen G. Villholth, 362-392. Trowbridge: Cromwell Press, 2007.

Haas, Peter M. "Introduction: Epistemic Communities and International Policy Coordination". *International Organization*, v. 46, n. 1 (1992): 1-35.

Hayton, Roberto D.; UTTON, Albert E. "Transboundary Groundwaters: The Bellagio Draft Treaty." *Natural Resources Journal*, v. 29 (1989): 668-722.

IGRAC. Transboundary Aquifers of the World. Edition 2015. 1:50 000000. Delft: IGRAC, 2015. Available at: http://www.un-igrac.org/sites/default/files/resources/files/TBAmap _2015. pdf. Consulted on: 08/11/2015.

Jarvis, Todd; Giordano, Mark; Puri, Shammy; Matsumoto, Kyoko; Wolf, Aaron. "International borders, groundwater flow and hydroschizophrenia". *Ground water*, v. 43, n.5 (2005): 764-770.

Margat, Jean; Gun, Jac van der. *Groundwater Around the World: A Geographic Synopsis*. Leiden: CRC Press/Balkema. 2013.

McCaffrey, Stephen C. "The International Law Commission's flawed Draft Articles on the Law of Transboundary Aquifers: the way forward." *Water International*, v. 36, n.5 (2011): 566-572.

McIntyre, Owen. "Fragmentation in International Water Resources Law: Reconciling the International Law Commission's 2008 Draft Articles on Transboundary aquifers with the 1997 UN Watercourse convention." In: *UNESCO; IAH; UNEP. Pre-proceedings of ISARM international conference, "Transboundary aquifers:challenges and new directions*" [CD-ROM]. Paris: UNESCO. 2010.

Mechlem, Kerstin. "Moving Ahead in Protecting Freshwater Resources: The international Law Commission's Draft Articles on Transboudary Aquifers." *Leiden Journal of International Law*, v. 22, n. 4 (2009): 801-821.

Mollinga, Peter P. "Water, politics and development. Framing a political sociology of water resources management". *Water Alternatives*, v. 1, n. 1 (2008): 7-23.

O'Neill, Kate; Balsiger, Jörg; VanDeveer Stacy D. "Actors, norms, and impact: recent international cooperation theory and the influence of the agent structure debate". *Annual Review of Political Science,* v. 7 (2004): 149-175.

ORGANIZATION OF AMERICAN STATES. *Guarani Aquifer: Strategic Action Program. Acuífero Guaraní: Programa Estratégico de Acción*. Bilingual edition. Brazil: OAS, 2009.

OEA, UNESCO PHI. *Proyecto: "Programa Marco para la Gestión Sostenible de los Recursos Hídricos de la Cuenca del Plata, en relación con los efectos hidrogeológicos de la variabilidad y el cambio climático"* Informe Final Componente: Aguas Subterráneas". Caso de estudio UNESCO/OEA/ ISARM Américas Sistema Acuífero Yrenda-Toba-Tarijeño Paraguay-Argentina-Bolivia. 2004. Available at: https://www.oas.org/dsd/isarm/Documents/Spanish/Informe_FINAL_SAYTT_ PARAGUAY.pdf. Consulted on: 03/12/2014.

Priscoli, Jerome Delli e Wolf, Aaron. T. *Managing and transforming water conflicts.* New York: Cambridge University Press, 2009.

Ribeiro, Wagner C. *Geografia Política da Água*. São Paulo: Annablume, 2008.

Roll, Gulnara; Timmerman, Jos. G (2006). "Communicating with stakeholders and the public". In: *Integrated Transboundary Water Managment in Theory and Practice,* edited by Geoffrey D. Gooch and Per Stalnacke, 127-148. Londow: IWA, 2006.

Sant'Anna, Fernanda Mello. "Cooperação Internacional e Gestão Transfronteiriça da Água na Amazônia". 2009. 197 f. Dissertação (Mestrado em Geografia Humana) – Faculdade de Filosofia, Letras e Ciências Humanas, Universidade de São Paulo, São Paulo. 2009.

Sant'Anna, Fernanda M.; Villar, Pilar C. "Gobernanza de las aguas transfronterizas: fragilidades institucionales en América del Sur." *America Latina Hoy*, v. 69 (2015): 53-74.

Sindico, Francesco. "How to regulate what you cannot see: emerging legal frameworks for transboundary aquifers." *KCL EUCERS Newsletter*, v. 41 (2015): 3-10.

Sindico, Francesco; Hawkins, Stephanie. "The Guarani Aquifer Agreement and Transboundary Aquifer Law in the SADC: Comparing Apples and Oranges?" *Review of European, Comparative & International Environmental Law* v. 24, no 3 (2015): 318–329.

Souza, Matilde de; Silva, Carla Pereira; Barbosa, Luciana Mendes. Governança e difusão de normas para a gestão de aquíferos compartilhados: o papel do ISARM. *Contexto Internacional*, v. 36, n. 1 (2014): 261-289.

Stephan, Marina R. *Transboundary aquifers: managing a vital resource. The UNILC draft articles on the law of transbounday aquifers*. Paris: UNESCO, 2009.

UNESCO/OEA/ISARM AMERICAS. *Sistemas Acuíferos Transfronterizos en las Américas. Evaluación Preliminar.* Montevideo/Washington: UNESCO, 2007.

UNESCO IHP ISARM PROGRAM. Atlas of Transboundary Aquifers: Global maps, regional cooperation and local inventories. Paris: UNESCO/ISARM, 2009.

UNESCO-IHP. *Methodology for the Assessment of Transboundary Aquifers*. V. 2. Nairobi: UNEP, 2011.

UN/ECE Task Force on Monitoring & Assessment. *Guidelines on Monitoring and Assessment of Transboundary Groundwaters*. Lelystad: UN/ECE Secretariat, 2000.

UNECE. *Model Provisions on Transboundary Groundwaters*. New York and Geneve: United Nation, 2014.

UNITED NATIONS SYSTEM. Administrative Committee on Coordination. *Inter-Agency Committee on Sustainable Development Report of the ACC Subcommittee on Water Resources on its twenty-second session*. Geneve: WMO Headquarters, 2001.

UNEP; GEF. *Implementation of Integrated Watershed Management Practices for the Pantanal and Upper Paraguay River Basin – GF/1100-99-16*. Final Evaluation Report. 2005. Available at: http://www.unep.org/eou/Portals/52/Reports/Pantanal_Final _unedited 20_MS.pdf. Consulted on: 03/03/2014.

Villar. Pilar C. *Aquíferos Transfronteiriços: Governança das águas e o Aquífero Guarani*. Curitiba: Juruá, 2015.

Villar, Pilar C.; Ribeiro, Wagner C. "The Agreement on the Guarani Aquifer: a new paradigm for transboundary groundwater management?" *Water International*, v.36, no 5 (2011): 646-660.

World Bank. Environmental Protection and Sustainable Development of the Guarani Aquifer System Project. Washington: The World Bank, 2009.

Wounter, Patricia. *Derecho Internacional: Facilitando la cooperación transfronteriza del agua*. Background Paper no 17. Estocolmo: Global Water Partnership, Comité Técnico (TEC), 2013.