



Sustainable development and the Guaraní Aquifer Agreement: A missed opportunity for truly sustainable groundwater governance

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Abstract

In a period marked by increasing stress on global groundwater resources, the recent 2020 ratification of the Guaraní Aquifer Agreement (GAA) demonstrates an international consensus that continued sustainable development requires legally defined transnational cooperation on water sharing and governance. It is the first transnational groundwater agreement to be ratified before conflict and is a model of successful preventative diplomacy. While there is a large body of research on groundwater governance, diplomacy, and conflict-resolution, previous research on groundwater treaties has largely focused on aquifers in water scarce regions such as the Nubian Sandstone Aquifer System shared by Egypt, Libya, Chad, and Sudan. The GAA has received comparatively little attention, with much of the research focusing on the ways in which it differs and expands upon the language of the UN Draft Articles on the Law of Transboundary Aquifers. Even less attention has been paid to its role in enshrining sustainable development as a shared, transnational focus. The GAA, ratified by the four riparian states of Brazil, Argentina, Uruguay, and Paraguay, contains a direct but vague commitment to the principles of the Rio Doctrine. Signed in 2010, and with a full decade between signature and ratification, the GAA is shaped by a relatively outdated approach to development focused on resource extraction fueled growth. This article surveys the manner in which the Sustainable Development Goals (SDGs) have entered the existing, shifting global normative frameworks of groundwater governance. It critiques the normative framework rooted in the Rio Doctrine, of the GAA and calls for a reevaluation of the widely lauded GAA through the lens of the SDGs and a 'green economy' approach.

Keywords: Guaraní Aquifer; Sustainable Development Goals; Rio Doctrine; Sustainability

Introduction

Groundwater cannot be contained or delineated by state boundaries. Water flows across borders, and as such, requires transnational agreements to manage groundwater resource use and ensure the sustainable development of the regions utilizing these resources. There are nearly 600 transboundary aquifers and water bodies, and yet as of 2016 there were less than 10 formal and informal agreements globally (Walton 2016). Groundwater is a vital resource across the world, including South America, where the waters of the Guaraní Aquifer System enable advancements in economic and human development of that region. However, a constantly shifting normative framework around groundwater governance and a lack of global focus on sustainable management of groundwater when compared to that of surface waters risks significant harm to these increasingly vital water repositories. A reevaluation of existing groundwater diplomacy that centers the SDGs is of increasing importance in identifying and understanding the challenges facing sustainable usage of groundwater in South America and beyond.

Groundwater is central to human development, with yet untapped groundwater potentially allowing for renewable energy production, irrigation, industrial, and domestic uses, climate change adaptation and hydrological resilience, and hydrogeological storage of carbon dioxide (Conti and Biermann 2017). However, human development and groundwater exist in a delicate balance, one in which human development may come at the cost of groundwater exploitation (ibid.). Continuing human development, defined by the UNDP in the first Human Development Report (1990) as “a process of enlarging people’s choices” by creating “a conducive environment for people, individually and collectively, to develop their full potential and have a reasonable chance of leading productive and creative lives in accord with their needs and interests” has the serious potential of depleting or deteriorating existing groundwater resources. Indeed, more than half of the world’s most significant aquifers are past sustainability tipping points, with extraction exceeding replenishment (Famiglietti 2019).

Recent studies have demonstrated an empirical relationship between groundwater and welfare. Katuva, Hope, et al., used coastal Kenya as a case study to prove that groundwater depth is related to welfare, finding that the association exists in two interrelated domains: “(a) increasing welfare is strongly associated with deeper groundwater usage, and (b) shallower groundwater dependency has a negative and significant relationship with household welfare” (Katuva, Hope, et al. 2020). While this does not necessarily transfer to global groundwater, and similar studies have not yet been carried out in the Guaraní Aquifer System, it nonetheless demonstrates the significance of sustainable groundwater management to human development.

The sustainable management of existing water sources is, in this context, of ever-increasing importance. 99% of the Earth’s freshwater resources consists of groundwater, although at the moment only a small proportion is readily accessible – meaning that despite the significant reservoirs of freshwater, depletion is an extreme concern. The importance of sustainable management of groundwater cannot be overstated. Over a third of earth’s population depends on groundwater for freshwater needs. Indeed, groundwater is estimated to contribute 36% of potable water, 42% of the water used in irrigate agriculture, and 24% of direct industrial water usage [GEF]. Groundwater is extracted more than any other raw material, with the rate of extraction exceeding that of oil by a factor of 20 (Margat and van der Gun 2013). NASA’s Gravity Recovery and Climate Experiment (GRACE), which collected 14 years of satellite data on changes in water mass, has revealed the Guaraní Aquifer System is one of several worldwide that is currently being over-depleted (Famiglietti 2019).

The Guaraní Aquifer is not the only major transboundary water resource shared by the riparian countries, with the Rio de la Plata Basin also shared by Argentina, Brazil, Uruguay, Paraguay, and also Bolivia. It is the fifth largest river basin in the world and immensely economically and socially important to the region, supplying water for 100 million residents and almost fifty cities, including the capital cities of Asunción, Brasília, Buenos Aires, and Montevideo (UNESCO 2007). To that extent, there is a history of transboundary water governance in the region. But, as has been common worldwide with surface waters, the Rio de la Plata Basin was addressed by these states in diplomatic agreements long before the aquifer was considered. The La Plata Basin treaty “promoting harmonious development and the physical integration” of the Basin was signed in 1969 (Sell 2006)—a full forty years before the signature of the GAA. In this context, the lack of attention that has been paid to the sustainable management of groundwater resources in the 20th century is notable.

There is a scarcity of studies of the relationship between sustainable development in the Guaraní Aquifer System and the GAA. This paper aims to contribute to the growing body of work examining sustainable development language in groundwater governance agreements, using the Guaraní Aquifer Agreement as a case study. First, this paper surveys the existing normative framework of groundwater governance. Second, it applies the SDGs to the norms of groundwater governance to determine the relationship between groundwater governance and the language of the SDGs. Third, the paper analyzes the language of the GAA in the context of the SDG framework to identify its limitations. The final section presents the findings, arguing that the language of the GAA prioritizes the “human development” model at the expense of “sustainable development” and of a “green economy focus” which will protect the aquifer for long-term future use and is therefore a poor model for future sustainability-oriented transboundary aquifer agreements, followed by a conclusion.

Groundwater Governance: A Shifting Normative Framework

The global normative framework surrounding groundwater governance is in flux and subject to rapid change (Conti and Gupta 2015). The rapid evolution of the field is evident in the established global governance texts, including international laws. An established and agreed upon understanding of groundwater governance is vital for ensuring the sustainable usage of groundwater. Following Conti and Gupta (2015), this paper will treat ‘sustainable development’ as a broad concept rather than an individual principle. The WCED (1987) established sustainable development as that which “meets the needs of the present without compromising the ability of future generations to meet their own needs.” In this context, groundwater sustainability is about using and developing groundwater in a way that does not create abiding negative environmental, economic, or social consequences, or, more scientifically phrased (Gleeson et al 2020) as “maintaining long-term dynamically stable storage [and flow] of high-quality groundwater using inclusive, equitable, and long-term governance.”

In 1966, the International Law Association’s non-binding Helsinki Rules on the Uses of the Waters of International Rivers made the first clear reference to groundwater in international law, mentioning “underground waters flowing to a common terminus” in Article II. A variety of UN and ILA conferences over the next few decades discussing water use continued to mention groundwater, particularly the Seoul Rules on International Groundwaters (1986), which expanded upon the Helsinki Rules by containing language on transnational groundwater. Article 1 of the Seoul Rules states “the water of an aquifer that is intersected by the boundary between two or more States [...] whether or not the aquifer and its waters form surface waters part of a hydraulic system flowing into a common terminus.” And since then, continuing into the present day, the United Nations and the ILA have continued to develop groundwater law, including: the Convention on the Protection and Use of Transboundary Watercourses and

International Lakes (UNECE 1992), which contains groundwaters that “mark, cross, or are located on boundaries between two or more States”; the 2014 UNECE Model Provisions on Transboundary Groundwater Management (UNECE 2014); the legally-binding UN Watercourses Convention (1997) which entered into force in 2014; and the UN ILC Draft Articles on the Law of Transboundary Aquifers, among others.

Among all the various documents and agreements on groundwater usage, there has been a wide range of language usage and differences, and often either disagreement or no discussion about an actual definition of groundwater (Conti and Gupta 2015). Conti and Gupta note that only the Berlin Rules and Draft Articles on the Law of Transboundary Aquifers clearly define aquifers, with the sufficiency of the definition provided by the Draft Articles somewhat contentious (Eckstein 2007). Equally, there is ambiguity in the Helsinki Rules and UN Watercourses Convention about the relationship between ground and surface waters—even on a scientific level, the discussion of groundwater is vague in a way that limits the ability to effectively address challenges to groundwater management.

But the breadth and variety of principles and language found within the larger corpus of groundwater governance texts provides a wealth of content from which to draw inspiration for groundwater agreements, with no one normative framework existing that could provide a clear international consensus on best-practices for the formulation of groundwater agreements. A nonlinear and rapidly accelerating evolution of global groundwater texts has resulted in a body of texts that incorporate and discuss groundwater in widely varied ways (Conti and Gupta 2015). The authors' analysis of twelve major international groundwater texts finds that principles contributing to sustainable development are incorporated in legally binding groundwater governance texts inconsistently.

An improved normative framework for sustainable groundwater governance, which would facilitate the completion of SDG targets, is necessary. To achieve this improved normative framework, Conti and Gupta (2015) argued for “(a) use a common terminology that is rooted either in the state of the art hydrogeology or legal norms, as appropriate; (b) include definitions and scope that recognize the duality of groundwater being both part of and apart from the contemporary hydrologic cycle, thus including aquifer of all types whether non-recharging, layered, or linked to surface water; (c) include norms presently underrepresented in legally binding texts; (d) reconcile tensions between principles; (e) elaborate best practices for well-accepted principles that are most challenging to implement; and (f) introduce principles of mechanisms to cope with the effects of trade and climate change.” The vague definitions and shifting normative framework of groundwater governance must be addressed, because the contentious normative principles provide states with an ability to pick and choose groundwater governance policies that benefit their domestic policies—even if those policies come at the cost of groundwater depletion. This shifting normative framework allows space for aquifer harm without international critique.

The GAA is, as one of the few ratified transboundary aquifer agreements, an important text within the larger corpus of groundwater governance and provides an extremely rare implementation of governance principles continuously under debate. However, although it was ratified in 2020, it was signed in 2010, the language developed while major documents such as the Draft Laws on Transboundary Aquifers were still being debated and considered within the international community. The GAA was created in this context of groundwater governance marked by shifting norms and contentious terminology, marked by tensions between groundwater governance oriented around growth-focused economic development and principles that prioritized the protection of the waters for the long-term over those of contemporary human development requirements; the agreement itself demonstrates these existing tensions and the ability of the four riparian states to prioritize extraction-based

development without contradicting the larger normative framework—as no such clear framework yet exists.

Groundwater and the SDGs

The adoption of the SDGs provides an opportunity to reevaluate groundwater governance and to reconsider the GAA. In 2015, the 2030 Agenda for Sustainable Development was developed and adopted in a UN General Assembly resolution in 2017. The SDGs demonstrate an important shift in development discourse away from development as purely growth fueled by resource-extraction. Carl Death and Clive Gabay (2015) argue that (i) the SDGs are “genuinely global,” allowing them to “destabilise long-standing divisions between ‘developed’ and ‘developing’ societies,” and (ii) “they might challenge existing growth paths of resource-intensive development.” This secondary shift, a new approach to resource consumption, is relevant to groundwater governance.

At Rio+20, there was positive discourse around a ‘green economy’ that is ‘low carbon, resource efficient, and socially inclusive’ (UNEP 2011). UN Environment “promotes a development path that understands natural capital as a critical economic asset and a source of public benefits, especially for poor people whose livelihoods depend on natural resources.” UN Environment makes it clear that the ‘green economy’ (GE) isn’t a replacement of sustainable development, but rather a reorientation towards a prioritization of reducing waste generation, carbon emissions, and resource consumption. A focus on development that is not oriented around resource consumption is a vital reconsideration of development for groundwater governance, as resource depletion is a vital threat to aquifers. This directly challenges development that requires resource extraction to drive economic growth (Death 2014, Melamed and Ladd, 2013, Tienhaara, 2014).

The SDGs are, indeed, empirically intertwined with natural resources. A study of systematic and empirical indicator-based articulation between SDGs and natural resources (Merino-Saum *et al.*, 2018) found significant interlinkages, with all SDGs linked with a minimum of one natural resource through the study’s GE indicators. The SDGs touch upon groundwater management in a way that, if not explicitly, at least implicitly connects groundwater to the larger sustainable development agenda. Goal six, ‘to ensure availability and sustainable management of water and sanitation for all,’ is the all-encompassing water goal (UNDESA 2015). Within that extremely broad Goal, target 6.6 is the only target to specifically refer to groundwater, stating “By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.” Groundwater is buried among a list of varying ecosystems, and the phrasing of “protect and restore” is extremely vague.

This minimal reference to groundwater makes it clear that it is not an explicit focus in the 2030 Development Agenda’s SDGs. Lisa Guppy *et al.* (2018) demonstrate in their study of groundwater interlinkages that “the importance of groundwater to sustainable development is poorly recognized and captured at the SDG target level” and that in international sustainable development discourse, groundwater is effectively an after-thought. However, groundwater touches on a significant portion of the overall sustainable development goal framework. Guppy *et al.*’s analysis of the core targets found that 42% of core targets (53 targets) can be connected to the larger theme of groundwater (*ibid*). Goal 1, poverty eradication; Goal 2, food security; Goal 5, gender equality; Goal 11, sustainability of cities and human settlement; Goal 13, combating climate change; and goal 15, protecting terrestrial ecosystems, as the secondary goals most directly linked to the sustainable management of groundwater (Velis *et al.* 2016). That there are fifty-three targets with interlinkages to groundwater that contain no

explicit acknowledgement of groundwater demonstrates a notable lack of attention and concern in the existing SDG framework (Guppy *et al.* 2018).

Guppy and Uyttendaele *et al.* (2018) focused on the use, management, and sustainability features of groundwater in their analysis of interlinkages between groundwater and the SDGs. The group delineated various interlinkages based on the degree to which the achievement of the SDG goal impacts groundwater and found that the majority of these interlinkages were 'reinforcing' rather than 'conflicting,' explaining that "from a policy perspective i) conflicting interlinkages are the most critical and difficult ones to manage and ii) it is important to draw synergies between SDG initiatives and groundwater to allow *reinforcing* interlinkages to materialize." That these interlinkages are more often than not reinforcing provides a degree of hope for a successful consideration of groundwater sustainability into the implementation of SDG targets; but within the larger discussion of sustainable development, it is necessary to identify and strengthen these reinforcing interlinkages to ensure that groundwater management is not considered secondary to the SDG targets that impact it.

The complex overlap of interlinkages within these SDGs is representative of the larger weakness of the 17 SDGs and 169 targets. They were developed and grounded in pre-existing normative frameworks and an already developed body international law (one in which, as previously noted, groundwater governance is comparatively underdeveloped). As Kim (2016) argues, the fragmented nature of pre-existing international law has led to the equally fragmented SDGs and targets. Kim writes, "even in an ideal world where all the SDG targets are met individually, the outcome may not necessarily be the desired state of sustainable development" because there is no clear system to identify and lessen trade-offs and the conflicts that may emerge between goals. In this context, there is a clear risk that groundwater—underdiscussed and barely mentioned within the SDGs—is at risk of harm caused by the pursuit of other, conflicting SDGs. However, as the primary framework of sustainable development, is vital that existing groundwater governance is re-evaluated to best center the SDGs and incorporate groundwater governance within the larger discourse around and implementation of sustainable development targets.

II. The Guaraní Aquifer Agreement

The Guaraní Aquifer System is located in the south central and eastern regions of South America and is notable for its sheer scale— in its extension and stored volume of water, it is widely believed to be one of the biggest transboundary underground water systems on Earth (Wendland *et al.* 2006). The aquifer is seen as a strategic source for Argentina, Uruguay, Paraguay, and Brazil (*ibid.*), located as it is near socio-economically vibrant and important regions. Approximately 15 million people live directly above the aquifer, with a further 75 million living in nearby cities (Hirata and Foster 2020). There is significant usage of the aquifer, although that usage is dominated by Brazil (94% of the water extraction). The aquifer is a major source of water for the public, with approximately 80% of the water used for public water supply (*ibid.*).

Based on the current rate of use of the Guaraní Aquifer System, it is reasonable to expect a steadily increasing rate of depletion and a greater threat of pollution (Wendland *et al.* 2006). To understand the challenges to sustainable usage of the Guaraní Aquifer System, a closer examination of the structure of the Aquifer and its groundwater recharge process. There are two primary mechanisms for groundwater recharge in the system: the first is direct infiltration through outcrop zones and second, indirectly through overlapping formations (*ibid.*). This direct infiltration occurs primarily in Brazilian states, eastern Paraguay, and Northern Uruguay. The complexity of the Guaraní flow system increases the ways of contamination. The pollutive

solutes from the industrial and agricultural industries and from domestic usage that are created on the surface can reach the reservoir through the outcrop zones and the Serra Geral Formation (ibid.).

Groundwater pollution due to agricultural activity is not, it must be noted, unique to the Guaraní Aquifer System. Dimitris Dermatas (2017) explains that although worldwide, depletion is a greater long-term concern, in the short-term, groundwater resources are in fact more threatened by soil, and groundwater pollution, writing “soil and groundwater are predominantly threatened by pollution from agricultural practices, solid waste and disposal, mining, manufacturing, and other industrial activities.” The Guaraní Aquifer is threatened by pollution, particularly from agricultural activities in Brazil and Paraguay. This, combined with the share of the water being extracted by Brazil, demonstrates the uneven harm *via* pollution and extraction that is negatively impacting the shared resource.

The Project for Environmental Protection and Sustainable Development of the Guaraní Aquifer System

A lack of information about groundwater is one of the primary challenges to sustainable management of aquifers. Inge de Graaf, a hydrologist studying groundwater depletion worldwide, explained that “we don’t know how much water there is, how fast we’re depleting aquifers, or how long we can use this resource before devastating effects take place, like drying up of wells or rivers” (AGU 2016). As Guppy *et al.* (2018) identified in their study of interlinkages, the lack of useful and SDG-relevant data on groundwater inhibits the ability to “make globally, and even locally, relevant recommendations for groundwater use, management and sustainability in the SDG era.” The science around aquifer flow and structure is continuing to develop, with a thorough and systemic mapping of aquifers only occurring in the last decade. And that is the information that is vital to create effective groundwater governance.

To combat the absence of information and to prepare for the negotiations of the GAA, the Environmental Protection and Sustainable Development of the Guaraní Aquifer System Project was started. The project, carried out by the OAS with funding from the IBRD, centers “sustainable, integrated management.” As a preparatory step for the development of the aquifer agreement, even the use of the terms “environmental” and “sustainable development” in the name were encouraging signs of a larger commitment to fully informed sustainable development governance moving into the negotiation period.

The World Bank’s 2010 report on the project summing up the results described it as successful, with the outcome “moderately satisfactory” although with higher-than-expected costs, stating that “the Project successfully supported the countries in learning to work together on their key transboundary concerns...as a result the risk of over-extraction and contamination of groundwater resources and any transboundary impacts have been significantly reduced.” The Project’s results showed that only 10% of the SAG was exposed to pollution, enabling a more targeted response. Although carried out before the development of the SDGs, this fits into a larger call for groundwater information as a facet of the SDGs, with Velis *et al.* (2017) concluding that “the general lack of capacity with respect to groundwater resource management is a major hindrance to benefiting from synergies and addressing trade-offs between groundwater and human development,” with Velis *et al.* recommending the use of the “Post-2015 Data Revolution” to gather better data on water usage.

The Project, the Bank stated, demonstrably informed future sustainable development work by enhancing understanding of the lack of access of water, noting that most of those who lack access to water within the aquifer system reside in rural areas, and that 300 cities draw water supplies from the aquifer. However, despite the usefulness of the information—allowing for a better understanding of the movement of the waters, where water availability was lacking, the risks of overdraft, and so-on, information alone is insufficient for ensuring sustainable development. The report determined “the longer-term sustainability of these improvements depends, inter alia, on adequate implementation of the SAP.”

It was this project that informed the creation of the GAA. The wording of the final agreement as signed in 2010 demonstrates clearly that the results of the Environmental Protection and Sustainable Development Project were utilized in the creation of the agreement, concluding a list of clauses in the introduction with an affirmation that the four states took “into consideration the valuable results from the “Project for Environmental Protection and Sustainable Development of the Guaraní Aquifer System.” In this regard, the Project was a hopeful sign that the GAA would center development in a sustainable manner that prioritized maintaining the water resources for future generations.

Development Language in the GAA

The language of the GAA centers sustainable management, but it does so in a manner that is so vague as to be potentially ineffective. The first section of the agreement outlines the various principles and documents from which the agreement drew language and focus, and which guided the wording and theoretical grounding of the GAA. The very first sentence of the agreement contains a reference to sustainable management. The agreement begins, “In the spirit of cooperation and integration that presides over their relations, and with the purpose of expanding the scope of their concerted actions for the conservation and sustainable utilization of the Guaraní Aquifer System transboundary water resources...” (Guaraní Aquifer Agreement, trans. Amore 2010). This frames the explicit purpose of the agreement as ‘conservation’ and ‘sustainable utilization’ of the aquifer, a framing that on the surface, at least, is encouraging as a firm commitment by the riparian states to center sustainable usage of the waters in their continued economic development (which, in the region, largely takes the form of agricultural usage).

It is clear that the developers of the agreement connected the language of the document with pre-existing international sustainable development texts. The third clause is the first to specifically reference environmental politics, phrased as “Bearing in mind the principles of natural resources protection, and the sovereign responsibility of States regarding their reasonable utilization, as expressed in the Declaration of the United Nations Conference on Human Environment, Stockholm, 1972” (). The following two clauses both specifically discuss previous international texts on sustainable development. The clause is worded, “Conscious of the responsibility to promote the sustainable development in benefit of present and future generations, in agreement with the Rio Declaration on Environmental and Development, 1992.” This is directly followed by an affirmation of the importance of “the conclusions from the Summit of the Americas on Sustainable Development, Santa Cruz de la Sierra, 1996, and the conclusions from the World Summit on Sustainable Development, Johannesburg, 2002.” The GAA is clearly intended to exist within a larger normative framework developed over the second half of the 20th century and the first few years of the 2000s.

The Rio Declaration is, however, a complicated document upon which to base sustainable development and sustainable management. The Rio Declaration was influenced (Conti and

Gupta 2015) by both the UN Stockholm Declaration (1972) and by the conversations leading up to and the language of the Brundtland Commission's 1987 release of *Our Common Future* (WCED), commonly referred to as the Brundtland Report. The Brundtland Report which popularized the term 'sustainable development' and led to the widespread, though contentious, popularity of a logic of sustainable development focusing on the "triple bottom line" model which seeks a balance between environmental, economic, and social concerns (Holden et al. 2014).

The Rio Declaration, building off these previous benchmarks in environmental governance, is comprised of two parts: the Declaration itself; and Agenda 21, the paired non-binding action plan. The latter non-binding declaration is a major foundation of international environmental governance, containing 27 environmental governance principles. The Rio Declaration does not address groundwater specifically, although many of the 27 principles touch on groundwater in varying ways, with applicable environmental principles featured within the text including emphases on the "do no harm" principle, and on notification requirements. The Rio Declaration differs from the draft articles and other key documents such as the UN Watercourses Convention in centering an open international economic system (Conti and Gupta 2015). Principle 12 of the Rio Declaration states that "states should cooperate to promote a supportive and open international economic system that would lead to economic growth and sustainable development in all countries," and concludes with a call for international consensus in all environmental measures taken that address transboundary issues. It is this environmental governance text, with a comparatively significant focus on economic principles, from which the GAA most closely draws.

The degree to which the negotiations were guided by these various international agreements and conclusions does not define the extent to which these conclusions were incorporated into the agreed upon articles of the treaty. Effective sustainable development requires sustainable management of the resources that is specific and measurable. In this regard, the agreement falls short. After affirming in the first two articles the sovereignty of the individual states over their own waters and territories, although "in agreement with the norms of applicable international law" (Article 2), Article 3 states that operate on a do-no-harm principle towards the other Parties "or the environment" but within their territory they have the "sovereign right to promote the management, monitoring, and sustainable utilization of the Guaraní Aquifer System water resources, and shall use such resources on the basis of reasonable and sustainable uses criteria" (Article 3). This allows significant leeway to each individual state to continue with development as they see fit—and this development is one largely focused on resource extraction in a growth-based model of sustainable development that does not align with the 2015 SDGs and a move towards a 'green economy.'

This does not mean that the parties can operate entirely without limit. Article 4 states, "The Parties shall promote the conservation and environmental protection of the Guaraní Aquifer System so as to ensure multiple, reasonable, sustainable, and equitable use of its water resources." The use of the word "promote" leaves significant room for inaction. To "promote" sustainable development is not the same as to regulate it. There is a significant focus on the do-no-harm principle, in this case repeatedly phrased as not causing "significant harm to other Parties or the environment" [emphasis own]. The "do-no-harm principle", despite ensuring that States cannot impact the aquifer in a way that would degrade it for other parties, suffers from the same issue the entire GAA suffers—it is too vague to provide a clear outline for steps to be taken, or a clear definition of what 'harm' meets the standards of the document. Speaking of groundwater management at large, Conti and Gupta (2016) note that "many aquifers/basin states may lack the practical and legal means to prevent significant harm to groundwater resources, especially because no environmental principles explicitly deal with over-abstraction."

An additional major concern is that the GAA makes no reference to climate change. Conti (2019) notes that in international groundwater law, “true sustainability may be compromised by a lack of principles designed to cope with climate change.” As a model of groundwater treaties, this lack of mention of climate change is concerning. Based as it is, on the Rio Declaration, the lack of mention of climate change in the GAA is unsurprising. And it is here where the outdated nature of the document in the context of modern sustainable development discourse is clear, and the application of the SDGs to groundwater governance is necessary. The official mission of SDG 13 is to “take urgent action to combat climate change and its impacts.” Target 13.2 calls for integrating “climate change measures into national policies, strategies, and planning.” The GAA - as the primary policy document governing the usage of this vital natural resource - falls short in incorporating climate change into local water policy. The abstract, shifting and often contradictory normative framework of groundwater governance in existence while the agreement was being negotiated in the 2000s does not stand up to the needs of the aquifer system in a future defined by climate change and at risk of extensive economic development at the cost of excessive extraction and depletion.

The Guaraní Aquifer Agreement in International Transboundary Governance

The GAA is a model for the global governance of aquifers. This is something the states involved take great pride in—pride that may be overstated. During the discussion of the Draft Articles on the Law of Transboundary Aquifers in 2016, some delegations specifically discussed the conclusion of the Guaraní Aquifer as an “important step in the implementation of the principles” (UNGA 2016). Martín García Moritán, the Permanent Representative of Argentina to the UN, speaking on behalf of Brazil, Paraguay and Uruguay, commended the work of the Special Rapporteur on drawing attention to transboundary aquifers, including the Guaraní Aquifer System, and discussed the GAA, which “aimed to expand the scope of concerted action for the conservation and sustainable use of the transboundary resources of the Guaraní aquifer system”, with the agreement framed by the representative of the four states as “an important contribution of the region to the topic and...one of the first instances of the implementation of General Assembly resolution 63/124” (UNGA A.C.6/71/SR.18 2016). The delegate argued that “the next appropriate step by the General Assembly on the issue would be the adoption of the draft articles in the form of a declaration of principles, to be taken into account in bilateral or regional agreements on the proper management of transboundary aquifers.” For Argentina, Brazil, Paraguay, and Uruguay, the GAA (even, then, unratified) was a clear win on the global stage and an opportunity to give the perception of leadership in the field.

The 74th session again referenced only the 2010 GAA as an application of the draft articles in principle, calling for the conclusion of the agreement. In both sessions, it was the only existing agreement discussed. At the 75th session, the resolution was adopted, and Argentina spoke in explanation of the position of Argentina, Brazil, Uruguay, and Paraguay. Fernando A. Marani, representing the four riparian states, “commended the International Law Commission, the Special Rapporteur and the Working Group on shared natural resources for their work on the topic of the law or transboundary aquifers. By seeking expert advice, the Commission had gained a better understanding of the nature of aquifers, including the Guaraní aquifer system,” in this moment providing one of the only mentions of a specific aquifer system to occur in the session and again centering the SAG as a vital region for groundwater governance innovation. He again discussed the signing of the GAA, arguing that “as one of the first multilateral agreements on the management of a transboundary aquifer, the Agreement was an important contribution to the topic” (A/C.6/74/SR.35 2019).

On the international stage, the GAA has served as a model for transboundary water diplomacy, and as an opportunity for the four states involved to burnish their reputations as leaders in the field of groundwater governance. In the context of the adulation surrounding the agreement and the attention paid to it in a field marked by comparatively few international agreements in comparison to those of other water bodies such as oceans and rivers, the GAA contributes to groundwater governance norms, and will continue to influence future groundwater diplomacy globally. However, the GAA's presence as the only agreement consistently discussed in United Nations conferences on groundwater governance ensures that the GAA will maintain a concerning, outsized influence on future groundwater agreements.

Conclusion

This paper carried out a brief survey of modern groundwater governance norms and a deeper assessment of groundwater governance within the SDGs. It then analyzed the sustainable development language of the GAA within the context of the Sustainable Development Goals. Finally, it examined the position of the GAA within the larger groundwater governance discussion on the international stage. The assessment has shown that the GAA, centered as it is around the Rio Declaration, which prioritizes human development at the cost of the security of the environment, does not serve as an effective foundation upon which to ensure sustainable groundwater governance.

For a significant and useful reevaluation of the agreement and of future agreements in the context of a 'green economy' and for the SDGs to be useful, the Sustainable Development Framework must itself be modified to provide a legitimate focus on groundwater. Guppy *et al.*, while recognizing that the existing SDG framework is complex and unlikely to be significantly changed, note that the review process is continuing. They argue groundwater must be considered in this process and in the lead-up to 2030, when it is possible that the SDG framework may be significantly changed. Indeed, they call for "a structured approach that simulates 'groundwater-centric' thinking in the context of SDGs" and the continuous development of "evidence-based arguments for a better target and indicator system that may be adopted by UN Member States after 2030" (Guppy *et al.* 19). The lack of sufficiently narrow and defined attention to groundwater paid by the sustainable development goals leaves water governance dependent on an outdated normative system. Nonetheless, the SDGs provide a useful framework from which to approach transboundary water agreements.

The recent 2020 ratification of the GAA demonstrates the continuing relevance and timeliness of groundwater governance yet reveals a serious disconnect between groundwater governance based on the Rio Declaration, and what is possible for groundwater governance in the context of the SDGs. The language of the GAA is concerningly outdated, with no discussion of climate change whatsoever, and a vague focus on the "do-no-harm principle" that does not clearly lay out how to constitute harm to the aquifer and to the other riparian states, creating space for the various states to pursue their economic development goals at the expense of the continued sustainable management of the aquifer. In the context shifting global groundwater governance norms, which allows states to pick and choose which of the contradictory principles they prefer while remaining within the larger international normative framework, the principles the riparian states of the GAA selected—rooted in the Rio Declaration—are principles that, despite continuously using sustainability buzzwords, do not in fact prioritize sustainable development or sustainable management over extraction-based

development. Despite being lauded on the international stage as a breakthrough in groundwater governance, the GAA does not successfully center sustainable development.

Although it is unlikely that the GAA itself will be modified, future groundwater treaties for which the GAA serves as a model should critically engage with the text through the lens of the 2015 SDGs. Future transnational groundwater agreements will most effectively allow for sustainable development if the designers move away from a focus on economic development that is dependent on intensive water-extraction and towards a model of transnational water governance that emphasizes sustainable development through the management of water in a 'green economy' orientation.

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