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‘Making the Invisible Visible’: Legislation on Transboundary Aquifers

ABSTRACT: *This article addresses an area of international law that is not often discussed, namely, the challenging management of transboundary aquifers. Following a short introduction to the importance and topicality of transboundary aquifers and how universal international law instruments deal with them, this article dives into an analysis of existing bilateral and multilateral cooperations of transboundary aquifers by systematically examining these systems based on the forms of cooperation, their institutional structures, whether they employ quantitative and qualitative measures and how they resolve disputes. Drawing from the experiences of the analysed cooperations, the article proposes a step-by-step path to improve the management of these resources. The article argues that it is possible to successfully prevent wasting resources by invoking the idea of giving more attention to these resources, establishing an international instrument to provide a minimal level of protection to transboundary aquifers and setting up cooperations to manage the given resources.*
KEYWORDS: *transboundary aquifers, shared resources, international cooperation, water law, best practices in managing shared aquifers.*

1. The Importance of Transboundary Aquifers

The regulation of transboundary groundwaters is an inexplicably neglected field of international law. Legislations regarding surface waters are plentiful — there have been at least 3,600 treaties concerning these[1] — but the same cannot be said about waters under our feet. This phenomenon is extraordinarily bizarre, as groundwater’s importance and future value are substantially higher than that of their surface counterparts. But what is this significance exactly? Overall, only 2.5% of the water on earth is freshwater, out of which 30% can be found in the form of groundwater and only 1%

1 Szilágyi, 2013, p. 37.

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in the form of surface water. To put it in another perspective, on Earth, we have 23 times as much freshwater available in groundwater than in surface water.[2] However, its significance does not only lie in its sheer quantity but also in the fact, that owing to the protection of the surrounding matter, groundwater is generally far cleaner than surface water bodies. Yet despite its importance, none of the existing binding or non-binding international treaties provide a meaningful solution to parties that wish to cooperate. In addition to the lack of universal legislation, the situation is not much better at the local level. Of the 468 known transboundary aquifers,[3] some form of cooperation exists only in 6 cases.

Fortunately, this lack of legislation has not yet resulted in a global humanitarian crisis, but that does not mean the possibility does not exist. According to UNESCO's 2019 UN World Water Development Report, at least two billion people live in countries facing high water stress.[4] However, this number is not constant as the current tendency of population growth combined with the unsustainable use of these resources will make it even worse. This terrible situation should be taken seriously even by states not currently facing a water deficit as it can result in mass migration towards them. Presently, every tenth migrant's reason for moving is the lack of water,[5] and no data suggest that the situation will improve in the future. Another terrifying but not impossible outcome of the lack of proper regulation is the appearance of conflicts over shared resources. This prospect is proven by studies observing a steep rise in recent years in the number of conflicts emerging over water.[6]

The future does not look too promising as the sovereigns at the moment do not seem to be fully aware of the importance of these transboundary resources. This lack of attention towards these resources must change as they will be crucial for humanity's survival.

In the following sections, the author will briefly discuss the definition of groundwater and the problems with the existing universal legislations. The article will go into more detail regarding the six existing cooperations, and finally, it will also present a roadmap, which aims to help achieve better management of these resources.

2. What Is Groundwater

The waters under our feet should not be imagined as being situated in caves filled with water. Groundwater is the water found in the saturated zone where all the pores

2 Dempsey, 2021, p. 1.
3 IGRAC, 2021, p. 2.
4 WWAP, 2019, p. 1.
5 The World Bank, 2021, p. 2.
6 Pacific Institute, 2022, p. 1.

between the particles are filled with water. The upper boundary of this saturated zone is the water table, which separates it from the unsaturated zone, where the pores between the particles are filled with air and water.[7] Those rock pools that store water and from which water can be economically abstracted are called aquifers. Aquifers can be differentiated into unconfined aquifers, which are close to the surface, and confined aquifers, which are closed off by a relatively impenetrable rock layer.[8] The benefit of confined aquifers is that they are less prone to contamination. To sum up, groundwater should be imagined as a pore-filling water body.

3. Universal Pieces of Legislation

Within public international law, legislation of transboundary aquifers has a short history of sixty years. When we discuss these legislations, two main problems surface. First, when creating most existing legal instruments, the focus was not on transboundary aquifers, which were included by the creators only as an afterthought. The first major international document that included transboundary aquifers was the non-binding 1966 Helsinki Rules, which aimed to discuss the use of transboundary waters. This lack of special focus is also apparent in the two existing binding instruments, namely the Convention on the Law of the Non-Navigational Uses of International Watercourses (1997) and the Convention on the Protection and the Use of Transboundary Watercourses and International Lakes (1992). The 1997 Convention mainly focused on surface waters, and what's more, its second article stated that the convention is only applicable to transboundary aquifers that are connected to surface waters.[9] This requirement of a connection might not strike us as a significant issue, but there are numerous occasions when these resources are not connected to surface waters. The 1992 Convention, as its name suggests, did not focus on groundwater, but when defining the term transboundary water, it used the word 'any', implying that it applies to every form of groundwater.[10]

The other main issue with the existing instruments is that they are not binding except for the two conventions mentioned above. This is especially saddening in the case of the 2008 Draft Articles on Transboundary Aquifers, which codified the

7 Mádlné Szőnyi et al., 2013, pp. 43–44.
8 Thompson, 2016, p. 2.
9 United Nations: Convention on the Law of the Non-Navigational Uses of International Watercourses 1997. Official Records of the General Assembly, Fifty-First Session, Supplement No. 49 (A/51/49), 3.
10 United Nations Economic Commission for Europe: Convention on the Protection and Use of Transboundary Watercourses and International Lakes 1992.

customary laws of transboundary aquifers.[11] As noted, these regulations do not really help those states that wish to cooperate over their shared resources. The draft articles were only influential in being used as a guide when the parties concluded cooperations regarding the Guarani and the Iullemeden–Taoudeni/Tanezrouft aquifers.[12]

4. Case Studies

As previously mentioned, there are six existing cooperations over transboundary aquifers. These are related to the Genevese aquifer system (Switzerland, France), Nubian Sandstone aquifer system (NSAS; Chad, Egypt, Libya, Sudan), North Western Sahara aquifer system (Algeria, Tunisia, Libya), Iullemeden–Taoudeni/Tanezrouft aquifer system (Algeria, Benin, Burkina Faso, Mali, Mauritania, Niger, Nigeria), Guarani aquifer (Argentina, Brazil, Paraguay, Uruguay) and the Al-Sag/Al-Disi aquifer system. Concerning these, we will discuss the following four issues: the forms of cooperation, institutional structure set up by the parties, qualitative and quantitative actions taken by the states to preserve these resources and the settlement of disputes.

4.1. Forms of Cooperation

The first important aspect worth discussing is the forms of cooperation and the goals the parties aim to reach. For all mentioned aquifers, except for the Iullemeden–Taoudeni/Tanezrouft aquifer, the states have entered into binding agreements, but each solution is worth discussing in greater detail because they differ greatly.

4.1.1. Binding Agreements

We will first discuss the binding agreement of the Genevese Aquifer Convention. The Genevese aquifer, 10% of which is situated on the territory of France and 90% on the border of Switzerland, provides freshwater to 700,000 people.[13] The cooperation became extremely necessary in the 1970s as the water levels decreased by seven meters because of the unregulated resource overexploitation.[14] The respective canton of Switzerland and the prefecture of France entered into a Convention in 1978, which remained in force for the next 30 years. In 2008, after a few amendments, the convention

11 Greenop, 2021, p. 51.
12 Eckstein and Sindico, 2014, pp. 39–40.
13 Cobos, 2018a, pp. 116–127.
14 Cobos, 2018b.

was renewed for another 30 years.[15] With this cooperation, the parties aimed to set up an artificial recharge system and manage the aquifer together. An essential aspect of this case is that the two sides realised the importance of subsidiarity and the resource's regional importance; thus, they implemented the cooperation on a local level where all the parties contributing to the success bore the competencies and interests.

The next binding agreement was contracted in connection with the Nubian Sandstone Aquifer System, the grandest known aquifer, which serves as the most crucial source of freshwater in its region. In the case of this fossil aquifer, the cooperation started long before the agreement was established. First, Egypt and Libya started an informal cooperation formalised in 1992 by setting up a Joint Authority for the Management of the NSAS. Sudan and Chad joined this Joint Authority in 1996 and 1999, respectively.[16] The Joint Authority's purpose was to conduct research related to the aquifer, to organise trainings and, most importantly, to optimise and balance the abstractions.[17]

The following binding agreement concerns the North Western Sahara aquifer system. The parties here followed an extremely pragmatic three-phase approach. In the first phase, they conducted thorough research on the aquifer; in the second phase, they built up the basis for the cooperation and analysed the different uses of the aquifer; finally, in the last phase, they drew up the permanent consultation mechanism in the form of a ministerial declaration.[18] The Consultation Mechanism was set up in an existing international organisation, namely the Sahara and Sahel Observatory (OSS), and aimed to provide a framework for the cooperation of the parties.[19]

The states also chose a binding solution for the Guarani aquifer, which is mostly a fossil resource that serves as an essential source of freshwater for the approximately 92 million people living in its territory.[20] The parties concluded a research project on the area and created a strategic action plan that proposed multiple ways to go forward. From the proposed options, the states selected the idea of a binding agreement. The Guarani Agreement was formulated in 2010, but owing to the lengthy ratification process, it only came into force in 2020.[21] The cooperation mainly aims to preserve the quality of the aquifer.[22]

15 Cobos, 2018a, pp. 116–127.
16 Constitution of the Joint Authority for the Study and Development of the Nubian Sandstone Aquifer Waters 1992.
17 Constitution of the Joint Authority for the Study and Development of the Nubian Sandstone Aquifer Waters 1992.
18 AbuZeid, Elrawady, and CEDARE, 2015, p. 8.
19 Déclaration des Ministres des Ressources en Eau des Pays Partageant le Système Aquifère du Sahara Septentrional 2006.
20 Sindico, 2011, p. 257.
21 Villar, 2020, pp. 1–2.
22 Acuerdo sobre el Acuífero Guarani 2010.

The last binding agreement was concluded for the Al-Sag/Al-Disi aquifer. According to the World Resources Institute, both Jordan and Saudi Arabia face high water stress, so the aquifer plays a crucial role in mitigating this challenge.[23] Despite the outstanding importance of the resource, agricultural abstractions were not sustainable, and by 2000, water levels had dropped significantly.[24] The parties realised the danger of this and entered into an agreement in 2015 mainly to preserve and manage the aquifer by setting up certain zones where abstractions are prohibited or only allowed for municipal use.[25]

4.1.2. Non-Binding Agreement

There is only one aquifer, the Iullemeden–Taoudeni/Tanezrouft, for which the parties have not yet established a binding agreement, as they are only at the stage of a memorandum of understanding (MOU) which could project they will deepen their cooperation. The MOU was decided upon in 2014 but has not been signed by all the states. Nevertheless, the details of the proposed MOU will be included in this study as it is a detailed and interesting document. In the MOU, the sovereigns aim to set up a consultation mechanism for the protection and management of the aquifer.[26]

4.2. Institutional Structures

After discussing the basis of the cooperations, the next issue to be discussed is the institutional structures the parties have set up. We can differentiate between agreements with the sole goal of setting up institutions to work out the rules for every emerging issue and those focused on other matters.

4.2.1. Agreements Focused on Setting Up Institutions

The Nubian Sandstone Aquifer Agreement, which set up the Joint Authority in Tripoli, belongs in this category. Its main body is the Board of Directors, which consists of

23 Hofste, Reig, and Schleifer, 2019, pp. 1–4.
24 UN-ESCWA and BGR (United Nations Economic and Social Commission for Western Asia; Bundesanstalt für Geowissenschaften und Rohstoffe), 2013, pp. 308–310.
25 Agreement between the Government of the Hashemite Kingdom of Jordan and the Government of the Kingdom of Saudi Arabia for the Management and Utilisation of the Ground Waters in the Al-Sag/Al-Disi Layer 2015.
26 Observatoire du Sahara et du Sahel, 2017, p. 21.

three members from each county, meets every fourth month and, as a general rule, decides by simple majority. The board is headed by a chairman, who is responsible for signing contracts on behalf of the Joint Authority and represents the body in front of courts and international organisations. In addition to the Board of Directors, the Joint Authority has two branches, the Executive General Director and the Administrative Body, which are mainly responsible for the implementation and execution of decisions. The tasks of the Joint Authority are quite diverse, as it is responsible for conducting common research on the aquifer, establishing joint trainings and, most importantly, rationing consumption from the aquifer.[27]

Also belonging to this group is the Consultation Mechanism of the North Western Sahara aquifer system. The very short Ministerial Declaration only discusses the role of the Consultation Mechanism. As stated previously, the states opted to construct their organs in an already existing international organisation, the OSS. The Consultation Mechanism's main organ is the Coordination Unit. Besides this organ, the parties have set up a technical committee and, for the sake of political legitimation, a council that consists of the ministers responsible for water.[28]

4.2.2. Agreements Not Focused on Setting Up Institutions

The MOU of the Iullemeden–Taoudeni/Tanezrouft aquifer is interesting from an institutional point of view. It aims to set up a consultation mechanism, as in the case of the North Western Sahara aquifer and contains a detailed institutional structure; therefore, it could be considered a cooperation only focused on setting up the institutions. However, a close comparison of the two previously mentioned solely organisational agreements and the MOU reveals a key difference—while the MOU specifies a very detailed organisational structure, it also contains numerous provisions that are not necessarily connected to the organs but more to the state of the aquifer. Conversely, in the case of the Nubian and North Western Sahara aquifers, the provisions almost exclusively concerned institutions. According to the MOU, the Consultation Mechanism aims to set up rules about conservation and the facilitation of sustainable management, among other things. The Consultation Mechanism itself has a legal personality and thus is able to sue others and enter into contracts. Within the Consultation Mechanism, the states have created the decision-making Council of Ministers composed of the ministers responsible for water, an executive secretariat responsible for the execution of decisions, a permanent scientific and

27 Constitution of the Joint Authority for the Study and Development of the Nubian Sandstone Aquifer Waters 1992.

28 Déclaration des Ministres des Ressources en Eau des Pays Partageant le Système Aquifère du Sahara Septentrional 2006.

technical committee in charge of giving advice, national committees responsible for implementation (which operate next to the ministries in charge of water) and a coordination unit assembled within the framework of the aforementioned OSS in control of coordination.

The Genevese Aquifer Convention also belongs to this category. The respective territories of the two countries have created the Genevois Aquifer Commission, which consists of three members from each side. It is headed by one member from each side and convenes at least once a year. The commission has varied tasks, and its main function is to propose a water usage plan that takes into account the possible extraction needs of the signatories. In addition, the commission may also appoint representatives to monitor the implementation of the convention. The commission also plays an important role in the financial side of the cooperation by monitoring the investment and operational costs of the artificial recharge system.[29]

The Guarani Aquifer Agreement is also a member of this group. Despite the relatively long agreement, the parties have devoted only one short article to a common institution, the commission, consisting of four members. According to the agreement, the commission's task is to coordinate the cooperation among the states to comply with the aims of the agreement, and it is also responsible for setting up the agreement's rules.[30]

The last cooperation in this group is that for the Al-Sag/Al-Disi aquifer. The states have set up the Joint Saudi/Jordanian Technical Committee composed of five representatives from each of the two states and headed by representatives of the respective ministries responsible for water. According to the agreement, the committee is responsible for three different things: the supervision of the implementation, overseeing abstractions from the aquifer and collecting and exchanging data concerning the aquifer. It must be mentioned that decision-making is not one of the roles of the committee.[31]

4.3. Qualitative and Quantitative Provisions

Another interesting issue is the qualitative and quantitative measures implemented by the cooperations. Before we discuss the concrete provisions, it must be noted that all six cooperations include qualitative actions but not quantitative measures, as this

29 Convention on the Protection, Utilisation, Recharge and Monitoring of the Franco-Swiss Genevois Aquifer. International 2008.

30 Acuerdo sobre el Acuífero Guarani 2010.

31 Agreement between the Government of the Hashemite Kingdom of Jordan and the Government of the Kingdom of Saudi Arabia for the Management and Utilisation of the Ground Waters in the Al-Sag/Al-Disi Layer 2015.

is a more contested issue. It is quite easy to understand that preserving quality is in everyone's interest, as an aquifer is an interconnected system which can be greatly affected by pollution. However, the case is extremely different for the disputed quantitative distribution of water possibly because borders themselves cannot stop excessive abstractions from the system. Thus, states do not feel obliged to extract only as much water as is located in their part of the aquifer. As lists of the qualitative measures would be excessive, in the following section, I will only focus on the most important ones while devoting more attention to the few existing quantitative provisions.

4.3.1. Cooperations That Set up Quantitative Limitations

The best example of a quantitative measure can be found in the Genevese Convention. As noted, the two sides have set up an artificial recharge system, but this was only financed by the Swiss side, as the French region decided to look for alternative sources. Nonetheless, the French side declared that if the system were built, they wished to enjoy its benefits as well.[32] In order to compensate for this unequal situation, the parties declared in the convention that the French side will be limited to a maximum abstraction of five million cubic meters per year and must pay a fee for crossing two million cubic meters of extraction, defined in the convention. The idea behind this provision was that a party unwilling to invest in the qualitative preservation of the aquifer—in this case, the artificial recharge system—shall be allowed only limited abstraction. Regarding quality, the convention has provisions on monitoring quality through common means, identifying and responding to situations affecting quality and the responsibility for pollution. Regarding the imposition of responsibility, it is worth noting that for pollution resulting from the artificial recharge system, only the Swiss side is liable.[33]

The next cooperation that contains quantitative measures is the Nubian Sandstone Aquifer Agreement. Here, the quantitative measures are not as well-defined as in the case of the Genevese aquifer, but the agreement contains some indirect references that are worth mentioning. When the agreement defines the Joint Authority's tasks, it states that it shall ration water consumption. This vague objective can be interpreted in many ways, but it most likely requires that countries not abstract more than what is situated

32 Cobos, 2018, pp. 116–127.

33 Convention on the Protection, Utilisation, Recharge and Monitoring of the Franco-Swiss Genevois Aquifer. International 2008.

in their territory.[34] On the qualitative side, the Joint Authority shall conduct studies in relation to desertification, which is a great risk in the region.[35]

The Iullemeden–Taoudeni/Tanezrouft aquifer's MOU also contains not-so-concrete provisions on this issue. The previously mentioned national committees are responsible for ensuring the resource's rational and equitable use. Even though the text of the MOU is not entirely clear on this issue, I believe that Article 13, which discusses equitable and reasonable utilisation, is connected to the national committees' task of ensuring rational and equitable use. If we accept this despite the linguistic differences between rational and reasonable, we can find a deeper meaning of what rational and equitable water use actually means. According to the document, in relation to rationalisation, the parties should take into account the regions' different social needs and other available water resources, among other things. When it comes to qualitative measures, the MOU has a long list of internationally well-known principles, such as the polluter pays and non-damaging use.[36]

4.3.2. Agreements Without Provisions on the Protection of Quantitative Attributes

I classified the Al-Sag/Al-Disi aquifer as a cooperation that does not contain any provisions on quantitative issues because there are no such direct or indirect references in the agreement. However, the situation is not so simple as qualitative measures may have an effect on the volume of abstractions and thus on the aquifer's quantitative attributes. Accordingly, it should be qualified between the two categories, but as there is no reference to quantitative measures in the agreement, it shall be classified in this category. However, what are the provisions affecting the quantity? The two states have defined a protected and management area. In the 10-km-wide protection zone, after five years, they must eliminate all activities dependent on abstractions of groundwater, so no water can be extracted there. In the management area, they can extract water but only for municipal use, and the digging of wells has to be per the standards approved by the two states. Thus, there is no reference to rationalisation or lesser abstraction. The goal of the states was not to preserve the quantity but to stop agricultural extractions and the accompanying pollution in certain areas.

34 Obviously, as this is a system from which any abstraction will affect the whole aquifer, this rationing only makes sense if the states do it knowing how much water is situated in the territory of each country.

35 Constitution of the Joint Authority for the Study and Development of the Nubian Sandstone Aquifer Waters 1992.

36 Memorandum of Understanding for the establishment of a Consultation Mechanism for the Integrated Management of the Water Resources of the Iullemeden, Taoudeni/Tanezrouft Aquifer Systems (ITAS) 2014.

Nevertheless, the aquifer's extent is much greater than the zones of the agreement, so outside of the management area, water can be abstracted without any limitation. Moreover, as aquifers are interconnected systems, these outside abstractions will affect the whole system, including the two aforementioned zones. However, the complete ban on extractions in the protected zone and the partial ban on extractions in the management zone may indirectly affect the whole system. In these areas, the number of abstractions will certainly decrease; thus, the inhabitants will have to stop agricultural activities or look for alternative resources (outside the zones). The search for alternative sources may not happen, which will preserve the water quantity of the aquifer. In terms of qualitative provisions, the zones must be mentioned again as they primarily aim to protect the qualitative attributes of the resource. The agreement specifically states that in the management area, injecting any pollutant into the groundwater is not allowed.[37]

The North Western Sahara aquifer system also belongs to the second group. As we have previously discussed, the goal of the parties was to set up the Consultation Mechanism, so unsurprisingly, they did not discuss quantitative issues. The Ministerial Declaration is also reticent about qualitative issues but mentions that the Consultation Mechanism must conduct studies on the aquifer, identify critical areas and develop relevant action plans, and finally, produce a yearly report on the state of the aquifer.[38]

No quantitative provision is included in the Guarani Aquifer Agreement, as the parties presumably did not consider it necessary because of the aquifer's size. Nevertheless, Article 4 states as a general aim that the waters of the aquifer should be used in a reasonable, sustainable and equitable manner. I think this article aims more at not wasting the waters of the aquifer than at limiting its abstraction. With regard to qualitative measures, the agreement is much more eloquent and states that the parties shall promote the environmental protection of the aquifer. When significant harm is caused, the responsible party must take all the necessary steps to eliminate it. Additionally, if a state fears that another signatory's action will negatively affect the quality of the groundwater, they can stop the activity during the consultations. Finally, the agreement requires the parties to cooperate in identifying critical and especially boundary areas that need special attention. In practice, this could be similar to the zones set up in the case of the Al-Sag/Al-Disi aquifer.[39]

37 Agreement between the Government of the Hashemite Kingdom of Jordan and the Government of the Kingdom of Saudi Arabia for the Management and Utilisation of the Ground Waters in the Al-Sag/Al-Disi Layer 2015.

38 Déclaration des Ministres des Ressources en Eau des Pays Partageant le Système Aquifère du Sahara Septentrional 2006.

39 Acuerdo sobre el Acuífero Guarani 2010.

4.4. Settlement of Disputes

From a lawyer's perspective, it is also fascinating to study how the parties handle disputes. Of the six cooperations, only in three cases have the parties decided on the means of dispute settlement. Accordingly, I will discuss the Guarani Agreement, the Genevese Convention, and the Iullemeden–Taoudeni/Tanezrouft Memorandum of Understanding.

In the case of the Genevese aquifer, it must be noted that the Convention stipulates that its interpretation shall be resolved according to Swiss law. In case a dispute emerges between the two parties, as a first step, it must be resolved through conciliation in the framework of the Franco-Genevese Regional Committee, which is one of the oldest institutions of the Franco-Swiss transboundary cooperations. If the dispute is not solved in this way, the case should be brought to the Franco-Swiss Consultative Commission for Problems of Neighbourliness.[40]

In case of a dispute, the states of the Guarani aquifer must notify the previously introduced commission (which is a common body). The first step involves the parties deciding to settle disputes through direct negotiations. If this step is not successful, that is, the dispute is not solved within a reasonable time or is only partially resolved, they will solicit the commission to analyse the case and give recommendations. If the issue remains, the states will seek to resolve it through an arbitration procedure established by the countries.[41]

The Iullemeden–Taoudeni/Tanezrouft aquifer's MOU also expresses a multi-level dispute settlement process. As a first step, if a dispute arises between the signatory states, they must resolve it through conciliation or other peaceful means. If the parties are unable to reach a consensus, they should seek to resolve it through the Council of Ministers (decision-making organ). If they do not reach a satisfactory solution, the dispute will be brought to the Conciliation Commission of the African Union. Finally, if the dispute cannot be resolved through all the aforementioned options, it must be decided by the International Court of Justice (ICJ).

In case of these solutions, it can be observed that the parties first seek more direct and cheap solutions and only if these do not bring satisfactory results do they turn to more official and expensive solutions.[42]

40 Convention on the Protection, Utilisation, Recharge and Monitoring of the Franco-Swiss Genevois Aquifer. International 2008.

41 Acuerdo sobre el Acuífero Guarani 2010.

42 Memorandum of Understanding for the establishment of a Consultation Mechanism for the Integrated Management of the Water Resources of the Iullemeden, Taoudeni/Tanezrouft Aquifer Systems (ITAS) 2014.

4.5. Conclusion of the Cooperations

In summary, I would like to highlight a few points about the cooperations that can serve as examples when creating new agreements. The Genevese Convention itself is a good example as it has successfully managed the aquifer for more than 40 years while preventing overexploitation. The key to success can be found in two things. First, it was not two states but two local territories that cooperated, ensuring throughout the creation and implementation of the convention that local knowledge and interest would be involved. The second reason for success was that the parties took an extremely pragmatic approach by always promoting the protection of the resource. It is worth highlighting that the North Western Sahara aquifer's Consultation Mechanism followed a very sensible route by first conducting research on the area and then deepening interparty relations. The Nubian Sandstone Aquifer Agreement is another good example owing to its detailed decision-making procedures. The Guarani Aquifer Agreement should be appreciated for setting up an agreement despite the aquifer not being in danger. For the Iullemeden–Taoudeni/Tanezrouft aquifer, the step-by-step dispute settlement merits serious attention. Finally, with regard to the Al-Sag/Al-Disi aquifer, the protected and management zones are something that could be useful in other cases as well. Parties with shared resources should consider these best practices in order to achieve better management of their groundwaters. However, there are certain steps that international law should take before this can happen. In the following sections, I will attempt to explain these in detail.

5. De Lege Ferenda

How exactly can international law develop? As a result of my previous research, with great respect towards the scholars of this field, I have set up a simple and, in my opinion, effective approach that aims to achieve better management of these shared resources. The proposal consists of three consequent steps. The first step is acknowledging the importance of these resources, the second is the creation of a binding international document that contains the basic principles of transboundary groundwaters, and the third is the creation of regional bilateral and multilateral agreements. I will now explain these steps in depth.

5.1. Acknowledging the Importance of Transboundary Aquifers

First, states must recognise the importance of these shared resources and the fact that cooperation is indispensable for their proper management. The significance of

transboundary aquifers is gaining increasing attention in academic circles, but the question remains whether this interest will spread to the sovereigns that actually share these resources. Unfortunately, I believe that this is doubtful with our current approach, which emphasises the benefits of this field. At present, states are only aware of the benefits of these resources and believe that cooperation would hinder the advantages they derive from them. It seems likely to me that the only way to induce the sovereigns to think about the necessity of cooperation is by highlighting the dangers of mismanagement. In the following sections, I would like to highlight a few issues that may secure the necessary attention.

The first thing that has to be pointed out is the issue of contamination. Aquifers are generally quite resilient towards pollution owing to the surrounding matter, but digging wells and other waterworks compromises this resilience. If the parties do not conduct these actions with care and dedication to ensure that the water stays clean then disasters await. In case of contamination, the quantity of the aquifer remains, but it may become unusable.

Regarding contamination, two points should be mentioned. First, it is imperative to understand that if an aquifer is polluted, especially a fossil aquifer, the consequences will not disappear naturally, at least not in a short period. There are artificial cleaning methods, but these are currently extremely costly and difficult to carry out.[43]

The second issue is that if contamination occurs in any part of the aquifer, it will affect the whole resource. As I have previously pointed out, groundwater must be viewed from a systematic perspective. These are interconnected systems where contamination can affect the whole aquifer, and borders will not stop this contamination. As an example, a country like France, which only has a small share in the Genevese aquifer, can pollute the aquifer to Switzerland's detriment simply by digging wells carelessly. For Switzerland, it is obviously a much more substantive resource, but in the absence of cooperation, they cannot prevent such an event from happening. To sum up, without cooperation we are at the mercy of others, and we cannot guarantee the future of water quality.

The second issue worth emphasising is the danger of overexploitation. Groundwaters are generally great sources of freshwater. Moreover, their benefits can be enjoyed for centuries in case of natural or artificial recharge. Unfortunately, however, in many instances, the rate of recharge (if present) does not match the rate of abstraction, which is when overexploitation occurs. Concerning overexploitation, again two points must be made. First, states must exercise great caution when exploiting their fossil aquifers as they will either never recharge or will only do so over centuries. Plans for abstractions must take into account that these resources are not infinite,

43 Li et al., 2021, pp. 1–10.

and the parties should consider using such good quality water only for certain purposes (for example, to provide drinking water).

Second, a systematic approach is needed. Parties sharing groundwaters must be cognizant of the fact that if any exploitation occurs within the system, it will impact the whole resource. Thus, just as in the case of contamination, without cooperation, a party by its borders with a small share in the aquifer can overexploit the resource by itself, which is not a favourable outcome.

Hopefully, the least likely, but perhaps the most alarming, possibility that can make states think about the joint management of shared resources is the danger of conflicts emerging over them. Unfortunately, conflicts over valuable resources are not uncommon on both the intrastate[44] and interstate levels.[45] The question of whether conflicts can emerge over shared aquifers is quite contested within the scholarly world. Some believe that states are much more likely to cooperate over shared waters than to enter into conflicts,[46] but there is a different perspective according to which conflicts over waters are common and their incidence is accelerating.[47] We must take the following facts into account. First, the population is still growing at a rapid pace; we have already reached eight billion people and hand in hand with this, our water needs are growing. Second, the available freshwater resources are disappearing because of climate change and overexploitation.[48] Third, despite new technologies, the need of water for agriculture is increasing.[49] Therefore, we can state that as the demand is growing and the supply cannot keep pace with it, known good-quality freshwater is gaining increasing importance. This means that these resources will be more important for the sovereigns in the future, and when sharing these scarce supplies with others, terrible conflicts can arise in the absence of cooperation.

These three issues can serve as motivators for state action, but how do we bring it to their attention? One possibility is scientific events like this year's World Water Day, which focused on groundwater, or the UNESCO's Water Summit on Groundwater, both of which are great starting points for raising state awareness. However, I believe that in this process, major international organisations with a focus on water must take a leading role.

44 Tabb, 2007, p. 2.
45 STWR, 2014, pp. 19–20.
46 Brooks and Trottier, 2014, p. 212.
47 Pacific Institute, 2022, p. 1.
48 Kohli, 2022, p. 2.
49 The World Bank, 2022, p. 3.

5.2. Creation of a Binding Document Containing the Basic Principles of Transboundary Aquifers

As previously discussed, a number of international documents have been created to handle the issues of transboundary groundwaters, but none of them tick all the necessary boxes. Thus, after the respective countries' interests and motivations have been raised, work can begin on a binding document that focuses on transboundary aquifers. In my opinion, the proper management of transboundary groundwaters cannot be solved solely via international treaties. There is a need for local cooperation that can reflect the specialities of a given aquifer, but these regional solutions can be more successful if they are built on a common basis encompassing the most basic principles of transboundary groundwater. It is a challenging task to construct such a document; if it is too vague, it will not serve its purpose, and if it is too detailed, the states might not sign it as it would require giving up too much of their sovereignty. Beyond keeping the balance, in the creation process, groundwater experts, namely hydrogeologists, must be included. I will now mention a few principles that I believe are essential to include in such a treaty. The first two principles are theoretical and the last three are practical.

The first principle is the well-known principle of *equitable and reasonable utilisation*. This term in itself is quite void, but the example of the Convention on the Law of the Non-Navigational Uses of International Watercourses could be followed as it lists relevant factors like social needs and the dependent population that should be taken into account when applying this principle.[50] In the planned document, the relevant factors must be listed, otherwise the principle could be misinterpreted.

The next principle is the *requirement of a systematic approach*. As previously noted, no proper management can be reached without this principle. Despite its importance, it has not been mentioned by any of the legal instruments that regulate transboundary aquifers. This approach requires the states to always be cautious with their actions as they affect the whole system.

Of the practical principles, the most important is the *requirement to create bilateral and multilateral agreements*. As this treaty will only aim to set up the basic principles on which local solutions can be built and these principles are void if no local solutions are created, the treaty must require the creation of such regional cooperations.

Another crucial principle is the *requirement to create common standards and means of inspections* concerning a particular aquifer. Without these, the parties cannot accurately measure the qualitative and quantitative attributes of the aquifer. Moreover, in the absence of these common results, the parties cannot improve the

50 United Nations: Convention on the Law of the Non-Navigational Uses of International Watercourses 1997. Official Records of the General Assembly, Fifty-First Session, Supplement No. 49 (A/51/49).

state of the resource. If states do not set these provisions at the beginning of the cooperation, it is destined to fail.

Finally, it is also important to state the *need for a common body that manages the aquifer*. As we noted in every case we analysed, a common organ was responsible for managing the aquifer. The treaty does not need to set up a strict structure but must necessitate setting up a common body devoted to the resource.

Obviously, this is not an exhaustive list. There are quite a few other provisions that should be included in such a treaty, which would require extensive cooperation with legal and groundwater experts. In this short list, I mentioned the provisions that should be considered non-negotiable when constructing such an important instrument.

5.3. Creation of Bilateral and Multilateral Agreements

The previously discussed basic principles must be the basis for local cooperation. However, this level requires the creation of solutions that are adapted to the aquifer's specification and the needs of the region where it is situated. When it comes to local solutions, the most important thing is that all the states that are party to the aquifer should be a part of the cooperation. If a country is left out, the principle of a systemic approach has already been breached. The first step that the parties should take before creating the local agreement is setting up a common means of inspection to research the aquifer. Without this initial source information, the parties cannot create an agreement that can sufficiently answer the needs of the area. After the common inspection of the aquifer comes the creation of the agreement. Aquifers differ from each other, so the local solutions will differ as well. Certain solutions that have proved their value in previous cases are worth considering by the states. In the following sections, I will list a few points that states should consider as necessary if they wish to manage their shared aquifers successfully.

One of the most important and basic aspects of any cooperation is the *exchange of information*. States cannot cooperate successfully unless they have sufficient data on what the other parties are doing with the aquifer. It is necessary to use a common means of inspection, preferably one used before the agreement materialises. It is also essential to exchange this data, otherwise the parties cannot obtain a clear view of the qualitative and quantitative changes in the aquifer. Furthermore, information must be shared quickly, for if it is not, there is no chance of mitigating the dangers. This exchange of information is also vital because all the qualitative and quantitative actions, like limits on abstraction, are only possible if we have data from all parties.

The next important issue the states should decide on is that of *common organs*. Earlier, I noted that all the analysed case studies included some sort of common

institutions but with different forms. Nevertheless, some good practices are worth considering. The institutional structure should include a decision-making body where the parties could be represented by their respective ministries responsible for water. This could be a platform for discussions, making decisions according to the changes in the aquifer's state and supervising the implementation of the agreement. A second body worth considering is a common scientific organ that researches the area, collects qualitative and quantitative information from the parties, develops the means of inspection and gives its scientific opinion to the decision-making body. Finally, there is a need for a legal organ that can help in the interpretation of the agreement and the settlement of disputes. It could also give its opinion to the decision-making organ.

Also worth including in the agreement are the *qualitative and quantitative actions* that the states plan to take. With respect to quality, it is worth discussing how the states are going to prevent pollution, what sort of warning mechanism they will set up to battle pollution, what quality standards they aim to reach, who is responsible for pollution and to what standards the wells need to comply to not harm the quality. Regarding quantity, the actions differ greatly from one aquifer to another, but the least the states should do is indicate how much water belongs to each country. I think that in the future, especially in some arid regions, it will be necessary to limit countries' abstractions to the amount situated within their territory. Obviously, such a system presupposes that every abstraction is recorded.

Lastly, I would like to mention the settlement of disputes. Disputes occur in any form of cooperation, so it is better to regulate how they must be settled than to not have a solution when they arise. Dispute resolution should preferably begin with direct negotiations. The parties should then try to settle the dispute through the common organs. Following that, they should move to the regional court of arbitration and finally to the ICJ.

Of course, there are many issues that have not been touched upon here. However, if the states are to agree on the matters listed above, the management of these shared resources would be much more successful than it is now.

Conclusion

In this article, I briefly discussed the importance of these shared resources and the inadequacy of current legislations. Nevertheless, all hope is not yet lost, and as we have seen, there are several highly promising local solutions from which many conclusions can be drawn. Finally, I proposed a plan for better management of these resources. I believe that by following a similar route to what I have presented, we can enjoy the benefits of these immensely important resources without worrying about conflicts emerging over them.

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