

THE BRAZILIAN GROUNDWATER LAW

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Abstract

Groundwater is typically the least known or understood part of the hydrological cycle in water resource management. Aquifers are the primary regulator of freshwater resources in the environment. Water crises around the world have taught us that water security problems are interconnected, and their solution depends on our understanding of the hydrological and biogeochemical cycles involved, as well as the interdependence of the different components with human behavior and socio-economic activities. These solutions need to be built in a collaborative interdisciplinary manner, including relevant economic, social, regulatory law, and governance aspects. Therefore, a regulatory law, a groundwater law is an important instrument for soil and aquifer management for the protection, prevention, and quality of groundwater. In Brazil, the constitutional competence to manage aquifers, present in the Brazilian Constitution of 1988, determines that groundwater be considered an asset of the states so that it can be managed through legal instruments and specific laws. However, only with the action of the municipalities, incorporating the areas of aquifer recharge in their laws of use and territorial organization, such protection will be achieved.

Keywords: *environmental law; governance; aquifer recharge areas; protect aquifers; legal integration.*

1. INTRODUCTION

Groundwater, as well as surface water, is an important supply source for populations, having been used since immemorial time, according to historical accounts. While little known and discussed by the technical-scientific and legal environment, it has more attributes than the known and celebrated surface waters: quantity and, mainly, quality. And despite been in knowledge shadows these waters have been widely used, almost without control in several regions of the country; and, in recent decades, losing their quality due to pollution and contamination of aquifers. In addition, for many people, these waters may be classified as mineral resource, depending on its chemical composition, thus losing its status as an environmental good, turning into a commercial product like any other on the market, and of high value. Current Brazilian environmental legislation must oppose this situation, because groundwater is part of the hydrological cycle and cannot be seen as a mineral. It is an environmental good, according to the environmental law.

Almost all groundwater on Earth originates from the hydrological cycle, that is, the system by which nature makes water circulate from the ocean to the atmosphere and from there to the continents, from where it returns, superficially and underground, to the ocean. This cycle is governed, in the soil and subsoil, by the action of gravity, as well as by the type and density of the vegetation cover. In the atmosphere and liquid surfaces (rivers, lakes, seas and oceans) this control is exerted by the elements and climatic factors, such as air temperature, winds relative humidity of the air (function of the vapor pressure deficit) and insolation (function of solar radiation), which are responsible for the processes of water circulation from the oceans to the atmosphere, at a given terrestrial latitude (Manuel Filho, 2000)

According to UNESCO (2023) the groundwater represents 98% of the world's unfrozen freshwater. It drives many geological and geochemical processes and sustains various ecological functions and services. The use of groundwater has increased significantly over the past 50 years due to its high reliability during drought seasons, good quality and generally modest development costs. We know more about groundwater and aquifers from work completed during previous Intergovernmental Hydrological Programme (IHP) phases, but we need to learn more about the complexity of aquifer systems, the increasing global risk to groundwater depletion, quality deterioration and pollution, and the resilience of communities and populations dependent on groundwater sources.

Brazil has about 13% of all fresh water on the planet (ANA, 2022), with aquifers throughout its territorial extension, including cross-border aquifer, such as the Guarani Aquifer System (GAS), the occurrence area of this aquifer was adjusted to 1,087,879 km² in PSAG, which corresponds to 92% of the previously estimated area. Thus, in Brazil the GAS extrapolates the Paraná Basin, with approximately 735,918 km² (being distributed under the Brazilian territory among several states: Mato Grosso do Sul, Rio Grande do Sul, São Paulo, Paraná, Goiás, Minas Gerais, Santa Catarina, and Mato Grosso), and extends in the Paraguay (87,536 km²), Argentina (228,255 km²), and Uruguay (36,170 km²) (OEA, 2009: 31). The GAS comprises one of the most important aquifers in the world due to its large water reserve and its groundwater quality.

This paper intends to present the role of Brazilian legislation in the management and protection of groundwater, in accordance with the constitutional competences.

2. METHOD

The trajectory to investigate the proposed object of study was based on the deductive analytical method, with a qualitative approach, structured in the review of the national legal literature. Data collection consists of researching the legislation in force and analyzing national doctrine. The legal framework, as part of the Enabling environment of a Integrated Water Resources Management (GWP), should encompass a multi-scaled legal instruments collection issued on water (surface and groundwater), land use management and zoning, and State organization. The gathered documents were analyzed and their jurisdiction and enforcement, as much as their mutual interplay, were established. This analysis led to identification of strengths and weakness concerning groundwater management laws in the study area.

3. RESULTS AND DISCUSSION

Groundwater is the most extracted natural resource of the Brazilian subsoil. The total water pumped exceeds 17,580 Mm³/year (557 m³/s)², i.e., enough volume to supply every year the current Brazilian population or 10 metropolitan regions the size of São Paulo, equivalent to 217 million people. Several economic activities use groundwater to meet its needs in the country, and its use is distributed between domestic supply (30%), agriculture (24%), urban public supply (18%) and multiple supply (14%), in which allocation of water is quite diversified for the provision of urban services. (Hirata et al, 2019).

In the Brazilian Constitution of the 1988 (Brasil, 1988), the classification system of the legislative power is different for each federal entity, the jurisdiction over waters is the Union responsibility (in 1997 enacted the Law n. 9433), and groundwater is the federative units (states, and the Federal District) responsibility, while the municipalities are responsible for legislating on the land use and its organization.

In a comparative analysis of legal diplomas in search of a specific law on groundwater or legal provisions on the subject carried out in the law repositories of each of the 26 states and also of the Federal District (Souza-Fernandes & Oliveira, 2018), it was found that only 12 federative units have specific laws about groundwater, they are: São Paulo, Minas Gerais, Santa Catarina, Rio Grande do Sul, Distrito Federal, Goiás, Mato Grosso, Mato Grosso do Sul, Alagoas, Pernambuco, Maranhão, and Pará. In the other federative units, the authors verified the existence of laws, decrees, regulations, and ordinances aimed at surface water, which together with the respective State Policy on Water Resources are used in this management, with no specific groundwater law. The synthesis of each legislation analyzed in this work showed that there is a lot of repetition of the concepts and determinations inscribed in the São Paulo Law, the precursor in the legislating groundwater, but not all federative units have adopted the concept of areas for protection and conservation. We also point out that with regard to the protection of aquifer recharge areas, only the Mato Grosso state prescribes the establishment of agreements with municipalities for zoning in these areas.

Hirata et al (2019), indicate that the states of São Paulo, Piauí, Ceará, Rio Grande do Sul, Bahia, and Paraná are more dependent on groundwater, and the research carried out by Souza-Fernandes & Oliveira (2018) showed that among these states, only São Paulo and Rio Grande do Sul have specific laws for groundwater.

Furthermore, throughout Brazil, 70–80% of the wells are irregular, and this prevents the implementation of adequate sustainable water resources management practices (Hirata et al 2019), and, soil use laws. This

factor, requires greater attention in legislation about the use and organization of the soil, with the implementation of specific zoning in vulnerable areas of aquifers, as well as in the inspection of these areas. In this sense, the constitutional role conferred at municipalities becomes even more relevant.

Groundwater governance processes enable groundwater management, planning and policy implementation. It takes place at multiple scales and geographic levels, including regional and transboundary scales. Groundwater management is action-oriented, focusing on practical implementation activities and day-to-day operations. It occurs more often at the micro- and meso-level. (UNESCO, 2022: 2).

The legal integration between states and municipalities is necessary to protect the quality of groundwater, but the Brazilian states that have not yet done so must fulfill their role in legislating groundwater (Souza, 2009). For this purpose, technical studies should support proposals for land use laws in recharge and outcrop areas. A (ground)water policy includes fundamental standards and basic guiding principles. Sustainability, efficiency, equity, the precautionary principle, the polluter pays principle, conjunctive management, demand and supply and maintenance management, and integrated water resource management (IWRM) are critical to inform future decisions (Smith et al., 2016).

This country's brief portrait about how groundwater is managed under legislative framework shows the necessity to integrate groundwater to surface water as an only one water belonging to the same water cycle. In addition, we need to be capable to integrate groundwater to surface water (Gardner, 2000; Sophocleous, 2002) and to salty water, like the effort that has been done to integrate fresh water and salty water by source-to-sea approach (Granit et al., 2017). In sum, devalued groundwater is a mere reflex of the fragmented view of water as a whole and the Integrated Water Resources Management is at the top of present-day priorities.

In this context, the UNESCO's World Water Day 2022 campaign titled "Groundwater: Making the invisible visible" is the recognition of this situation and challenges and it is welcome to reinforce groundwater awareness in Brazil and worldwide.

4. CONCLUSIONS

The use of aquifers is common throughout Brazil, in all regions we find wells being drilled, either for own consumption or for the general supply of the local population.

Groundwater is vulnerable to contamination by anthropogenic pollution, and in most cases its decontamination becomes impossible. This contamination occurs via the soil, and the aquifers have two sensitive areas: recharge and outcrop areas.

The aquifers are under the soil of the municipalities, whether in their urban or rural areas, and the municipality can be legislated on themes of local interest, as well as organize the use of its soil. Now, it is in the city that, effectively, life happens. And it is up to the municipality, through the municipal planning instruments, to provide a healthy life for its population.

We could see that few states have legislated on the subject and that we still lack legal diplomas that reconcile land use with groundwater management.

We can also infer that the protection of groundwater will only happen when there is a joint effort between states and municipalities to implement the groundwater legislation alongside the soil use and planning legislation. Considering a global perspective, groundwater should be put out of the shadows, and water cycle has a whole need to be addressed. Therefore, much remains to be done to protect Brazilian aquifers. This proposal opens up the concrete possibility of raising and mapping the effectiveness of the application of the legal arsenal of the three existing legislative spheres and identifying their converging points to propose a common legal framework in the future aimed at local territorial protection with the consequent protection of groundwater.

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