Water governance in Brazil

The need to share water in the anthropocene

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5. Water Governance in Brazil

5.1. Introduction

Focusing on the national level, Chapter 5 presents the political context that has shaped changes in water governance in Brazil. The chapter explores two questions: What are the current drivers of water challenges in Brazil? Which policy instruments address water-sharing problems in Brazil? First, the chapter provides a general historical context of Brazil (see 5.2), then presents the current policy framework and existing water-sharing instruments (see 5.3), discusses the implications of the water-sharing instruments on paper versus in practice (see 5.4) and draws conclusions (see 5.5). Please note that although as mentioned earlier in the methodological chapter I have made a systematic attempt to evaluate all the instruments, such an evaluation is limited. There is very little monitoring of the effectiveness of the instruments by the government; scholarship on these instruments is patchy, and interviewees often had a perspective, but could not always support this with data. Thus, the evaluation in this chapter must be seen as a first attempt at making sense of the existing instruments to share water within Brazilian policy. This limitation also holds for the empirical chapters focusing at basin and state level (chapter 6 and 7 respectively).

5.2. The context of Brazil

5.2.1. The political context

Although I examine the political context here, it should be noted that I am not conducting a political analysis of the instruments. Since its independence in 1822 Brazil has moved between more authoritarian and more democratic forms of governance. Despite these movements, there are some general tendencies that have remained stable throughout Brazilian modern history: a strong concentration of political and economic power in the hands of a small elite, and the resulting different forms of inequality, voicelessness and exclusion, with clientelist networks forming the main access route to resources (Holton, 2008). Past inequalities were mainly reflected in land concentration in the hands of the few, which has been exacerbated by concentrated wealth in large entrepreneurs. Al-

though there is some relationship between the degree to which a regime is dictatorial and the rise in inequality, income inequality remains notoriously high in Brazil also under more democratic regimes (Mourao &Junqueira, 2021). The Gini-coefficient – measuring income inequality – has been going both up (mainly between 1985-1999) and down (2000-2012), yet it remains among the highest in the world. Between 2000 and 2014 Brazil witnessed a process of inclusive growth, and 26.5 million Brazilians climbed out of poverty (Mourao & Junqueira, 2021). Yet since 2014, this process has been interrupted, extreme poverty has increased again by 40%, and the Gini-coefficient is rising again (Mourao & Junqueira, 2021). Similarly, wealth inequality has been steadily growing over the past 25 years, with 1% of the Brazilian population owning 42% of the countries' wealth in 1995 and 48% in 2021 (Chancel et al., 2021), therewith being the democracy with the highest concentration of wealth in the top 1% of the country (Chancel et al., 2021). The possibility to exercise citizenship rights and participate in political and decision making processes has, however, significantly improved since the latest return to democracy in 1985.

Table 5.1 illustrates the evolution of political regimes in Brazil in recent history, the characteristics of corresponding governance systems, and their objectives, analyzing this from an inclusive development (ID) perspective. It shows how Brazilian society has moved from a democratic to authoritarian government and then back to a democratic government; has become more and more liberal over time; and that there has been a continuing focus on increasing GDP with only a more recent trend to also protect human rights and the environment (Antunes, 2004; Hall, 2006; Fogel, 2019; Engelmann, 2020; Lima-de-Oliveira, 2020), which is however increasingly at risk.

From an ID perspective, there have been many recurring problems throughout the evolution of political regimes in Brazil, including worsening inequalities and poverty (Oxfam Brasil, 2017); increasing ecological damage (Pott & Estrela, 2017); rural to urban migration (Nascimento et al., 2018); censorship of free speech and other violations of human rights (Miranda & Reynard, 2020); increased external debt (Batista Jr, 2002); and strained relations between the state and the people (Bercovici, 2004). Some of these problems have periodically seen improvements. For instance, during the democratic regime between 2003 and 2016, the country experienced economic growth, reduction of inequalities and poverty, expansion of the middle class, and the relationship between the

state and the people improved (Marinho, Linhares & Campelo, 2011). Since 2017, however, corruption scandals, economic recession, fiscal deficit, inflation, violence, and greater ecological destruction resulting from prioritization of neoliberalism is again plaguing the country (Fogel, 2019; Lima-de-Oliveira, 2020; Engelmann, 2020).

5.2.2. The physical context of water and related problems

Brazil possesses around 12%-16% of the world's fresh water resources (Fontes Filho & dos Anjos, 2016) and therewith is the country with the largest volume globally. Similar to many large countries, Brazil has vastly diverse climates that vary from tropical rainy to dry (Benetti, Lanna & Cobalchini, 2004), hence the geographical distribution of these resources is highly uneven, with the variation based on these different climatic, geological, and hydrological circumstances. The country is divided into twelve hydrographic regions[7] (see Map 5.1). An estimated 80% of the country's surface water resources is located in the Amazon hydrographic region, with very low population densities of only 4.5 % of the country's population (ANA, 2018; Pasqualetto, Presti & Junior, 2019) and low water use demands. Conversely Parana, the economically most developed and populated hydrographic region of the country, home to 32% of the population, possesses only 5% of the surface water (Chiquito Gesualdo et al., 2021). Water availability is even lower in the dry North Eastern region.

Surface water availability is estimated at around 78,600 m³/s, with the Amazon Basin contributing 65,617 m³/s (ANA, 2018). Brazilian groundwater availability is estimated at 14,650 m³/s (ANA, 2018, p. 38). Several aquifers and aquifer systems extend beyond the boundaries of the hydrographic regions and national borders (Benjamín, Marques & Tinker, 2005; ANA, 2018). The annual average rainfall is estimated at 1,760 mm, whereas the total annual rainfall varies between 500 mm in the semi-arid region to more than 3,000 mm in the Amazon region (ANA, 2018). In the semi-arid Brazilian Northeast, groundwater resources are scarce due to salt water intrusion and overexploitation (Marques, Gunkel & Sobral, 2019). Storage of water in reservoirs is, therefore, extremely important (Interviewees N-2).

7 In 2003, Brazil defined the twelve hydrologically homogeneous regions: Amazon Basin, Araguaia-Tocantins Basin, Paraguay River Basin, Western North Atlantic Basin, Eastern Northeast Atlantic Basin, Paraná Basin, Parnaiba Basin, São Francisco River Basin, Eastern Atlantic Basin, Southeast Atlantic Basin, South Atlantic Basin and South Basin.

Table 5.1. The evolution of political issues in Brazil (1950s – 2020s)

Nature of political regime	Characteristics of the development strategy	
Democratic (1950 – 1964) Populist State (restricted democracy)	Transition from an agrarian/export-oriented economy into an increasingly urbanized and industrial society; received financial and technical support from the U.S. Marshall Plan; started an intense nationalization of resources, modernization of agriculture, and an energy-intensive industrialization plan	
Authoritarian (1964 – 1985) Military dictatorship	Acceleration of industrialization through help from foreign capital – 'Brazilian miracle'; measures to attract foreign capital and promote exports; import substitution; development of large infrastructure and basic industries; expansion of agricultural frontiers and promotion of capital-intensive agriculture; implementation of regional programmes (i.e., SUDENE, SUDAM); social movements suffocated, demoralized and demobilized	
Democratic (1985 – 1990) Democratization	Implementation of mechanisms for democratic social control and popular participation such as the Constitution and autonomy to the states and municipalities; nascent process with emergence of strong international environmental and human rights movements; adoption of new forms of representation and relationships between local communities, government, international agencies, NGOs, and global institutions	
Democratic (1990 – 2002) Liberalization	Modernization aiming at sustainable development and environmental management model; liberalization-oriented economy more focused on commercial and financial markets; privatization of state-run services (energy and telecommunications); agricultural frontier continued to expand (coexisted with higher productivity in settled areas)	
Democratic (2003 – 2016) Developmental state	Neoliberal capitalism-oriented economy; great expansion of the energy grid (increased electricity capacity); high investment in agriculture, health, education, and public security; conditional cash transfer programmes adopted in social policy (e.g., Bolsa Família, Fome Zero)	
Democratic (2016 – ...) Neo-liberal approach	Neoliberal capitalism oriented economy; agricultural development continues to expand; suppression of opposition/environmental/ social movements	

Source: Building further on Antunes (2004); Hall (2006); Fogel (2019); Lima-de-Oliveira (2020); Engelmann (2020)

	Objectives	Analysis from an ID perspective
	Industrial promotion; increase GDP; promote democracy	Although GDP increased there was growing inequalities and poverty; relations between state and people fragile
	Industrialization; increase GDP; control population	Increased external debt; crisis in the balance of payments; rural-urban migration; high inequalities, poverty; violation of human rights; free speech censored at all levels
	Democratization	Interruption of foreign financing; negative economic growth; greater social inclusiveness; growing ecological damage; growing trust between state and people
	Increase GDP; promote democracy	Increased external debt; high unemployment, inequalities, and poverty; ecological damage continues; trust between state and people damaged
	Increase GDP per-capita; BOP equilibrium; increase HD and SD	Economic growth; reduction of inequalities and poverty; expansion of middle class; ecological damage continues; relationship between state and people improves; corruption scandals
	Increase GDP per-capita; BOP equilibrium; ncrease HD and SD	Corruption scandals; economic recession; fiscal deficit; inflation; poverty; violence; ecological destruction; lack of trust between state and people

Map 5.1. Brazilian river basins

Source: Author's elaboration

As a consequence, whereas in most of the Brazilian territory the ratio water availability and demand is still considered 'excellent' or comfortable, in around 18% of the country it is considered worrisome (5%), critical (4%) or very critical (9%) (Pasqualetto, Presti & Junior, 2019, p. 407).Table 5.2 Water problems in Brazil

Many factors directly or indirectly shape water-related problems (namely water quality, quantity and climate variability and change) in Brazil (see Table 5.2, Figure 5.1). The historical evolution of ever increasing water demand in Brazil is clearly linked to the intertwined processes of economic development and urbanization (PNAD, 2015; Pasqualetto et al., 2019). Unpacking this, the four main direct drivers include: 1) demand for commercial agriculture (e.g. coffee, soybeans, beef, and crop-based ethanol) and livestock (ANA, 2018) (Interviewees N-2/13); 2) demand for energy (e.g. hydropower); 3) demand for industry (e.g. mining) and services (IBRAM, 2018); and 4) demand for households (ANA, 2017a) (see Table 5.3). Next to the (indirect) drivers of pursuit of economic growth, , international trade and urbanization, also climate change and variability affects water availability. For example: in recent years (2012-

Table 5.2. Water problems in Brazil

Issues	Water problems
Water quantity	Unequal spatial distribution; unequal distribution between people; decreasing water availability and quantity; decreasing water availability for nature in some parts of the country (e.g., São Paulo city)
Water quality	Organic pollutants (e.g., pathogens and microbial contaminants); heavy metals; thermal pollution; high phosphorus concentration in some areas; silt suspended particles; groundwater pollution in some areas (e.g., nitrate, gasoline, chlorinated solvents)
Climate variability & change	Change in rainfall patterns (stronger and more frequent rains in the South and Southeast); increasing number of droughts (in the Northeast); increasing temperatures (forest fires)

Sources: ANA (2017); ANA (2018); ANA (2019)

Table 5.3. Drivers of water problems in Brazil

Direct Drivers	Indirect Drivers
Demand for commercial agriculture (e.g. coffee, soybeans, beef, and crop-based ethanol) and livestock	Rapid urbanization
Demand for energy (e.g., hydropower)	International trade (trade in virtual water)
Demand for industry and service	Climate change
Demand for households	The pursuit of economic growth

Source: Interviewees N-2/13; ANA (2017a, 2018); Da Silva et al. (2016); Leão et al. (2022); Flach et al. (2016, 2020)

2017) annual rainfall in the dry periods has been well below long year averages, significantly affecting the refill of existing reservoirs (Pasqualetto, Presti & Junior, 2019, p. 404).

Historically, wealth and power was clearly linked to landownership, and Brazilian economic development has been influenced by large-scale agriculture and livestock (Figueiredo et al., 2012; Abbade, 2014; de Oliveira et al., 2017). Brazil is consider one of the major agricultural producer

and net exporter of agricultural commodities (i.e., Brazil exports around 54.8 billion m³ of virtual water per year)(Da Silva et al., 2016). For instance, Brazil is the largest exporter of coffee, soybeans, beef, and crop-based ethanol (FAO, 2018). Commercial agriculture is responsible for direct deforestation through land-use change and indirect deforestation through the construction of roads and power lines (Assad, Ribeiro & Nakai, 2019). In 2018, Brazil had the highest loss of tropical primary rainforest in the world at 1.3 million hectares (Cerri et al., 2018). Furthermore, commercial agriculture has intensified the use of agrochemicals and fertilizers (see Box 5.1), causing water pollution (IBGE, 2017) with concentrations of heavy metals and high phosphorus (Brazil, 2017) (Interviewee N-22).

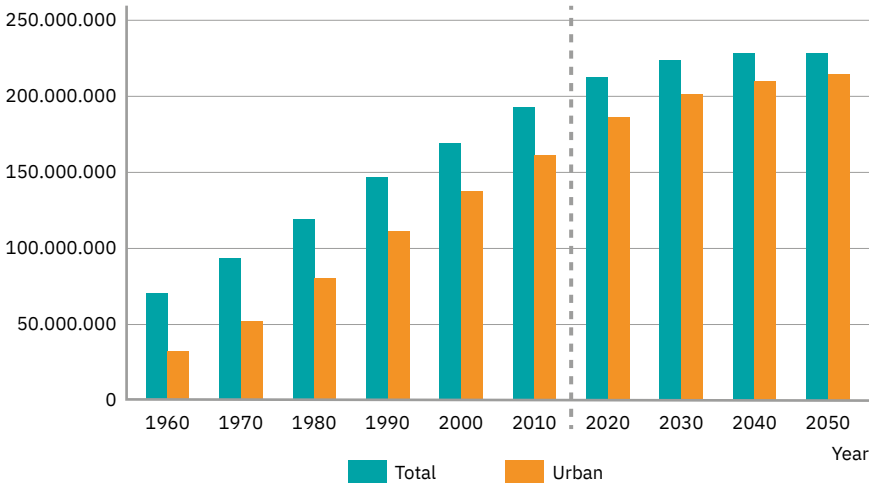
Another direct driver of water problems in Brazil is energy. The Brazilian electricity matrix is mainly based on renewable energy sources, with hydropower being the main source. Renewable energy accounted for 81.7% of total energy in 2017, of which 68.1% was hydroelectricity, 8.2% biomass, and 8.2% solar and wind power (GTSC, 2018). Thus, Brazil is the most hydropower dependent country in the world (Mayer et al., 2021). Also in absolute terms Brazil is one of the largest producers of hydropower, with a capacity of 120 GW (Hunt et al., 2022). Given the great variability in geography, geomorphology and climate, conditions for hydropower differ significantly over the country. Yet until 1998 states had to generate their own electricity. In more developed regions (like Parana) with higher energy demand there consequently was a higher concentration of hydropower. When in 1998 the electricity grid became a nationwide network, locations of energy production and consumption could become separated (Moura, 2010), resulting in hydropower infrastructure causing social and ecological damage in certain locations with other regions reaping the benefits of these projects. Brazil plans to meet its future energy demand through the construction of new hydropower plants. Of the total 29 GW additional capacity to be realized, 41% is foreseen to be built in the Amazon region (Hunt et al., 2022). The production of hydropower has a high water footprint. Although it is difficult to separate evaporation caused by the creation of reservoirs from evaporation that would have taken place anyhow, yearly evaporation of Brazilian reservoirs was estimated at 60km³ between 2010-2016 (Semertzidis, Spataru and Bleischwitz, 2018). Semertzidis also notes that most reservoirs in Brazil are solely used for hydropower generation, whereas much could be gained from multiple uses (Semertzidis, Spataru & Bleischwitz, 2018, p. 134).

Because of increasing protests and the recognition of the detrimental social and environmental consequences of the construction of large hydropower reservoirs, Brazil has increasingly opted for run-of-river hydropower generation. This source is however less reliable in the dry season when the flow levels are low (de Souza Dias et al., 2018). Climate change is expected to have significant impacts on the production of hydropower. Since 2010, Brazil has been using thermoelectricity to meet energy demands during drought episodes (Interviewee N-2), and thermoelectricity is expected to become more important as an energy provider in the dry season in the near future (de Souza Dias et al., 2018). There are different interdependencies between agriculture and (hydro) power. Commercial agriculture relies on energy use for irrigation systems and related machinery production. With the increase of blackouts in the recent drought episodes, also this sector has been affected. There is also an interlinkage between increased water demand for irrigation in drought periods, resulting in lower river flows, affecting power generation (Semertzidis, Spataru & Bleischwitz, 2018).

A third important driver is the increasing demand from households. Between 1960 and 2020 the total population of Brazil almost tripled (see Figure 5.1), which resulted in a significant increase in water demand for human consumption. Despite significant efforts of the state to address this growing demand, more than 34 million Brazilian households lack access to safe drinking water and another 100 million lack sanitation services (Interviewees National-2) (ANA, 2017a). Only 33% of towns (n = 1832) have adequate services, including sewage collection and treatment systems. This represents only 55% of the country's population (ANA, 2017a). Therefore, the lack of access to drinking water and sanitation services can increase overuse and pollution water.

As already noted, an important underlying driver of water issues in Brazil is climate variability and change. Water scarcity periods in Brazil have become more frequent in the last decade; rainfall patterns are changing with stronger and more frequent rains in the South and Southeast; and numbers of droughts are increasing in the Northeast (Milhorance et al., 2020). These changes have had a series of socio-economic effects, including reduction in agricultural and livestock production in some areas and of water levels in reservoirs for human supply (e.g. Cantareira Reservoir in São Paulo), animal feed, and power generation (Nobre et al., 2019).

Figure 5.1. Total and projected expected urban population in Brazil (1950 - 2050)



Sources: Based on raw data from IBGE(2010); Cabral et al. (2008)

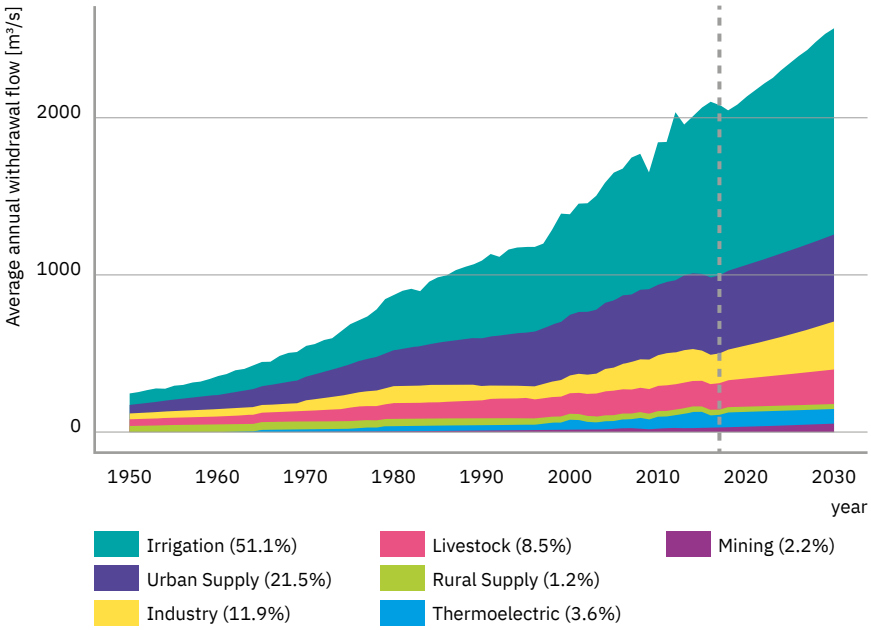
Dashed line delimits the year 2017(historical data) and future projected data

Box 5.1. Comparison of overuse of agrochemicals between Brazil, Europe and the United States

Brazil is among the biggest consumers of pesticides in the world (Bombardi, 2017; Dos Santos, Otesbelgue &Blochtein, 2018). Many Brazilians in agricultural areas and surroundings have been affected by pesticides through inhalation and ingestion of contaminated water and food (Bombardi, 2017; Abessa, Famá & Buruaem, 2019). Chronic and acute intoxication, cancer, cognitive disorders, depression and elevated suicide rates have been the direct effects of such exposure (Abessa, Famá & Buruaem, 2019).

In developing countries, the maximum acceptable limits for some pesticide residues in water and food are much higher than those allowed in the European Union and United States. Bombardi (2017) points out that the minimal residue levels established in Brazil are 10 times higher than the EU standards for coffee, 200 times higher for soybean, and 500 times higher for drinking water. The Brazilian national limit for glyphosate in food is 10 mg/kg and that of malathion is 8 mg/kg. This is compared, respectively, to 0.05 mg/kg and 0.02 mg/kg in the EU (Abessa, Famá &Buruaem, 2019).

Figure 5.2. Evolution and projected water withdrawal by use in Brazil (1950 - 2050)



Source: Author's elaboration based on raw data from ANA (2019)

Dashed line delimits the year 2017(historical data) and future projected data

5.2.3. Sharing Challenges

The direct and indirect drivers just discussed have significantly impacted water use in the country. Figure 5.2 presents the evolution of water withdrawal per use in Brazil, considering historical data between 1950 and 2017, and projections towards 2050. This table is based on data of water licensed, the best available proxy for water use. Between 1950 and 2000 there was an average annual growth of 8.7% in water consumption, resulting in a total growth of 17 billion M³. In 2017, water withdrawals totaled 2,098 m³/s per year and water consumption totaled 1,109 m³/s (ANA, 2018). Since 2000, water demand has increased by 80%, and this trend is likely to continue to 2050 (ANA, 2018). In Brazil, the main consumptive water use is agricultural irrigation and the main non-consumptive uses are navigation, hydroelectric power generation, and in-stream uses such as navigation, fish propagation and use, and recreational activities (ANA, 2018) (see Table 5.4).

Table 5.4. Water use (demands) by purpose in Brazil in 2016

Uses (m^3/s)	Withdrawal[a]	Consumption[b]	Consumption (%)	Return
Irrigation	969	745	67.15	224
Urban Supply	488.3	97.7	8.81	390.6
Industry	192.4	104.9	9.46	87.4
Rural Supply	34	27	2.43	7
Mining	32.8	8.9	0.80	34
Thermal electricity	216.3	2.9	0.26	213.4
Livestock	165.1	123	11.09	42.2

Source: Building on data from Brazil (2018)

a. Withdrawal refers to the total amount of water uptake for a specific use (e.g., water withdrawn for urban supplies)

b. Consumption refers to is the withdrawn water that does not flow back directly into water bodies. It is the difference between withdrawn water and return flows

Figure 5.2 clearly shows that irrigation, first and foremost used in commercial agriculture, uses not only the largest share of the available water, but also accounts for the steepest growth in consumption. In 1960 water consumption for irrigation represented 33.2% of the withdrawal, in 2020 the values had risen to 50.1%, and actual consumption even doubled consumption in 60 years (Pasqualetto et al., 2019, p. 53).

The current 6.95 million hectares of land under irrigation is likely to increase by 2.085 million hectares (30%) by 2030 (ANA, 2018). Urban water supply accounts for 21% of water withdrawal (see Figure 5.2). This growth rate can be explained both by the urbanization process as such (rapidly growing demand) as by an improvement in the provision of water and sanitary services. Roughly 90% of this water returns (see Table 5.4) in the form of waste water. However, although 75% of wastewater is collected, only 47% is treated, negatively impacting water quality in surface waters (Chiquito Gesualdo et al., 2021).

Industry is responsible for almost 12% of water withdrawals, currently at ca. 6 billion m³ per year. Industrial water consumption has increased by 310% between 1950 and 2017. The food industry is the largest water consumer (using 56% of the industrial water use). The mining sector consumes relative little water in absolute terms, and over 60% of this water returns. However, most of this water is so heavily contaminated that it has devastating effects on fresh water ecosystems and can also seriously affect human health (Carmo, Lanchotti &Kamino, 2020).

Livestock accounts for 8.5%. Brazil is the largest beef exporter in the world, and the second largest producer. The beef industry has boomed, with an increase in production of 45% between 2015 and 2020, nowadays generating 6% of the country's GDP (Chiquito Gesualdo et al., 2021, p. 762).

Although water is abundant in Brazil, the different water uses cause many different sharing challenges. The uneven geographical distribution results in some regions of the country having more than enough water, whereas other parts of the country face serious water scarcity. In some parts of the country there is thus already a clear need to share, whereas in quantitative terms in other parts of the country this need might be less. The disparity in water allocation between different uses has become more evident during recent droughts (e.g., the case of water-sharing between uses and users in Northeast Brazil and São Paulo city) (see Chapters 6 and 7) (Rockmann, 2020; van den Brandeler, 2020).

And in many regions (both water abundant and water scarce) mining and/or industrial use has led to such high levels of pollution that water has become unsuitable for human consumption and has led to serious damage to fresh water ecosystems. In such situations water has become unusable for sharing with other uses or nature.

5.2.4. Evolution of the water governance regimes in the context of environmental policy

Water governance regimes in Brazil date back before the colonial period (from 1500 till 1815) when indigenous people owned water resources and governance thereof was based on customary principles, not written rules (Farias, 2009, p. 69). For instance, the Tupinambá indigenous people relied on community-based water-sharing principles (Farias, 2009, p. 69). During the colonial (from 1500 till 1815) and imperial periods (from 1822 till 1989), equity principles were neglected and water

resources were exploited based on the economic interests of the Portuguese Crown[89] and Brazilian elites (Benjamín, Marques & Tinker, 2005), demonstrating deep 'extractive' characteristics (Benjamín, Marques & Tinker, 2005).

By the 1950s, water was perceived as an abundant resource and the source of energy to drive the Brazilian industrial sector (Von Sperling, 2012). National laws were created to incorporate natural resources (e.g., water, rivers, oil, and forests) into government assets under the "public domain" (Benjamín, Marques & Tinker, 2005). This implied the nationalization of natural resources. Accordingly, the governance of water was entrusted to the federal government and water-sharing became focused on energy development (Tucci, Hespanho & Netto, 2000). bringing the responsibility for water management under the ministry of energy (Lorenzo, 2001).

Under military dictatorship (1964 - 1985), water governance was still centralized at the federal government level and the electricity sector remained responsible for water management (ANA, 2018). Many hydroelectricity projects supported by foreign capital were undertaken by the federal government during this period, including construction of approximately one hundred large hydroelectric plants (Hochstetler & Tranjan, 2016, p.497). This 'hydrocratic' orientation is similar to that of the Tennessee Valley Authority (TVA) model, as it used large scale public investments in infrastructure to simultaneously stimulate economic development and generate employment. This investment in great water infrastructures explicitly followed the hydraulic engineering paradigm (Molle et al., 2007; Lima 1995a; Lima, 1995b) (see 3.4). The construction of dams resulted in large scale displacements and ecological damage (Rocha, Canto & Pereira, 2005; Estrela, 2009; Pott & Estrela, 2017).

Between the 1960s and early 1980s, environmental issues were not fully recognized in public policy nor in political discourse (Barros, 2017). A main change during this period was the implementation of the National Basic Sanitation Plan (PLANASA), "when a new structural regime was established for the sector" (Heller, 2007, p. 143) which further expanded infrastructure and created powerful state-owned water companies (CESBs)

8 This guaranteed the navigable and perennial rivers as royal domain and included penalties for unauthorized water use (*Farias, 2009*). But penalties were not observed nor enforced during this period (*Conca, 2006*).

9 The economic interest was mainly focused on wood exploitation, mining, and cattle production.

(Saiani & Toneto Júnior, 2010; Jacobi et al., 2015). Access to water and sanitary services, however, remained highly unequal (van den Brandeler, 2020). This period reinforced national sovereignty and the government's control over a centralized and top-down water governance system.

By the 1990s, Brazil experienced a democratic shift through which political and financial decentralization was promoted and civil society participation encouraged (Eghrari, 2012). The UNCED conference in Rio de Janeiro in 1992 (see 1.6) popularized the sustainable development discourse in Brazil, leading to water governance becoming more decentralized. This resulted in that the electricity sector created the Brazilian National Power Grid Operator (ONS) in 1998 and shared the responsibility of water management with the National Water Agency (ANA). The basin was then prioritized as the main unit of water management, stakeholder participation was stimulated, and water became a public resource with economic value (Elabras Veiga and Magrini, 2013). The IWRM paradigm was adopted and reflected in water laws such as the Water Policy Act of 1997 (Campos, 2015). Although the new approach also emphasized water-sharing between humans and nature, which attracted resources from multilateral agencies (e.g. World Bank, see Box 5.2)(Conca, 2006), much more investments were put in the expansion of commercial agriculture and increasing areas under irrigation (Guimaraes & Landau, 2014).

Table 5.5 summarises the above and illustrates how, from an ID perspective, water governance regimes have contributed to environmental policy in Brazil over time showing in particular how social inequity has been exacerbated and the environment externalized. The concentration of control over natural resources has not necessarily taken social and ecological inclusiveness into account.

5.3. Current policy framework and the sharing of Water

This section examines the current water policy framework and instruments dealing with water-sharing in Brazil (see Table 5.6). The Table shows how the federal Constitution deals with water, how the 1997 Water Law characterises water and the instruments it uses, the instruments of the Resolutions of the Hydraulic National Resources Council (CNRH) and the instruments of the National Water Agency.

The national discourse on water in Brazil has shifted from a centralized to a decentralized approach. The 1988 Constitution, created re-

Table 5.5. The evolution of water governance regimes in the context of environmental policy issues in Brazil (1950s – 2020s)

Political regime	Environmental policy	
Democratic (1950 – 1964) Populist State (restricted democracy)	Nationalization of resources implied the creation of national laws to incorporate rivers, water, oil, and forests as assets under the "public domain"; ecological concerns neglected; separation of sanitary policies from health policies	
Authoritarian (1964 – 1985) Military dictatorship	Some ecological concern (e.g., some national parks were created to protect pristine rivers' headwaters); intensive extraction and use of natural resources; implementation of the National Basic Sanitation Plan	
Democratic (1985 -1990) Democratization	Recognition of the sustainable development concept	
Democratic (1990 – 2002) Liberalization	Brazil hosts the 1992 Earth Summit in Rio; changes in environmental regulation pushed by the Summit; adopts science-based environmental laws; the beginning of privatization of energy, water and sanitation services	
Democratic (2003 – 2016) Developmental state	Ecological concerns considered in the decision-making process	
Democratic (2016 – ...) Neo-liberal approach	Ecological concerns less considered in the decision-making process; easing of environmental regulations	

Source: This table builds further on Paulino (2014); Campos (2015); Pott & Estrela (2017)

	Water governance regime	Analysis from an ID perspective
	Water governance centralized and hierarchical; single-purpose – energy development; inventory of water resources; hydroelectric undertakings and plans for large systems; ministry of mines and energy responsible for water-related decisions	Social displacement and ecological externalization; unequal access to WSS
	Water governance centralized and hierarchical; single-purpose – focus on energy development; construction of centralized infrastructure (large hydroelectric plants); information management fragmented	Inequitable access to WSS; deterioration of water quality in rivers and lakes near urban centres; social displacement and ecological externalization
	The transition from centralized to decentralized water governance; reduced investment in large hydroelectric plants; increased investment in irrigation	Unequal access to WSS; water quality deteriorates in rivers and lakes near urban centres
	Water governance decentralized and increasing stakeholder participation in decision-making; multipurpose - energy and commercial agriculture development; federal laws for integrated management, basin adopted as the main planning unit; multilateral agencies invested in the Northeast states and influenced water policies at the state level (e.g., Proagua-Semiarid Programme)	Unequal access to WSS; deterioration of water quality in rivers and lakes
	Water governance decentralized with stakeholder participation; multipurpose energy and commercial agriculture development; adoption of IWRM; institutional development (e.g., adoption of urban drainage plans for cities; sharing water information)	Unequal access to WSS; deterioration of water quality in rivers and lakes;
	Water governance decentralized with stakeholder participation; integrative framework; multipurpose energy development and commercial agriculture development	Unequal access to WSS; deterioration of water quality in rivers and lakes; destruction

Box 5.2. The World Bank and water management in Brazil

Historically, the World Bank has funded water infrastructure projects (including hydropower) throughout the world (Conca, 2006). However, in the 1990s, the Bank moved from "its traditional model of large sector-specific infrastructure loans to the federal government" to lending to "actors that it viewed as reformers, often finding them at the state level" (Conca, 2006, p. 279). The bank has since invested aggressively in greater private sector participation and rationalized approaches to pricing water (Conca, 2006). The Proagua Project is one regional project launched in the Brazilian semi-arid region that received USD 198 million to promote and encourage institutional decentralization and participatory water management (Lopes, 2005; Brannstrom et al., 2004).

The World Bank's new financing strategy first focused on the sub-national arena to implement actions related to water resources management, such as institutional development, legislation, state agencies, increasing water supply infrastructure, and bulk water rights (e.g. Ceará state) (Conca, 2006). The World Bank then became more interested in supporting reform at the national level to create a regulatory framework and attract the private sector (Conca, 2006). In the 2010s, the World Bank supported the launch of the National Water Management Covenant Consolidation Programme (PROGESTÃO)[10] which was set up by ANA and assisted federal units in promoting efficient water management systems (ANA, 2018).

forms across sectors and transferred substantial revenues from federal to state and local governments (Abers & Keck, 2004). The Constitution established that all waters within the national territory are public and belong to the nation if they cross federative borders and to a specific state or province if they are contained within its borders (Art. 20 and 26, 1988 Federal Constitution). The federal government was made responsible for establishing a national system for water resources management and criteria for water allocation (Art. 21, 1998 Federal Constitution). This is consistent with the federal government's protective responsibilities and police power over the executive, judiciary, and legislature branches. In

10 PROGESTÃO included five annual payments of almost USD 230,000* (BRL 750,000) to each state (*ANA, 2018*). As a result, nine states signed up to receive and implement the Progestão Program between 2013 and 2016, and all of them signed up again for the new cycle of actions in 2017 (*ANA, 2018*).

other words, legislative competence regarding water is shared among all federative units and each federative unit exercises its power[11] over water resource issues within its jurisdiction (Limia, 2020).

In 1997, the National Water Law (Federal Law No. 9433/1997) moved towards the IWRM paradigm, which identifies the multiple uses of water and suggests a multilevel governance system, including integration, decentralization at the basin level, and stakeholder participation (Libanio, 2014).

The National Water Law gave more autonomy to the federal units and allowed them to create their own legal regimes observing the limits defined by the national policies. This inspired a shift in the national discourse on water and introduced the policy principles, such as: recognition of water as a finite resource that is a public good with economic value (Benjamín, Marques & Tinker, 2005); allocation of water to meet people's basic needs; accountability for the multiple uses of water in water management; use of the river basin as the unit for water management; decentralization of water management; and enabling of participation of government, stakeholders and society in decision-making processes (Elabras Veiga & Magrini, 2013). Federal states became instrumental in promoting the reform effort on water legislation (Victor, Almeida & Wong, 2015).

The Federal Law also identified six policy instruments for achieving integration in water resources management: (i) River Basin Plans at federal, state and river basin levels (see Box 5.3); (ii) classification of water bodies according to their designated uses; (iii) water use permits for allocating water to large users ; (iv) water use charges; and (v) Water Resources Information System (SINGREH) (Federal Law No. 9433/1997). The foreseen interplay of the different policy instruments is summarized in Figure 5.3.

The previous sections have discussed the development of a set of instruments relevant for water governance as laid down in Brazilian law. Based on the criteria as outlined in section 2.9 a number of instruments were selected to assess their functioning at multiple levels of governance. Instruments that address water-sharing challenges between levels, states, uses, users, humans and nature, and/or water-related risks are considered relevant for this study. The instrument also has to be related to water quantity. This led to the selection of instruments as listed in Table 5.7.

11 Within the limits of its constitution, to regulate the conduct of its citizens in the interest of the common good

Table 5.6. Relevant Brazilian legislation related to water resources

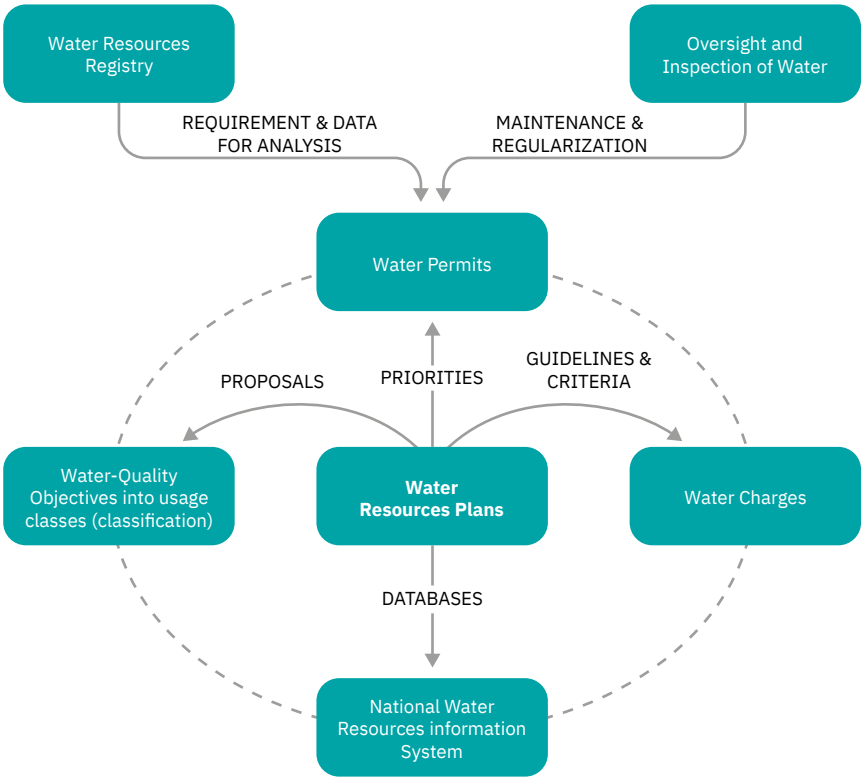
Subject	Article	Description
1998 FEDERAL CONSTITUTION		
Federal water bodies ownership	20 – III	Covers lakes, rivers, and other water streams situated in federal areas, or flows through more than one state, or transboundary ones
Disaster risk management	21– XVIII	Plans and promotes permanent defence against public disasters, especially droughts and floods
	22 – XXVIII	The Union has exclusive power to legislate concerning territorial, aerospace, maritime and civil defence, and national mobilization
State and Federal district water bodies ownership	26 – I	Surface and groundwater flows, springs and reservoirs; springs and deltas which is located in the same state or federal district
Exclusive legal competence of federal	21 – XIX	The federal government is responsible for a national system for Water Resources Management and defining criteria for water allocation including the criteria for granting rights to its use
Concurrent Federal, State, and Federal District	24 – VI	Forests, hunting, fishing, fauna, nature conservation, soil and natural resource protection, environmental protection, and pollution control
NATIONAL WATER LAW OF 1997		
Public domain	I	Water is considered a good in the public domain
Economic value	1 – II and 19 – I	Water is considered a limited natural resource with economic value
Priority of use	1 – III	During water scarcity, the priority use for water is first for humans and second for animal consumption
Integrate water resources management	3 – III, V, VI	Integrate land use, environmental management, watershed, estuarine and coastal zones on water management
River basin plan	5 – I	Define river basin plan as an instrument
Water rights	5 – III	Define water rights as a policy instrument
Water charge	5 – IV	Define water charges as an instrument
Content of Master plan (priority of use)	7	Determine that master plans must include priorities of use, water rights, support capacity for water allocation, and water charging system
Water permit	11	Water permits must ensure the qualitative and quantitative control of water use to guaranty the effective exercise of water rights

Table 5.6. Relevant Brazilian legislation related to water resources

Subject	Article	Description
Water permit (users)	12 – I to V	Define different economic and social uses of water to be subjected to the water permit process
Water permit (users)	12 § 1 to III	List the water uses that do not need water permits
Water permit cumulative analysis	13	Water permit should consider watershed master plan definitions
Water permit (competent authority)	14	Executive power defines the water permit
Water permit (revoking circumstances)	15 – I to VI	Define circumstances when water permits may be revoked for different reasons ranging from exceeding water permit limits to tackling environmental degradation
Water permit (lifetime)	16	Define 35 years as the maximum lifetime for a water permit
Water permit (alienation)	18	Water permit does not imply water alienation but just the right to use
Water charge and permit	20	Water charges applied to users subjected to the water permit process, art 12 I to V
HYDRAULIC NATIONAL RESOURCES COUNCIL (CNRH) – RESOLUTIONS		
Water permit	16/01	Disciplines the water permit systems to be observed by the Federal Executive authority
National Water Agency (ANA) – Law No. 9984 /2000		
Water permit	4 – IV	Define ANA's attribution to emit water permits for the water bodies under Federal domain
Water permit (validity)	5 – I, II, III	2 years, 6 years or 35 years
Water permit (exceptions)	5 §§ 1, 2, 3	Presents the exceptions; depending on the circumstance the water permit validity can be extended considering 5 – I, II, III
Water permit (volume reservation)	6 §§ 1 and 2	Introduces the possibility to make a virtual water reservation for future allocation. It does not create rights, it introduces the possibility for investors to plan their projects considering an available amount of water
Water permit (reservation for specific purpose)	7 §§ 1, 2, 3, 4	Describes the procedure for specific users such as hydropower, infrastructure construction

Source: Based on Semeia (2014) and Limia (2020)

Figure 5.3. National Water Resource Policy Instruments



Source: Adapted from ANA (2017b)

5.4. Analyzing sharing of water in paper and practice

This section presents the assessment of the functioning of the selected water-sharing instruments in Brazil. It provides a qualitative assessment of the functioning of the instrument from design to goal achievement (see Table 2.5 for the assessment criteria) and analyses to what extent the instrument contributes to inclusive development (see 2.2 for the assessment criteria).

5.4.1. Federalism

In terms of design, Brazilian federalism is characterized as non-linear with oscillating centralization (Braga et al., 2009). However, following Brazil's independence, a republican model of society was implemented

Box 5.3. The River Basin Plans at federal, state and river basin levels

The water resources plans are drawn up at the river basin, national, and state levels. The National Water Agency (ANA) is responsible for addressing water resource plans in hydrographic basins within the Union's domain, where the watercourse passes through more than one state or country, and offers technical support in the preparation of water resource plans at other levels. ANA is also the regulatory agency responsible for mediating conflicts of interest regarding water at the national level. The National Water Resources Council (CNRH) is responsible for approving general criteria for allocating water, including granting water permits (Section 5.4.4).

The first National Water Resources Plan was approved by the CNRH in 2006 for the period from 2006 to 2020 (CNRH Resolution No. 58/2006) (ANA, 2019c). The Plan presented macro-guidelines for implementing the National Water Resources Policy at different levels (i.e., federal, state, district, and basin). These macro-guidelines proposed priorities of actions, such as institutional strengthening through the implementation of the water permit instrument (Section 5.4.4) (ANA, 2019c). Nonetheless, the National Water Resources Plan has a long set of priorities that it has not successfully addressed at different levels, nor has it coordinated decision-making processes (OECD, 2015c).

through the Constitution of 1891 and a federal government system was established (Souza, 2002). The military dictatorship (1964–1985) did not allow democracy and political freedom, and local communities did not trust the national government and feared the return of centralized power (Miranda & Reynard, 2020).

The Brazilian decentralization process in which the central government started to share both responsibilities and finances with lower levels of government began with the adoption of the 1988 Federal Constitution. This presented a clear design of how the federal structure would work on paper and conducted legal and institutional changes in many sectors such as the water sector. The new federal structure is based on the principles of subsidiarity, instigating that decisions should be taken at the lowest possible level.

The Brazilian Constitution of 1988 has four aims: To (i) build a free, fair society characterised by solidarity; (ii) guarantee national develop-

Table 5.7. Sharing instruments in Brazilian policy documents

Instruments	Water-sharing categories	Policy
Federalism	Sharing between states	Federal Constitution in 1988
Priority of Use	Sharing of water between uses	National Water Law in 1997 (Art. 1, III, Law No. 9433/1997)
Human Right to Water	Sharing of water between uses	Federal Constitution in 1988
Water use permit for allocating water to large users	Sharing of water between users	National Water Law in 1997 (Art. 11)
Protected areas	Sharing of water between humans and nature	National System of Protected Areas in 2000 (Law No. 9985/2000)
Minimum flow	Sharing of water between humans and nature	National Water Law in 1997 (Law No. 9433/1997)
Climate proofing/ adaptation	Sharing of water-related risks	National Policy on Climate Change in 2008
Disaster risk management	Sharing of water-related risks	National Policy of Civil Protection and Defence in 2012 (Law No. 12608 of 2012)

Source: Author's elaboration

ment; (iii) eradicate poverty and marginalization and reduce social and regional inequalities; and (iv) promote the good of all, without prejudice to origin, race, sex, colour, age and any other forms of discrimination (Art. 3, Constitution 1988). It has often been praised as transformative because of these egalitarian aspirations. Yet it has been simultaneously noted that the expansion of neo-liberal reforms run in parallel to this neo-constitutional movement (Côrtes et al., 2021, p. 2) possibly leading to a prioritization of aim ii over the other aims. Both the egalitarian aspirations and the neoliberal reforms were later also translated into the National Water Law established in 1997 (Federal Law no 9433/1997). With this law surface waters became state property when contained within state borders, and only came under federal jurisdiction when crossing

state borders. All groundwaters are under the exclusive domain of the states (Art. 26), and states started to develop policies. The sharing of responsibilities in water governance between federal and state governments was laid down in the Constitution (García & Bodin, 2019), and can be interpreted as a serious attempt to give states more autonomy. However, the Constitution also sets a list of both legislative and administrative common powers, where the federal government sets the guidelines, and it is up to states and municipalities to detail these guidelines to laws tuned to local realities. This results in confusion, overlapping responsibilities and power disputes (Sampaio & Sampaio, 2020). The law also created the river basin committees and agencies and aimed at decentralization and participation in the decision-making process (Cunha, Veiga & Kelman, 2004). The law therewith created a new level of governance. For river basins covering more than one state, this resulted in a governance level between the national government and the state. For river basins within the territory of one state it resulted in a level between municipalities and the state. Several of the overarching principles of the Constitution are also reflected in this new water law. First, is the subsidiarity principle, with the basin being considered the most appropriate level for decision making in water governance (van den Brandeler, 2020). Second, the law instigates that water governance should involve the participation of government, users and communities (Art. 1.VI), which is operationalized in the creation of the river basin committees.

Details of how federalism was operationalized in the water sector are shown in Table 5.6. The general shift can be summarized as 'from centralized to decentralized; instituting a new governance level (the river basin) as the most appropriate level. Various authors have noted however that despite the clear influence of IWRM in the reforms, the traditional dominance of the hydraulic engineering paradigm, engineering knowledge and a preference for large infrastructural works remained the same (van den Brandeler et al., 2014). This results in a somewhat paradoxical situation. While Brazil's progressive water laws and institutional framework have been praised, especially when it comes to sharing between different levels, and by enabling participation, it is simultaneously observed that the reforms are unable to address the existing power structures in water management (Ioris, 2009; van den Brandeler et al., 2014).

In terms of budgets, Brazilian federalism transferred financial resources from centre to state and municipal level, but also from more

developed states and regions to the least socio-economically developed ones as a strategy to reduce regional inequalities (Empinotti, Gontijo & de Oliveira, 2018). It thus aimed at reducing inequality between states and this has to some extent been achieved (Interview N-22/26). Gaining access to federal funds is however often dependent on states' capacities to formulate adequate projects and plans. More developed states are often better equipped to do so than less developed states, resulting in reduced access to federal funds for the latter. It is also noted that some traditionally more powerful states such as São Paulo and Rio de Janeiro are more advanced in the discussion of water policy instruments, than other places that are less advanced. For instance, while the state of São Paulo has implemented all the river basin committees including the bulk water charge instrument in some areas, the state of Maranhão has not yet created any committee (Morais, Fadul & Cerqueira, 2018). This example clearly presents some asymmetries between states.

In terms of implementation, however, there is a lack of effective federal policy to promote the reduction of development differences among the federal units (Interview N-22/26; see Figure 5.3). Considering that the Constitution has been in force for more than 30 years, little progress has been made as Brazil's substantial regional asymmetries and inequalities did not change much since its adoption. For instance, the regions with the smallest populations have the highest water availability (Amazon region), whereas areas with the highest population density (normally near to the coast) suffer from water scarcity (Braga et al., 2009; Victor, Almeida & Wong, 2015; Miranda & Reynard, 2020). In terms of ecological inclusiveness, Brazil's decentralization is aimed at bringing control over groundwater to the states, enabling them to individually decide how groundwater should be used in their respective contexts (Benjamín, Marques & Tinker, 2005). However, state laws and management tools are alike throughout the country and do not consider local contexts and disparities, as analysed by Gontijo (2013) who evaluated ten case studies of river basin institutions in different regions of Brazil (Miranda & Reynard, 2020).

More than that, Brazil is dealing with several challenges related to institutional processes and participatory approaches. First, the implementation of IWRM in rivers crossing more than one state is challenged by the lack of clarity and overlapping distribution of functions (Miranda and Reynard, 2020). For instance, the three river basins in the state of São Paulo (Piracicaba, Capivari and Jundiaí) have both federal and state

rivers, which are dealt with by three committees (i.e., São Paulo state, Minas Gerais state and the federal committee). Decisions must be taken by all three committees, and if there are modifications in the rules in Minas Gerais and São Paulo, the process stagnates (Miranda, 2020; Miranda & Reynard, 2020). Another challenge is the implementation of the water policy instruments established by law, which varies across bottom-up (e.g., the case of the PCJ Committees) (see Miranda & Reynard, 2020) and, more commonly, top-down (e.g., the case of Alto Tietê committee) initiatives among the committees (Victor, Almeida & Wong, 2015). The confusion of stakeholders in distinguishing between federal and sub-national control units and the responsibility of the agencies and committees is also a challenge (Miranda & Reynard, 2020).

Thus, the significant progress in design, operationalization and even implementation of the federal structure in water governance go hand in hand with many difficulties in practice. Decentralization of water governance aimed for greater autonomy. For instance, Brazil's decentralization aims at bringing control over groundwater to the states, enabling them to individually decide how groundwater should be used in their respective contexts (Benjamín, Marques & Tinker, 2005). Decentralization of water governance thus has enabled decision making at lower levels and in several cases with increased participation (hence can be considered partially relationally inclusive in its design), but has also created a complicated governance system with many overlapping responsibilities.

The *design* of the instrument can be considered socially inclusive because it intends to eradicate poverty and reduce social and regional inequalities. For instance, eradicating poverty, reducing social and regional inequalities and building a free and fair society based on solidarity are two aims of the 1998 Constitution (I and III, Art. 3, 1988 Constitution). It aims at social inclusion guaranteeing basic rights, such as access to water, food, health services, housing, and justice (Pouw & Gupta, 2017). However, this has not been adequately implemented.

5.4.2. Priority of use

In terms of *design*, Brazilian National Water Law recognized the priority of use as a principle. This recognition as an overarching principle is very important, because it implies that all laws and plans subsequently developed should follow and/or operationalize this principle. It declared that,

in cases of water scarcity, priority in water use should be given first to humans and second to animals in the animal husbandry sector(Art. 1, III, Law No. 9433/1997). In 'normal periods', water allocation occurs based on the accountability instrument (i.e., water resources plans), which defines the availability of water and grants water permits to individual water users (Section 5.4.4) (OECD, 2015c). In terms of *operationalization*, the responsibility of the priority of use principle instrument is a common competence of the Union, states, and the federal district. However, as noted in 4.4.2.1, the principle needs further operationalization through defining how much water should be reserved for whom or what, and the threshold numbers when this principle comes into effect. The operationalization of the principle has not yet reached this level in Brazilian law.

In terms of *implementation*, some progress has also been made with priority of use being coordinated between water availability, water resources plans, and water permits instruments (Interview N-25).

In terms of a *policy goal*, the priority of use instrument has been partly able to fulfil its purpose, For instance, this is the case when the river basin plan and water permit instruments are designed considering the priority of use as a principle such as in the São Francisco River Basin Plan (see 6.4.2).

Moreover, the priority of use instrument also means the extension of the universalization of water to marginalized groups, including low-income populations and residents of informal settlements who are most exposed to water-related risks (Magalhaes & Heller, 2018)(Interview N-9). However, in both rural and urban areas, these groups are still left to their own devices to access potable water, despite the need for adequate infrastructure for sanitation, drainage, and solid waste collection (Magalhaes & Heller, 2018) (Interview N-9).

Besides, there is no strategic guidance on how water should be allocated between different geographic or administrative regions (OECD, 2015c). There is also a lack of clear guidance for water-sharing in transboundary rivers or inter-basin transfers, leaving decisions to be made on a case-by-case basis (OECD, 2015c). Furthermore, priority of use implies that the state has the ability to reallocate water during times of stress. This requires budgetary and administrative capabilities. Hence we can conclude that the principle of priority of use requires considerable commitment to set its own numbers considering the context of each Brazilian region and remains poorly debated and inadequately implemented in practice.

The *design* of the priority of use instrument can be considered socially inclusive because it commits to minimizing the risk of low access to water of humans and animals. The National Water Law explicitly adopts priority of use as a principle, supporting priority of use during water scarcity, first to humans and second to animals (Art. 1, III, Federal Law no 9433/1997). This considers human wellbeing and promotes universal access to water, thus, increasing the probability that the urban and rural poor people have access to drinking water in terms of water scarcity. It also protects the animals in the farming sector.

The design of this principle is also considered partially *ecologically* inclusive because it reserves water for animals and promotes integration with other instruments such as river basin plans and water permits. However, it does not reserve water for nature nor promote the preservation of ecosystems.

The design of the priority of use instrument is not considered *relationally inclusive* because it does not explicitly promote participation. At the same time, I believe that in this specific dimension, it can be justifiable. One of the main reasons is that promoting participation is likely to enable more powerful actors to demand access and thus distort the way priorities are defined.

So when I look at the text on paper, in the next round of policy making it is important to consider ecological inclusiveness as one of its criteria.

5.4.3. Human right to water and sanitation

In terms of *design*, the human right to water and sanitation is also adopted as a principle. The right to life and the dignity of human beings is protected by the 1988 Constitution and Art. 11 of Federal Law no 9433/1997. The Constitution recognizes water as a fundamental human right, considering life is not liveable without water (Benjamín et al., 2005). Later, the National Policy on Basic Sanitation in 2007 (Federal Law No. 114455 of 2007) introduced general guidelines for developing state and provincial policies. For instance, this law ensured that all Brazilian populations have access to drinking water supply, sanitation services and sewage systems, urban cleaning, and solid waste management services, taking into account the basic conditions of public health and protection of the environment (Art. 2, item I). It also introduced a set of guidelines to promote sustainable development, efficiency, and effectiveness (Art. 48).

In terms of operationalization and budget, the Constitution declares that health and housing, among other necessities, are guaranteed social rights (Art. 6) and refers to the common competence of the Union, states, federal district, and municipalities to promote initiatives that improve basic sanitation (Art. 23, IX). However, despite the adoption of PLANSAB, federal spending on sanitation has been continuously declining. Between 2012 and 2018, federal spending decreased by 45%, bringing the budget for sanitation to R$1.6 billion in 2018 (IDS, 2018b). Most investments in WSS services come from the providers. A revised version of PLANSAB adopted in 2019 projects an investment of 89 billion dollars in WSS services over a 14 year timespan (40% for water supply and 60% for sanitation) (Narzetti &Marques, 2021).

In terms of *implementation*, the National Plan for Basic Sanitation (PLANSAB) was set in 2013. This basic guideline for the legislation was translated into goals and indicators. One of the main goals set in this document was to ensure universal access to sanitation throughout the country by 2033 (Aleixo et al. 2016; Civil Society, 2018). In order to achieve this, the Ministry of Health was mandated to implement the PLANSAB in municipalities of less than 50,000 inhabitants, and the National Secretariat for Sanitation was mandated to do so in municipalities of more than 50,000 inhabitants (SNS, 2019).

In terms of policy goals achieved, the National Plan for Basic Sanitation initiated an important step towards the universalization planning process (Aleixo et al., 2016). It presented a strategic vision for the future, the percentage of the population with access to safe drinking water remained stable despite population growth, and the share of the population with access to sanitation grew by 23% between 2000-2017 (Narzetti & Marques, 2021). However, designing a water tariff system that is affordable for all consumers proved to be a challenge, considering drastic inequalities between consumers (van den Brandeler, 2020). The general water distribution network reached 85.5% of the population by 2019. The regional distribution is however highly uneven, with over 92% reached in the South East, but only 59% reached in the North. Furthermore the investments often do not reach the informal settlements, which implies that improvements are not realized where they are most needed (Narzetti & Marques, 2021).

Brazil systematically thus violates the human right to drinking water and sanitation. More than 34 million Brazilians lack access to drinking water and another 100 million to sanitation services (IDS, 2018b). Infor-

mation regarding sewage collection and treatment is not available in approximately 55% of municipalities, and only 30% of municipalities have sanitation plans (IDS, 2018b). There is limited knowledge and understanding of the characteristics of the country's water supply and sanitation conditions (Aleixo et al., 2016). More effective actions to support the human right to water are needed as many problems remain, such as the majority of Brazilian municipalities still do not have a budget to operationalize the universalization of drinking water and sanitation (IDS, 2018a).

The design of the human right to water and sanitation is considered socially inclusive because it implicitly recognizes access to water as a human right (Art. 11, Federal Law no 9433/1997). It is also considered partially ecologically inclusive because it is based on water quantity and water quality assessment, however, the principle does not adopt a definition of sanitation components to ensure environmental sustainability and equity.

So when I look at the text on paper, in the next round of policy making it is important to consider ecological flow as one of its criteria and relationally inclusive issues. This paragraph further exemplifies how legal provisions on the one hand can be used to push for their implementation (as in the different rulings calling authorities to action), but are insufficient to guarantee their implementation unless financial and accountability mechanisms are included.

5.4.4. Water use permit for allocating water to large users

Permits and charges for water use has been foreseen in Brazil since 1934, with the promulgation of the Water Code by Federal Decree 24.643 of July 10, 1934. This code established that "the common use of the waters can be free or paid, according to the laws and regulations of the administrative district" to which they belong (da Silva, Pereira & de Oliveira Vieira, 2020, p.23).

The requirement of permits for allocating water to large users and the requirement of permits for water use and wastewater discharge was established by the Federal Law No. 9433/1997. In terms of design, the Brazilian system for granting water use rights aims to ensure the quantitative and qualitative control of water used to guarantee the effective exercise of water rights (Art. 11, Federal Law No. 9433/1997). In specific, Brazil has a modern permit system implemented, which considers the five main components presented in section 4.5.2.1.

First, regarding the right to use water, Brazilian water use permits authorize permit holders to use a specific amount of surface or groundwater for a certain time, under terms and conditions established by an administrative act (ANA, 2018). These permits are issued by ANA for federal waterbodies or by state management entities if the water is drawn from a waterbody under state domain (Art. 14, XX, Federal Law No. 9433/1997). ANA is also responsible for the water availability report for hydroelectric purposes[12] (da Costa & Tybusch, 2017). Permits for the discharge of liquid wastes into waterbodies are also issued by set entities (ANA, 2018).

The main purpose of the permits is to ensure qualitative and quantitative control of water usage, as well as the effective exercise of the right to water (ANA, 2018). Water users with insignificant water uptake volumes do not need water permits but must register with the respective water resource management entity (Art. 12, Item 1, 2, and 3, Federal Law No. 9433/1997). The criteria to define water usage as "insignificant" vary according to the hydrographic basin plans and the criteria established by the management entities (ANA, 2018). In the case of rivers within the federal domain, these are subject to Resolution 1.175 since 2013[13] (ANA, 2018).

Second, regarding the possibility of renewing the permit, Brazilian water users can apply for pre-emptive permits to reserve stream flows that can be licensed to support enterprise planning (ANA, 2018). Permits are valid for a maximum of 35 years and can be renewed and are subject to the ranking of water use priorities established in the water resources plan. Brazilian water users can apply for pre-emptive permits to reserve stream flows that can be licensed to support enterprise planning (ANA, 2018).

Third, regarding the possibility of changing the permit conditions during the allotted period, Art. 15 of the 1997 National Water Law presents six conditions that allow partial or total suspension, or for a spec-

12 In the case of hydropower complexes, Brazil's Power Sector Regulator (ANEEL) must obtain authorization from ANA or the respective water resource management entity, which is automatically transformed into a permit after authorization or concession of hydropower complex site" (ANA, 2018)."Waterworks financed by the several government worth more than just over USD 3 million (BRL) 10 million also require a CERTOH, which attests to the hydrological and operational sustainability of the enterprise, in terms of the capabilities of the institution in charge in the existence of funds for its operation and maintenance" (ANA, 2018).

13 Some examples are: abstractions equal to or less than 86.4 m^3/day; effluent discharges with a maximum load of DB05 2º equal to or less than 1.0 kg/day and maximum effluent discharge with a temperature higher than that of the water body equal to 216 m^3/day (for discharge of effluents with a temperature higher than that of the water body c less than 40°C) (Art.6 Resolution *1.175/2013*)

ified period or definitively : (i) non-compliance by the grantee with the terms of the grant; (ii) no use for three consecutive years; (iii) urgent need for water to meet calamity situations, including those arising from adverse weather conditions; (iv) need to prevent or reverse serious environmental degradation; (v) need to meet priority uses, of collective interest, for which alternative sources are not available; and (vi) need to maintain the navigability characteristics of the water body. In the event of a drought, for example, permits can be suspended by ANA for a period without any compensation for the user (Interview N-26).

Fourth, regarding the possibility to transfer the permit to others, water use permits for allocating water to large users can be transferred to other holders for an administrative fee but cannot be traded or leased.

Fifth, in terms of appealing and/or being compensated by the State, the Brazilian water system does not compensate the permit holder in case the conditions change prematurely and lead to financial loss. Although the law prohibits compensation, the permit holder can appeal the decision either judicially or administratively.

The adoption of the National Water Resource Plan (2006-2020) was a first step in the operationalization of this policy instrument. Unfortunately the plan stipulates so many priorities, that these cannot be effectively addressed, nor has it helped to coordinate decision making at the different government levels (see Box 5.3). The World Bank funded the Progestão Programme, focused on strengthening the water system (see Box 5.2), and ensured a budget for the permit system. However, since Brazil still needs to improve the National Water User Registry (CNARH), implementation is lagging behind (Interview N-13). As of November 2017, water resource management entities are required to register regularized user data in the National Water User Registry (CNARH) (ANA, 2018). The system is not entirely unified, and the CNARH remains inefficient in some regions (ANA, 2018). For instance, the total number of federal permits granted by ANA in July 2018 was 9,894 for a total flow of 1,507 m³, whereas total water volume licensed was much higher than total water available (ANA, 2018).

As a consequence of this dysfunctioning of the permit system, it is unclear how much water is available for human uses and other activities in some basins. The case of one of the biggest soft drink company in the world installed a factory in Itabirito City at Minas Gerais state illustrates this situation[13]. The company claims that it has operating licenses and

denies that its withdrawal of 125 m³/h is interfering with the springs. However, according to a complaint from the Minas Gerais Association for the Defense of the Environment in 2018, the company's activities are significantly reducing the flow of the Paraopeba and Velhas rivers. The State Public Ministry had been following the case for 3 years, but it was not possible to find a referral available for consultation (i.e., a range of documents that ultimately provide end-users with information about this case). It is fundamental to have complementary mechanisms such as fluviometric monitoring and water availability studies which could help minimize the risk of water damage in some basins.

This shows how much water is used by the large users in the country, even though it is not possible to know how much the small users use. Thus, it also shows how problematic enforcement of the water permit instrument can be and there is too much water allocated right now (ANA, 2018). On the one hand one can argue that progress has been made, but given the fact that the registry system is not yet unified, and that a lot of water use takes place unregistered, the instrument thus far has only very partially been able to fulfil its policy goal of qualitative and quantitative control of water usage.

If considered from an ID lens, in its *design* the instrument can be partially socially inclusive because under the many priorities it sets, it benefits some use of water such as, for instance, small farmers and households (insignificant uses). It can also be considered partially *ecologically inclusive* because its main goal is to ensure the quantitative and qualitative control of water used to guarantee the effective exercise of water rights (Art. 11, Federal Law No. 9433/1997). However it is just guaranteeing an adequate amount of water to accommodate human needs but it is not accommodating the needs of nature (i.e., vital ecosystem functions and freshwater biodiversity). Furthermore, water availability is measured in the water basin plan approved by the River Basin Committee. Measurements are based on the number of water permits, not taking into account ecological flow, nor inclusiveness in the decision-making process of defining the characteristics of the river basin and sequence of priority uses.

From the perspective of sharing, I conclude that already in the design the notion of sharing is insufficiently present. If so many priorities are set without weighing one against the other, the necessity to share is insufficiently foregrounded. On the positive side it should be noted that water permits can be suspended, even without compensation, under ca-

lamity situations and/or to meet priority needs. To be able to decide on sharing, one needs to know how much there is to be shared. Since adequate and integrated data on the total available water budget and its regional spread are missing, decision making on sharing remains difficult. Although potentially a very important instrument, it currently is unable to fulfill its purpose.

5.4.5. Protected areas

In terms of *design*, the Brazilian government's policies on federal protected areas are mainly based on the 2000 National System of Protected Areas (Law No. 9985/2000). The main goals of this environmental policy are to:

> "(i) contribute to the maintenance of biological diversity and genetic resources in the national territory and jurisdictional waters; (ii) protect endangered species at the regional and national level; (iii) contribute to the preservation and restoration of the diversity of natural ecosystems; (iv) promote sustainable development based on natural resources; (v) promote the use of nature conservation principles and practices in the development process; (vi) protect natural and little altered landscapes of remarkable scenic beauty; (vii) protect relevant geological, geomorphological, speleological, archeological, paleontological and cultural characteristics; (viii) protect and recover water and edaphic resources; (ix) recover or restore degraded ecosystems; (x) provide means and incentives for scientific research activities, studies and environmental monitoring; (xi) economic and social value of biological diversity; (xii) favour conditions and promote environmental education and interpretation, recreation in contact with nature and ecological tourism; and (xiii) protect the natural resources necessary for the subsistence of traditional populations, respecting and valuing their knowledge and culture and promoting them socially and economically" (Art. 4, Law No. 9985/2000).

This document divides protected areas into two categories, Integral Protected Areas and Sustainable Use Areas (Map 5.2). There are five types of Integral Protected Areas which are restricted: Ecological Stations, Biological Reserves, National Parks, Natural Monuments, and Wildlife Refuges. Sustainable Use Areas include Environmental Protection Areas

of Relevant Ecological Extractive Reserves, Fauna Reserves, Sustainable Development Reserves, and Private Cultural Heritage Reserves. There are also areas classified as Indigenous lands, which are inhabited by indigenous peoples.

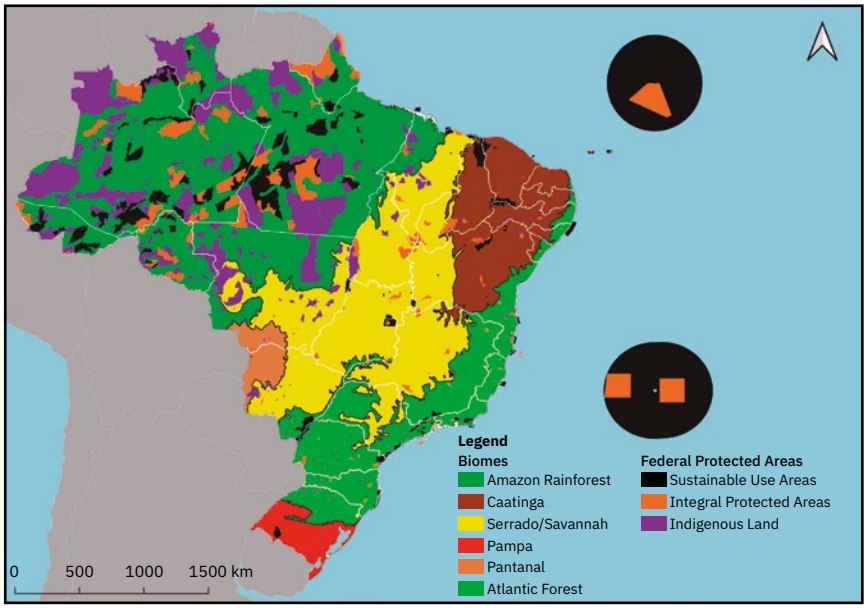
The Ministry of Environment coordinates the *operationalization* of the National System of Protected Areas through its executive agencies[14]. The Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) is in charge of issuing environmental licenses, controlling the quality of the environment, and sanctioning and controlling the use of natural resources. The Chico Mendes Institute for Biodiversity Conservation (ICMBio) is in charge of management, enforcement, and monitoring of the federal protected areas.

In terms of *budget*, there is a limited budget for the implementation of this instrument, resulting in a lack of capacity, management, monitoring, and resources for maintenance of the created Protected Areas (Semeia, 2014) (Interview N- 6). For instance, Da Silva et al. (2019) conducted a study on the Brazilian government's spending towards 289 protected areas (7% of its territory) between 2013 and 2016. They found that the government spent only US$ 297.8 million, with an average of US$74.8 million per year, on these areas, and 55% of this spending was used to cover personnel costs (da Silva et al., 2019).

In terms of *implementation*, currently, Brazil has 324 federal protected areas that span 787,451 km² (MMA, 2018; da Silva et al., 2019). Brazilian public policy is constantly faced with conflicting interests between environmental conservation and economic growth (Semeia, 2014). Despite increasing anthropogenic pressures on protected areas (e.g., deforestation and opening of areas to agriculture, pastures, and mining), ministries of agriculture, mining, energy, and the environment still take conflicting actions (Interview N- 6/ 26). This is evident by, for instance, the increase of illegal land use within protected areas in the Western part of Bahia State (de Oliveira 2017). The lack of capacity, management, monitoring, and resources for maintenance of the created Protected Areas therefore affects its effective implementation.

14 Until 2007, the Brazilian Institute for the Environment & Renewable Natural Resources (IBAMA) was responsible for policy execution. In 2007, Chico Mendes Institute for Biodiversity Conservation (*ICMBio*) was established and it shares the task of executing Brazilian System of Protected Areas policy (*SNUC*) at the federal level. At the state and municipal levels, the management of PAs is the responsibility of local environmental agencies.

Map 5.2. Brazilian biomes and Protected Areas



Source: Author's elaboration based on raw data from the Brazilian Institute of Geography and Statistics (2020) cartographic database in shapefile format (.shp) and the Ministry of Environment (2000)

In terms of goal achieved, Brazil is one of the world's leading countries in the delimitation of protected areas for environmental conservation (OECD, 2015b). However, it is also true that Brazil still struggles with enforcing environmental regulations (Interview N- 6/ 26). For instance, many 'paper parks' exist only on maps and in the law (Rife et al., 2013; Bernard et al., 2014). Nearly 50% of protected areas in the Brazilian Amazon do not have management plans or the land that is indicated to become a protected area has not been expropriated (Veríssimo et al., 2011). Another issue is the lack of classification of protected areas in the Cerrado[15] and Caatinga Brazilian Biomes (Interview N -26) (see Box 5.4). The Cerrado Biome, which consists of dry forests, woodland savannas, and grasslands (Spera et al., 2016), is recognized as one of the world's biodiversity heritage (Myers et al., 2000). Caatinga is known for its significant levels of both species richness and endemism (Suazo-Ortuño et al., 2008; Beuchle et al., 2015). It is a natural laboratory for studying the adaptation

15 Brazil holds 204.7 million hectares of the Cerrado in its central part (*Brazilian savannas*), and it is the second most extensive biome in South America (*Sano et al., 2010*).

Box 5.4. Need for water-sharing in the endangered Caatinga Biome

The Caatinga is a heterogeneous biome containing a mosaic of shrubs and areas of seasonally dry forest (Leal et al., 2005; Santos et al., 2011; Beuchle et al., 2015), which mainly occur under semi-arid conditions. This is natural vegetation that accounts for 11%, or 844,000 Km², of Brazilian territory (Alves & Martine, 2016: 49). The main factor that impacts the structure and distribution of vegetation is precipitation, with an annual mean of 500–800mm, and high spatial and temporal variability (Hastenrath & Heller, 1977; Cunha et al. 2013; Vieira et al., 2015).

The area is a highly dynamic ecosystem that reacts quickly to climatic conditions (Vieira et al., 2015). It presents climatic uniqueness that has inspired numerous important morphological and physiological adaptations to aridity by many species of plants (Mares et al., 1985; Cunha et al. 2013). Its rich biodiversity includes the following species: 79 amphibians, 177 reptiles, 178 mammals, 221 bees, 241 fish, and 591 birds, (Alves & Martine, 2016: 49).

Yet, despite its importance, the Caatinga has been deforested at a high pace in recent years, mainly for pastures and agriculture, as well as for firewood (Alves & Martine, 2016: 49). Consequently, more than 10% of the semi-arid area has already suffered a very high degree of environmental degradation and is susceptible to desertification (Oyama &Nobre, 2004; Cunha et al. 2013; Vieira et al., 2015).

of plants, invertebrates, and vertebrates to highly variable and stressful moisture regimes in arid and semi-arid regions surrounded by tropical mesic biomes (Leal et al., 2005, p.703).

Brazil's law enforcement and legal systems have many avenues for managing infractions against environmental laws (Interview N- 6/ 26) (Carvalho et al., 2019). Yet, authorities only catch a small fraction of illegal actions, and when caught, the likelihood of an offender paying the fine is insignificant (Interview N- 6/ 26)(Carvalho et al., 2019). According to data from assessments and fines applied by IBAMA between 2008 and 2013, Schmitt (2015) revealed that 45% of deforestation in the Amazon is not detected in time for appropriate action to be taken, and fines are charged in only 24% of detected cases (Schmitt 2015 cited by Carvalho et al., 2019 p. 127). The lack of technicians to handle the fines and various other administrative issues result in only 0.2 to 5% of fines being paid (Carvalho et al., 2019).

Box 5.5. Land rights considering land occupation types in rural Brazil

The Brazilian agrarian structure is a product of the colonial period. It reflects the disorderly land occupation with limited control by the government and inadequate separation between public and private lands (Damasceno, Chiavari & Lopes, 2017). The shifts of power and regimes resulted in seven types of land ownership co-existing in rural Brazil: (a) Settlement 'Assentamentos' (i.e., rural settlements with public ownership created with state-assistance usually for land reform purposes); (b) Indigenous Lands (i.e. portions of territories with public ownership inhabited by indigenous peoples and used for their productive activities, welfare, and physical and cultural reproduction); (c) Vacant Lands (e.g. public land not assigned to any specific use); (d) Possession 'Posse' (i.e. public or private lands); (e) Protected Areas (i.e. geographically defined space, in public or private lands, which is designated to achieve specific conservation objectives); (f) Property (i.e. land owned by public or private legal entities or individuals); and (g) Quilombolas (i.e., territories of ethnic groups with a presumption of black ancestry linked to resistance to slavery) (Damasceno et al. 2017). These land ownership categories have been endorsed without precise knowledge of boundaries, resulting in territorial overlaps and land grabbing affecting especially traditional populations and indigenous groups (Damasceno et al. 2017).

Brazil has one of the highest concentrations of landownership in the world. According to the country's last Agricultural Census in 2017, about only 1% of landowners control almost 50% of the country's rural areas. On the other hand, farmers with areas smaller than 10 hectares represent half of all rural property owners but control only 2% of the total land.

Source: Based on Damasceno et al. (2017); Marina Duarte de Souza (2020) and Annex H

If considered from an ID lens, the design of a protected area is considered socially inclusive because it contributes to minimizing the risk of water damage to humans (e.g., stabilize soils and reduce dust storms and desertification in arid areas by reducing grazing and trampling pressures (Amiraslani & Dragovich, 2011); can help regeneration by maintaining drought resistant plants (Randall, Stolton, & Dolcemascolo,2010)). This is the case of one of its aims which intends to protect relevant geological, geomorphological, speleological, archaeological, paleontological, and cultural characteristics (Art. 4, VII, Law No. 9985/2000). It is, however,

critical to consider if the location of the protected areas negatively impacts on social concerns of indigenous peoples and local communities (Schreckenberg et al., 2016).

The design of the protected area is considered ecologically inclusive because it recognizes the high value of the ecosystem services and the necessity of recharge areas of groundwater as presented in several of its aims (e.g., contributing to the maintenance of biological diversity and genetic resources in the national territory and jurisdictional waters, protection of the endemic species at the regional and national level, and contribute to the preservation and restoration of the diversity of natural ecosystems) (Art. 4, I to III, Law No. 9985/2000).

Moreover, the design of the protected area is considered relationally inclusive because aim XIII of Art 4, (Law No. 9985/2000) focuses on positive discrimination towards the most marginalized. It aims to include protected areas of traditional populations, respecting and valuing their knowledge and culture and promoting them socially and economically (Art. 4, XIII, Law No. 9985/2000). These protected areas reserved for indigenous peoples' productive activities are fundamental for their welfare and physical and cultural reproduction (Damasceno et al., 2017). However, there is growing evidence from newspaper articles about the violation of these rights and much of this is embedded in historical distribution of land rights (see Annex H).

5.4.6. Climate proofing

In terms of the *design*, the climate proofing instrument was first designed in 2009 by the Brazilian National Policy on Climate Change 2009 (PNMC, Law 12187 of 2009 and Decree No. 7390 of 12/2010). Article 4 of the Law 12187 defines the eight main ideas of this policy as:

> "(i) the compatibility of economic and social development with the protection of the climate system; (ii) the reduction of anthropogenic greenhouse gases in relation to their different sources; (iii) the strengthening of anthropogenic removals by sinks of greenhouse gases in the national territory; (iv) the implementation of measures to promote adaptation to climate change by the 3 (three) spheres of the Federation, with the participation and collaboration of relevant economic and social agents or beneficiaries, in particular those es-

pecially vulnerable to its adverse effects; (v) the preservation, conservation and recovery of environmental resources, with particular attention to the large natural biomes considered as National Heritage; (vi) the consolidation and expansion of legally protected areas and the incentive to reforestation and the restoration of vegetation cover in degraded areas; and (vii) to encourage the development of the Brazilian Market for Emission Reduction" (Art. 4, Law 12187).

Besides, the objectives of the National Policy on Climate Change must be in line with sustainable development in order to pursue economic growth, eradicate poverty and reduce social inequalities (see 1.5.2).

In terms of *operationalization*, the Brazilian Ministry of Environment (MMA) is the key responsible body and the main source of funding for implementing the PNA is the National Climate Change Fund. This fund was instituted in 2009 (Law No. 12114 and Decree No. 7343/ 2010) to support initiatives that focus on mitigating and adapting to climate change. The fund was mainly financed by revenues generated from a tax on oil companies, donations from the public and private national institutions, and international loans (Art. 3, Law No. 12114).

In terms of *implementation*, the Brazilian National Plan for Adaptation to Climate Change (PNA, MMA Ordinance No. 150 of 05/2016), inspired by the Conference of the Parties to the Climate Change Convention in Cancun in 2010, was not launched by the federal government until 2016 (Milhorance et al., 2020). The PNA presented the climate change agenda and settled the objectives and guidelines for adaptation (Milhorance et al., 2020). It aimed to cut Brazilian greenhouse gas emissions by 37% from 2005 levels by 2025 and set an "intended reduction" goal of 43% by 2030. In practice, however, the National Plan for Adaptation to Climate Change does not provide guidance for implementation, and is also still being designed by the Brazilian Ministry of Environment (MMA) (Nicolletti, Maschietto & Moreno, 2020; Torres et al., 2020) (Torres et al., 2020). Therefore, Brazil has made insignificant progress around the climate-proofing instrument beyond the initiation of the National Plan for Adaptation to Climate Change, which is still being designed by the Brazilian Ministry of Environment. The Brazilian climate change agenda is still under construction (Nicolletti, Maschietto & Moreno, 2020) and efforts are being focused on actions towards mitigation (Torres et al., 2020). The cross-sectoral nature of climate challenges requires concrete actions

to address climate change drivers to reduce vulnerability and promote adaptive capacity. There is specific need for integrated approaches to policymaking and, yet, Brazil's knowledge of such approaches is limited.

If considered from an ID lens, the design of the climate-proofing instrument is considered socially and ecologically inclusive because it aims to contribute to minimizing the risk of water damage through conservation and preservation of protected areas and minimizing emissions. Two goals can have a direct effect on the conservation of nature such as preservation, conservation, and recovery of environmental resources and the incentive to reforest and restore vegetation cover in degraded areas (Art. 4, VI and VII, Law 12187 of 2009). The design of the instrument is also considered relationally inclusive because it contributes to participatory approaches and positive discrimination towards the more marginalized groups. There are also other specific goals tackling these issues, such as the implementation of measures to promote adaptation to climate change taking into account the three administrative levels (federal, state, and municipality), economic and social agents, and beneficiaries (including the most vulnerable ones) (Art. 4, V, Law 12187 of 2009).

5.4.7. Disaster risk management in terms of drought

Brazil does not have active volcanos and has never experienced a significant earthquake or tsunami. However, Brazil is still considered a vulnerable country considering the risks of other natural disasters, including droughts, flash floods, and floods. In terms of *design*, the 1988 Constitution entrusts the federal government with the power to plan and promote permanent defence against public disasters, particularly droughts and floods (Art. 21, XVIII, 1988 Constitution). This implies that the Union has exclusive competence to legislate civil defence and national mobilization (Art. 22, XXVIII,1988 Constitution). Further, the National Policy of Civil Protection and Defence in 2012 (Art. 5, Law No. 12608 of 2012) presents 15 specific goals:

> "(i) reduce disaster risks; (ii) provide relief and assistance to populations affected by disasters; (iii) recover areas affected by disasters; (iv) incorporate disaster risk reduction and civil defence and protection actions among the elements of territorial management and planning of sectorial policies; (v) promote the continuity of civ-

> il defence and protection actions; (vi) encourage the development of resilient cities and sustainable urbanization processes; (vii) promote the identification and assessment of threats, susceptibility and vulnerabilities to disasters, in order to prevent or reduce their occurrence; (viii) monitor meteorological, hydrological, geological, biological, nuclear, chemical and other potentially disaster-causing events; (ix) produce early warnings about the possibility of occurrence of natural disasters; (x) to encourage the ordering of the occupation of urban and rural land, with a view to its conservation and the protection of native vegetation, water resources and human life; (xi) combat the occupation of environmentally vulnerable and risky areas and promote the relocation of the population residing in these areas; (xii) to encourage initiatives that result in the destination of housing in a safe place; (xiii) develop national awareness of disaster risks; (xiv) guide communities to adopt adequate prevention and response behaviours in a disaster situation and promote self-protection; and (xv) integrate information into a system capable of supporting SINPDEC bodies in predicting and controlling the negative effects of adverse events on the population, goods and services and the environment" (Art. 5, Law No. 12608 of 2012).

In terms of *operationalizing*, the Ministry of National Integration through the National System of Civil Defence (SINDEC) is responsible for planning, articulating, and coordinating civil defence actions throughout the nation (Law No. 12340/2010 and Decree No. 7257/ 2010). The National System is composed of public administration bodies and entities of the Union, states, federal district, and municipalities, as well as civil society organizations responsible for civil defence actions (Art. 2, Law No. 12340/2010). The National Centre for Monitoring and Early Warning of Natural Disasters (CEMADEN) is responsible for monitoring and issuing warnings for landslides, flash floods, and floods. The Ministry of Cities also supports disaster risk management through the prevention and eradication of risks in settlements. Since 2003, the Ministry of Cities has offered support to municipalities in articulating actions to reduce risks in urban areas (Costa, 2012). Brazil has made little progress around the disaster risk management instrument, and in terms of *budget*, the federal government is responsible for providing emergency funds to the municipalities to manage the effects thereof. However, the money allocation is

not a straightforward process, normally there is a significant bargaining process to access the emergency funds involving the municipality in need, the state and federal governments.

In terms of *implementation* taking into account droughts, Brazil does not have a consolidated drought policy. Most mechanisms implemented over time have been reactive approaches, including rain-fed water cistern construction; well drilling and recovery; dam and pumping station construction; and social safety net mechanisms (e.g., 'Operação Pipa', 'Bolsa Estiagem' and 'Garantia Safra'). Mechanisms that would be characterized as proactive include building resilience at the farm level, supporting work of the Brazilian Agricultural Research Corporation (EMBRAPA) on drought-resilient crops, and monitoring the Brazilian Northeast (Gutiérrez *et al.*, 2014). Consequently, the most marginalized people rely on water trucks at a higher price or exchange favours with the region's powerful politicians (e.g., exchange of votes) (Frey, 2020) (Interview N-9/ B-4).

Moreover, the lack of a consolidated drought policy aggravates the risk of people's exposure to contaminated waters. Such extreme events can cause deaths and lead to the homelessness of millions of people overnight. In Brazil, from 1998 to 2017, more than 145 thousand people died as victims of climatic events (Eckstein et al., 2019). It is, therefore, essential to have emergency plans to strengthen local capacities and local mechanisms. One of the possible negative consequences of prolonged drought is desertification. In Brazil, 16% of its territory (1.34 million km²), an area covering more than 1,400 municipalities (almost 35 million people)[16], is susceptible to desertification. It is fundamental to have practical actions for the recovery of degraded forests through the implementation of new trees, training technicians, and strengthening of forest seed banks (Interview N-12/ B-2).

If considered from an ID lens, the design of the disaster risk management instrument is considered *socially inclusive* because it intends to minimize the risk of water damage. This is the case of the goal of incorporating disaster risk reduction, civil defence, and protection actions among the elements of territorial management and planning of sectorial policies and encourage the development of resilient cities and sustainable urbanization processes (Art. 5, I to V, Law No. 12608/2012).

16 http://www.fao.org/brasil/noticias/detail-events/en/c/1073924/

The disaster risk management instrument can be also considered *ecologically inclusive* because its goals reserve water for nature. This is the case of the goal about the ordering of the occupation of urban and rural land, which demands respect and conservation of the native vegetation, water resources, and human life (Art. 5, X, Law No. 12608 of 2012). Besides, one of the goals also states the need to combat the occupation of environmentally vulnerable and risky areas and promote the relocation of the population residing in these areas (Art. 5, XI, Law No. 12608/2012). Such relocation may have negative social consequences.

However, it is not considered *relationally inclusive* because it does not present a participatory approach in its goals. So when I look at the text on paper, the next round of policy making they need to reallocate to relational issues.

5.5. Inferences

Brazil's current water governance challenges need to be understood in their contexts. Brazil is a very large country marked by a history of inequality, exclusion and unequal access to resources and power. In its more recent history, the timespan covered in this thesis, its development process has been driven by agricultural expansion and industrialization, also being key drivers of the country's current water problems. Making use of the favourable conditions for hydropower production added Brazil among the largest hydropower producers globally. This has fuelled development processes while also having detrimental social and environmental effects and seriously affecting waterflows and cycles.

Brazil's waters were governed by the Ministry of Energy and Mining until the 1990s, reflecting the country's priorities and the dominance of the hydraulic paradigm. By the end of the 1990s, Brazilian water governance shifted from this hydraulic engineering paradigm (5.2.4) based on energy development and characterized by a "command-and-control" approach, towards the IWRM paradigm. This shift occurred as a result of the adoption of a new water framework in 1997 (Federal Law No. 9433/1997), which established multiple uses of water, a multilevel governance system, decentralization to the basin level, and stakeholder participation. It also stimulated privatization and public-private partnerships based partly on neoliberal ideology, allowing for the introduction of market-based instruments such as bulk water charges and water use permits.

On paper Brazil has put a coherent set of instruments in place (see Figure 5.3). At the heart of this set of instruments are the water resource plans, which i.e. prioritize water permits, set guidelines for water charges and are supposed to do so based on an integrated information system from which the water budgets can be derived. This information base is very important. As stated earlier in the chapter: to be able to decide on sharing, one needs to know how much there is to share. However, this chapter has shown that the integrated information system is not yet adequately implemented and that, for instance, the water permits granted far exceeded total water availability (5.4.4).

The changing framework, policies and instruments resulting from the shift to IWRM have both pros and cons. It is a clear advantage that ANA has been established as a national water authority, providing a regulatory framework, standards and – in theory – also a comprehensive information base. The new water policy, inspired on IWRM, institutes participation of relevant actors in water governance as a clear principle, and therewith creates the deliberative spaces where decisions on sharing can take place. It is also important to note that from an ID perspective, all instruments do at least in their design address at least one of the dimensions of inclusive development, and therewith further operationalize some key objectives of the new Constitution (5.4). However, with creation of the river basin committees an additional governance level has been created that has further complicated water governance, even more so for federal rivers that cross more than one state. An extreme example are basins with both federal and state rivers where decisions must be taken by three river basin committees. The problem is not the creation of the river basin committees as such, but the fact that responsibilities and mandates have not clearly been delineated. The overall participatory turn in Brazilian governance has led to such a multitude of participatory institutions, that some refer to this as 'a participatory jungle' (Acharya, Lavalle & Houtzager, 2004). Increased participation is not a magic bullet, and not all relevant actors can participate on equal footing in the process. In conclusion: the opening up of participatory spaces is a significant step forward, but needs further improvement. A first step would be more clearly delineate responsibilities and mandates, and decide which subjects should be dealt with in participatory processes and which are better dealt with in other settings.

It is also clearly noted that the developed instruments at least at the national level do not sufficiently address the underlying drivers. As

direct drivers of water-sharing challenges in Brazil are identified: demands for commercial agriculture (e.g., coffee, soybeans, beef, and crop-based ethanol), energy, industry and services, and households. The indirect drivers are rapid urbanization, international (virtual water) trade, climate change, and the pursuit of economic growth including how this translates into, for example, agricultural policy. While demand for commercial agriculture and livestock, demand for energy, industry and services, and household demand can be addressed by a mix of the developed instruments such as water permits, water budgets, and water plans, this chapter has proven that at least at the national level the implementation and application of the instruments has not significantly affected the identified drivers. As mentioned, the share of water used for agriculture has risen from 33% tot over 50% and actual consumption doubled (5.2.3). The amount of water licensed exceeds available water (5.4.4). Along similar lines: both the instruments 'priority of use' and 'human right to water and sanitation' in their design address the driver 'demand of households'. These are potentially strong instruments from a sharing perspective, because they entitle people without access to drinking water and sanitation such access (either in crisis situations as with the priority of use or on a structural basis). However: this chapter has shown that progress in implementation of these instruments is insufficient. As noted, legal provisions alone, even when used to push for implementation, are insufficient to guarantee implementation. It should also be noted that improving access to drinking water and sanitation might imply more water consumption overall, therewith negatively impacting water availability (e.g., not addressing the driver in the sense of reducing water consumption). However, water used for human consumption can have a high return rate. Much of this potential remains unused since only part of wastewater is treated. Reducing water leakages could also significantly reduce water needed for households.

Currently, the indirect drivers of climate change are addressed by three instruments: protected areas, climate proofing and disaster risk management in terms of drought. However, while on paper Brazil has recognized the value of the environment and the benefits of the ecosystem to sustain human society, in practice, the country has yet to develop strategic planning for long-term environmental conservation. Lack of capacity and political will continues to hinder effective action. This is consistent with the predominant narrative of pursuing immediate eco-

nomic growth, which, for instance, puts the preservation of protected areas and the marginalized at a disadvantage against stronger national interests in mining and commercial agriculture.

On paper, Brazil also seems willing to address key water-sharing issues. Yet again, in practice, the country fails to provide financial and human resources for implementing many of the water-sharing instruments. There are even certain instruments that have been identified but still not considered for implementation, such as flood insurance, drought, and emergency planning, and climate change mitigation and adaptation plans.

In the face of conflicting interests between environmental conservation and economic growth, the latter has been given preference time and again. Despite water-sharing between humans and nature being emphasized on paper, in practice, there are stronger interests in the economic benefits of hydroelectricity and commercial agriculture (e.g., financial incentives provided for agricultural expansion). The concept of water-sharing remains a paper narrative in which nature and social goals are often disregarded by dominant powers. As demand for commercial agriculture and the pursuit of economic growth prevails, it is important to consider the following drivers should the government decide to advance towards inclusive development: sectoral fragmentation of water-related tasks across ministries and agencies, international trade, and deteriorating ecosystem services. The evaluation of the different instruments in this chapter is limited as there is very little systematic monitoring of such instruments, but I hope that this a first step towards a more systematic evaluation.