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CONFERENCIA INTERNACIONAL SOBRE GESTIÓN DEL AGUA EN PAÍSES FEDERALES Y SEMEJANTES A LOS FEDERALES.

Water Management in Brazil

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1. Introduction

Water is a vital natural resource. On the contrary to other natural resources (crude oil, gas, aluminium, etc.) for which there could be alternatives, there is no possible replacement for water. Water can be used for many ends: supplying people and industry, animal farming, production of foodstuffs through the use of irrigation, sailing, generation of hydroelectricity, mining, conservation of aquatic flora and fauna, leisure and tourism. In Brazil, during times of scarcity, supplying the population and animal farming are the uses with the highest priority. The priority of all the other uses is established according to the aptitude of the water basin in question for the basin plan as passed by the respective committee.

This chapter is going to deal with the situation of the water resources in Brazil. It will lay out the conditions of availability and demand in the various water zones in Brazil. The most recent developments of the last ten years in the legal and institutional areas for the management of water resources will be presented along with examples of implementation in water basins that are shared by different States.

2. Water availability and demand

Brazil is a federative republic comprised of the Union, 26 states, 1 federal district and 5,561 municipalities (Figure 1). This is a very peculiar configuration as regards the numerous municipalities that have complete administrative autonomy in, for example, the supply of water and sanitation services. Fortunately, in the matter of the management of water resources, the autonomy lies with the states and the Union. In accordance with the Federal Constitution passed in 1988, the following were established as Union goods: “lakes, rivers and any body of water on federal land or shared by one or more States,

serving as a border with another country...”⁵ Other watercourses and underground waters lie within the dominion of the states. Thus, the management of water resources in Brazil provides challenges similar to the management of cross-border river basins shared by independent countries.



Figure 1 – Political Division of Brazil

In Brazil, the most intensive use of water is in irrigation for the production of foodstuffs. Nearly 70% of water consumption goes to this end (Figure 2). Urban supplies represent 11%, animal farming 11%, industrial 7% and rural supplies 2%.

⁵ Art. 20, inc. III of the Federal Constitution of 1988

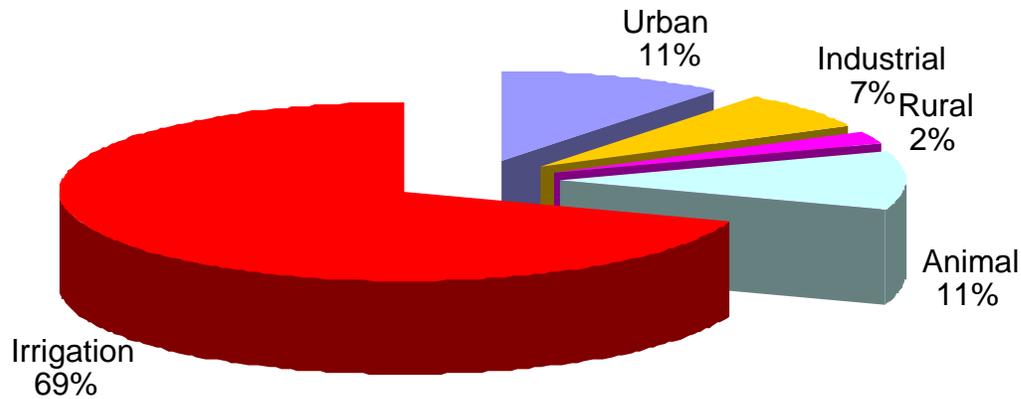


Figure 2 – Water Use in Brazil (NWA, 2007)

Figure 3 shows the 12 water regions (combination of one or more water basins) considered for water management in Brazil. The limits of these regions do not coincide with the geo-political limits of the Brazilian States. This fact will have important implications on the model of water management adopted by the country, as shown later.



Figure 3 – Water Regions and Brazilian States

Table 1 shows the average annual flow per capita in these twelve water regions. The results show that Brazil is rich in terms of water availability. Considering the total of the average flow for the country as $179,433 \text{ m}^3/\text{s}$, we can see that the country contains

12% of the planet's fresh water. However, this availability varies greatly across the extent of the country. In addition, there is also a great seasonable variation in this availability. Even in water regions with high availability, such as the Amazon (74% of Brazil's total), major periods of low water can be found. This was the case during a series of serious droughts in the south of the Amazon in 1983 and 2001. However, these isolated data do not reflect the problem of water management in Brazil given that they do not take into account the demand for different uses.

TABLE 1 – Average water flow per inhabitant in Brazil (NWA, 2007)

WATER REGIONS	POPULATION	AVERAGE FLOW	
	(1000 inhabitants)	(m ³ /s)	(m ³ /inhab/yr)
Amazon	7,806	131,947	533,062
Tocantins Araguaia	7,178	13,624	59,856
Western Northeast Atlantic	5,302	2,683	15,958
Parnaíba	3,729	763	6,453
Eastern Northeast Atlantic	21,465	779	1,144
Sao Francisco	12,796	2,850	7,024
East Atlantic	13,996	1,492	3,362
Southeast Atlantic	25,245	3,179	3,971
South Atlantic	11,634	4,174	11,314
Uruguay	3,834	4,121	33,897
Paraná	54,670	11,453	6,607
Paraguay	1,887	2,368	39,575
Brazil	169,542	179,433	33,376

Studies undertaken by the NWA (2004) evaluated the demand/availability relationship for water in these 12 water regions. The demand is calculated from the available data provided by concessions given by both the Union and the states for the various uses of the existing water in the water regions. The availability is the flow regulated by the upstream river deposits system, with a 100% guarantee, added to the permanent flow at 95%, in the unregulated stretch. In the unregulated rivers, the availability is the permanent flow at 95%. With the aim of characterising the situation of the rivers in these water regions, a qualitative scale has been used for this availability/demand relationship

which varies from “acceptable” to “critical”, as shown in Figure 4. The situation is acceptable in the Amazon and Tocantins/Araguaia water region, except for some areas at the head and in the rivers Jaburu and Formoso – where irrigation activities have intensified in the last few years. In the Western Northeast Atlantic, the river Mearim is in a critical condition. The river Parnaíba is able to attend to the demands of the basin acceptably, with the exception of a few tributaries. In the Eastern Northeast Atlantic the situation is the most critical. Almost all of the sub-basins in this region have an availability to demand relationship of above 40%. The Sao Francisco water region also has a somewhat worrying situation in the sub-basins of the Velhas and Paraopeba rivers and some tributaries of the Paracatu (the rivers Preto, Sao Pedro and watercourse, Entre-ribeiros, and the Upper river Grande), as the majority of these rivers are found in the semi-arid region of the basin. Some basins in the East Atlantic also have difficulties fulfilling the water demand: among others – Vaza-Barris, Itapicuru and Paraguaçu.

Additionally, the basins near to urban centres present a more problematic situation, such as those in the Southeast Atlantic region (for example, the rivers Paraíba do Sul, Pomba, Muriaé, Guandu and the rivers that flow out into Guanabara Bay) and in Paraná (the rivers Sao Bartolomeu, Meia Ponte, some tributaries of the river Grande – the rivers Sapucaí, Turvo, Pardo and Mogi-Guaçu Piracicaba and Tietê, for example). Lastly, some basins located in the region of Uruguay are in a situation that requires a good management and intervention mainly due to the conflicts between uses of irrigation (the rivers Icamaquã, Ibicuí, Santa Maria and Quaraí, among others).



Availability/Demand ratio < 5% 10% 20% 40%



Figure 4 – Relationship between water demand and availability in the main watercourses (NWA, 2007)

There are also regions in the country where it can be seen that, despite having high natural water availability, the intense and disorganised occupation of the land has led to conflicts over the use of water – mainly with regard to questions linked to the quality required for particular uses. This is the case of the water regions of Paraná and Uruguay or the upper courses of the rivers Tocantins and Sao Francisco, in addition to a good part of the Southeast and South Atlantic water regions, where the conflicts for water use have, mainly, pollution problems or excessive consumption of water by irrigation.

In the above explanation, it must be highlighted that, despite Brazil having the largest quantity of fresh water available in the world at 12% of the total, there are serious

problems in the water offer for the various associated uses. These problems derive from elevated quantitative demands in relation to availability and the compromised quality of the water through pollution. The most visible result is that the marginal cost for dealing with urban demand for water in metropolitan areas around the world has greatly increased (Figure 5). One of the reasons for the increase in the marginal cost is the need to look for the source of water in neighbouring water basins to the needy region. Two important Brazilian metropolitan areas, Sao Paulo and Rio de Janeiro, supply their populations with water transferred from neighbouring basins. In the first case, 50% of the urban water supply comes from the basin of the river Piracicaba. On average, 33 m³/s is transferred, which in turn is no longer available to the metropolitan areas of Campinas and Piracicaba. In the second case, the water from Paraíba do Sul River is transferred to the Light System for hydroelectric generation before being dumped back into the river Guando. In this transfer, 65% of the water from the Paraíba do Sul (160 m³/s) no longer flows towards the upstream region of Santa Cecilia, which includes, among others, the cities of Barra do Pirai and Campos dos Guitazes.

The challenge for the management of water in Brazil is therefore linked to the argument of guaranteeing the water offer in water regions with low availability and with the improvement of water quality through the reduction of industrial and domestic pollution. The work undertaken by the environment sector with the system of command and control (fines) has resulted in the containment of industrial pollution. However, domestic pollution, in other words that produced by sanitation companies, is far from being resolved. Only 15% of domestic waste is treated before being poured into Brazil's urban rivers.

3. National Water Resources Management Policy and System

The National Water Resources Policy – NWRP established under Law n° 9,433/97 (Water Law) – has its primary objective as ensuring the necessary availability of water for current and future generations, with patterns of quality that are correct for the respective uses, at the same time that it seeks to prevent and defend against situations of

water and sustainable development crises through the rational and integrated use of the water resources.

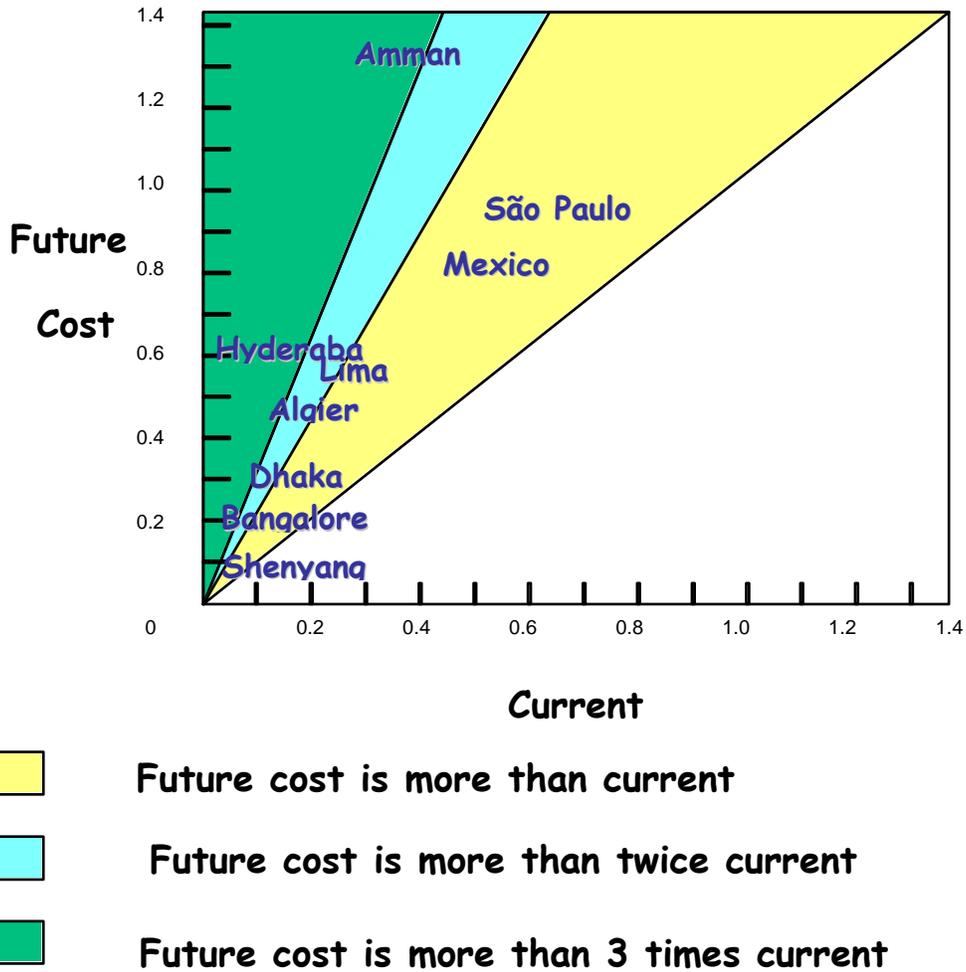


Figure 5 – Marginal cost for domestic supply in metropolitan areas (adapted from the World Bank, 2006).

The principles on which the national water resource management policy is based can be summarised in the following way:

- recognition of water as a public good with an economic value;
- guarantee of multiple use of water;

- priority for human consumption and animal farming in the use of resources in times of scarcity;
- adoption of the water basin as a territorial planning and water management unit: decentralised management;
- participation of the different levels of public power, from the users to civil society, in the decision taking process: participatory management.

The Water Resource Policy is guided by the following general action directives:

- systematic management of the water resources considering parameters of quantity and quality;
- conditioning the management of water resources to the physical, biotic, demographic, economic, cultural and social diversities of the different regions in the country;
- coordination of the water resource management with environmental management;
- coordination of the planning for water resources with that of the users sectors and with regional, provincial and national planning;
- coordination of water resource management with the management of ground use; and
- integration of water basin management with the estuary and coastal zone systems.

In order to improve the condition of water availability in quantitative and qualitative terms and with the intention of implementing the NWRP, the National System of Water Resource Management was created – NSWRM. This system, foreseen in the Federal Constitution of 1988, was regulated by Law 9,433 in 1997 and it entails an innovation as regards the environmental system in the sense that it uses economic mechanisms for the management of water. Through this system, the country is introduced to the polluter-payer and the user-payer. Water now has an economic value and its use is subject to a charge. This system (Figure 6) takes the federative character of the country into account and the possibility of societal involvement in the decision taking process. The Water Basin Committee was created and it includes members of the government, users and non-governmental organisations. The Committee is responsible for the management of the water basin once the basin plan has been passed and proposes the quantity to be charged for the use of water. Table 2 features the functions of each of the parties in this sophisticated management system.

The management tools advocated in Law 9,433 and available to NSWRM are: water basin plan, framework of watercourses, concession, charge for the use of water resources and information system.

The water basin plan needs an information system with data about water availability in terms of quantity and quality, in addition to the demands for multiple uses added per water basin. The basin plans are directive plans whose objective is to lay the base for and orientate the implementation of the water resource management policy at the level of water basins, defining the priority of uses and the investment programme for the development, recuperation and conservation of the water resources of the basin.

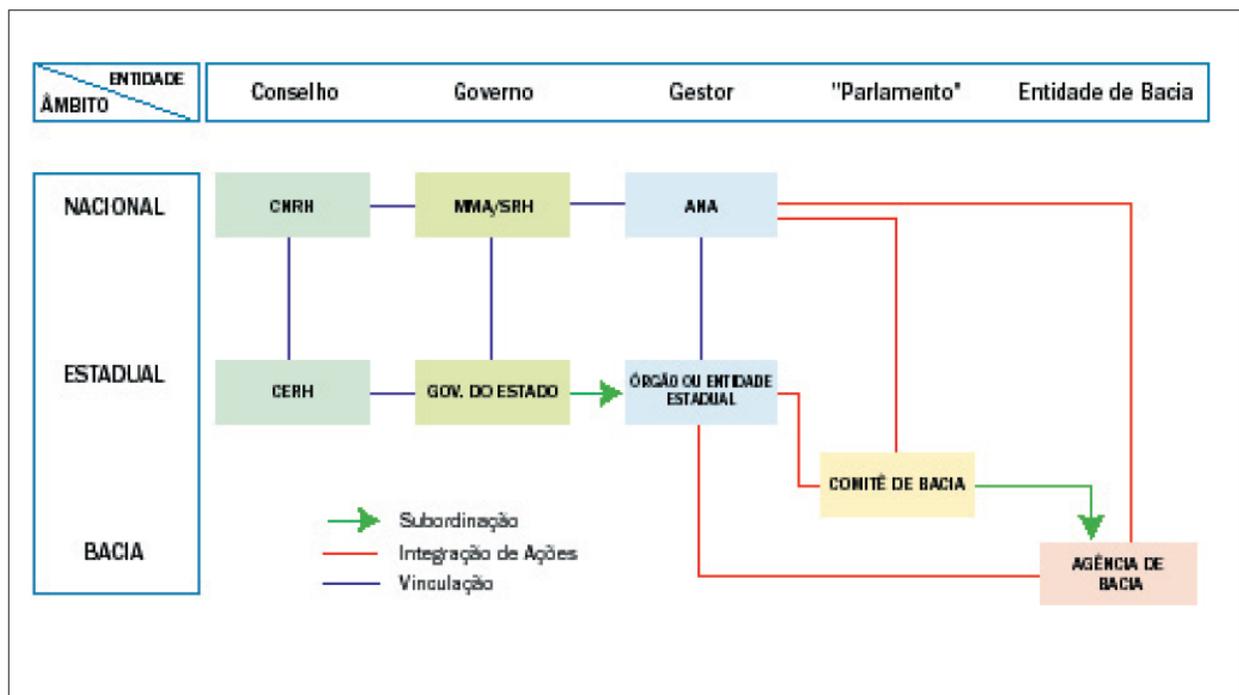


TABLE 2 – National System of Water Resource Management – NSWRM (Braga et al., 2006)

Entity	Function
National Council on Water Resources – NCWR	Chief body of the NSWRM, responsible for settling conflicts about use as a last resort and subsidising the creation of the national water resource policy.
Water Resources Secretariat	Federal entity charged with formulating the National Water Resource Policy, subsidising the budget formulation of the Union and acting as executive secretary of the NCWR.
National Water Agency – NWA	Regulator of water resources in rivers under the dominion of the Union and coordinator of the implementation of the NSWRM throughout the country.
Provincial Water Resource Council – PWRC	Chief provincial body responsible for settling conflicts about use in the area of the State and subsidising the formulation of the provincial water resource policy.
Provincial Water Resource Manager	Chief body and coordinator of the Provincial Water Resource Management System that has similar powers to the NWA, with the power of concession and inspection of the use of water resources in the dominion of the State.
Water Basin Committee – WBC	Collegiate committee constituted by public power, users and civil society with powers to pass the basin plan, follow up on its execution, establish charging mechanisms and suggest to the NCWR the quantities that should be charged.
Basin Agency	The executive arm of the Basin Committees and responsible for maintaining the water balance up to date for the availability of water resources, maintaining a registry of users, making the charges work, managing the information system and creating the basin plan.

The objective of the framework is to determine quality levels over time in the different stretches of the water network according to uses and the programmes and goals in order to attain these objectives. The definitions foreseen in this directly affect the concession undertaken on the dilution flows, which are – in turn – based on the quality levels established.

The concession is an instrument whose objective is to ensure the qualitative and quantitative control of the uses of water. It is the right of access to water or the entitlement for its use. The implementation of concession needs data relating to water availability in terms of quantity and quality and of the water users up- and downstream from the authorisation point from the information system.

Regarding the group of users subjugated to the demands of the concession, a charge is established for the use of water resources. This is the management tool that allows resources to be brought to finance the basin investment programmes, in addition to pursuing the rationalisation of water use objectives and the stimulus to not pollute.

The main objective of the information system is to produce, systemise and make available data and information that characterises the water conditions in the basin in terms of quality and quantity in its various uses. These last assume diverse possible forms of characterisation by maps of uses and land occupation, decline, surface vegetation and specific charges, referring to harnessing and launching in different areas in the water network indicated within the registry of water users in the basin.

4. Implementation of the NSWRM

In order to implement such a complicated system, it was necessary to create an institution that would have competence to act on a national basis. Law n° 9,984, from 17 July 2000, establishes the mission of the NWA as the implementation, within its sphere of power, of the National Water Resource Policy and the coordination of the National System of Water Resource Management (NSWRM), with special regard to the execution and operability of the technical and institutional instruments for the management of the water resources. Additionally, the NWA is charged with regulating water use in the rivers in the jurisdiction of the Union through the concession of the right to use and its inspection.

The activity of the NWA conforms to the bases, objectives, directives and instruments of the National Water Resource Policy, particularly in the adoption of the water basin as a unit of territorial planning and management of water resources, and it develops in coordination with private entities and organs that form part of the NSWRM.

The NWA also plays the, no less important, role of induction of the processes through the definition of strategies for the establishment of mechanisms of coordination and cooperation – independently of the location of the watercourses. Above all, and in accordance with Law nº 9,984, some of the functions of the NWA must be highlighted:

- supervising, controlling and evaluating the actions and activities derived from fulfilling the federal legislation relating to water resources;
- regulating, in terms of standards, the implementation, operability, control and evaluation of the instruments of the National Water Resource Policy;
- creating technical studies to contribute to the definition – on the part of the National Water Resource Council – of the quantities to be charged for the use of water resources in the area of the Union, based on the mechanisms and amounts suggested by the Water Basin Committees;
- stimulating and supporting the initiatives aimed at creating Water Basin Committees;
- implementing, in coordination with the Water Basin Committees, the charge for the use of water resources in the Union area;
- collecting, distributing and applying amounts obtained through charges for the use of water resources in the Union area;
- planning and promoting actions aimed at preventing or minimising the effects of droughts and flooding in coordination with the main body of the National System for Civil Defence, helping the States and Municipalities;
- promoting the creation of studies to contribute to the application of financial resources in the Union for work and services in the standardisation of watercourses, the locating and distributing of water, and the controlling of water pollution, in accordance with that established in the water resource plans;
- defining and inspecting the operating conditions for tanks on behalf of public or private agents, with the intention of guaranteeing multiple use of the water resources – as per the water resource plans in the respective water basins;
- promoting the coordination of the activities developed in the national hydro-meteorological network, in coordination with the public and private entities and organs that form part of it, or are users of these;

- organising, introducing and managing the National Water Resources Information System;
- stimulating the recruitment and training of human resources for the management of water resources;
- giving aid to the States in the creation of water resource managing organs;
- proposing to the National Water Resource Council the establishment of incentives – including economic ones – for the qualitative and quantitative conservation of water resources.

From the point of view of its organic structure, the NWA is directed by a Collegiate Board comprising five members nominated by the President of the Republic and ratified by the Federal Senate, with non-coinciding mandates of four years – with the possibility of re-election only once. In order to provide technical support to the decisions of its Board, the NWA has subject matters that it oversees.

5. The challenge of management by water basin

The great challenge to the implementation of the NSWRM in a federative country like Brazil is the existence, within the same water basin, of rivers administered by the States and by the Union. The autonomy of the States brings about situations such as that which can be seen in the basin of the Paraíba do Sul river, where the Basin Committee decided on the charge for the use of water, the NCWR approved the quantity, the Union implemented the charge in rivers in its zone and some States have still to implement the charge on the rivers within their zones. This asymmetry is a risk to the system.

Shared management of the water resources requires, of necessity, compatibility in the different conflicts of interest. It requires, among other aspects, the creation of institutional areas that are adequate for the resolution, negotiation and overcoming of the problems and the great gaps that exist in the legal-judicial formats. These areas are created from the inter-relation of multiple factors, among which the following are decisive (Pereira, 2003):

- A common tendency in the objectives;

- An understanding on the part of all the players of the questions and challenges included;
- The creation of bonds of trust through a management process that is ethical, transparent and democratic, that leads to equity, rationality and efficiency in decision making; and
- The creation of a sense of identity with the basin, a sense of unity of harmonious acts, of co-responsibility and of co-dependence.

In order to establish the minimum homogenous conditions in concession, inspection and charging criteria in the area of the water basin, the NWA has created the body of the *integration agreement*. This agreement – a pact between the NWA and the States under the supervision of the Basin Committee – is the commitment between the federal entities to work together to implement the management tools advocated in Law nº 9,433/97. However, the integration agreement is not enough to guarantee the sustainability of this introduction. Some states do not have an institutional apparatus that is compatible with the needs of this new and complicated management system. Therefore, the NWA has also created the body of the *cooperation agreement*, through which the regulatory agency provides technical and financial support to the state to face up to the challenges of decentralised, participatory management. In addition, it is necessary to establish a *management contract* between the federal or provincial body that manages the area of water, so that the financial resources collected by the Union or by the States can be transferred on to the Basin Agency. This multi-institution order is shown in Figure 7.

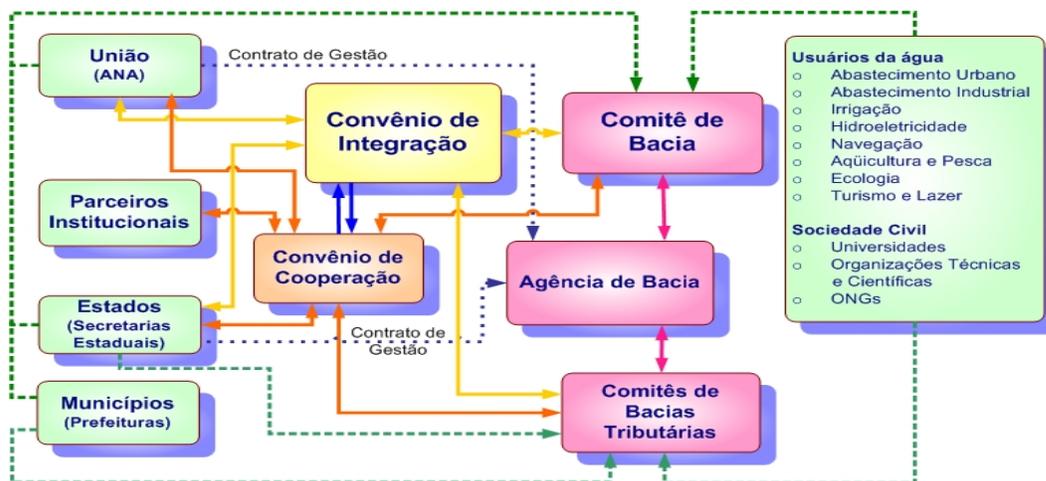


Figure 7 – Organisation of the Water Resource Management in the water basin (NWA, 2004)

6. Case study: Water basin of the river Paraíba do Sul

With a drainage area of nearly 55,400 km², the water basin of the river Paraíba do Sul reaches along the Southeast Region, covering the Paraíba Paulista Valley (13,500 km²), the Mata Mineira zone (20,900 km²) and nearly half the State of Rio de Janeiro (21,000 km²) (Figure 8). Despite its lack of territorial size – barely 0.7% of Brazil and just 6% of the Southeast Region – the Basin is one of the most industrial areas in the country, contributing nearly 10% of the Brazilian GNP, and supplying approximately 14 million people with drinking water – including more than 8 million inhabitants in the Metropolitan Region of Rio de Janeiro, located beyond the boundaries of the basin.

The great water power of this basin is used primarily for public supply and, then, for other uses such as the generation of electricity, industrial uses and irrigation. Fishing, leisure and tourism have little presence, though there is great potential for their development; on the other hand, water transport has never been important nor are there good sailing conditions on the basin.

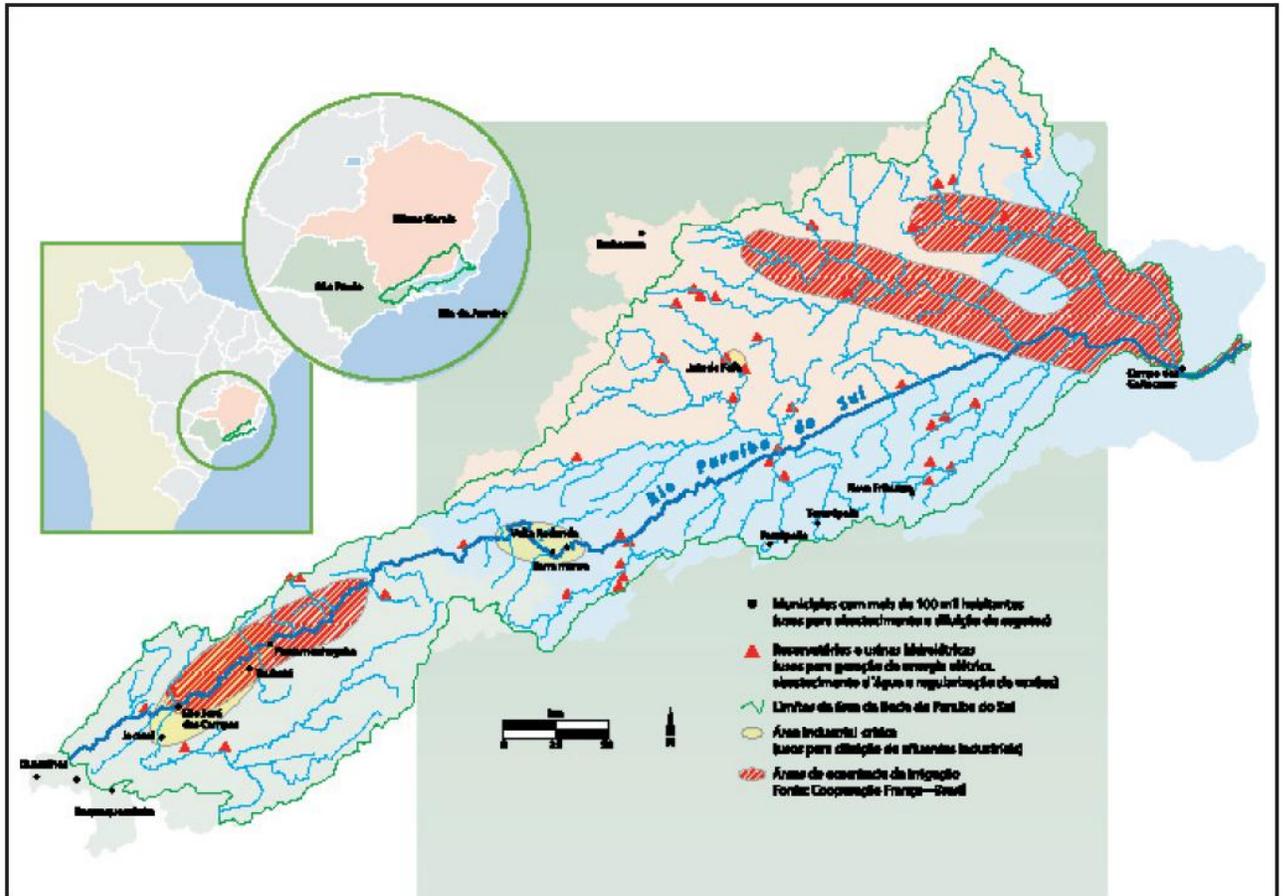


Figure 8 – Basin of the Paraíba do Sul: location and main uses (PEREIRA, 2003)

The main user of the basin is the Light System which, through a water transfer system between basins, uses nearly two-thirds of the average flow of the Paraíba do Sul in its middle stretch together with everything from one tributary (river Piraí) to generate electrical energy in the Hydroelectric Complex in Lajes on the Atlantic slope of Serra do Mar. This transfer generates a serious water offer in the receiving basin of the river Guando, which has become the main source of water supply to the Metropolitan Region of Rio de Janeiro and to various industries and thermo-electric generation factories located in the area. Table 3 presents the main uses of water in the Basin.

TABLE 3 – Main uses of water from the basin of the Paraíba do Sul (PEREIRA, 2003)

Uses	Harnessed (m ³ /s)		Consumed (m ³ /s)	
Public supply	16.84		3.37	
Industrial	13.65		6.19	
Farming	Irrigation	49.73	Irrigation	30.28
	Livestock	3.45	Livestock	1.73
Transfer to Light System	Up to 180		Up to 180	
TOTAL	83.67		41.57	
Including transfer	Up to 263.67		Up to 221.57	

Source: COPPE (2002)

The development of farming and urban-industrial activities has meant an accumulation of environmental problems that are growing year on year, showing themselves in damage to the quality of the water resources. Diagnoses already undertaken in the basin point out serious problems in all the environmental aspects that could be taken into consideration, from the scarcity of woodland (reduced to 11% of its original size) to the pollution of the water due to dumping of domestic and industrial waste that has been inadequately treated, to the wearing out of the productive capacity of the lands – degraded by the generalised erosion in the basin. The disorganised urban growth on the steep sides and the banks of the rivers have created a number of situations at risk of land slips and flooding. The main conflict linked to the waters of the basin concerns the transfer of water from the basin of the river Paraíba do Sul to the Light System.

6.1 Organisation of the basin: shared management

At first sight, the gravity of the current problems in the basin of the Paraíba do Sul contrasts with its history of trying to implement integrated management – something that dates back to the thirties. In fact, a number of initiatives have had great significance in the management of the main problems in the basin and have left a serious legacy in terms of knowledge of the characteristics and problems related to water and the predisposition of the main players to organise its defence. However, these initiatives have not been enough

to anticipate or face up to the size of the original impact of the accelerated urbanisation and industrialisation processes – above all between 1950 and 1980 – at a substantially greater rhythm than the attempts at conserving, protecting and recovering the basin of the Paraíba do Sul.

From the mid-nineties, the basin of the Paraíba do Sul has experienced an intensive mobilisation process about its waters, translated into the creation of a number of basin organisms in the area of the current dynamic that is the implementation of new management systems. This is a complex process, in large part due to the double dominion that is imposed by the cohabitation in the basin of four different management systems: national systems, and those of the States of Sao Paulo, Minas Gerais and Rio de Janeiro. The content of the different laws were similar in their beginnings – tools for management and political-institutional order – but the differences in the rhythm of implementation have been significant.

These different dynamics are reflected in the internal institutional order of the basin of the Paraíba do Sul, as shown in Figure 7, which nowadays has various basin organisms that originated, thus, from different organisational processes:

- In 1994, in the State of Sao Paulo, the first of the new basin bodies for the basin of the Paraíba do Sul was created: the Water Basin Committee for the river Paraíba do Sul (WBC-PS) or “Paulista Committee”, which covers the whole of the Paulista land in the basin;
- The Committee for the Integration of the Water Basin of the river Paraíba do Sul (CIWBPS) was born out of an inter-provincial coordination with the Union, prior to the passing of Law nº 9,433/97, and it stands for the legislation and regulation of the federal sphere.
- The Committee for the Water Basins of the rivers Pomba and Muriaé, federal tributaries of the Paraíba do Sul was created in 2001 from the demand of the inter-municipal regional consortiums and is, equally, under federal jurisdiction;
- The Committee for the sub-basin of the rivers Grande/Dois Rios, formally being in creation since 2001, will form part of the management system of the State of Rio de Janeiro;

- In a distinctly regional process – as these are spontaneous support bodies which do not have anything to do with the water laws – several inter-municipal consortiums and users associations were created from 1997 in sub-basins or stretches of basin. Returning to the topic of water and the environment, these basin bodies are created as standard regional spokesmen in the management process. These are: Inter-municipal Consortium for the Environmental Recovery of the basin of the river Muriaé (1997), Inter-municipal Consortium for the Environmental Recovery of the basin of the river Pomba (1998), Association of Water Users in the Environment of Paraíba do Sul (2001), Inter-municipal Consortium for the Environmental Recovery of the basins of the rivers Bengalas, Negro, Grande and Dois Rios (2001), Inter-provincial Consortium for the Recovery and Conservation of the basin of the river Carangola (2001) and the Inter-provincial Consortium for the Recovery and Conservation of the basin of the river Paraíba (2002).

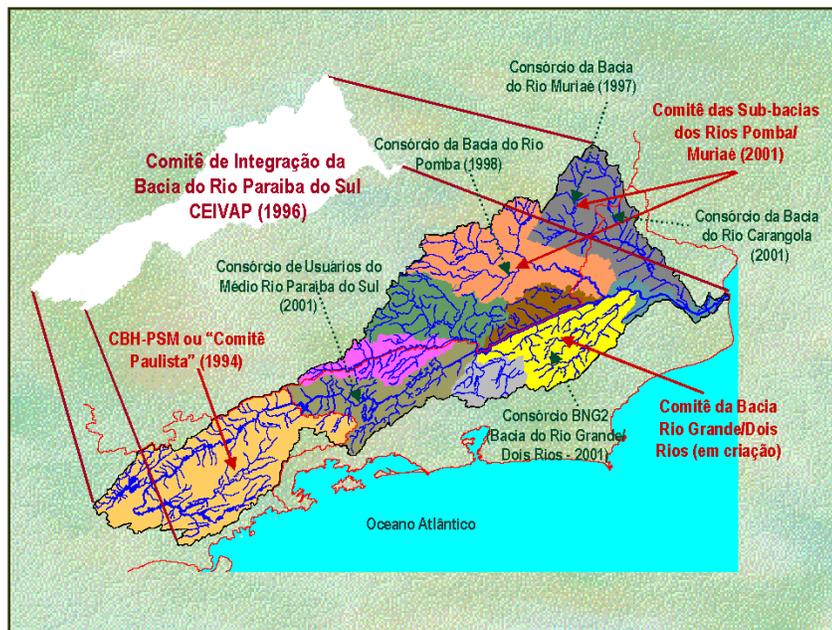


Figure 9 – Basin of the river Paraíba do Sul: basin bodies (PEREIRA, 2003)

The institutional mosaic that is being created shows that the local players are interested in the development of their water resources and their protection and recovery.

Within their specific interests, and to a greater or lesser degree of intensity, all of these organisms have created windows of information, training and discussion about the principles and tools for the management of the water resources.

However, the multiple fronts equally require a necessary harmony in the joint actions, while respecting the autonomy of each basin body. This is one of the challenges in shared management that is currently being faced in the management of the basin of the Paraíba do Sul. In this context, the role of CIWBPS stands out; in addition to being formed as the primary institutional application for the Basin as regards the planning and management of the water resources, the CIWBPS – as an integration committee – has an important role in the discussion process and in the search for commitments in the implementation of integrated management in the Basin.

6.2 – Creating the management pact: CIWBPS, NWA and States

Faced with the diverse rhythms and abilities of each of the management systems included in the basin of the Paraíba do Sul, the implementation of shared management has been undertaken gradually. Until the end of 2000, the advances occurred primarily in the creation of basin committees and in the development of diagnoses and planning studies. From then on, the implementation process of the management tools has received a great push with the decision of the CIWBPS to begin charging for water use in the Union area including, above all: the regulating of water use (registry and concession of licence), the standardising of the charge for different users, the creation of the water resource plan for the initial charging stage and the creation and installation of the CIWBPS's Basin Agency.

All of these activities require systematic and harmonious action on the part of all the players involved in the management of the basin of the Paraíba do Sul – in other words, the establishment of a management pact as regards the respective functions and competences. As for the CIWBPS, their activities were given great impetus from 2001 with the decision to make the basin management operative, in the short term, with their primary function being the implementation of the charge for water use. In this process, the CIWBPS has to take important decisions as part of its functions, such as for example:

- establishing a methodology and criteria for the charging for the use of water resources and suggesting quantities to be charged by the requisite bodies;
- proposing numerous minor uses for the collecting, diverting and launching of effluents with a view to the exemption of necessity for a licence or charge;
- proposing directives for the creation of a Water Resources Plan for the initial charge stage in the basin of the Paraíba do Sul, making it compatible with the plans for the sub-basins, passing it and following up on its execution;
- passing the investment plan agreed in the Water Resources Plan for the application of the financial resources coming from the charge; and
- creating the Water Agency for the Basin of the Paraíba do Sul, jointly with the NWA, which should be the executive arm of the CIWBPS.

Therefore, the NWA, the States of Minas Gerais, Rio de Janeiro and Sao Paulo and the CIWBPS concluded, in March 2002 and with a duration of five years, an Integration Agreement whose objective was the integrated management of the basin of the Paraíba do Sul – wherever it might be in that basin – through a technical and institutional integration for the introduction and operability of the water resource management tools, so that the water basin would be consolidated as a single territory for planning and management. This was the tool used to create harmony between the NWA, the States and the CIWBPS as regards the criteria and procedures adopted, above all in the area of water resource plans, the registry of uses and users, the licensing for the right to use water resources, the charge for water use, the information system concerning water resources, the inspection of the uses of water resources and their quantitative and qualitative monitoring, and the development of training activities for human resources.

6.3 - Implementation of the management tools

The management tool implementation in the basin of the Paraíba do Sul was pushed forward significantly by the decision of the CIWBPS to begin the charges in the waters under Union dominion. In fact, the operability of the charge had a prior condition by which other closely linked management tools were put into operation immediately – basin plan and use regularisation – as well as the creation and installation of the Basin Water Agency (CIWBPS Deliberation n° 08, 6 December 2001).

In the short term, the strategy adopted for the implementation of these management tools went through a series of simplifying proposals. Its conception began a period of difficult discussions and negotiations, becoming a real challenge in technical, political and institutional terms. The great plus in the process was the consensus established between the bodies (public managers, users and civil society), which was the result of numerous discussions in the Technical Chambers and in the full session of the CIWBPS, based on studies and reports developed especially for the proposed task.

The main sections that formed part of this strategy were the following:

- adoption of a simplified charge equation, including collecting, consumption and dumping of effluent (DBO_5), wherein the untreated effluent was charged for but not by diluted volume – allowing the possibility of making a distinction, in the initial stage, between the charge and the classification or establishment of river decontamination goals;
- creation of the Basin Water Resources Plan from the pre-existing studies, making use of two of the other management tools, namely: the information system, which had been developed over many years for the various basin management projects, and the classification of the watercourses according to types of use – which came from environmental legislation. The plan basically comprises an Investment Programme which covers a group of structural and non-structural interventions, as well as proposals for the development of studies and technical management tools;
- in a new way, the development and implementation of a broad regularisation of uses process based on public notification, in the Union's Official Paper and by a self-registry of the users. The primary objectives of the process were licensing and the charge. The declaratory-obligatory registry of users has acted as a license

- requirement whose introduction has been performed – at all stages – by a joint process between the Union and the states. Its specific orientation and all the steps were discussed in the Technical Chambers and were passed by the CIWBPS, with the participation of the Federal Government and the three provincial governments. The regularisation was a joint decision by all four of these bodies and implemented as a single integrated process across the complete basin. The process had a system that allowed the self-registration of nearly 4,500 users, of whom 81% performed their declarations through internet. A large advertising campaign was launched – announced through the main media bodies (radio, television and local newspapers) – with the intention of informing users;
- the effective beginning of the charge came about from the registry that was part of the regularisation process for all users subject to licenses – independently of their previous concession.

6.4 – Paraíba do Sul Basin Water Agency

In addition to being organised as a functioning and integrating organism for discussions and definitions related to the implementation of water resource management in the basin of the Paraíba do Sul, the CIWBPS became the first Basin Committee to pass measures and suggest quantities to be charged for water use. The implementation of the charge in 2003 led to the creation of the Paraíba do Sul Basin Water Agency (PSBWA), as per article 42 of Law nº 9,433/97. However, the legal regulations to allow it to be applied were not present. In 2003, through deliberations of the CIWBPS, it must be pointed out that the NWA delegated the function of being able to directly apply the resources derived from the charge in the basin – a total of nearly R\$ 5.8 million – in accordance with the Investment Programme passed by the CIWBPS.

On 11 February 2004, the President of the Republic published Provisional Measure (PM) nº 165 in which the Management Contracts created between the NWA and the delegate entities for the functions of the Water Agency were regulated, under the terms of article 51 of Law nº 9,433/97. On 9 June 2004, PM nº 165 became Law nº 10,881, by which the Management Contracts created between the NWA and the delegate

entities for the functions of the Water Agency were regulated for the management of water resources in the dominion of the Union. Shortly after, on 20 August 2004, the NWRC published Resolution n° 38 which delegated competences in the PSBWA for exercising of functions inherent in the Paraíba do Sul Basin Water Agency – which was legally consolidated by the creation of a Management Contract.

Law n° 10,881/04 satisfactorily resolved the regulation matters to do with Water Agency constitution, guaranteeing the delegate agencies with Water Agency tasks the resources derived from the charge for water use – eliminating the possibility of either a delay or non-payment.

The PSBWA Management Board met in August 2004 and it passed the Management Contract and the Work Programme. In addition, in separate meetings both in the PSBWA General Assembly and the Full Meeting of the CIWBPS, the Management Contract was endorsed. The text passed had the objective of the Management Contract as reaching the goals in the activities that would be performed as part of the role of the Water Agency by the PSBWA, fully explained in the Management Contract Work Programme. In particular, the Work Programme takes into account in detail the macro-processes (strategic objectives), goals and results that will be achieved by the PSBWA, measured by means of performance indicators.

The Management Contract guarantees the return of the financial resources collected in the Basin, per a schedule of monthly payouts. It also establishes the rules that should be respected by the PSBWA, published by the NWA, for the selection and recruitment of personnel and for the purchasing and hiring of work and services by the PSBWA.

7. Final Considerations

Two basin committees are working: that of the river Paraíba do Sul – which covers the States of Sao Paulo, Minas Gerais and Rio de Janeiro – and that of the rivers Piracicaba, Capivari and Jundiaí – which covers Sao Paulo and Minas Gerais. In these water basins there is a plan of action, a charge and an information system implemented. The results of the charge in operation by the NWA and by the DAEE (provincial

management body for Sao Paulo) for the basins of the rivers Piracicaba, Capivari and Jundiaí has already reached an annual total of over R\$ 10 million. These resources have been used to construct the Waste Treatment Plants – WTP – helping, in this way, to improve the water quality in the basin.

It is worth highlighting the work of the National Water Agency – NWA – in the area of improving the quality of the water in Brazilian rivers. In 2001, the NWA launched the WBDP – Water Basin Decontamination Programme. This programme, also known as the Treated Waste Purchasing Programme, subsidises municipalities with federal resources for the construction of WTPs in an innovative way. Instead of handing over the financial resources prior to the construction of a WTP, the municipality receives the resources only once the plant is working correctly, through quarterly payments. The subsidy is the equivalent of 50% of the total cost as estimated by the NWA. The guarantee that the municipalities have of receiving these quantities from the NWA allows them to apply for loans from official financial agents. This programme promotes technological innovation and combats corruption. By 2004, 37 new treatment plants had been constructed, with a total investment of R\$ 272 million, thanks to the catalysing effect of the WBDP. In 2007, more than R\$ 40 million were applied as part of the programme.

It is hoped that through the use of the nature programmes of the WBDP, the country will be able to keep up with the commitment taken on during the Millennium summit in Johannesburg in 2000. On that occasion, the countries belonging to the United Nations signed a document committing them to reducing the number of inhabitants with no access to drinking water and sanitation by half by the year 2015. The Brazilian situation is acceptable as regards the water supply but the areas of channelling and treatment of domestic effluent lacks investment and adequate programmes to fulfil this international commitment.

Lastly, it is important to point out that global changes – in particular those related to climate variability – are going to put forward serious challenges for the management of resources in the world in general, and in our country in particular. The predictions of more extensive droughts and more intensive flooding in studies by the IPCC – Intergovernmental Panel on Climate Change – imply direct consequences in the

definition of the most flexible water infrastructure and more efficient and effective consumption patterns. Additionally, the non-seasonality of the water series as a result of the climate change process will require new statistical models for the definition of this water infrastructure. This is a challenge which the world water science must rapidly respond to so that the long term decisions can be taken as soon as possible.

References

NWA, 2007 National Water Agency (NWA). Availability and demands on water resources in Brazil, Brasilia. (ANA, 2007 Agencia Nacional de Aguas (ANA). Disponibilidad y demandas de recursos hídricos en Brasil, Brasilia.)