

# SOME THOUGHTS ON WATER MANAGEMENT AND INITIAL ALLOCATION OF WATER RIGHTS IN CEARÁ, BRAZIL

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## **Abstract**

*The State of Ceará is located in the Northeast of Brazil, characterized by a semi-arid climate, with a pronounced time and space variability on its rainfall distribution. As recurrent droughts have been plaguing the region, it was created a culture of storing water in reservoirs as much as possible. However it is has been shown that, in spite of the large number of reservoirs built all over the State, a considerable volume of the natural discharges keep on flowing to the ocean. The main reason for that reservoirs low efficiency comes from the high variability of rivers' inflows.*

*After years practicing a water resources management based only on supply side, Ceará State's current water policy emphasizes the demand side, including legal water rights, charging, educational campaigns and the decentralized decisions through the users' participation incentive in rivers basins committees. This policy is carried out by Secretariat of Water Resources (SRH), which motivates, analyzes and formalizes the requests of water use rights, and the Company of Water Management of the State (COGERH), which acts as a catalytic agent in the support activities to the users' organization in river basins.*

*This paper shows how Ceará is dealing with the water rights initial allocation - once they never existed in Ceará - and analyses the obstacles and challenges of that new way of managing water in the State.*

*Keywords: Water Management, Initial Allocation, Northeast Brazil, Water Rights.*

## **1. Introduction**

The State of Ceará, with a total area of 148,016 km<sup>2</sup>, is inhabited by approximately 6,2 million people. Its climate is typically semi-arid, with a pronounced time and space variability on its rainfall distribution. The average precipitation for the State, in a normal year, is 800 mm, where the annual evaporation is around 2,000 mm. The rainfall varies from 400 mm in Sertão to 1,200 mm on the coast. About 90% of the rainfall happens in February to May.

Since there are no perennial rivers in Ceará, the only way to provide water for all needs, during dry season, is from the stocks of water accumulated in surface reservoirs during the wet season. Campos et. al. (1999) showed, however, that, even with a high degree of surface control of hydrographic basin by reservoirs, a great part of the inflows over the controlled area keep on going to the sea. This paradox, high control of surface with relatively low control of mean discharges, comes from the high overyear variability (CV ~ 1.3) of the rivers' annual discharges.

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Despite extensive efforts by the State and Federal Government in improving water infra-structure in Ceará all over this century, some serious water shortages has been happening in the last few years; population growth and urbanization are key factors underlying these problems. By 2,020, the state's population will probably reach 9 million inhabitants – 82% located in urban areas – increasing, even more, the pressures for water, for all purposes.

## **2. Water Management in Ceará**

There are two approaches under which water resources management can be conveniently considered: *supply management* - which covers those activities required to locate, develop, and exploit new sources - and *demand management* - which addresses mechanisms to promote more desirable levels and patterns of water use (Bhatia, et. al.,1994).

Until recently, supply side dominated water resources management practices in Ceará. These actions, taken initially by the Empire and followed by the Federal Government, started in 1877, when whole Brazilian Northeast Region was devastated by a severe drought. From that date, up to the end of the third quartile of the current century, the water policy in Ceará contemplated, mainly, the formation of a hydraulic infrastructure. This policy was implanted on two great lines: the big and medium reservoirs, built with public money, were used for irrigation, pisciculture and domestic water supplies - eminently public actions. The small reservoirs, otherwise, also built by Government, but in cooperation with private landowners, had a private character, but with free access for the surrounding populations. As new water-supply sources have become less accessible, and as developing them has become more expensive and less acceptable environmentally, managing demand has taken on increasing importance in Ceará.

The change in the way of managing water in Ceará is a long term process, but certainly had its bench mark in 1988 - by Federal Constitution promulgation - which enlarged the power of the states. Up to 1988, the water administration in Ceará was defined and executed by the Federal Government, through the National Department of Works to Overcome Droughts (DNOCS), which had the legal domain of reservoirs built with federal money – which are, still now, the most important ones.

After 1988, the State Government started to influence and act directly in the water sector in Ceará. From 1988 to 1990, the Water Resources State Plan was developed, in which a new philosophy of water policy was inserted, strongly influenced by new water resources' paradigm. This broad strategy includes legal water rights implementation, charging – to get the message that water is a economic good, educational campaigns and decentralized decisions, through users' participation incentive in rivers basins committees.

The water policy in Ceará is attribution of the Secretariat of Water Resources (SRH) - which motivates, analyzes and formalizes the requests of water use rights. The State Water Management Company (COGERH) acts as a catalytic agent in the support activities to the users' organization in river basins.

## **3. The Initial Water Rights Allocation**

Once customary water rights never existed in Ceará, three basic questions appear in the process of water resources management: who will grant the water rights, which is the maximum volume that can be allocated and who will receive the initials rights.

## ▪ **The competence to grant the water rights**

The ownership of the water resources in Brazil is defined in the Federal Constitution. According to Article 20 §3, the lakes, rivers and any water courses on lands under federal authority, or those that flow through more than one state, serve as frontier with other country, or flow into or originate in other country, as well as marginal lands and riverine beaches are property of the Union. Article 26 §1 says that surface or underground water, flowing, emerging, or in deposit, except those from works owned by the Union, belongs to the states.

Once almost all rivers in Ceará flows inside its frontiers – being, so, state properties - the concession of right of using this water is state's competence - through SRH. The only exception is Poti river basin, which extends to Piauí, being under federal jurisdiction.

However, as all rivers in Ceará are intermittent, they had to be regulated by dams, almost all built by Union. This fact leads to an interesting situation: water resources are under state jurisdiction while they are flowing, but under federal jurisdiction while in stock in reservoirs owned by Union. So, the question is: which institution – state or federal – has the competence to grant the right of use of the water stocked in those reservoirs and in the rivers regulated by them?

The Federal Law nº 9,433/97 may probably undo these competence conflict once it says in its Article 4º that " the Union and the States will be articulated on water resources management of common interest " and in its Article 14 §1º that the " Federal Government can delegate to the States the competence to grant the right of use of the water resources under federal authority", consolidating the trend of strengthening the states power and the existence of a unique manager.

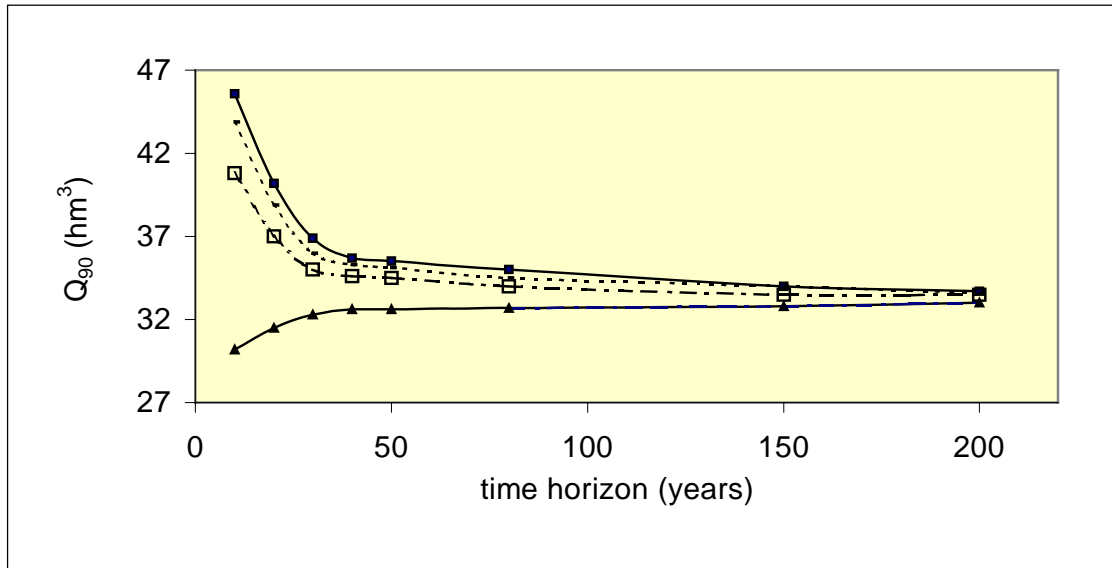
## ▪ **The maximum volume that can be allocated**

The crucial point in water resources management is the determination of the amount of water that can be effectively allocated. If technical approach is used, small amounts are going to be adopted as reference. Otherwise, if political approach is followed, there will be probably a trend of increasing the volume of water to be granted, which, obviously, will decrease the reliability level.

According to the State Decree nº 23,067/94, the maximum amount of water that might be granted is 9/10 of the reservoir yield with 90% of reliability -  $Q_{90}$ . However, the high values of the coefficients of variation of the annual discharges cause an immense variability on  $Q_{90}$  values (Campos et al., 1997), which implies that this unique value is certainly not an efficient estimator of the real system's availability.

Stuart and Campos (1999) studied the uncertainties involved on reservoir annual yield ( $Q$ ) determination and showed that several parameters intervene in that process. They were: reservoir capacity ( $K$ ), reservoir initial storage ( $S_0$ ), mean annual inflows ( $\mu$ ), coefficient of variation of annual inflows ( $CV$ ), mean evaporation depth during the dry season ( $Ev$ ), reservoir shape factor ( $\alpha$ ), time horizon adopted ( $H$ ) and reliability ( $G$ ). Just to show the influence of only two of those parameters on reservoir annual yield with  $G = 90\%$  ( $Q_{90}$ ), they simulated the behavior of Caxitoré Dam, in Ceará, for different values of  $S_0$  and  $H$  (Figure 1). It was considered:  $K=202 \text{ hm}^3$ ,  $CV=1.2$ ,  $\mu=126 \text{ hm}^3$ ,  $Ev=1.2 \text{ m}$  and  $\alpha=14.3 \times 10^3$ . The initial storage assumed values equal to  $K$ ,  $K/2$ ,  $\mu/2$  and empty, and  $H=10, 20, 30, \dots, 200$  years.

For H=200 years, the values assumed by  $Q_{90}$  were very similar, no matter the initial storage used – they range from 33,7 to 33,0 hm<sup>3</sup>, a difference of only 2%. For low values of H, otherwise, the results were quite different. Assuming H=30 years, a very common value in hydrological studies,  $Q_{90}$  assumed values from 36,9 hm<sup>3</sup> (starting full) to 32,3 hm<sup>3</sup> (starting empty), a difference of 12%. For H=10 years, the results were even worse: they varied from 45,6 hm<sup>3</sup> to 32.2 hm<sup>3</sup> (a difference of 30%).



**Figure 1.** Values of  $Q_{90}$  of Caxitoré's Dam for different values of time horizon and initial storage. (Source: Studart and Campos (1999))

#### 4. Water Rights Initial Allocation Process in Ceará

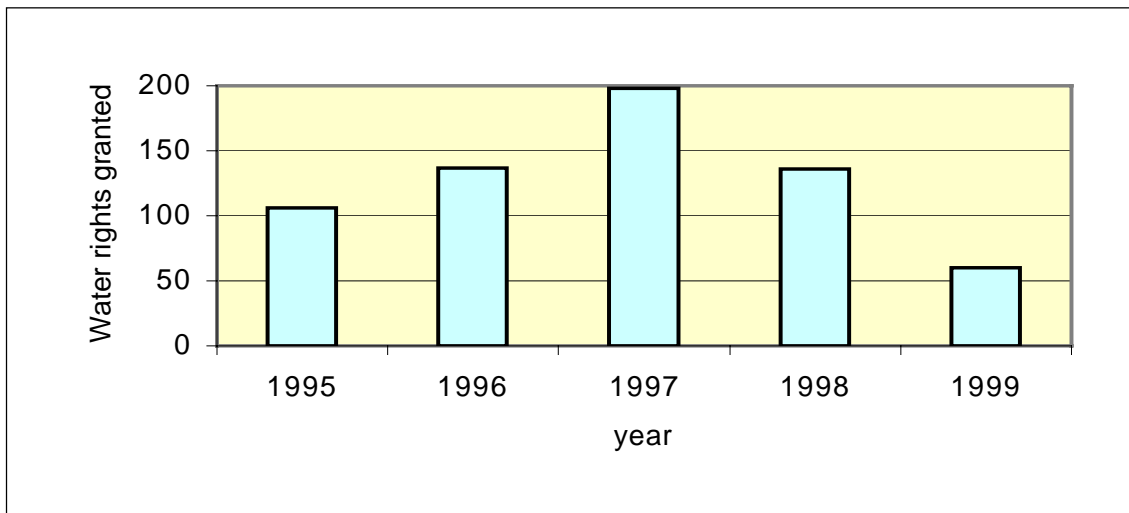
Formal rights never existed in the state, but its perception still does. Many users have the opinion that their rights were acquired by historical use (Kemper, 1996).

Initial allocation of water use rights in Ceará is in its very beginning. The culture of water being a free access resource is very strong in the State's rural area. SRH is trying, in that first moment, to make the users aware of the importance of the water right formalization in the near future.

Some parameters were already defined: personalized right, not transferable and absolute quantification of the granted amount. The uncertainty inherent to it is reflected in the tiny periods of validity, in general around 6 months to 1 year.

There are not also complete information about demand – COGERH is making now a comprehensive water users census - irrigated areas, cultures and irrigation methods and is also implementing a water measurement program, both in Jaguaribe Basin, the larger in the State.

During the five years that followed the publication of State Decree n° 23,067/94, 637 water requests were formalized by SRH, temporally distributed as shown in Figure 2.



**Figure 2.** Water rights granted by SRH during the years of 1995, 1996, 1997, 1998 e 1999 (up to October/99). (Source: SRH)

The small number of requests may be attributed to the lack of understanding of the need of formalizing the water right as a way of assuring its future access. Undoubtedly, the state decree that instituted the charging for water use in Ceará really influenced the user to do not request the water right and do not renew old solicitations.

## 5. Obstacles to the Modern Water Administration

The formal institutional arrangements for the new way of water administration seem to be very clear, and logical, in the technicians' perception. However, it is necessary to observe the local population's informal and cultural arrangements. Some obstacles have to be overcome, such as:

- **Ignorance about the amount of water volume consumed** - The users ignore the volume of water they use. The lack of information, both from consumer side and manager side constitutes, without a doubt, a serious obstacle for an efficient water demand management.
- **Low organization level** – The users are mostly poor and unorganized farmers, and therefore, a very weak and politically unimportant group.
- **The user's perception on droughts** – Curiously, drought had always been seen as an emergency situation; however, technical studies show that, even in normal years, water shortages may happen if the stocks are inadequate managed.
- **Water rights perception** - Users believe that the ownership of water rights is based on their historical consumption and not on the bases defined by law. In public irrigation projects, there are old contracts made by DNOCS in which irrigators have the right to land and water. Although those contracts don't specify the volume to be diverted, they assure the right of receiving water.

## 6. Challenges to the Basin Committees

User's participation in the decision process constitutes one of the foundations to the new water administration policy. However, the willingness to participate by the users and the acceptance of the users' participation by local political leaderships are the real challenges.

The public's participation may happen in two main aspects: first, in the definition of new hydraulic structures that could be built in the basin; second, in the operation rules of the basin reservoirs.

Referring to public participation on the priorities of new hydraulic structures construction, certainly there is a lot to improve. This role was historically played by local politicians, which won't accept to lose this power so easily. Therefore, in a short run, it should not be expected a high level of public participation.

On the other hand, in respect of managing the stocks of water in reservoirs, the public have been already participating in annual seminars, at the end of the rainy periods. That aspect has been constituting the main difference from the new and the old water policies in the State. The user participation are even important in dry years. This mechanism must be understood as the way for a future broad public participation.

## 7. Conclusions

The main water problems in the Ceará come from the relative hydrological stress and the accentuated growth of water demands. The solution must pass by a cultural changing in understanding the water as economic and scarce good and the real importance of popular participation. Although much progress has been achieved in the last ten years, there is a long way to travel. There is still a great gap between theoretical models and what the local practice allows and it is capable to absorb.

In those aspects, there are big challenges for the Water Agency (role played by COGERH) and basin committees. The first one must act as a public participation's inductor and give technical support; the second one must be a catalytic agent of this new culture, being the link between *water users* and *water agency, theoretical model* and *reality*.

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