



Research Paper

**PERCEPTION AND USE OF WATER RESOURCES IN THE MULUNGU
SETTLEMENT, CEARÁ, BRAZIL**

**Helida de Oliveira Barroso¹, Maria de Fatima Barbosa Coelho² and Elisângela
Clarete Camili³**

¹ Universidade da Integração Internacional da Lusofonia Afro-brasileira (UNILAB),
Instituto de Ciências Sociais Aplicadas,
Mestrado Acadêmico em Sociobiodiversidade e Tecnologias Sustentáveis.

Unidade Acadêmica dos Palmares,
Rodovia CE 060 – Km51, CEP.: 62785-000 – Acarape – CE – Brasil

^{2,3} Universidade Federal de Mato Grosso (UFMT),

Faculdade de Agronomia e Zootecnia (FAMEZ),

Programa de Pós-Graduação em Agricultura Tropical (PPGAT),

Av. Fernando C. da Costa, nº 2367 – Cidade Universitária - 78060-900. Cuiabá – Mato
Grosso,
Brasil.

Abstract

Water is essential to human life and man uses it not only for consumption, but to produce food. For the population of the semi-arid of Ceará there are serious limits to the use of water. In order to characterize these limitations and contextualize them historically, this study was conducted in the Mulungú settlement using interviews, workshops and participative experiences and Rapid Participative Diagnosis (DRP). The Mulungú Settlement has a weir, a lagoon and four water source, but reported that 10 years ago there were 10 water sources. The water is used for irrigation of the gardens and to feed the animals, besides the domestic uses. The concentration in short periods of precipitation influences mainly the water reserves, being these fundamental for the basic life system 333maintenance activities, like the production of foods, as much animal proteins as vegetables. There are some changes in the number of water sources and their time with availability of water. Thus, we have that both the quantity of water resources and their storage capacity and consequently the time it takes to dry the reservoirs are factors that directly influence the potential productive potential of the Settlement.

Key words: *water use, reservoirs, water distribution, small farmers.*

INTRODUCTION

Water is essential to human life and the man not only used for consumption, but to produce the food. Present in natural springs, this common and scarce good has caused some limitations for the population of the semiarid, precisely of the State of Ceará, Brazil. The maintenance of these springs depends on a rainy season above average, which according to [1] 553 mm. If it does not rain the reservoirs are in deficit which will influence from the human consumption to the agricultural consumption.

And so some policy and strategic measures are designed to lessen this growing demand for water. According to [2] the state policy of water resources in Ceará has been based on large and incessant expansion of water supply infrastructure. The State has a capacity of accumulation of the order of 18 billion m³, of which almost 90% in the large dams. Even so, the state still suffers strongly from the socioeconomic effects of prolonged periods of drought, even in a year of near or more than normal rainfall, as in the current year, the driest regions of the state remain dependent on the water supply of the diffuse rural population.

It can be verified that the Settlements have an interesting water potential, usually coming from governmental structuring policies, being able to be used for fish farming and even extractivism of fish resources. Not being different in the Mulungu settlement where in the midst of the structuring of the site there is a reservoir and mandallas (circular structures with water in the center for the creation of fish and vegetable and fruit trees in the surroundings) for production activities.

In view of the above, this study aimed to describe the water resources of the Mulungu settlement, as well as the use and management and effects of irregular rainfall on the lives of the families of the community.

MATERIALS AND METHODS

The study was conducted with the families of the Mulungu Settlement in Tururu, a municipality located in the State of Ceará, 136 km from Fortaleza, the capital. The Mulungu Settlement came about after an arduous process of fighting a landowner, with the support of the Pastoral Land Commission (CPT) and the Union of Rural Workers

(STR) and expropriation on 25 September 1987 by INCRA where 61 families were benefited, but nowadays it is estimated that they live in Settlement 160, adding up the families settled 99 families added.

Based on the identity and the agrarian context of the place, the tools of Participatory Rural Diagnosis (DRP) were selected in order to facilitate the data collection process, considering that the objective of the DRP is to stimulate self-analysis and self-determination of communities where, participatory form, obtaining and analyzing primary or "Field" information in the community [3].

Initially the visit to the Settlement allowed us to sharpen our gaze, listen and write about the reality seen. As well as improving the senses in the search for questions and answers that influenced the object of study. In this case, water resources.

Throughout the experience workshops were held in order to strengthen ties with residents of the Settlement. However, this work was followed by a methodological order to facilitate and streamline the data collection that would complement informal conversations with the settlers.

All the activities were carried out in a group, where the purpose of each tool was initially explained, then questioning questions were sent to the farmers' group in order to direct the information that was recorded by setting tables on wood, fixed in a strategic location that would allow easy visualization, at the end it was discussed in a group about the result and later analyzed by the researcher.

One of the key tools was the historical Redemption of the use and perception of water resources, in order to represent changes that these have caused in production systems, water resources and environments at a given time. In addition, to identify the water sources that were already in place at the time the land was farm, taking into account the use of this and seasonality, where it was later compared to the reality found today, as settlement.

For the construction of the timeline, where the drought trajectory was taken into account and years of flooding were compared, the situation in which they were found and how long it took to dry, with years of drought, also situation and how long it takes to fill. The last step was the integration and synthesis of the results aiming to describe and analyze the potentialities of the information.

RESULTS AND DISCUSSION

A. Hydrographic situation of the municipality of Tururú

The municipality of Tururu is drained by the Curú river basin, which drains another 12 municipalities (Figure 1). This river is born in the mountainous region formed by the sierras do Céu, Imburana and Lucas. the average rainfall for the whole basin is 919 mm per year. This rainfall has been growing in the sense of the sertão to the coast, where it reaches higher values near the mouth of the river. The hot semi-arid tropical climate provides an annual average temperature around 27 ° C [4].



Figure 1: Municipalities of the Curú river basin and main effluents, in particular the approximate location of Tururu. Source: Pacto das Águas, (2009).

The predominant types of vegetation are the Vegetation Complex of the Coastal Zone to the north, the Caatinga Arbustiva Densa in the center and southeast of the basin, besides

the Dry Forest to the southwest (Serra do Machado), and the Ciliary Forest bordering the low course bed the Curú river, which is very degraded [4].

This region is characterized by the large number of reservoirs, with a total of 818 reservoirs, of which 229 have an area of more than 5 ha. Of note are those of General Sampaio and Petencoste, who contribute about 70% of the volume of water in the basin [4].

Predominantly the waters of the reservoirs are monitored by the Water Resources Management Company (COGERH), and are classified as oligotrophic, mesotrophic and eutrophic. This classification is related to the enrichment by nutrients of the waters and their effect, related to the growth of algae or aquatic macrophytes, that is, with the trophic state of the water reservoir [4].

Thus, it is perceived that the water quality may be related to vegetation characteristics, rocks and soils. The lack of any of these factors or their excess may imply the sudden variation of pH, salinity, alkalinity and other chemical indicators important for water quality certification.

B. Mulungu settlement water resources

Mulungu Settlement Project is located in the sub-basin of the Mundaú River, being this one of the littoral watershed [5]. Water sources, such as the reservoir, water reservoir, river and river, have water all year round. The first two as anthropic sources denote a greater relationship of craving for water resources and this causes rules to be established for their use by those who have control, even if theoretically it is freely used as well as the last two sources of water cited.

There is a reservoir called Mulungu, being supplied by the São Domingos creek, with water accumulation capacity of 93.016,00m³ and maximum height of the water column equal to 9,20m [5]. The capacity of this pond to accumulate water varies greatly annually, depending on precipitation (Figure 2).



A



B

Figure 2: Mulungu irrigation in Tururu, Ceará in the dry season and in the rainy season 2014.

These water resources have availability of water throughout the year, depending on precipitation for their maintenance. Considering that the seasonality of rainfall is perceived in the first half of the year. Thus, it is evident that the resources are mainly used for domestic consumption, such as washing clothes, bath and kitchen, for agricultural production and animal watering.

There is a seasonal lagoon (Figure 3) with low depth in the Lagoon Village called Mulungu lagoon. Many houses in the village were built or have backyards in the Permanent Preservation Area (APP) of the lagoon, which no longer has the primary vegetation in all its extension [5].



A



B

Figure 3: Seasonal lagoon in Tururu, Ceará, Brazil.

Source: PDA Mulungu, 2008

The settlers reported that 10 years ago there were approximately 10 springs (water eyes) located in the settlement, a situation that currently does not occur, because only

four are found. According to the PDA elaboration team, this situation is due to the type of culture and cultivation techniques performed in inappropriate areas [5].

Among the four sources, the most important is the one that is in Vila Capelão. The residents gave to this source a cement structure adding cement rings, and even after the water withdrawal the previous day, the water volume is the same in the morning of the following day [5].

The Mundaú River is inserted in the water resources of the Mulungu settlement. Although they are degraded and, according to the settlers themselves, polluted, their ebb is used in the cultivation of grass, besides supplying the mandallas with water and to be used by the animals of the settlement to kill the thirst [5].

It is worth mentioning that in the view of the residents there is a possible irregularity of rains over the years, this caused the number of water sources, such as water eyes, to decrease. In addition, other environmental factors such as erosion and evaporation contribute to the reduction of water and the extinction of water sources. Anthropogenic factors, such as how to use them, in particular the sources and their surroundings, such as deforestation, agriculture and grazing, should be taken into account.

Regarding this issue, the sources are the ones that suffer most from the lack of forest cover, leading to their complete disappearance [5].

C. Uses of water

From the time of the Farm the space presents a water structure that favors the agricultural production, watering of herds, guarantee for the human consumption and domestic use. However, at the time the land was in the possession of the landowner, the access of the residents to the water sources was conditioned to the permission of the landlord (Table 1). Now with land ownership in the settlement all have free access to water sources.

With the agrarian reform the habitat takes a redesign in order to structure. Together came the mandallas as an alternative production. Coupled with the water facility, given

that the river that covers the region is perennial "there will be no shortage of water" to supply this productive system.

Table 1: Use and Availability of Settlement Water Sources

Water Source	Used	Goal
Farm		
Heath	Boss	Dessedentation, Fishing, Laundering and Bathing
Hick	Boss	Dessedentation
Olhos D'água	Boss and Residents	Dessedentation
River	Boss and Residents	Deducation, Irrigation, Fishing, Laundering and Bathing
Lagoon	Boss and Residents	Dessedentation and Irrigation,
Settlement		
Heath	Seated	Dessedentation, Irrigation, Fishing, Laundering and Bathing
Hick	Seated	Dessedentation
Olhos D'água	Seated	Dessedentation
River	Seated	Dessedentation, Irrigation, Fishing, Laundering and Bathing
Lagoon	Seared	Dessedentation and Irrigation,
Well	Seated	Dessedentation
Mandallas	Work Groups	Irrigation,

Source: Research data, 2014.

Generally, men use water resources for irrigation and livestock, an example of this is the Mulungu dam be used by cattle, goats, sheep, pigs and other animals raised by the settlers, the dam is still used in the fishing activity [5].

It is noticed that the settlers develop different activities giving them a diversified character. (...) man appropriates himself in certain ways, the productive environments and the world in which he lives. This appropriation takes place in the work process and goes beyond it, since it also inspires ways of being and establishing social relations, of

constituting family and of organizing work [6]. However, what is common these days is that each one is denominated in terms of professional occupation based on what they do, how they do it and what the purpose of the productive environment is, and thus a self-identification is necessary.

In spite of the tendency of generalization, they prevail in the studies of fishing from sociology and anthropology, threads that clearly pervade the literature on what they relate to the way man has adapted to the production (...) and are organized economically at the family level, to an industrialization and salaried scheme. And so in the different studies the classification and identification of the sea peoples with the agrarian peoples is controversial, often identifying them as "producers who differ from the farmers, because they fish" [6].

Still on the diversification of identities and activities Maldonado [6]. says that: "This exploration of land and sea is called economic pluralism, a phenomenon that in addition to occurring in the Brazilian coast, also appears in fishing groups from various places of the world".

What makes it relevant in this fusion of activities is that these fishermen-farmers form within family units, with no wage or surplus production occurring and guaranteed subsistence rates in the rainy season or in times favorable to fishing [6].

Specificity common in the Settlement, considering that even in drought, the geographical location of the Settlement brings interesting peculiarities about the climate, as for example, in the dry season many places have been harmed, but in this region there is "drought green" because even though it has rained a few millimeters, the water reservoirs still manage to remain. This contributes to the maintenance of productive activities, even if water resources are scarce.

D. Perceptions on the Effect of Rainfall Irregularity on Water Reserve Sources

The historical perception about the irregularity of water precipitation and its effects on the sources of water reserve, and consequently on productive and reproductive activities, is marked by drought and flood years. (Table 2).

Table 2: Historical and seasonal perception of water sources and their water situation

Year	Source	Situation
Drought season (Farm)		
1970	Heath	Still has water
	River	Still has water
	Hick	Dry
1971/72	Heath	Still has water
	River	Still has water
	Hick	Dry
Rainy season (Farm)		
1973	Heath	Still has water
	River	Still has water
	Hick	Dry
1974	Heath	Full
	River	Full
	Hick	Full
Drought season (Settlement)		
1980/81/82/83	Heath	Still has water
	River	Still has water
	Hick	Dry
12/11/2010	Heath	Still has water
	River	Still has water
	Hick	Still has water
	Mandalla	Depends on the river
Rainy season (Settlement)		
1984	Heath	Still has water
	River	Still has water
	Hick	Still has water
Expectativa 2014	Heath	Almost dry
	River	Still has water
	Hick	Still has water
	Mandalla	Depende do rio

Source: Research Data, 2014.

Dividing the time in two distinct relevant periods to productive issues and access to resources, we have the farm season and the current Settlement times. For farmers until the 1970s they perceived a greater ease of rain, however even in periods of drought still had water. What was described is clear in the settled farmer's speech: "One year or another, a drop would not drop, but we had bleeding from the pond to the point where the fish were in the homegarden."

The PACT OF WATERS [4] shows, from the series of data calculated by Funceme from 1970 to 1990, that the average annual precipitation for the region where the Mulungu settlement is located is 1,274 mm. Compared with the current days [1] brings that average is 607.4 mm. In other words, in some ways farmers perception of the frequency of rainfall is assertive. Even though farmers in Mulungu compared to other municipalities in the state do not suffer so much from the drought they realize that they must adopt measures to manage water sources so that the water volume of them can remain for longer.

For a long period of time, we can observe the maintenance of the water volume of the dam, which had a significant decrease in the last decade (from 2000). However, nothing has been done about the management of this water source.

The decrease in water volume of the river was caused mainly by the dam breaking, which dispersed all water. The community representatives have already tried to solve the problem with the city hall, but the process is slow and has not yet been solved.

By questioning them about the lack of water, they did not react differently and say that this situation is very uncomfortable and they would need to find a solution. But, so far, they have been unable to think of anything practical except government aid, in this case crop insurance.

Perhaps a measure with a positive effect in reducing water consumption would be the non-use by the animals of the water of the dam and the control of the amount of times that fill the mandallas. That is, designate how many times it really is necessary to fill the reservoir and all do at the same time. Measure is aimed at decreasing the use of water and energy [7]. (SIDERSKY, 2008).

It is concluded that the concentration in short periods of precipitation influences mainly in the water reserves, being these fundamental for the activities maintaining the basic life system, such as the production of food, both animal and vegetable proteins. There are some changes in the number of water sources and their time with availability of water. Thus, we have that both the quantity of water resources and their storage

capacity and consequent the time it takes to dry the reservoirs are factors that directly influence the potential productive potential of the settlement.

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