**Trajectory of the community of Olho d’Agua – Piquet Carneiro**

The next section is built into four sub-section looking at: (i) the droughts events and their main impacts on water, food, and livelihood securities; (ii) the agricultural practices undertaken by the community; (iii) the government interventions and support programs, whether they are directly or not targeted at drought; (iv) market and community’s specific challenges. While the two first sections reveal partly what drought indicators or hydrological and agricultural reveal about drought and drought impacts, the two last sections deepen the social context that modulate the severity of drought impacts and that are overlooked.

Droughts and their main impacts

The community's earliest recollection of drought dates from **1958,** mentioning “*children that had to break rocks with their father, and there was a lot of suffering because of the work.*" This refers to the "*frente de trabalho*", which translates as "Workfront," a government-sponsored program aiming to provide temporary employment and income during times of economic hardships like droughts. Similarly, during a drought in **1970**, community members recall men working on public projects, such as road construction, and the community well turning dry. During that drought, community members recall buying damaged white beans "*at the price of meat*," which signifies they were as costly as the most expensive product. They mention that these high prices prompted them to learn how to cultivate beans, to avoid future purchases at such high rates.

In **1983**, the most prevalent impact of the drought was on water security, particularly for drinking and hygiene purposes. The **1993** drought, however, is remembered differently by various individuals. One woman, pregnant at the time, recalls food insecurity as the main issue, forcing them to survive by hunting and eating small birds. She also remembers the absence of government financial support and the erosion of her family’s financial resources, contrasting with the current cash transfer programs that exist nowadays and that we develop later. Other community members primarily recall the effect on their drinking water security, by having to fetch water from a well five kilometers away during their childhood. In **2003**, a drought interrupted the community's first attempts at irrigation. Additionally, farmers recount resorting to feeding their animals with cactus palms due to the failure of forage.

Between 2003 and 2012, the community significantly expanded its productive activities, including the irrigation of cash crops, on-site processing of these crops into food and drink items, and the introduction of beekeeping, which will be discussed later. In 2010 and 2011, the community received a second, larger cistern that enabled them to irrigate staple crops such as maize and beans during the dry season and sell any surplus that wasn't needed for family consumption.

**2012** was the onset of the infamous multi-annual drought that lasted until 2019. Impacts on agricultural production halted the plans of developing a small agroindustry in the area for food processing. The cattle were once again fed with cacti palms due to forage and pasture failures. Farmers recall the failure of any crop, including the trees of banana, guava, soursop, acerola, and mango. Impacts on water security were important. The community mentioned “*fish dying in the mud*” to refer to the Sao José II reservoir drying i**n 2017**. During that year, the municipality dispatched water trucks to the community. However, these were insufficient for the needs, leading to conflicts. Additionally, the community water source was shifted to privately-owned wells that were officially contracted by the municipality, and later to a new well drilled by the municipality.

In **2020**, the irrigation for bananas, beans, and acerola restarted in the community with the recharge of Sao José’s reservoir. This period of water scarcity combined with the lockdown inflicted by the Covid-19 pandemic led to the experiment of innovative, self-made, and financed techniques, including hydroponic systems and greenhouses.

Agricultural Practices and Market Opportunities

Until 2000, agriculture in the community mainly consisted of rainfed cotton, corn, and beans. A more diverse production of cash crops was not contemplated since there was no market for them at the time. In other words, they wouldn’t sell, and irrigation, supported by small reservoirs and shallow wells, was made uncertain due to the drought in 2003. The introduction of the Food Acquisition Program (Programa de Aquisição de Alimentos- PAA) in Brazil in 2003, and its subsequent implementation in the community, was pivotal for the expansion of agricultural activities in the area. Its combination with another program, the National School Feeding Program PNAE (Programa Nacional de Alimentação Escolar - PNAE), fruit seedlings provided by the municipality, and the inauguration of the Sao José II reservoir, incentivised the production of irrigated fruits and vegetables and their on-site transformation into food and drink items. We will explore these programs in detail later. Such production coexisted with poultry, livestock, corn, and beans to sell the related products in the city market. Also, in 2003, a beekeeping project was initiated in the community. Initially introduced as an educational project funded by the Ministry of Education, it later transformed into the "Casa do Mel" association (translating as House of Honey) in the community in 2007 due to their high honey production. This diversity in production allowed for a corresponding diversity in income sources, maintaining the livelihood of the community stable in the face of unsatisfactory rainy seasons or flash droughts.

During the 2012-2019 drought, most fruit trees died, making the production and selling of these products on the market or through the PAA and PNAE impossible. However, selling processed items through these programs or at the city market was still feasible. Farmers continued producing fruit concentrate for juice, using inputs they were buying from less impacted neighboring producers or more distant markets. Similarly, roots and starches like potatoes and cassava were grown during the drought to be transformed into cakes and breads. These were then purchased through the PAA and PNAE, sold to the local market, or delivered door-to-door. This allowed the community to maintain an income when impacts on the other sources and the family food were important. Honey production was significantly impacted. The *Marmeleiro-do-mato* (Croton sonderianus), shrubs typical of the Caatinga biome whose flowers are pollinated by bees, did not bloom and eventually died. Additionally, farmers mentioned the proliferation of the Neem (Azadirachta indica), an invasive species in the area. They associate the decrease in honey production with the death of honey bees, which they believe is caused by pollinating the Neem. As a result of this production drop, they “*are no longer a reference in honey production in the area*”, in their words.

Government Interventions and Support Programs

The government intervened in multiple ways, through local policies and immediate responses, designed to directly mitigate the impacts of drought. These interventions sometimes served other initial intentions but ended up being useful during the drought.

The first one mentioned is the "Frente de Trabalho” in 1958 and 1970. It mitigated drought-induced poverty, even though it is now ethically contested due to its previous tolerance of child labour and the suspected government agenda to deter the migration of rural populations to the capital, Fortaleza. Moreover, enrolees remember the payments being extremely irregular, stating they had to “*stay on the street from dawn waiting to receive the money*.”

The water cisterns and water trucks partially mitigated the community's water insecurity experienced from 2012 onwards, mostly eliminating the most severe impacts. Unlike in previous droughts, there was no direct lack of water for basic sanitation or drinking, nor was there a need for children to walk to a distant source and queue to fill water buckets. The spontaneous comparisons of drought impact severity made by the rural population underscore the distinct effect of these two interventions. However, water availability was still below what was needed for drinking, for animals, and for irrigation of subsistence crops. Moreover, the second cistern enabled the irrigation of subsistence crops like maize and beans during the dry season, enabling their sale rather than just their production and consumption for family meals, thereby increasing income.

Another policy tool that alleviated drought impacts between 2012 and 2019 were the cash transfer programs, mainly the crop-based insurance, Garantia Safra, and the poverty-reduction cash transfer, Bolsa Família. Garantia Safra is a social protection program directly related to drought; it provides financial assistance to small family farmers who have suffered crop losses due to natural disasters like droughts or floods. On the other hand, Bolsa Família is a social welfare program in Brazil that aims to reduce poverty by providing financial aid to low-income families with children and adolescents up to the age of 17. Although Bolsa Família was not implemented specifically for drought-impact alleviation, it still had this effect. All the women interviewed mentioned receiving or having received the Bolsa Família, which was a substantial aid during the economic hardship caused by the 2012-2017 drought.

The two programs that proved crucial in the community are the Food Acquisition Program (Programa de Aquisição de Alimentos- PAA) and the National School Feeding Program PNAE (Programa Nacional de Alimentação Escolar - PNAE). Both programs enable the government to purchase food directly from small-scale producers, normally at prices higher than the market, and then distribute the food to vulnerable populations and school meals. The municipality presents a comprehensive list of food items and their respective purchase values, enabling farmers to register and plan their crops. These programs played a key role as proactive measures against drought. As mentioned before, they were pivotal in diversifying agricultural production beyond the subsistence, rainfed crops like beans and maize, and income sources, thus preventing a collapse in the community's livelihood during drought. These programs also enabled an agricultural income source through the purchase of processed products when crop cultivation was impossible. Additionally, another program that benefitted farmers during the drought is "Hora de plantar" (Time to Plant), a government initiative in Ceará that provides seeds and inputs to farmers during the rainy season. This program, like the PAA and PNEA, is tied to the INSS (National Institute of Social Security), as they contribute to the social security benefits of registered farmers, ensuring their future retirement benefits. This acts as an incentive for farmers to register for these programs. The beekeeping project, which also significantly contributed to income diversification, was originally a governmental program. Introduced in 2003 as an educational project funded by the Ministry of Education, it later evolved into the "Casa do Mel" association (translating as House of Honey) in the community in 2007 due to their high honey production. This diversity in production allowed for a corresponding diversity in income sources, helping the community maintain stable livelihoods in the face of unsatisfactory rainy seasons or flash droughts.

Credit lines were another essential tool for proactive measures against drought, with Pronaf B being the most widespread. Pronaf B supports larger agricultural operations for family farmers, allowing a repayment period of up to three years, and timely monthly payments lead to a reduction between 25 and 40%. It is also a credit line that is negotiable and adjustable in the event of a drought. Other available credit lines (Agro-amigo, Ceará Cred) have played a crucial role in increasing the construction of private reservoirs, aligning with the municipality's policy of promoting reservoir construction and water mobilisation.

Obtaining these credits or registering for these programs is contingent upon registration and declarations issued by the agricultural assistance office. It is important to emphasise the crucial role of the technicians in providing detailed information about the existence of, and rights to access, governmental financial tools that rural populations can request, along with the necessary documentation.

Market Challenges and Aging Community

The PAA and PNAE gained popularity in the past because they offered higher payment rates. The CEASA (Central de Abastecimento do Ceará) sets the base prices for products paid by the PAA and PNAE. Despite inflation and rising costs, the rates agreed upon in the contract are not adjusted accordingly. A new price table is released with each new program call (in Portuguese, “edital”), annually or biannually. However, farmers estimate that these two programs contribute to 30% of their income, with the primary source predominantly from door-to-door and local market sales.

Whether farmers can sell their products on the local market depends on two factors that are completely unrelated to drought: the age of the community and the availability of cash in banks.

Interviewees acknowledged that the community is aging, with fewer individuals who consider themselves persistent and refuse to rely solely on subsistence farming. They mentioned that today's youth prefer to pursue education rather than agriculture.

The individuals who purchase farmers' products in the local markets are primarily retirees who dictate the sale pattern. Sales tend to fluctuate, largely because the majority of buyers are retirees, whose purchasing power depends on the timing of their pension payments. Sales generally dip towards the end of the month, coinciding with the period when pensions are paid. The availability of cash in banks also significantly influences the purchase of products. Piquet Carneiro houses only one branch of Banco do Brasil (the national bank where pensions are disbursed), and it frequently experiences cash shortages as retirees withdraw their full pensions concurrently. Some buyers resort to traveling to other cities to withdraw their pensions, capitalising on this trip to buy products from the local markets of their displacement. The farmers interviewed noted that while some other farmers prefer to sell in these other cities, they choose to remain in Piquet Carneiro. Failing to make sales in Piquet Carneiro, they don't incur any financial setbacks. However, traveling to another location brings the risk of being at a loss, by incurring fuel expenses without any return if no sales are made.