

## PUBLIC POLICIES FOR COEXISTENCE WITH THE SEMI-ARID REGION: THE P1+2 PROGRAM IN A MUNICIPALITY IN CEARÁ, BRAZIL



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### ABSTRACT

The objective is to present the P1+2 Production Cisterns Program as a Public Policy for the strengthening of family farming in the municipality of Icó in the Semi-arid Sertão of the State of Ceará, Brazil. Methodologically, this research is an exploratory case study of a basic nature with a qualitative-quantitative approach. The data were secondary to the Elo Amigo Institute, the institution that executes the program in the municipality. In general, the results pointed out that from the promotion and access to the Program, the families of Icoense were able to have their productive activities strengthened in the areas of cultivation, animal husbandry, family agribusiness and handicraft production. Regarding the fulfillment of the functions attributed to the productive projects, all families had an increase in efficiency within the subsystems and the strengthening of the relationship with the market. As for income, if food needs are met, families can sell the productive surplus and thus generate an improvement in income. Finally, the structure generated by the program provides support so that families can maintain a production condition, at least minimum in the dry season, giving sustainability to the working conditions in the field.

**Keywords:** Public policies. Arid. Social technology. Icó-Ceará-Brazil.

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## INTRODUCTION

The scarcity of water in the semi-arid region of the Northeast is directly linked to the development and guarantee of the quality of life of its population, since it influences the productive development and consequently the permanence of this population in the countryside, that is, access to water is a minimum condition of subsistence. However, in recent years, the worsening of climatic issues has been observed through phenomena such as El Niño, which influences the variability and irregularities of rainfall, prolonging and aggravating the drought in the region (Marengo, 2008).

The effects of climate change on the most vulnerable populations (Darela Filho *et al.*, 2016; Marengo *et al.*, 2011) have been increasingly debated socially and politically, in an attempt to build strategies to minimize the negative effects that truly mark the semi-arid region, such as the lack of water that strongly affects the basic issues of subsistence and permanence of men and women in the countryside.

In view of this, civil society organizations represented by the Brazilian Semi-Arid Articulation Network (ASA), in partnership with the public authorities at different scales, have been developing actions that try to mitigate the effects of severe droughts on the populations and agroecosystem of the semi-arid region, through coexistence policies. Among the consolidated policies is the cistern, established under the premise of the need to guarantee low-income families access to quality drinking water, implemented through the One Million Cisterns Program (P1MC) in 2003 (ASA, 2022a).

Another discussion raised was the need to establish means that would enable the food sustainability of families in the region. To this end, the One Land and Two Waters Program (P1+2) was created in 2007, which seeks, based on social technologies of coexistence with the semi-arid region, to guarantee access to water for the production of food of animal and plant origin in a healthy way, to develop the sovereignty, food and nutritional security of families, as well as to enable the generation of work and income in the region (ASA, 2022b).

With the worsening of climate issues and within the current perspective of water crisis, it is important to evaluate the development and effects of social technologies for coexistence with the semi-arid region that aim at access to water and consequently can generate indicators for social and regional development. It is also important to note that according to the Ceará Foundation of Meteorology and Water Resources (Funceme, 2016), from 2012 to 2019 the semi-arid northeast faced one of the worst droughts in the last

hundred years and Ceará (CE) stood out as the state with the highest drop in the levels of water reservoirs in the region (Brasil, 2017a), a fact that draws attention to the state's water security and to the scope of the programs and public policies of the Federal Government or other spheres that aim to mitigate the negative impacts of drought on the population.

In view of the recurrent water crises in the state of Ceará, the social technologies for food production defended by public policies must meet their purposes. Therefore, this work had as a general objective to understand the contributions/benefits generated by the P1+2 Program for sustainability, food security and promotion of work and income of beneficiary families in the municipality of Icó-CE. It is based on the hypothesis that, from this program, families will be able to improve or maintain their food production, encourage work and provide some increase in income to the beneficiaries. For this, the water and productive situation of families before the implementation of the technology will be presented. Finally, the program's contributions to food security and the promotion of work and family income will be verified.

In addition to this introduction and conclusions, this work is structured in three other sections. In the second section, a presentation of the P1+2, its history, social objectives and target audience is made, and the technological models implemented by the program are presented. In the third section, the methodological processes used in the construction of the research are presented. Subsequently, in the fourth section, the contributions/benefits of P1+2 for food security and promotion of work and income of the families covered by the program are verified.

## **THE ONE LAND AND TWO WATERS PROGRAM (P1+2)**

The P1+2, created in 2007, arose from the perception of the need to think about strategies that would enable the sustainability of families in the Brazilian semi-arid region. With the P1MC program, a political-social debate had begun on the recognition of the values and real needs of the populations of the region, and the availability of water to quench the thirst of families next to their homes was a great step, but, although water is a food, by itself, it would not be enough to guarantee the food sustainability of families in the semi-arid region. It was known that in order to produce food, it would be necessary, in principle, to attend to at least two basic issues, access to water not only for domestic consumption, but also for food production, and access to land, a determining factor to make production possible. Regarding

the attention to these needs, the P1+2 was elaborated, in which "P1" means access to land and "+2" expresses access to both waters, for drinking and for production (ASA, 2022b).

Composing the ASA's Program of Training and Social Mobilization for Coexistence with the Semi-arid Region, the P1+2 ignites the debate on the democratization of access to the minimum structure for family production. The objective is to promote food and nutritional sovereignty and security, fostering work and income through the construction of participatory processes with farmers in the semi-arid region (ASA, 2022b).

The strategy outlined by the P1+2 was elaborated considering that even in the face of the high potential (natural and population) of the semi-arid region, the region suffers, marked by poverty and social inequalities, which have led its population to a situation of hunger and social exclusion (Souza; Pozzebon, 2020). In this regard, Guimarães and Lopes (2002) say that, even before the lack of water, the population of the semi-arid Northeast suffers from social exclusion, given the lack of land, which makes it impossible for the population to produce their food, as stated by Gnadlinger, Silva and Brito (2007, p. 67): "there is no way to conceive a sustainable proposal for the Brazilian Semi-arid without considering, not to say, without solving the fundamental problem of land concentration".

In view of this, the P1+2 was built with a view to expanding the area of agriculture based on appropriate agricultural reform, achieving an increase in the efficiency of land and water use through the development of agroecological principles and respect for nature (Gnadlinger; Silva; Brito, 2007), seeking to strengthen the sovereignty and food and nutritional security of families in the semi-arid region.

The Chinese semi-arid region, especially in the state of Gansu (Northwest China), is marked by the climatic conditions common to the other semi-arid regions, irregular rainfall and high evapotranspiration, but its water deficit situation was aggravated by the contamination of groundwater. placing rainwater as the only source of water in the region (Gnadlinger; Silva; Brito, 2007). In view of the adverse condition, a program called "1-2-1", or *Zhu*, in Chinese, was developed, based on the rescue of ancient rainwater harvesting techniques, which was developed by the Chinese people (Gnadlinger, 2001).

The proposal of the "1-2-1" program was that from a rainfall catchment area of 100 m<sup>2</sup> of two underground cisterns, it would be possible to maintain families and production systems using salvation irrigation in the critical water period. This experience allowed a considerable increase in the family production of grains and fruit trees, as well as in the

commercial production of other products of plant and animal origin, enabling an increase in family income (Gnadlinger, 2004).

In this logic aimed at the development of family production systems, social and economic inclusion and conscious use of natural resources, the P1+2 was elaborated. However, it is worth highlighting the importance of the theoretical framework and the technological collection inserted by the research developed by the Brazilian Agricultural Research Corporation (Embrapa) of the Semi-arid Region, as well as by the experiences and knowledge presented by the diffuse population of the semi-arid region that constituted outstanding characteristics of the program.

The P1+2 is configured on the principles and strategies of strengthening local policy, educational and socio-organizational processes, aiming at the autonomy and protagonism of farmers for rural development; the valorization and organization of them as holders of knowledge that leads to a social transformation; to favor their interaction through exchanges for the exchange of experiences and knowledge; the promotion of training processes based on popular education; and the adoption of agroecological principles as a technical-methodological and scientific basis used for the development of coexistence actions (ASA, 2022b).

To be a beneficiary of the program, it is necessary to meet the following eligibility criteria: have a *per capita* income of up to half a minimum wage; be enrolled in the Unified Registry for Social Programs (CadÚnico) of the Federal Government; have the Social Identification Number (NIS); and have a first-water cistern (ASA, 2022b). It is important to emphasize that this is a program aimed at serving rural populations, so it is essential that individuals are domiciled in rural areas.

Among the priorities to be addressed by the program are families that are in a condition of extreme poverty or misery, headed by women with children aged 0 to 6 years, with school-age children; elderly people aged 65 or over and people with disabilities (physical and/or mental) (ASA, 2022b), that is, those who are in a greater degree of social and economic vulnerability. Families must meet the productive requirements, which is to have an area for productive development and technology allocation, as well as meet the technical criteria of the program, following the standards determined for each technology.

The P1+2 works in an attempt to promote rural development in the semi-arid region through the implementation of seven types of social technologies for capturing water for

food production: the stone tank or cauldron, the underground dam, the trench barreiro, the dam, the water pump and the sidewalk and runoff cisterns.

The stone tank is a technology built in a slab area, taking advantage of geographical conditions to create and/or expand the area and storage of water. Through this technology, there is no loss of water through the infiltration process; As well as the fact that it is deeper and less extensive, there is also the minimization of water loss through the evaporation process. The stone tank represents a source of water for domestic and productive use, intended to quench the thirst of animals (Gnadlinger, 2011).

The underground dam, in turn, is a type of water damming technology that is located underground and superficial in the soil (Müller, 2018), acting by retaining rainwater in the area of the dam, in which crops can be developed. In Brazil, the first record of the use of this technology occurred in the Northeast region, but there are divergences between the period and place of implementation (Ximenes; Silva; Brito, 2019).

Generally built in areas of shoals, streams and streams formed during the rainy season, the structure of the underground dam is made through a barrier with canvas, to take advantage of the waters of the floods (ASA, 2014a). In the dry season, the water collected is stored in the soil itself, keeping the area moist, allowing the planting of fruit trees, vegetables and other annual crops. Therefore, there is a better use of the water mirror in the ebb and flow agriculture system (Ximenes; Silva; Brito, 2019).

The trench barrier is a rainwater harvesting technology for animal watering and plant production; its structure is similar to that of a tank. Built close to the production areas, the trench bar is a technology that has the capacity to store up to 500 thousand liters of water (ASA, 2022b). As it is a technology with a greater depth of water depth, given the fact that it is deeper and narrower, it has the advantage of having less solar and wind incidence, making the technology more resistant to the evaporation process (Porto *et al.*, 1990).

The dam is a small dam in the shape of an excavated basin. Usually its structure is in shell or semicircular, with a size of 12 to 30 meters and a depth of up to two meters. This technology acts as an erosion containment system, acting to improve the cultivation and/or grazing area. From the construction of the containment area, the water that would flow into the runoff system is contained in a reservoir, allowing the infiltration of water to act less aggressively on the soil, thus reducing the erosive process. Therefore, in addition to the technology allowing an increase in the availability of water in the groundwater, acting directly on the soil management of the production area (Barros; Ribeiro, 2009).



The popular water pump (BAP) is the model of technology for coexistence with the semi-arid region used to ensure access to water for an entire community through the revitalization of deactivated wells that have a depth of up to 100 meters (ASA, 2022b). The pump is manually operated by means of a large diameter handwheel, which allows considerable quantities of drinking water to be obtained with a minimum of effort and at a low cost of implementation.

BAP is a resource placed as a great strategy for water use. From the recycling of abandoned wells, there is a technology with a long useful life and low maintenance cost that makes it possible to expand water for families (ASA, 2014c).

The Calçadão Cistern is another of the rainwater harvesting strategies for food production in the Brazilian semi-arid region carried out by the ASA network. Considered by farmers as a cement yard, it is a tool for access to water formed by three basic structures, which are: the collection system, formed by a 200 m<sup>2</sup> masonry sidewalk; the water storage system, which is the cistern with the capacity to store 52 thousand liters of rainwater; and the lifting system, formed by a concrete base built to place a 500-liter water tank allocated at the highest point of the land (near the cistern) to allow gravity irrigation.

Like the Calçadão Cistern, the Flood Cistern consists of a technology with a storage capacity of 52 m<sup>3</sup> of water for the production of food of plant and/or animal origin. Its structure follows the same pattern as the Calçadão Cistern, plus a collection system or runoff collection and decantation system, formed by a water containment structure built on the ground that directs the water that descends in the form of runoff to the decanters (filters) connected to the cistern. Therefore, the land is used as a source of funding (Brasil, 2017b).

Like the P1MC cistern and the Calçadão, the Enxurrada one is made of cement board. Like the other technologies, the Flood Cistern adds to the coexistence with the semi-arid region, making life easier for farmers, guaranteeing them water for drinking and cooking (P1MC), as well as for producing their food (animal and vegetable) in a more sustainable way.

According to Gnadlinger, Silva and Brito (2007), based on rainwater harvesting technologies, it is possible to use a portion of the water that would be returned to the atmosphere in the natural process of evapotranspiration, by percolation or even by surface runoff into the rivers, and direct it to productive needs. In this sense, social technologies for rainwater harvesting seek the best use of this water, reserving it to be used consciously at

times of scarcity, showing itself as a strong strategy for adapting to the reality of the semi-arid region.

## **MATERIAL AND METHODS**

### **CHARACTERIZATION, LOCATION AND DELIMITATION OF THE STUDY**

Methodologically, this investigation is an exploratory case study of a basic nature, with a qualitative-quantitative approach, based on a theoretical-empirical investigation that will seek, from secondary data, to present the contributions of the P1+2 Program as a public policy for the strengthening of family farming in the municipality of Icó-CE.

The survey was carried out in the municipality of Icó-CE, approximately 361.53 kilometers from the state capital, Fortaleza (IBGE, 2021). The municipality is located in the Center-South mesoregion. The climate is of the hot tropical type and mild semi-arid, with a historical average rainfall of 733 millimeters; rainfall occurs between the months of January and April, and its average temperature ranges from 26° to 28°C (Ipece, 2022). Many of the characteristics mentioned make Icó-CE one of the 175 municipalities that make up the delimitation of the semi-arid region of Ceará.

The research population comprises the beneficiaries of the municipality's P1+2 Program, of the development criterion, formed by 35 families. For the segmentation of the research universe, the conditions of the beneficiaries of the 2019 program who fit within the development criterion were adopted, a condition that is intended to serve families in situations of extreme poverty. This project was financed with resources from the year 2018 from the National Bank for Economic and Social Development (BNDES), from the agreement No. 054/2018.

In 2019, the P1+2-BNDES program, aimed at families in conditions of extreme poverty, served 12 communities in the rural area of Icó-CE, through the implementation of two types of technologies: the runoff cistern and the sidewalk cistern.

### **SOURCE, COLLECTION AND ANALYSIS OF DATA AND INFORMATION**

The data are of secondary origin, coming from the Instituto Elo Amigo, the institution that executed the program in the municipality in 2019, which, under the requirement of the program, carried out the socioeconomic surveys of the families and applied two questionnaires, one before and the other during the implementation of the program. All surveys were carried out through semi-structured research.



The data analysis was carried out from the verification of the productive characters of the families. For its construction, at first a prospecting is carried out, which forms a productive structure based on food security and sovereignty, followed by the disposal of the surplus of agricultural products. This structure is elaborated within what the families produced, had already produced and/or had the desire to produce considering their conditions.

In short, this document is formulated soon after the registration of the families, that is, during the execution of the P1+2, and is formed by a structure for identifying the productive area, the types of crops developed and the areas that will be benefited. The intention is to make a survey of the main productive areas that will be strengthened through the implementation of the program.

For the second part of the data analysis, a detailed reading of the files (productive characters) was carried out, adopting content analysis, which consists of a research methodology used to interpret and describe the content of documents and texts, for a broader interpretation (Moraes, 1999).

In the open questions of the productive characters, the answers were grouped and categorized for the construction of tables and graphs to synthesize the central ideas. Thus, content analysis was used from the perspective of Bardin (2009), in which qualitative data are tabulated, synthesizing them according to the repetition of words, for the elaboration of the registration units. Then, the Excel 2019 software was used to process the data. For a better explanation and aiming at a better reading of the basic descriptive statistics, the results are presented in percentage terms.

## **RESULTS AND DISCUSSION**

To verify the program's contributions to food security and promotion of work and income of beneficiary families, this section was divided by productive areas of the families. Among the most prominent activities performed by the farmers surveyed are the actions from agricultural exploitation, livestock, agro-industrial and family handicrafts, areas on which the productive investments of the P1+2 were focused, built with the purpose of meeting the potential and productive needs of each family. All production projects were designed in line with the precepts of food sovereignty, in which the family plays the main role in decision-making about production processes.

The results showed that in relation to the productive activities benefited by the implementation of P1+2, it was possible to verify that poultry production includes the largest proportion of benefited families, representing 80% of the families, that is, of the 35 families in the development category contemplated, 28 had their poultry production strengthened by the program's productive project. Regarding the development of livestock, pig (46%), sheep (14%) and goats (9%) and beekeeping (6%) also appear as activities benefited by the program.

As for activities related to agricultural cultivation, the results highlight olericulture as the second position in the proportion of activities strengthened by P1+2, representing 57% of the families surveyed. In sequence, in the cultivation area is the activity focused on the orchard, representing 31% of the families studied. The lowest proportions of the productive activities benefited by the program were those focused on the processing and processing of cheese and the production of handicrafts, each representing approximately 3% of the families.

In view of the above, it is possible to verify that, in proportional terms, animal husbandry stands out as being the subsystem most strengthened with the implementation of the program. However, this fact does not diminish the importance of the execution of the P1+2 for the productive diversification verified from the total of the subsystems of the benefited families, in line with what was stated by Alencar, Justo and Alves (2018), who, when analyzing the impacts of the P1+2 on productive diversification, found that the program presented positive effects in relation to the level of productive diversification, significantly influencing the food and nutritional security of families.

Regarding the improvements that occurred in the productive areas of the families benefited by P1+2, in Icó-CE, in 2019, the data show that 97% of the families had some type of improvement in animal breeding facilities and 91% had an expansion of animal husbandry.

In the cultivation area, 54% of the families had an expansion of cultivation and 6% showed some improvement in the cultivation facilities. Finally, 3% of the families opted for the acquisition of inputs for the production of handicrafts (threads and trimmings), the same proportion of improvement as the family agribusiness.

Taking into account the improvements that have occurred in the production system and the infrastructure of families, we can say that P1+2 plays a significant role in the quality of life in the countryside. With the program, families not only have a technology for

capturing and storing water, but there is also an improvement in the productive potential of family establishments.

Because the program presents a relationship with the adoption of more efficient and conscious production practices based on agroecology, there is also an improvement in agrobiodiversity, which is fundamental for environmental conservation and consequently for increasing the quality of life of families, generating rural development (Grisa; Schneider, 2015).

Regarding the distribution of the productive subsystems benefited by the implementation of the program, it was verified that all families had some area of animal husbandry strengthened and 94% of the families had the productive backyard area benefited by the program. Regarding the swidden subsystem, it was observed that 54% of the families were strengthened in this area. Finally, 3% of those contemplated by the P1+2 had their family agro-industrial production strengthened by the program, the same proportion presented by artisanal production.

As Souza (2014) points out, this type of diversification of agricultural and livestock activities has led to a significant improvement in the levels of food and nutritional security, as well as in the occupations of families. According to Aquino, Alves and Vidal (2020), the social technologies for coexistence with the semi-arid region, such as those developed by P1+2, consist of technologies with low-cost practices, but which have effective results in increasing production.

In relation to the productive areas supported by the productive projects developed for the families of the P1+2, it was possible to observe that, in the area of rural constructions, 74% of the families opted for the construction of chicken coops, 43% for the implementation of pigsties and 3% for the structuring of the sheepfold.

As for improvements in the infrastructure of breeding and/or cultivation, 46% of the families chose this modality as a way to strengthen their production systems, while 51% opted for the implementation or improvement of cultivation areas. The results also showed that 63% of the families acquired animals for their livestock and 34% of the beneficiaries of the program acquired some type of productive input.

Regarding the functions assigned to the productive projects that were met with the implementation of P1+2, from the program the families showed an increase in efficiency within the subsystems, as well as a strengthening of relations with the markets. Such facts correspond to the way in which the productive projects were set up, strategically designed

in the best use of the products, for example, in the case of the family that opted for the improvement of the animal facility, acquisition of breeders, revitalization of the vegetable garden and orchard. If family consumption is supplied, the surplus production can be used in animal feed as well as commercialized, generating income for families. In this sense, there would be a better interaction of the subsystems, as well as the strengthening of market relations.

The data also pointed out that 54% of the families surveyed showed strengthening of interactions between production systems and only 3% contributed to the processing of production.

Alves, Rezende and Ribeiro (2022) bring that P1+2 presents itself as an efficient program for farmers, because through it families can have a source of water reserve to grow food and develop small livestock, promoting food and nutritional security, in addition to generating income through the commercialization of the productive surplus.

In summary, the results showed that, in relation to the activities, the production of poultry (80%) and vegetables (57%) appear as the activities with the highest proportion chosen by the families to be strengthened.

As for the improvements that occurred, 97% of the families had improvements in their animal husbandry facilities, 91% had their livestock expansion, and 54% expanded their cultivation area. Among the main areas supported were: construction of chicken coops (74%), pigsty (43%) and sheepfold (3%); acquisition of animals; infrastructure improvement (cultivation and/or breeding) (46%); and implementation or improvement of cultivation areas (beds, vegetable gardens, orchards, etc.).

Regarding the benefits of the subsystems, all the beneficiaries of the program had some benefit in their animal husbandry subsystems: 94% of the families had their productive backyards benefited and 12% had their swiddens improved.

Finally, with regard to the fulfillment of the functions attributed to the productive projects, it was observed that all families had an increase in efficiency within the subsystems, as well as a strengthening of the relationship with the market; 54% had an increase in the interaction of the subsystems and 3% had contributions from production processing.

In view of this, we can say that, through the P1+2 program, the beneficiary families in the municipality of Icó-CE, referring to the year 2019, had their production subsystems

strengthened, with their food needs being met by the products produced; In addition, families can sell the surplus production, thus generating an improvement in income.

The structure generated by the program provides support so that families can maintain at least a minimum production condition during the dry season, helping in the process of sustainability of working conditions. Therefore, we can say that P1+2 is established as an innovative alternative for improving food security, promoting work and income for rural families.

## **CONCLUSION**

Public policies to combat drought and coexistence with the semi-arid region, which guarantee the implementation of technologies such as those developed by the P1MC (2003), which enables families in the semi-arid region to access quality water for drinking and cooking, and those of the P1+2 (2007), aimed at access to water for food production, emerge as two of the most disseminated and of great importance tools regarding the democratization of access to drinking water and food production in the semi-arid region. In this context, the P1+2 production cisterns were addressed as a technology for strengthening family farming in Icó-CE.

Therefore, this work aimed to understand the contributions/benefits generated by the P1+2 program for sustainability, food security and promotion of work and income of beneficiary families in the municipality of Icó-CE.

In general, it was possible to conclude that, from the access to P1+2 (development), the benefited families in the municipality of Icó-CE, in 2019, were able to have their productive activities strengthened in the areas of cultivation, animal husbandry, family agribusiness and handicraft production.

The development of small-scale livestock appears as one of the activities chosen by families to be benefited, with emphasis on the production of poultry, pigs, sheep, goats and beekeeping.

In the cultivation area, the families showed a predilection for strengthening the cultivation of vegetables and fruit trees. To a lesser extent, the agro-industry of cheese manufacturing and the production of handicrafts appear as strengthened activities. However, none of the activities addressed here appear to be more or less important, since all the processes were relevant to meet the food needs of the producers, according to their ways of life, traditions and culture.

From the results presented here, we can say that social technologies have contributed in a participatory and democratic way to the objectives of public policies to combat and coexist with the Brazilian semi-arid region. In addition, they contribute to the 2030 agenda, through the achievement of the sustainable development goals, being important instruments for the construction of a fairer, more resilient and sustainable society.

In view of this, the results indicate the confirmation of the hypothesis that, with the P1+2, families are able to maintain their productive systems, playing a relevant role in food production, promoting work and providing some increase in the income of their beneficiaries.

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