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DRY PROPENSITY AREAS IN PARAÍBA STATE: A SPATIAL ANALYSIS OF THE EMERGENCY SITUATION DECREES AND THE OPERAÇÃO PIPA ACTIONS

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Abstract

Drylands are natural spaces with landscapes marked by water scarcity. In the current global context of climate change, these regions tend to increase in the occurrence and magnitude of phenomena such as dry and drought. The municipalities of the Brazilian semi-arid have higher recurrence of these phenomena. The Brazilian State has acted through actions and public policies that help these municipalities and their populations to face and live with these phenomena and their effects. Among these, Operação Pipa (OP) stands out, which provides access to drinking water. The objective of this study was to perform a spatial and comparative analysis between the Decrees of Emergency Situation (SE) / State of Public Disaster (ECP) and the actuation of the OP in Paraíba in the years 2012-2016. The methodology used was the Spatial Analysis and Cartographic that used the OP information, coming from the Military Command of the Northeast and SE decrees / ECP by dry and drought available in S2iD by Ministry of Regional Development. The results indicate the extent and impacts of the last drought, which more than 90% of the municipalities in the state had their SEs recognized, in relation to the OP, this was present in more than 70% of the municipalities in Paraíba

Keywords: Dry and Drought; Emergency Situation; Operação Pipa.

ÁREAS DE PROPENSÃO A SECA NO ESTADO DA PARAÍBA: UMA ANÁLISE ESPACIAL DOS DECRETOS DE SITUAÇÃO DE EMERGÊNCIA E A ATUAÇÃO DA OPERAÇÃO PIPA

Resumo

As terras secas são espaços naturais com paisagens marcadas pela escassez hídrica. O atual contexto mundial de mudanças climáticas, essas regiões apresentam tendência ao aumento na ocorrência e magnitude de fenômenos como a estiagem e seca. Os municípios do Semiárido brasileiro possuem maior recorrência destes fenômenos. O Estado brasileiro tem atuado através de ações e políticas públicas que auxiliam esses municípios e suas populações no enfrentamento e convivência a esses fenômenos e seus efeitos. Entre essas, destaca-se a Operação Pipa (OP), que possibilita o acesso à água potável. O objetivo deste estudo foi realizar uma análise espacial e comparativa entre os decretos de Situação de Emergência (SE)/Estado de Calamidade Pública (ECP) e a atuação da OP na Paraíba nos anos de 2012-2016. A metodologia empregada foi a Análise Espacial e Cartográfica que utilizou as informações da OP, oriundas do Comando Militar do Nordeste, e os decretos de SE/ECP por estiagem/seca, disponíveis no S2iD do Ministério do Desenvolvimento Regional. Os resultados indicam a extensão e os impactos da última grande seca, o qual mais de 90% dos municípios do estado tiveram as SE reconhecidas, já em relação à OP, esta esteve presente em mais de 70% dos municípios da Paraíba.

Palavras-chave: Seca e Estiagem; Situação de Emergência; Operação Pipa.

ÁREAS DE PROPENSIÓN A LA SEQUÍA EN EL ESTADO DE PARAÍBA: UN ANÁLISIS ESPACIAL DE LOS DECRETOS DE SITUACIÓN DE EMERGENCIA Y EL DESEMPEÑO DE LA OPERAÇÃO PIPA

Resumen

Las tierras secas son espacios naturales con paisajes marcados por la escasez de agua. En el contexto global actual del cambio climático, estas regiones tienden a aumentar la ocurrencia y la magnitud de fenómenos como la sequía. Los municipios del semiárido brasileño tienen una mayor recurrencia de estos fenómenos. El Estado brasileño ha actuado a través de acciones y políticas públicas que ayudan a estos municipios y sus poblaciones a enfrentar y vivir estos fenómenos y sus efectos. Entre estos, se destaca la Operação Pipa (OP), que permite el acceso al agua potable. El objetivo de este estudio fue realizar un análisis espacial y comparativo entre los decretos de Situación de Emergencia (SE) / Estado de calamidad pública (ECP) y la acción de la OP en Paraíba en los años 2012-2016. La metodología utilizada fue el Análisis espacial y cartográfico que utilizó la información de la OP, del Comando Militar del Nordeste, y los decretos SE/ECP debido a la sequía, disponibles en el S2iD del Ministerio de Desarrollo Regional. Los resultados

indican el alcance y los impactos de la última gran sequía, que más del 90% de los municipios del estado reconocieron sus SE, en relación com a la OP, esta estaba presente en más del 70% de los municipios de Paraíba.

Palabras-clave: Sequía; Situación de Emergencia; Operação Pipa.

1. INTRODUCTION

The dry regions are geographic spaces with particular natural characteristics, these are related to the physical-natural composition (geological structure, soil depth, hydrography and relief) as well as climatic order (referring to the circulation of air masses, latitude, etc.), which constitute a typical landscape, marked mainly by water scarcity. According to the United Nations Convention to Combat Desertification - UNCCD (2000), these regions are called drylands and include areas of hyper-arid or desert, arid, semi-arid and sub-humid climates.

According to Black (2016), dry land corresponds to 41% of the planet's land cover, where approximately 40% of the world population (2.1 billion inhabitants) live, which two-thirds of this population is located on the Asian continente. In view of the current panorama of climate change on the planet, with the tendency to intensify extreme events, the perspective is that these regions will become increasingly arid, to the detriment of the increase in temperature, evaporation and evapotranspiration rates, and consequently, the increase in occurrences and the prolongation of drought events (BLACK, 2016; FARIAS, 2018).

In Brazil, the Brazilian Semiarid region constitutes the largest and main example of drylands in the national territory, which encompasses a large part of the Northeast region and a small area in the northern Southeast. Historically, this territory has been delimited since the 30s of the 20th century, being first called "Polígono das Secas" and changed several times until its last delimitation, through Resolution No. 115/2017 of SUDENE, which instituted a territory that comprises a total of 1.262 municipalities.

This configuration naturally places the municipalities inserted in this context in a situation prone to the risk of disasters caused by natural phenomena, especially those of a climatological order such as dry and droughts.. According to the United Nations Office for Disaster Risk Reduction - UNISDR (2009), the term disaster is understood as the result of the action of natural events or those arising from human activity and which cause adverse effects on populations living in the affected areas. According to Moura et al (2016), disasters cause extensive losses, human, material, economic and/or environmental damage, which can overcome society's ability to deal with the problem using its own means.

The impact of natural phenomena and disasters on society is strongly related to the degree of vulnerability of these populations. The concept of vulnerability, associated with the issue of risks, refers to the exposure of an individual, social group or population to a danger or threat, presenting a certain fragility in relation to the event and, therefore, not being able to absorb the disturbance suffered, to reestablish or readjust to the new reality (VEYRET E RICHEMOND, 2007; SANTOS, 2015).

Throughout history, the Brazilian State has acted, through its various instances, through public policies that aimed to solve the problems arising from dry and droughts, whether they are continuous actions or through specific and/or emergency actions that help the municipalities. affected by these disasters, one of these actions is the federal government's Operação Pipa (OP).

According to Farias (2018), the Operação Pipa is characterized as an emergency public policy for the distribution of drinking water for human supply, through water tank trucks, to serve the populations of the municipalities that enact an Emergency Situation (SE) or State of Public Disaster (ECP). Established by Ministerial Decree No. 1/MI/ MD, July 25th (BRASIL, 2012), the OP is operationalized by the Brazilian Army (EB), through their organizations and military units, whose mission is to plan, coordinate and supervise the operation's actions.

The operation of this public policy is linked to a cooperation of various agencies of the three levels of government (Federal, State and Municipal) in the performance of the OP. Among these are the Ministry of National Integration (MI), the Ministry of Defense (MD), through the Land Operations Command - COTER (Brazilian Army Organization), the National Secretariat of Civil Defense - SEDEC, the state governments and their respective State Civil Defense Departments, as well as the municipalities and their Municipal Civil Defense Coordination - COMDEC (BRASIL, 2012; MARTINS & JUSTO, 2014; LIMA, 2016 and FARIAS, 2018).

In view of the above, the afore mentioned work aims to identify the municipalities that have declared an Emergency Situation or State of Public Calamity in relation to dry and drought, as well as those who received the actions of Operação Pipa in Paraíba's state, for the purpose of pointing and spatializing the actions of this policy and if there is consonance with the devices and tools to face the effects of natural disasters of climatological order in the region.

1.1. Characterization of Study Area

The State of Paraíba (Figure 1), located in the Northeast region, is one of the 27 states that compose the Federative Republic of Brazil. According to information from IBGE (2010), it has a population of 3.766.528 inhabitants, spread over four intermediate geographical regions and fifteen immediate regions, that are distributed state 223 municipalities, which as a whole has an area of 56.340 km^2. According to the 2005's Semiarid Delimitation (BRASIL, 2005), Paraíba had 170 municipalities inserted in that territory, which corresponded to 76.2% of the municipalities and 86.6% of the state's territorial extension. However, with the New Delimitation of the Semi-Arid Region (BRASIL, 2017), Paraíba now has 194 municipalities included in this territory, covering about 87% of the municipalities and approximately 91% of the state's territorial extension (51.334, 637 km^2).

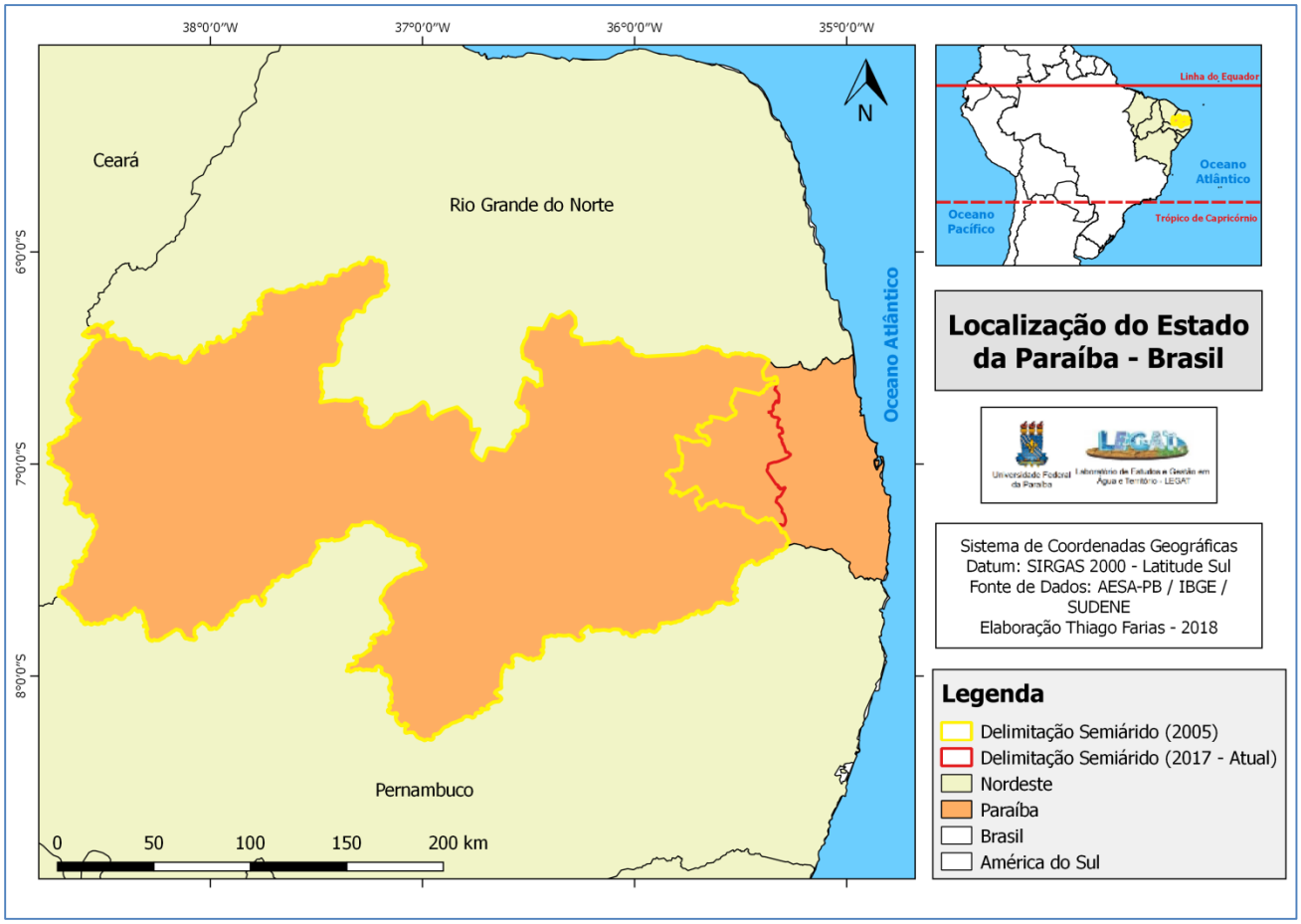

Figure 1 – Paraíba's State Location. Source:Author (2019).

According to the Paraíba State Water Resources Plan - PERH-PB (2006), the natural regions of Paraíba are classified by reference to the old mesoregional classification, being thus arranged in 3 main zones: Litoral-Zona da Mata, Agreste-Brejo and Zona Semiárida. From the physiographic point of view, some main factors are presented as determinants for the composition of the other aspects related to the physical-natural environment. The first is related to the topographic issue. For Schmidt (2014), the relief interferes with the performance of atmospheric mechanisms and systems that form precipitation, resulting in differences in rainfall between the windward and leeward areas of the topographic barrier. In the case of Paraíba, the Borborema Plateau, located in the central portion of the state, has a strong influence on the circulation of air masses from the ocean and, consequently, on the rains.

The second relates to the phenomenon of continentality and proximity to the sea. According to Costa (2012), this phenomenon is characterized by the performance and influence of the distance of an area or region, in relation to water bodies, mainly to the ocean. The proximity to the ocean guarantees temperature stability over the days, as well as a greater presence of humidity, resulting from the action of the air masses originating from it, allowing greater rainfall levels.

Regarding the climatic characteristics, according to Becker et al (2011), Paraíba has three main types of climate: The humid tropical, with average annual rainfall above 1.500 mm, located in the coastal portion and, as it enters inland, mainly after the Borborema Plateau, the present climate is semi-arid, with high concentration and spatial and temporal irregularities of the rains, presenting averages of 500 mm per year. And finally, in the Sertão Paraibano, where the predominant climatic configuration is the semi-humid, with rainfall averages of up to 800 mm/year, which is influenced by the warm and humid air mass from the Amazon region (CEPED, 2012).

Regarding the vegetation cover of the state, according to the University Center for Studies and Research on Disasters (Op. Cit.), It is constituted by several morphological types, influenced by the climatic location and by the natural and climatic

conditions. The eastern portion consists of the Atlantic Forest, coastal vegetation, riparian forests and cerrados. In the semi-arid portion, it is entirely composed of the Caatinga biome, which within it, there are variations in the types of vegetation, sometimes more dense (tree), sometimes less dense (shrub-tree or shrub), presenting the loss of its foliage during the dry season, as an adaptive capacity.

2. METHODOLOGY

The Group of Studies and Research in Water and Territory (GEPAT), through the Laboratory of Studies and Management in Water and Territory (LEGAT), has been working for four years focusing, through one of its lines of research, its studies on performance and territorialization of the water tank truck and emergency water programs, especially Operação Pipa. With the need to deepen the knowledge of these policies, the group has turned to issues related to vulnerability and risks to disasters, especially dry and drought, in the region.

For this work, the secondary information was used, coming from the Northeast Military Command (CMNE), for the performance of the Operação Pipa, as well as information regarding the Emergency Situation dec,rees (SE) and the Calamity Public State's decrees (ECP), from the Ministry of Regional Development (MDR), former Ministry of Integration (MI), through the S2iD platform, for the state of Paraíba in the 2012 to 2016 analysis timescale[1]. The data initially consisted of tables in *pdf format, with information regarding the municipalities that were included in Operação Pipa and receiving the actions of this public policy, as well as those that decreed SE or ECP due to dry and drought. In a second step, this information was used, through the spatial database of the research group in the format * shp (characteristic of GIS's), to spatialize through the QGIS 2.18 Las Palmas program and, consequently, to generate cartographic products that subsidized the analysis and discussion about these public policies and emergency actions.

3. RESULTS AND DISCUSSIONS

According to the results obtained, from 2012 to 2016, 1.944 decrees were made, all of which were in recognition of the Emergency Situation, of which 1.943 were due to dry and only one due to drought. Of the 223 municipalities that compose the Paraíba's state, 203 were covered by the Emergency Situation decrees during the analyzed period, representing about 91% of the municipalities that compose the state, as shown in the table below:

Table 1 – Government decrees in response to Disasters caused by Dry and Drought in Paraíba from 2012 to 2016. Source: Author (2019).

Year	Recognitions	Municipality	Disaster Type	Recognition Type
2012	196	196	Dry (196)	Emergency Situation (SE)
2013	593	202	Dry (592) Drought (1)	Emergency Situation (SE)
2014	394	198	Dry (394)	Emergency Situation (SE)
2015	394	197	Dry (394)	Emergency Situation (SE)
2016	367	197	Dry (367)	Emergency Situation (SE)

Analyzing the period from 2012 to 2015, it is noted that there are variations in the number of municipalities included in the decrees, which all municipalities in the Semi-arid region of Paraíba were covered by the decrees. It is also noticed that the effects of the dry and drought extended beyond the borders of the Semiarid, even serving municipalities in the coastal region of Paraíba, notably the most humid region in the state, according to Figure 2.

In 2012, the 196 recognitions extended to 196 municipalities in Paraíba, of these, not only all the municipalities belonging to the semiarid region of Paraíba at the time were included, but 26 municipalities outside this territory. In 2013, of the entire period analyzed, it was the most critical year in relation to the number of SE recognitions, as well as the number of municipalities included in this action There were 593 SE decrees, 592 due to dry and only one, in the municipality of Itapororoca, due to drought. In 2014, there was a decrease in the number of recognitions and municipalities, 394 SE decrees covering 198 municipalities in the state. Finally, in 2015, the number of SE recognitions remained the same as in 2014 (394), however in relation to the number of municipalities, this decreased by only 1, totaling 197.

[1] Because the time scale is prior to the changes in delimitation and regionalization, the New Delimitation of the Brazilian Semiarid by SUDENE and the New Regionalization of Paraíba from IBGE, promulgated in 2017, were discarded from the analysis, using the previous regionalizations and territorializations..

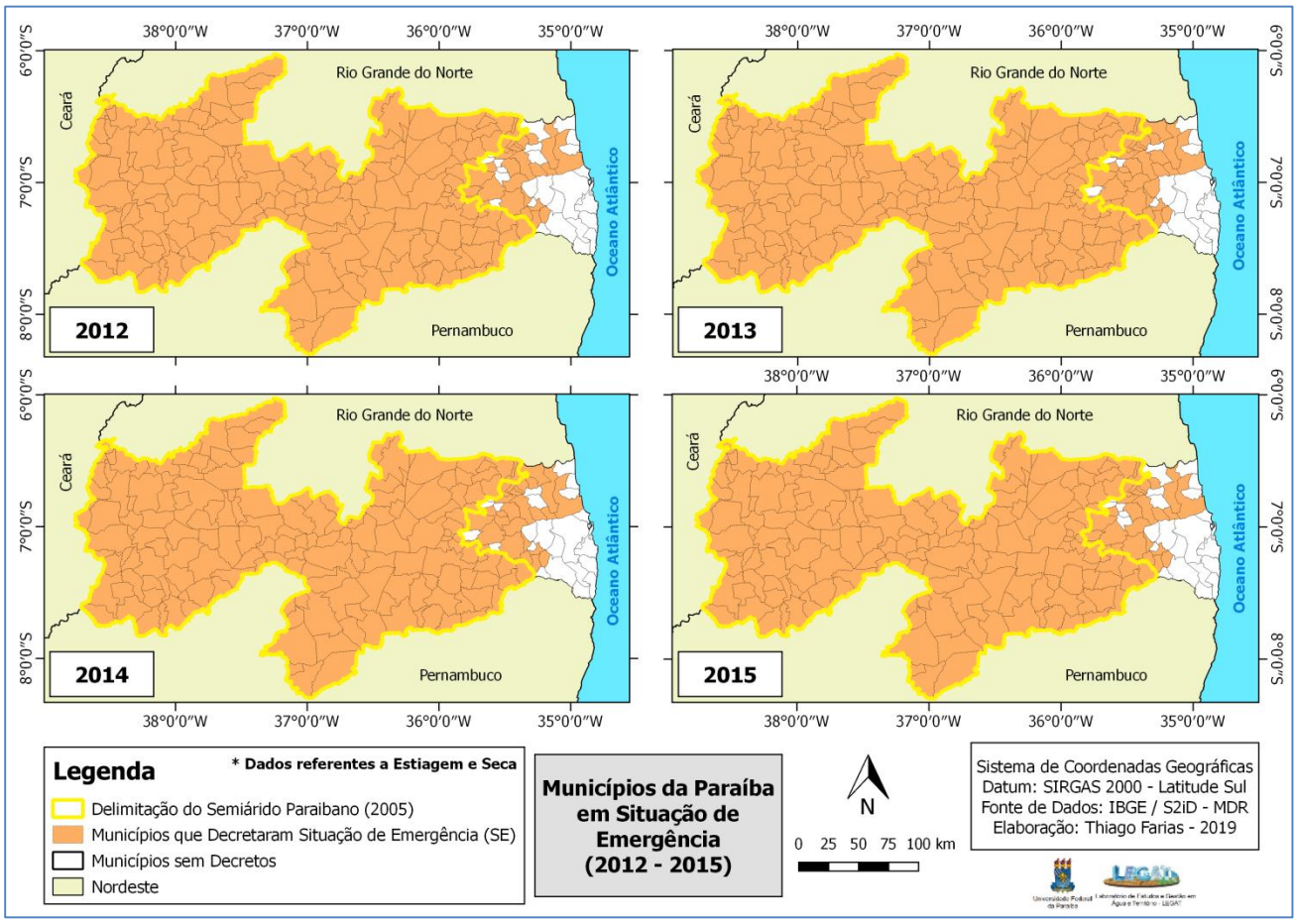

Figure 2 - Municipalities in an Emergency Situation in Paraíba due to Dry and Drought between 2012 and 2015. Source: Author (2019).

Regarding Operação Pipa, during the period from 2012 to 2016, it was observed that, unlike the SE recognitions, there was a continuous growth in the number of municipalities served by the OP in Paraíba, covering 173 of the 223 municipalities, which represents 77, 5% of the state's municipalities. When analyzing and spatializing the information referring to the municipalities that receive OP actions, it is clear that, during the period from 2012 to 2015, not all municipalities in the semiarid region of Paraíba needed the OP. However, it is observed, in a less intense way, that this emergency public policy for the distribution of drinking water also went beyond the territorial limits of the Semiarid, a region naturally more prone to dry and drought, consequently arriving in more humid regions than this, as shown in Figure 3.

In 2012, the year of the beginning of the last major drought in the region, 119 municipalities were served by the operation, of these 108 belonged to the Semiarid and 11 were located outside this territory. In 2013 there was a sharp increase of 41 municipalities, totaling 160, 144 municipalities were located in Paraiba's Semiarid and 16 beyond the borders of this territory. In 2014, the growth was of only 6 municipalities, constituting a total of 166 municipalities served by OP in Paraíba. The number of municipalities belonging to the semiarid region of the state served by the operation increased to 150, whereas those located outside this region remained in 16 municipalities. Finally, in 2015, the number of municipalities receiving OP actions in the state was only two, totaling 168 municipalities served, of these 152 were located in the Semiarid and the other 16 outside the limits of this territory.

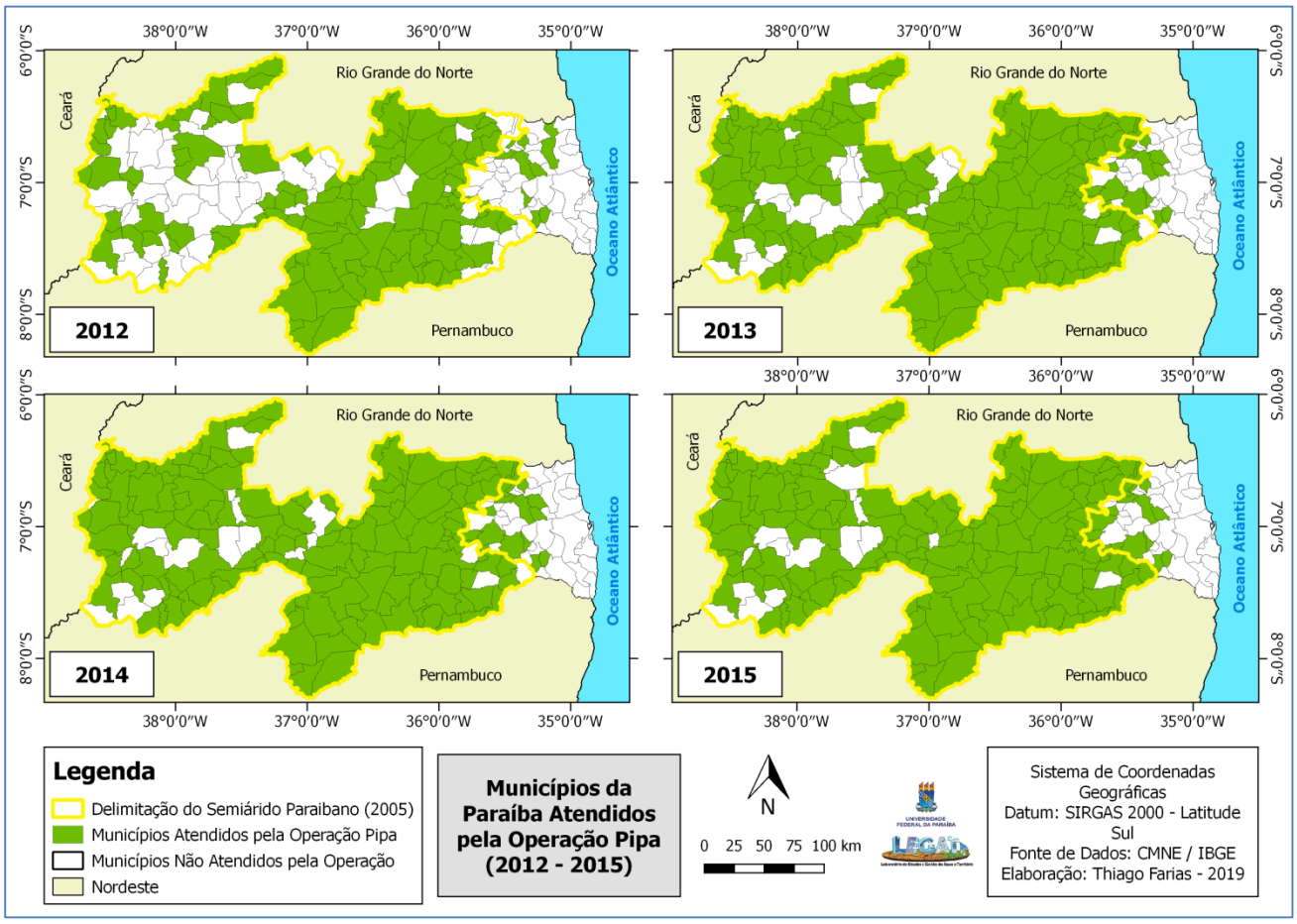

Figure 3 - Municipalities served by Operação Pipa in Paraíba between 2012 and 2015. Source: Author (2019).

Analyzing the year 2016 and comparing the data from Operação Pipa and the SE decrees in Paraíba, it was observed that there were few changes in relation to the scenario identified in 2015. With regard to SE decrees due to dry or drought, the only change was the decrease of 27 recognitions, which represents a decrease of approximately 7%, resulting in a total of 367, however when analyzing the number of municipalities in SE, it remained the same in relation to 2015, representing 197 municipalities. Regarding the actions of Operação Pipa in the state, the number of municipalities also remained at the same level as the previous year, totaling 168 municipalities served, as shown in figure 4.

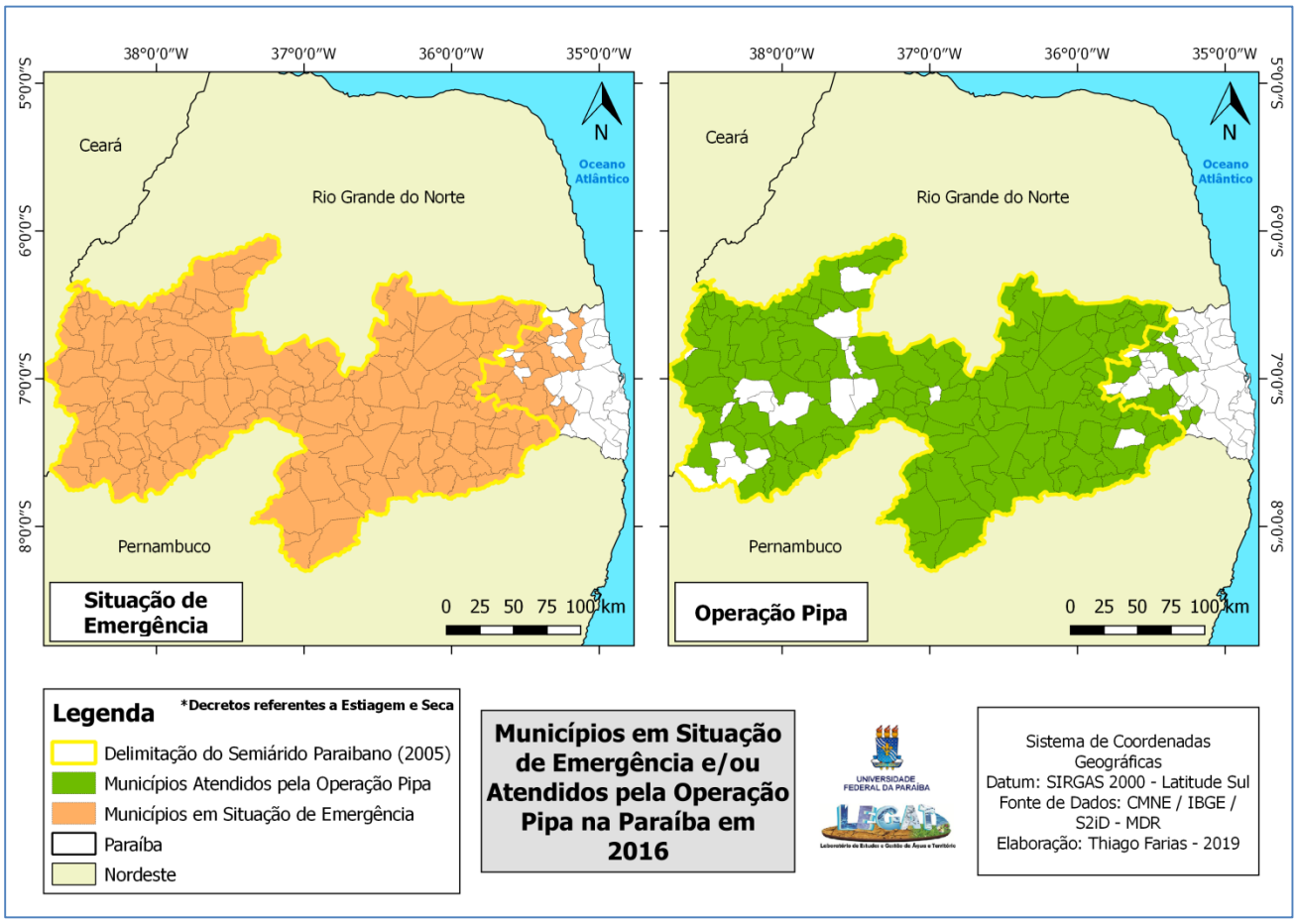

Figure 4 - Spatialization of Municipalities in Emergency Situations and served by Operação Pipa in Paraíba in 2016. Source: Author (2019).

Analyzing the behavior of these two actions of the State, it is noted the fulfillment of the basic prerequisite for receiving Operação Pipa, which is precisely the decree, by the municipalities, and the recognition of Emergency Situation or State of Public Calamity, by the state and federal governments, which in the case of this study, no case of ECP was identified in the period analyzed. However, a greater number of municipalities were identified in SE compared to those receiving the shares of Operação Pipa.

There are several explanations for this phenomenon, the first of which is based on the demands of the municipalities, considering that when the SE is decreed due to drought, the municipality does not need the supply of drinking water for its populations, but other actions such as the Bolsa/Garantia Safra, which also has the prerequisite for recognition of SE. Another issue to be highlighted is that with the SE decree and recognition, the municipalities have, as an administrative tool, the waiver of the bidding process to precisely meet the demands imposed by this panorama, which in this case, this legal provision (SE decrees), may be used as a political-administrative purpose.

Another factor to consider is that there are cases where the municipality points out the need for water supply, but does not present the documents and information required to be included in the OP. Finally, another issue to be highlighted is the use of tools for analyzing and monitoring the effects of dry and drought and drought, among them the Monitor das Secas. According to ANA (2019), the Monitor das Secas has been used as an aid tool for several public policies, including Operação Pipa. If the municipality, when decreeing SE, is in an area identified by the monitor as affected by drought, access to OP actions is facilitated, reducing the waiting time for assistance, if not, the admission process in the OP remains according to the rules established by the ordinance that regulates the functioning of this public policy.

4. CONCLUSIONS

The results obtained in this study highlight the importance and the consolidation of support mechanisms in facing the effects related to disasters caused by natural

phenomena, which in the case of this study are due to dry and drought, phenomena of climatological character. Emergency aid and support policies for municipalities in SE or ECP, such as Operação Pipa (focus of this study) and Bolsa / Garantia Safra, has fundamental importance for the populations of these municipalities, ensuring social security in face of these phenomena, which historically have caused several negative impacts on regional society.

Geotechnologies are fundamental tools for territorial planning and management in general and, especially, in disaster situations, as they allow the acquisition and spatialization of information that contribute to the response of governments to the new reality imposed by the phenomena that originate the disasters, thus enabling a better intervention and consequently assistance to affected populations.

The information presented indicate the impact of the last major drought in the region, affecting almost all municipalities in Paraíba, even extending to the coastal zone, which is naturally more humid and has a different climatic configuration from the Paraíba's semiarid region. This comprehensiveness is verified when spatializing the municipalities that enacted SE, as well as those that received the OP's actions, the latter, however, in a more restricted way when comparing with SE recognitions.

Finally, highlights not only the importance of these emergency action programs due to dry and drought, but also the existing water infrastructure must be strengthened, expanded, increased and consolidate the actions and mechanisms aimed at ensure greater capacity of municipalities in the region in dealing with and adapting to these phenomena, with the aim of reducing the various types of vulnerabilities that exist in their populations.

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