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Use of Geotechnologies in Mapping Grants in the Piancó/PB Hydrological Planning Unit in Years 2021 – 2024

Utilización de Geotecnologías para Mapear la Concesión de Recursos Hídricos en la Unidad de Planificación Hidrológica de Piancó/PB en los Años 2021 – 2024

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Abstract: The grant is one of the instruments of the National Water Resources Policy-PNRH that emphasizes the regularization of the assignment regarding the use of water resources in the country. In this way, the main objective of this work is to analyze, under the temporal aspect, the granting of the right to use water resources in the Piancó Hydrological Planning Unit, located in the Piancó-Piranhas-Açu River Watershed, issued by the Paraíba, by through the Executive Agency for Water Management of Paraíba (AESA). In the methodological steps, the qualitative analysis was approached as the main method in an exploratory approach, as it sought, through the analysis of data and information, to explain the patterns of grants granted in the planning unit of Piancó/PB. In the period studied from 2021 to 2024, 256 grants were identified, with the predominance of the use of irrigation with 70% of the grants issued, as for the type of abstraction, there is a preference for underground abstraction with a percentage of 56%. As for uses, irrigation is well dispersed throughout the basin area, highlighting the importance of grants for rural supply. Therefore, there is a lack of standardization of grants, as well as the concentration of water use for irrigation activities.
Keywords: *Water resources management; rationality; water.*

Resumen: La concesión es uno de los instrumentos de la Política Nacional de Recursos Hídricos-PNRH que enfatiza la regularización de la asignación relativa al uso de los recursos hídricos en el país. Así, este trabajo tiene como objetivo principal analizar bajo el aspecto temporal, las concesiones de derecho de uso de los recursos hídricos en la Unidad de Planificación Hidrológica de Piancó, localizada en la cuenca hidrográfica del Río Piancó-Piranhas-Açu, emitidas por el Estado de Paraíba, a través de la Agencia Ejecutiva para la Gestión del Agua de Paraíba (AESA). En los pasos metodológicos, se abordó como método principal el análisis cualitativo en un enfoque exploratorio, pues se buscó a través del análisis de datos e informaciones, explicar los patrones de las concesiones emitidas en la unidad de planificación Piancó/PB. En el período estudiado, de 2021 a 2024, se identificaron 256 concesiones, predominando el riego con el 70% de las concesiones emitidas. En cuanto a los usos, el regadío se encuentra muy disperso por el ámbito de la cuenca, destacando la importancia de las dotaciones de abastecimiento rural. Por lo

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tanto, se percibe una no estandarización de las concesiones, así como la concentración del uso del agua para actividades de irrigación.
Palabras clave: *Gestión de recursos hídricos; racionalidad; Agua.*

INTRODUCTION

For the National Water and Sanitation Agency - ANA (2019), the management of water resources corresponds to an integrated set of guidelines necessary for the maintenance of the qualitative and quantitative availability of water, dealing with the management of water availability and demand, the knowledge of existing problems in the river basin, the definition of planning strategies for future use, identification of sources of financial resources and planning for the application of these resources in the short, medium, and long term.

The implementation of management instruments is necessary due to the increasingly evident conflicts over the use of water, represented by the difficulties in accessing water, both in terms of quality and quantity, in order to satisfy the growing demand. Water has several purposes, which can generate conflicts between its users, hence the importance of management and regulation of water resources, which promote sustainability in the demands of the economic, social and environmental tripod for water, also promoting harmony between current and future uses by minimizing conflicts of use (BARBOSA ET AL., 2014; WORLD BANK, 2016).

In Brazil, the management of water resources is ensured and guided by Law No. 9.433 of January 8, 1997, which establishes the National Water Resources Policy and creates the National Water Resources Management System. The management instruments established by the law are highlighted, among them the granting of water use rights, an important tool to support the management of hydro resources.

Granting and charging for water use are management instruments that aim to induce the user to a more rational and sustainable use of the natural resource. The granting system aims to maintain the quality and effective right of access to water, while charging aims to assign value to water to finance the infrastructure of a watershed, as a way also, to rationalize the consumption of a scarce resource (BRASIL, 1997; ANA, 2019; RODRIGUES and LEAL, 2019).

However, it can be seen that the grant is not an instrument of easy implementation and administration. This instrument is an authorization for the use of water that, notwithstanding its administrative character, depends on a series of technical analyses carried out by the water resources management agencies. Because it is a public good, there is still no private ownership of water in Brazil, so it is up to the public power to manage its allocation (BRASIL, 1997; ANA, 2019).

In this sense, the present study has as its main objective to analyze the release of grants in the Hydrological Planning Unit of Piancó/PB, through a database made available by the Executive Agency of

Water Management of Paraíba - AESA (2021) in the time series of the period 2021-2024, evidencing the demands, type of use and springs.

THEORETICAL FOUNDATION

Hydric Resources Management: Conceptualization and history

When analyzing the Brazilian Constitution of 1824, as well as that of 1891, there was no mention neither of water, nor of the planning and management of hydric resources. In 1916, through the Civil Code, some points related to water were established, such as: the natural formation of water deposits belongs to the owners of colonial lands; solutions for certain conflicts over the use of water; and prevention regarding constructions that might pollute the water. It was then that, in the promulgation of the Federal Constitution on July 16, 1934, in article no. 5, that water constitutes a property of the union and gives it the duty to legislate on this natural resource (MMA/SRH, 2006; CABRAL, 2015).

On July 10, 1934, through Decree No. 24,643, the "Water Code" appears as the first legislation dealing exclusively with water. This, in turn, was limited to the authorization of hydroelectric use in Brazil and allowed the expansion of this sector. Through Law No. 6.938 of 1981, there were concerns related to the needs of conservation and preservation of water. In the law of this period, it is up to the National Council of the Environment (CONAMA) to establish standards on the maintenance of the quality of the environment, aiming at the rational use of environmental resources, especially water resources (OTTONI et al, 2011; CABRAL, 2015).

Another factor that deserves to be highlighted is the management of water resources under the Federal Constitution of 1988. The legislation allowed the states and the Union to create a management system for water resources. In this way, the formation of legal and institutional mechanisms began, assigned to the control over the use of its natural resources, valuing the preservation and maintenance of water (SANTIN; GOELLNER, 2013).

Thus, in 1997 the National Water Resources Policy (Law 9.433/97) was enacted, characterizing a new vision on the management of water use and reinforcing its recognition as an indispensable resource for living beings and endowed with economic value. For its implementation, the National Water Agency (ANA) was established by Federal Law 9.988/2000 together with the public and private agencies that make up the National System for the Management of Water Resources (SINGREH), in order to supervise, control and grant the use of water resources belonging to the Union, as well as charge for their use (MMA/SRH, 2006).

According to Guedes (2009), the management of water resources involves a series of discussions that are related to social, economic and environmental issues, and its main objective is to organize and

adjust the use, control and protection of this natural resource. It is noteworthy that the management of this resource must take place in accordance with the criteria established by specific legislation. In Brazil the guidelines for the management of Brazilian water resources are conducted through the National Water Resources Policy (Federal Law 9433/97).

According to the fundamentals presented by the PNRH (Law 9433/97) "water is a limited natural resource, endowed with economic value". As this is a limited resource, it is important to manage its use, bearing in mind the need to keep this resource available in quantity and quality. And, in view of its relevance, it is evident that a value must be assigned for its various uses. Also according to the PNRH "the management of hydric resources must always provide for the multiple uses of the water", thus, it becomes indispensable a structured planning that allows the use of this resource for several purposes, so as not to compromise its availability and quality.

According to the PNRH the management of hydro resources "must be decentralized and rely on the participation of the government, users and communities", it is important that during and after this planning and management process there are representatives of the society as a whole. To help in this management the PNRH has instituted the following instruments: "i) the Hydric Resources Plans; ii) the classification of bodies of water in classes, according to the preponderant uses of the water; iii) the granting of the rights to use hydric resources; iv) charging for the use of hydric resources; v) compensation to municipalities and vi) the Hydric Resources Information System. These instruments guide the construction of hydric resources management".

Based on this principle, Nascimento and Vilaça (2008) state that the management of hydric resources must go beyond the walls of traditional politics, whether in the federal, state or municipal spheres, facing this process as a tool that provides environmental, economic and social development. This management must be integrated, promoting a holistic view of the territory, including public, technological and educational policies, in order to favor a long-term process with the participation of the entities involved, as well as public and private organizations and institutions.

The National Water Resources Policy

The National Water Resources Policy, also known as the "Water Law", is responsible for establishing the entire management process of water resources in Brazil, through legal and institutional instruments. The National Water Resources Policy is known for its decentralizing, integrating and participative character.

The several historical events, as well as the emergence of several legislations referring to hydric resources management systems, were fundamental to institute the National Policy of Hydric Resources,

through Law No. 9.433, of January 8, 1997 (BRASIL, 1997), which covers the entire national territory and has a strategic character (ANA, 2013). It also aims to prevent and defend against critical hydrological events of natural origin or arising from the inappropriate use of natural resources and to encourage and promote the collection, preservation and use of rainwater (BRASIL, 1997).

Soon, the National System of Water Resources Management (SINGREH) was created and was responsible for Coordinate the integrated management of waters; Deliberate in the administrative sphere the conflicts related to water resources; Implement the National Water Resources Policy; Plan, regulate and control the use, preservation and recovery of water resources; And promote the charging of these resources for the use. To this end, the SINGREH structure is integrated mainly by the following entities (MMA/SRH, 2006): National Council of Hydric Resources (CNRH); Secretary of Hydric Resources (SRH); National Water Agency (ANA); State Councils of Hydric Resources (CERH); and Hydrographic Basins Committee (CBH);

For the Ministry of the Environment and the Secretary of Hydric Resources (2006), the decentralization occurs through the creation of a national system that integrates the Union and the states and the participation through the implementation of the Basin Committee, which involves the public authorities in the three instances, the water users and the civil society. Still according to the same authors, this integration refers to the incorporation of the management of these resources together with environmental management, land use, and also estuarine systems and coastal zones.

Hydrographic Basin

According to Silveira (2001) the hydrographic basin is understood as a region of natural collection of water from precipitation that converges the flows to a single outlet point, defined as outflow. It is basically made up of a main river and its tributaries, that is, a set of surfaces and a drainage network formed by water courses that communicate until they result in a single bed at the outlet.

The watershed is considered an essential unit for the management of a region's water resources. The discussions about watersheds in the field of hydric resources management begin with the integrating character, according to studies by Guerra and Cunha (1996) watersheds are pointed out as management units of natural and social guidelines, through this view it is admissible to follow the anthropic actions and the return of the environment.

Still according to these authors, in more developed nations the watershed has also been used as a planning and management unit, making compatible the various uses and interests for water, in order to ensure its quality and quantity.

According to Vilaça (2018) the watersheds are presented as physical units for evaluation, characterization, and recognition, aiming to favor the approach and approach on water resources, considering that the performance/conduct of a watershed over time occurs by two main factors, being them, of natural order, responsible for the pre-disposition of the environment to environmental degradation, and anthropic, where human activities interfere directly or indirectly in the systematization of the basin.

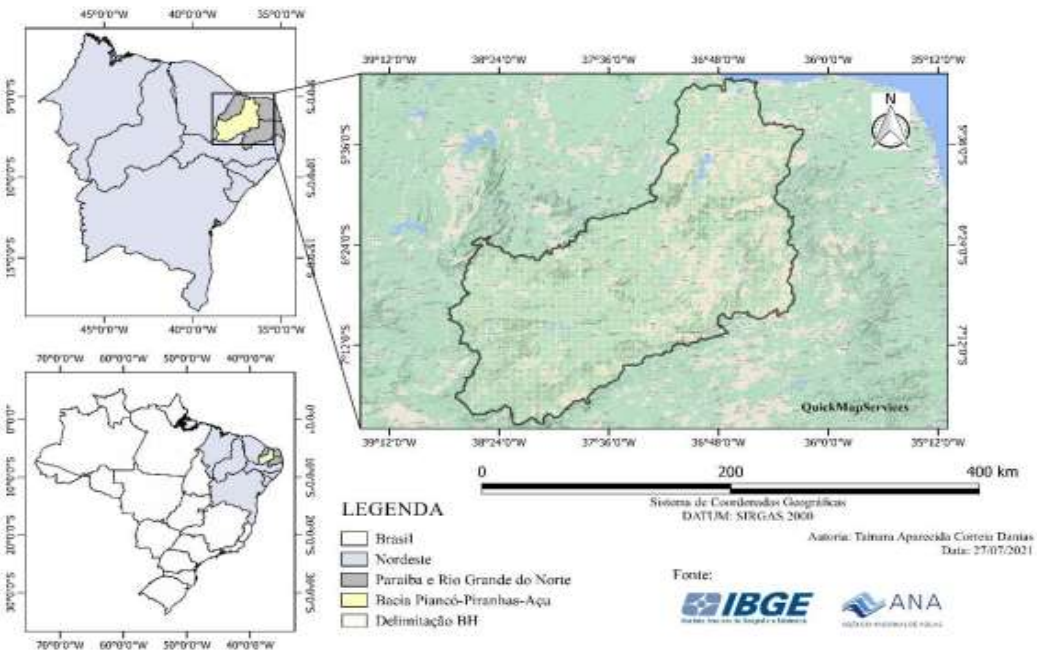
METHODOLOGY

Study site

The Piancó-Piranhas-Açu River Hydrographic Basin (BH-PPA) is located in the semi-arid region of the Brazilian Northeast, between the geographic coordinates 38° 75' and 36° 17' west longitude and 5° 06' and 7° 83' south latitude, with a drainage area of 43,683 km² being partially inserted in the states of Paraíba and Rio Grande do Norte (ANA, 2014).

Figure 01 shows its location at the national, regional and state levels. In all, the basin has 147 municipalities, of which 47 belong to the State of Rio Grande do Norte and 100 to the State of Paraíba (ANA, 2018), highlighting the municipalities of Patos, Sousa, Cajazeiras and Pombal in Paraíba, and Caicó, Assu and Currais Novos in Rio Grande do Norte (CBHPPA, 2021).

FIGURE 01: Location of the Piancó-Piranhas-Açu River (BH-PPA).



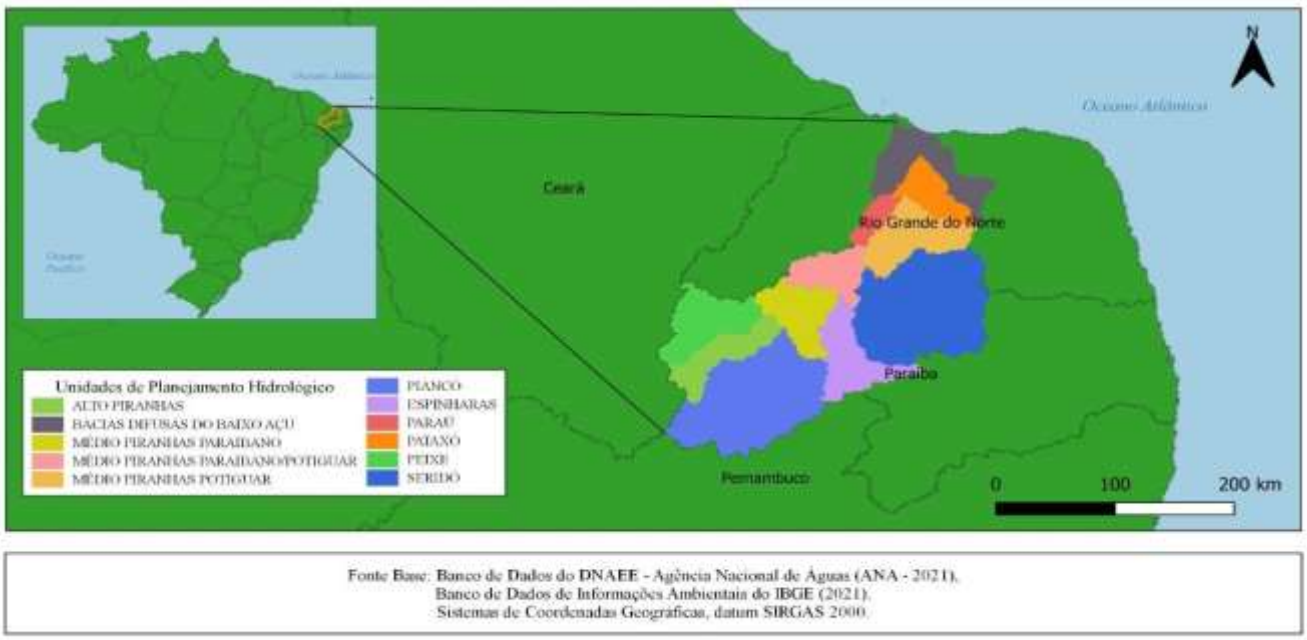
SOURCE: Own authorship (2021).

Also according to ANA (2014), in Paraíba, the Piranhas River forms a hydrographic system constituted in its high and medium courses by the basins of the rivers Peixe and Piancó and part of the basins of the rivers Espinharas and Seridó. In Rio Grande do Norte, the Piranhas river enters through the municipality of Jardim de Piranhas, receives the waters of the rivers Espinharas and Seridó and crosses the central region of the State. When it passes the Armando Ribeiro Gonçalves dam, the Piranhas River is renamed Piranhas-Açu. The Curema-Mãe d'Água reservoir system perennializes the Piranhas River, while the Armando Ribeiro Gonçalves reservoir perennializes the Açu River, both located in the States of Paraíba and Rio Grande do Norte, respectively, and are essential for the development of the region.

Geoenvironmental characteristics of the study area

According to ANA (2018), the basin was subdivided into 11 hydrological planning units - UPHs, based on the following criteria: hydrography, presence of large reservoirs and management units adopted by the states, as shown in Figure 02. These units are very important because they enable a better organization of the planning and use of existing water resources. The basin is considered strategic according to the Resolution of the National Council of Water Resources CNRH No. 109/2010, which defines the Water Resources Management Units of Hydrographic Basin of rivers under the domain of the Union.

FIGURE 02: Hydrological Planning Units (UPH) of the Piancó-Piranhas-Açu River.



SOURCE: Own authorship (2021).

Box 1 presents the municipalities that belong to the Piancó UPH, as well as the area belonging to the basin (km²), percentage of the area in the basin, headquarters in the basin and total population of the municipality. According to data presented by the Brazilian Institute of Geography and Statistics - IBGE (2010) the municipalities presented in Table 01 correspond to 82.75% of the total of municipalities incorporated in the referred basin, missing only the following municipalities: Tavares, Serra Grande, São José da Princesa, Santa Inês and São José da Caiana. It is verified that the insertion of the studied municipalities interferes with an average drainage area of 332,93 km² in the sub-basin, corresponding to 90% of the total drainage area of the Piancó sub-basin.

BOX 01: Municipalities belonging to the Piancó hydrological planning unit of the Piancó-Piranhas-Açu hydrographic basin.

Municipalities	**Area in the Basin (Km²)**	**Area in the Basin (%)**	**Headwaters in the Basin**	**Total Population (2010)**
Ibiara	253.51	100	yes	6,031
Conceição	592.45	97.4	yes	18,363
Emas	231.56	100	yes	3,317
Coremas	381.41	100	yes	15,149
Nova Olinda	80.42	100	yes	6,070
Catingueira	516.24	100	yes	4,812
Piancó	568.05	100	yes	15,465
Curral velho	223.11	100	yes	2,505
Diamante	271.64	100	yes	6,616
Santana dos Garrotes	350.69	100	yes	7,266
Pombal	883.23	100	yes	32,110
Juru	403.41	100	yes	9,826
Itaporanga	465.96	100	yes	23,192
Boa Ventura	168.6	100	yes	5,751
Santana das mangueiras	413.41	95.8	yes	5,331
Cajazeirinhas	300.67	100	yes	3,033
Pedra Branca	117.31	100	yes	3,721
Aguiar	340.02	100	yes	5,530

Olho D' água	616.85	100	yes	6,931
Igaracy	197.06	100	yes	6,156
Imaculada	305.73	99.3	yes	11,352
São Bentinho	188.33	100	yes	4,138
Manaíra	332.93	96.8	yes	10,759

SOURCE: Own authors, according to AESA's Grant Database (2021).

Methodological aspects

The main method used in this study was qualitative research. The research can also be characterized as exploratory, since it seeks, through the analysis of data and information, to clarify and explain the patterns of the permits granted in the basin. To carry out this study, three main steps were designed to guide its execution and the achievement of the desired results: treatment and production of graphs; characterization of the grants by use and the preparation of maps of the location of the grants granted.

The information about the grants was made available by the responsible granting agencies and was organized in two different spreadsheets, characterized as secondary data treatment. One spreadsheet contains the grants made by the Executive Agency for Water Management (AESA). In the columns of the spreadsheets there were the study parameters, such as the municipality, the grant number, the date of issue and validity, the quantity and place of capture, the water source, the purpose of water use, the irrigation area, the total flow and the geographic location points. On the lines are the respective information for these parameters.

For practical purposes, all these data were put together in a single spreadsheet, so that the grants could be quantified, and thus begin the treatment of the data. The first analysis was according to the number of grants awarded in each year of the study, as this was the base parameter for analysis. In a similar way, the other categories mentioned above were counted and divided, such as the number of grants per municipality, types of use, types of capture, volumes of flow granted, and so on.

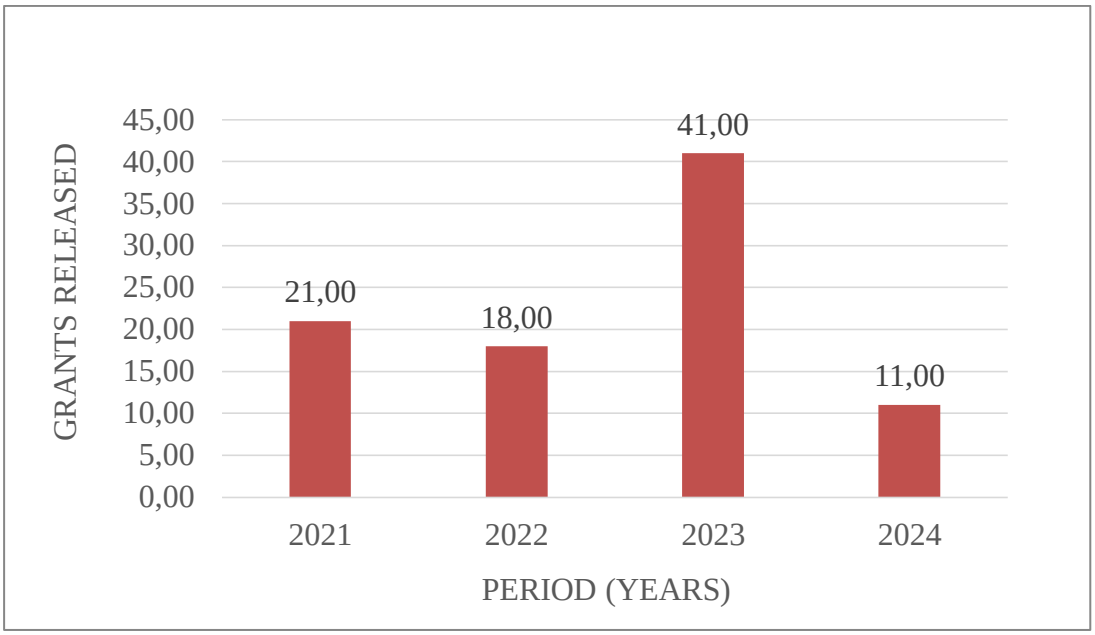
In addition, to facilitate the visualization and interpretation of this information, graphs were developed that combine two or more of these factors. With the quantification of the grants by purpose of use and knowing their various types, the second step was to characterize them. This definition served to deepen the knowledge of the basin, fostering the discussion of the main types of grants, associating their purpose with the geographical and temporal space. Finally, in the third and last stage, the location maps of the watershed were built, using the Geographic Information System QGIS 2.18 Las Palmas. These

maps were obtained through the coordinates of the allocation points, to facilitate the visualization of these points, by highlighting the areas and regions of concentration. Thus, we seek to achieve a true analysis of the study basin.

RESULTS AND DISCUSSIONS

Based on the grants in the areas of the municipalities that are part of the Piancó sub-basin / PB, data provided by the Executive Agency of Water Management of Paraíba - AESA (2021), shown in Figure 3, shows the quantitative evolution of the grants issued, both surface and underground, totaling 256 in the period under study (2021 - 2024). It is noted that in the year 2022, a percentage of 71% of the detention of the release of grants was presented; it is important to report that these requests can be changed for future years.

FIGURE 03: Number of grants issued in the Piancó sub-basin - PB, between 2021 and 2022.



SOURCE: Own authors, according to AESA's Grant Database (2021).

For Silva et al. (2019), the considered increase in grants for the year 2022 corresponds to a positive consequence of the stimuli of the managing bodies of the State of Paraíba in enabling the regularization of the situation of well owners, through a commission responsible for sensitizing and raising awareness of these people about the importance of legalizing the use of water resources in the studied region. This regularization has had a considerable impact on the number of concessions granted, since the water comes from underground sources.

It is important to emphasize that, according to information from AESA (2021), since 2016 the Curemas dam, located in Paraíba, which is responsible for perennializing the Piranhas River, presented low water volumes, reaching its dead volume. Through this crisis, it was reflected for the next few years, until the first half of 2018, when its storage increased considerably. So that this increase and water availability may have directly impacted the amount of permits issued according to the released flow.

Box 02 presents the quantitative evolution of the distribution of the grants released for the Paraíba municipalities belonging to the UPH of Piancó, in the analyzed time series, according to data made available by AESA. According to Chart 1, it can be seen that the municipality of Ibiara has the highest percentage of grants, corresponding to 25% of the releases, followed by Conceição and Nova Olinda.

BOX 02: Authorizations granted by municipality in the UPH of Piancó/PB.

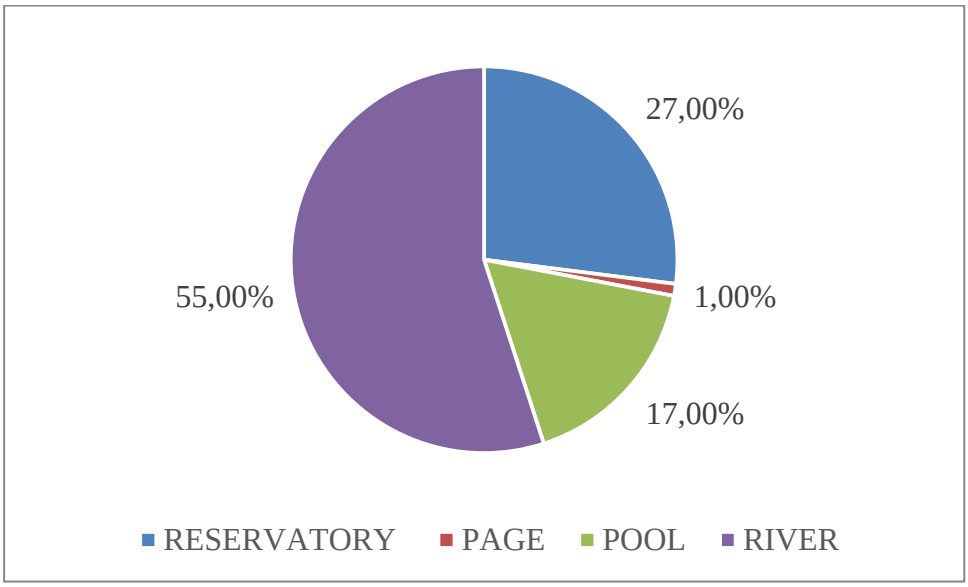
MUNICIPALITIES	RELEASE OF GRANTS
Ibiara	66
Conceição	48
Nova Olinda	17
Coremas	16
Catingueira	15
Piancó	12
Diamante	10
Curral velho	9
Santana dos Garrotes	9
Pombal	8
Juru	8
Itaporanga	6
Boa Ventura	6
Santana das mangueiras	5
Emas	5
Cajazeirinhas	4
Pedra Branca	3
Aguiar	3
Olho D' água	2
Igaracy	1
Imaculada	1
São Bentinho	1
Manaíra	1

SOURCE: Author, according to AESA's Outorgas Database (2021).

Regarding the grants issued by type of capture in the sub-basin throughout the period, 56% (143 grants) of the grants were for groundwater, while 44% (43 grants) were for surface sources, distributed in

rivers, lakes and reservoirs. The grants for surface water in the basin under study are related to the presence of a large number of surface water bodies in the region, and the high percentage of grants for groundwater sources is related to the effective presence of aquifers. Figure 04 shows the distribution of water sources according to the data analyzed.

FIGURE 04: Types of springs in use in the Piancó sub-basin - PB, between 2021 and 2022.



SOURCE: AESA's Grant Database (2021).

According to Figure 04, it is noticeable the difference between underground and surface capture, so that the underground one is much more expressive in the state of Paraíba, especially through tube wells with aquifer capture. The ANA (2014) presents that the surface availability is related to the storage capacity and regularization through reservoirs of the basin, while the underground availability is influenced by geological constraints. Thus, considering the characteristics of the basin, and the high evaporation rates with a short winter period, surface water availability is quite limited in certain periods of the year.

According to the data analyzed and the exposure of the concessions of the grants in the mentioned years, it was clear to notice the growth of the underground grants in the state of Paraíba in 2022 when compared to the years 2020, 2021 and 2024, confirming the impact established by the regularization of the grants of abstraction wells. The ANA (2014) reinforces that even with the low hydro-geological potential, the crystalline aquifer has manifested itself in several situations as the solution for rural supply and numerous small communities. Differently from what was observed by the National Water and Sanitation Agency (2019), in most Brazilian states, in which only 4 states grant greater abstraction for

groundwater, in the rest of the states surface water abstractions represent more than 50% of the total flow granted, this data may be related to the low precipitation in the region, which naturally opens for a greater underground demand. The data with the purposes of water resource uses in the sub-basin under study showed that for the grants of surface water, the irrigation sector was dominant, with 70% of the grants, followed by the purposes of rural supply with 24% and industrial use 3.93%, the other uses: effluent discharges, public supply and industry, together represented about 6% of the total grants, as can be seen in Table 01. According to ANA (2019), these results are consistent with the economic reality of the region and the state of Paraíba, in which most of the allocated flow is for agriculture, which requires techniques such as irrigation to meet water needs.

TABLE 01: Types of uses for the concessions granted in the UPH of Piancó/PB.

TYPES OF USE	GRANTS AWARDED
Irrigation	178
Rural supply	61
Industrial	10
Public supply	5
Effluent discharge	2

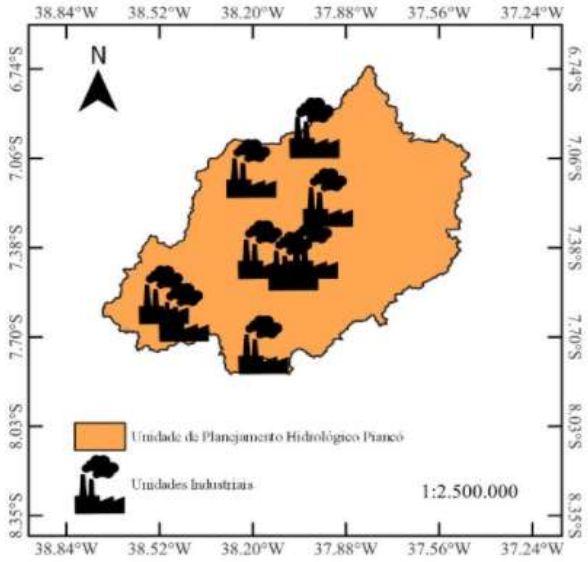
SOURCE: Survey Data (2021).

Irrigation is considered an agricultural activity that uses equipment and methods that enable the availability of water in a particular crop, moreover, it is characterized as an activity that has long been developed in the Piancó-Piranhas-Açu River Basin, because since the 1970s it has behaved as an important economic alternative, due to the decline in cotton production caused by the plague of the cotton bollworm, being consecrated especially by federal and state government aid, which installed and encouraged the development of private irrigation (ANA, 2014).

ANA (2018) emphasizes that the high demands registered for the irrigation process are related to the techniques developed for the execution of the activity in the basin, with the main use of sprinkling, gravity, localized, such as drip and micro-sprinkling, and other techniques. It is important to report that irrigation by sprinkling is the most traditional method, besides also being the method in which there is the largest use of water volume, not being a very appropriate practice, given the low water availability of this region, generating conflicts regarding the uses, however, the population that makes use of this technique, has no training to develop others, much less resources. Figures 05, 06 and 07 represent the spatial distribution of the grants for industry, public supply and effluent discharge, respectively. The region analyzed does not present large numbers of industries, considering that the economy revolves around

local and regional agriculture. The grants granted to industries present an average annual volume of 38,570 m³.

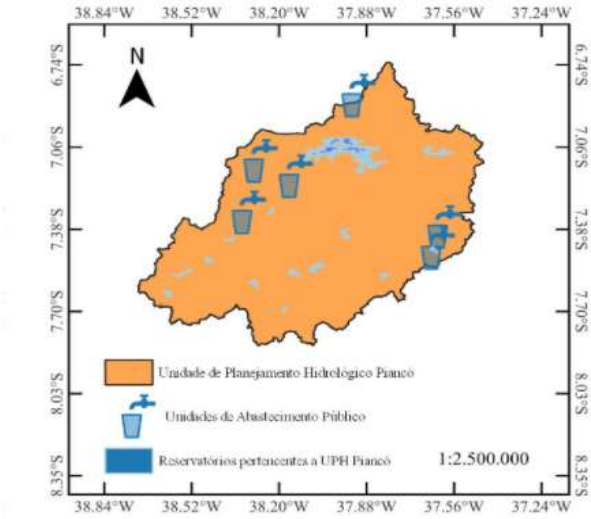
FIGURE 05: Spatial distribution of grants for industrial use.



SOURCE: Survey Data (2021).

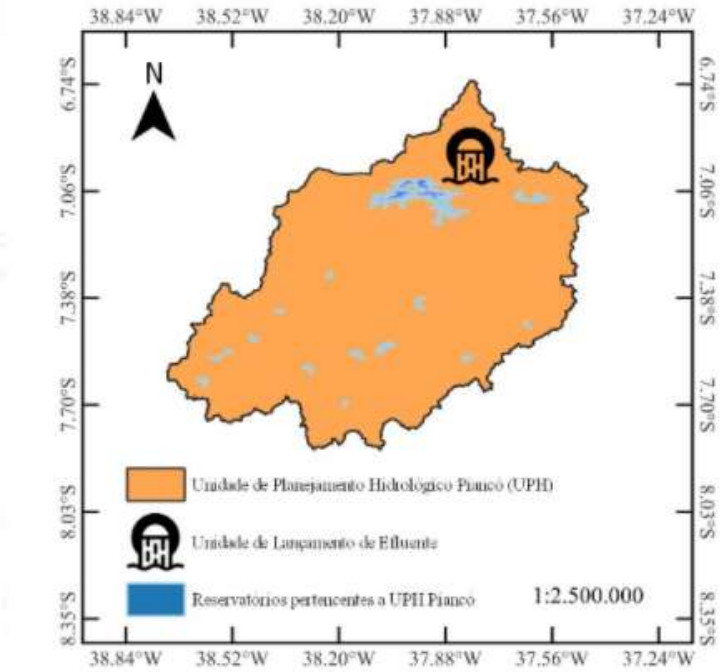
A total of ten points were visualized for the public supply system, aimed at the urban population of the region.

FIGURE 06: Spatial distribution of grants for public supply.



SOURCE: Survey Data (2021).

FIGURE 07: Spatial distribution of grants for effluent discharge.



SOURCE: Survey Data (2021).

According to the data analyzed and presented in Table 02, the averages presented considerable variations when compared to the different years analyzed. The year 2022 presents itself as the year of greatest deliberations for the irrigation process.

TABLE 02: Average grants for irrigation use granted in the UPH of Piancó/PB.

YEAR	AVERAGE ANNUAL VOLUME (m^3)
2021	51550
2022	62226,7
2023	8750
2024	4500

SOURCE: Own authors (2021).

In the analysis of Table 02, it is evident that rural supply corresponded to the second largest activity to which grants were granted, being these requested by the National Institute of Colonization and Agrarian Reform and the National Department of Works Against Droughts (DNOCS), it was evident that the predominant source for this activity were wells.

The rural supply system is very characteristic for small-sized municipalities, as is the case of the municipalities analyzed, especially for rural areas. According to the data analyzed, it was noticed that the

average annual volume destined for this activity corresponded to 8409.6 m³, all deliberations for the year 2022.

CONCLUSIONS

Family farming keeps local and regional markets supplied with food, thus strengthening the economy. These activities are essential to the region. However, low education and lack of information cause farmers to use pesticides that are harmful to the environment, in addition to this, there are inadequate agricultural practices that are culturally rooted.

Over the years this class has gained notoriety and policies have been implemented so that farmers remain in the field. Examples of policies are PRONAF (Programa Nacional da Agricultura Familiar) and Seguro Safra, programs developed to help producers and collaborate with their permanence in the rural zone.

Thus, family agriculture is important for local development and for feeding the population of this region. Even with the droughts, the farmers persist in maintaining this activity. In this sense, the development of actions and policies aimed at improving the living conditions of these people is fundamental for them to continue producing and staying in the field. Furthermore, better conditions to assist farmers by informing them about environmental protection laws are necessary, as well as new information that encourages environmental protection such as payment for environmental services.

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