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Evaluation of adverse environmental impacts of agricultural practice around the Epitácio Pessoa reservoir (Boqueirão-PB)

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Abstract: The Epitácio Pessoa reservoir (Boqueirão), is the second largest freshwater reservoir in the State of Paraíba, considered for most local farmers the main source of irrigation and currently supplies 19 municipalities, including Campina Grande, which is the largest among them. Thus, the objective of this study was to evaluate the adverse environmental impacts caused by inadequate agricultural practices around the Epitácio Pessoa reservoir, as well as to propose environmental control measures. Initially, a check list of the environmental impacts presents in the vicinity of the Epitácio Pessoa reservoir, Municipality of Boqueirão-PB, was subsequently analyzed using the Pressure-State-Impact-Response methodology, making it possible to diagnose the environmental quality of the watershed, as well as the answers or absence of them for each type of impact on the environment. Information was also obtained through formal interviews with producers and photographic records.

The results revealed that there are numerous environmental impacts on the dam today and that most of them do not present a response to its elimination or mitigation. Even though the watershed presents a relevant socioeconomic importance for the State of Paraíba, it is subjected to a continuous and gradual deterioration of environmental conditions, compromising its environmental quality, also evidencing the need for more effective interventions by the public authorities, represented by those of the responsible agencies.

Keywords: Agriculture. Impacts. Dam. Sustainability

1. Introduction

For a long time, the concern with the environment was the subject of few discussions in society, which was more concerned with the capitalist perspective of unbridled production than with the sustainable exploitation of resources, thus causing high levels of degradation to the environment.

Water resources and their multiple uses represent one of the major challenges for today's societies. The growing need for drinking water, in combination with the decrease in its availability, both in its quantitative and qualitative aspects, has intensified conflicts over the access, use, consumption and management of this resource, constituting a problem of ecological, cultural, social and public management policy dimensions (BRITO, 2008).

In this perspective, the historical relationship between man and nature is being reevaluated. According to Cunha *et al*. (2010), nature can no longer be seen as a mere source of raw material. After all, it presents two vital dimensions to life: it provides the essential conditions for the existence of life on the planet and availability of essential raw material for the population.

Thus, as a fundamental and indispensable basis for human survival itself, the environmental issue is a theme of vital importance, not only restricted to the object of regulatory measures, established by legislation, but also becoming an ethical problem; so strongly degraded by anthropic actions that the relationship between man and nature has become a decisive issue, directly affecting the living conditions of the population and the possibility of survival human species, thus evidencing the need for ethical actions on the part of society (CRISPIM, 2015).

In this constant human-nature interaction, a non-uniform distribution of man's influence on the environment is reached, highlighting three categories of interference: uncontrolled, partially controlled and with a high degree of human domain, according to the degree of man's influence on the environment (DUPAS, 2008).

Among the various environmental facets, a very critical issue and worth mentioning is the world's freshwater stocks, in view of their importance for human survival, as well as the severe restrictions that anthropic actions impose on them today and, consequently, in the future. As Crispim (2015) points out, highlighting water as an indispensable element for survival, its availability has become increasingly limited and scarce.

The Epitácio Pessoa reservoir (Boqueirão), is the second largest freshwater reservoir in the State of Paraíba and currently supplies 19 municipalities, including Campina Grande, which is the largest among them, with approximately 410,332 inhabitants, according to the Brazilian Institute of Geography and Statistics (IBGE, 2017). Thus, it is "indisputable" the importance of the dam with regard to economic, social and mainly ecological aspects for the region.

It is assumed that currently the reservoir is subjected to numerous environmental impacts arising from human actions on the site, such as the use and occupation of soil for irrigated agriculture, the intensive use of chemicals in agriculture, deforestation due to agricultural areas, among others. In view of the above, it is based on the premise that monitoring the environmental situation of the reservoir through an environmental quality assessment of the Epitácio Pessoa Reservoir micro basin is fundamental, considering that despite its social, economic and environmental importance for the State, the reservoir is subject to numerous impacting anthropic actions.

Thus, the present study focuses on the knowledge focused on Agricultural Production, focusing on environmental preservation, considering that, for a long time, the concern to maximize production left environmental issues in the background.

The objective of this study was to evaluate the adverse environmental impacts caused by inadequate agricultural practices around the Epitácio Pessoa reservoir, as well as to propose environmental control measures.

2. Methodology

Location and description of the study area

The research was carried out in the vicinity of the Reservoir of the Epitácio Pessoa reservoir, also called Boqueirão, located in the municipality of Boqueirão-PB (Figure 01), which comprises the Semiarid geoeconomics zone of Paraiba. According to IBGE data (2010), the municipality is located in the microregion of Cariri Oriental Paraibano, Mesoregion of Borborema Paraibana, whose altitude is 355 m above sea level, between coordinates 07°28'54" S and 36°08'06" W, with predominantly dry climate, with annual rainfall between 500 and 700 mm, distributed over a period of three months during the year (FRANCISCO *et al*., 2015).

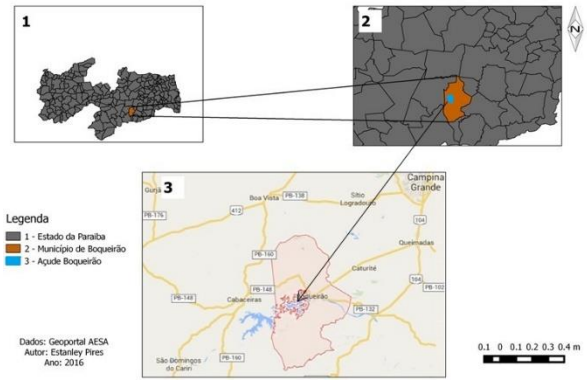

Figure 1. Map of location of the municipality of Boqueirão-PB and the Epitácio Pessoa reservoir**. Source**: Own Authorship (2018).

The Epitácio Pessoa watershed, as well as its entire area of influence, is geographically located in the municipalities of Boqueirão, Barra de São Miguel and Cabaceiras, being one of the most important reservoirs of the State of Paraíba, evidenced by destinations its main purpose that is basically divided into irrigation and urban supply of several municipalities with emphasis on Campina Grande. The flow contribution basin for Boqueirão comes mainly from the alto Paraíba and Taperoá sub-basins, near the Carnoió mountain range in the municipality of Boqueirão-PB. The Paraíba and Taperoá rivers are the main effluents of Paraiba (SILVA, 2006). In general, the natural water courses that cut through the region under study and that benefit in some way the soil and agricultural production of the region are as follows: Paraíba River, Riacho do Marinho Velho, Riacho da Perna, Riacho dos Canudos, Riacho da Ramada, Riacho da Relva and Riacho do Feijão.

General characterization of the research

The methodological procedures adopted during the research were: a) Documentary and bibliographic study; (b) Field visit for recognition and delimitation of the study area; c) Survey of the environmental quality of the area through on-site analysis and data and information collection; d) Analysis of the collected data; e) Organization and systematization of data collected through the Pressure-State-Impact-Response (IRP) matrix.

For the survey and evaluation of environmental impacts, two distinct and complementary methodologies were used, including: the Check List and the Pressure-State-Impact-Response (IRP).

The Assessment of Environmental Impacts in the watershed and its area of influence was as follows: first, through on-site visits, a preliminary identification of possible impact interactions was performed, relating the actions and their probable impact factors to the environment. In this first stage, the Check List methodology was used, which, according to Mitchell (1979), is used to ensure that important environmental aspects will not be neglected.

After the initial stage of impact listing (Check List), the Pressure-State-Impact-Response (IRP) methodology was used in order to perform a thorough analysis of the pressure in which the environment is subjected, the state of the environment, the impact arising from the pressures, as well as identify and propose mitigating measures or proposals for the solution of the environmental problems encountered. Thus, the methodological stages that comprise the research from the stage of bibliographic research to the evaluation of the environmental quality of the watershed were systematized as shown in Figure 02.

Figure 2. Methodological chain. **Source**: Own Authorship (2018)

The impacts were described according to a pressure generated to the environment, the state of the same and consequently the presence or absence of responses for elimination or mitigation of the impact.

3. Results and Discussion

The impacts that affect the physical, biotic and anthropic means become increasingly frequent and worrying, in view of the current situation of the watershed with regard to its integrity and maintenance.

For the initial identification and systematization of environmental impacts in the watershed, a check list was elaborated and applied, composed of a list of environmental indicators that were taken into account in the initial stage of the EIA. Most indicators were pre-established based on previous studies, however, some were removed or inserted to best adapt the checklist to the reality of the object of study (Table 04).

Table 01 shows the indicators and environmental impacts, as well as their presence or not in the reservoir, information that makes up the check list of researches and that were collected during field visits.

Table 01. List of environmental indicators and impacts verified in the Epitácio Pessoa reservoir

Environmental indicators	Environmental impacts	Yes	No	Observation
Presence of invasive exotic flora		X		*Prosopis juliflora* (Algaroba)
	Change in surface coverage	X		Opening roads in the reservoir
River control and flow modification		X		Sand extraction and water catchment in the river
Irregular plumbing/irrigation		X		Clandestine pipes
Burned			X	
Opening wells and removing fluids		X		Agricultural irrigation
Deforestation / Other timber services		X		
	Erosion/Ravination	X		On the reservoir bus (baldo)
Irregular dredging		X		Taperoá River
Use of chemicals in agriculture (pesticides)		X		Boqueirão and Cabaceiras-PB
	Contamination of Water Resources	X		Discharge of waste and effluents / Use of pesticides

Source: Own Authorship (2018)

Analyzing the data from table 02, it is evident that there are numerous environmental impacts to which the reservoir is subjected. Thus, the environmental indicators diagnosed in greater occurrence and more significantly will be analyzed and discussed in more depth through the PEIR methodology.

Reduction of native vegetation cover

Table 02. Reduction of native vegetation cover in the Epitácio Pessoa reservoir (Boqueirão-PB) - Pressure-State-Impact-Response

REDUCTION OF NATIVE VEGETATION COVER			
Pressure	**State**	**Impact**	**Answer**
Removal of vegetation cover (Deforestation)	Scarcity of the native plant species	- Change in soil structure and fertility; - Extinction of the floristic species; - Reduction/extinction of fauna; - Problems in the microclimate; - High evaporation rate of the reservoir water.	Reforestation project of the area (cooperative 8-green).

Source: Own Authorship (2018).

One of the environmental problems quite noticeable in the micro basin of the Epitácio Pessoa Reservoir is the high reduction of vegetation cover, especially of the native species of the site, being the "man" the main responsible for structural, floristic and ecological modifications, sometimes giving rise to the deterioration and desertification of the environment, as well as, also causing, numerous secondary environmental problems in the watershed (Figure 03).

Figure 03. Reduction of native vegetation cover in the Epitácio Pessoa reservoir. **Source**: Own Authorship (2018).

According to Lourenço (2016), one of the factors responsible for environmental degradation is deforestation, and can also generate impacts on soil, fauna and flora. In addition to suppressing vegetation deforestation, it reduces the capacity of infiltration of water underground and increases surface runoff, the formation of floods and, consequently, the formation of gullies and these effects can cause other serious impacts to the environment.

According to Silva (2006), one of the main causes of the reduction of native vegetation cover in the watershed is agricultural production in the vicinity of the Epitácio Pessoa reservoir, causing indiscriminate deforestation of the caatinga and intensifying the deterioration of the ecosystem, causing serious environmental problems, such as: compromising the quality of water resources, erosion, salinization and soil compaction, reduction of biological diversity, among others.

Faced with this reality, the only and a plausible response diagnosed is a proposal of reforestation around the reservoir. This proposal has been developed by the "Cooperativa 8 Verde", which, according to its president, received this name because, seen from the upper angle, the reservoir has a format similar to numeral eight.

The revegetation of degraded areas is a fundamental recovery strategy to improve the physical and chemical attributes of soils, because in addition to providing vegetation cover, it provides the necessary protection to reduce sediment loss by water erosion (PEREIRA; RODRIGUES, 2012).

Figure 04. 8 Verde Cooperative's Home in Boqueirão-PB. **Source**: Own Authorship (2018).

According to information from the president of the cooperative, it has no its own headquarters, operating in a space provided by the city and has the support of offending people (provided by the local forum) who provide service to the cooperative in exchange for reducing their prison sentence. The president stressed that the difficulties are numerous, especially financial ones, but that it has been gaining important partnerships with universities and strengthening the work of the cooperative.

Agricultural practice and use of pesticides

According to Silva (2006), plantations near the waters of the Epitácio Pessoa reservoir were and are causes of concern regarding the environmental degradation of the region, and are associated with indiscriminate deforestation of the caatinga and the natural fragility of the ecosystem, causing serious environmental problems highlighted in Table 03.

Table 03. Use of pesticides in the watershed of the Epitácio Pessoa reservoir

Deggratoxic use			
Pressure	**State**	**Impacts**	**Answer**
Use of plant protection products in agriculture and inadequate agricultural practices	Degradation in soil quality, water resources and intoxication of living beings; Reduction of biological diversity;	- Soil contamination; - Pollution of water resources; - Contamination of human beings; - Increased pest resistance in crops.	- No answers.

Source: Own Authorship (2018).

According to Lourenço (2016), the intensive use of soil in its various forms is pointed out as one of the major responsible for environmental degradation. Thus, when managed improperly, the soil can be affected by several problems such as erosion, resulting in the loss of the most fertile layers, the loss of crop productivity and the increase in production costs, with the demand for more insums to maintain the previous productivity line.

Agricultural work, when practiced inappropriately and recklessly, can be considered a dangerous practice, among the various risks, highlight the indiscriminate use of agrochemicals that can cause the poisoning of living beings and several other environmental damage. According to Silva (2006), often these pesticides are carried by flood irrigation waters or rains, directly into the Epitácio Pessoa reservoir. Therefore, what worries most is that great part of farmers is unaware of the risks imposed by these products and, consequently, neglect some basic standards indispensable for the correct use of phytosanitary, thus resulting in numerous socio-environmental problems.

In the micro basin under study, the volume of the reservoir is very low (dead volume), so many places that were once submerged, are now discovered and quite attractive for agricultural practice, due to their fertility. However, the worrying factor is that some farmers are performing agricultural practice in these places and using pesticides within the perimeter of the reservoir (Figures 06 and 07).

Figure 05. Storage of pesticides and agricultural practice in the area of influence of the Epitácio Pessoa reservoir. **Source**: Own Authorship (2018).

Figure 06. Pesticide storage and agricultural practice within the perimeter of the Epitácio Pessoa reservoir. Source: Own Authorship (2018).

The indiscriminate use of pesticides causes numerous problems, if used without respecting safety standards and without technical guidance, which can contaminate soils,

rivers, applicators and consumers.

In view of this reality, there is concern regarding environmental degradation, considering that the use of pesticides in the above-mentioned sites, in addition to contaminating the soil, will contaminate the waters of the reservoir when there is an increase in the volume of its waters, corroborating what Silva (2006) points out, stating that these pesticides, they are often carried by flood irrigation waters or rains, directly into the Epitácio Pessoa dam. It's also worth noting the factor amount of water used in irrigation, which according to the author mentioned above, has relevant value, because there are several types of irrigations, being less efficient the flood, which was used by the irrigators of the weir for several years, causing low water index in the reservoir, thus contrasting with the real purpose of the reservoir, mentioned above throughout this work.

Thus, as Seabra and Mendonça (2011) affirm, the aggressions provoked to the environment directly affect the life of living beings, becoming increasingly urgent in the current conjuncture the search for harmonic integration between man and nature.

With regard to the answers to eliminate or mitigate such environmental problem, no action was diagnosed in this sense. Assuming that it will be necessary to obtain new areas for planting, which in turn implies more deforestation, causing a reduction in biological diversity, leading to the extinction of some birds and other wild animals existing in the region. Thus, the lack of training courses aimed at guiding farmers, together with the absence of inspections in the places to control or combat this practice, enhance the environmental vulnerability of the watershed.

For Galharte and Crestena (2010), remediation and assessment of environmental impacts are vital needs for the sustainability of an activity and to ensure the protection of ecosystems.

A possible alternative to mitigate such an environmental problem would be the practice of organic agriculture, which does not "harm" the environment and that can provide healthy sustenance for people, as well as regeneration for soils punished by the constant use of chemicals. However, it is worth mentioning that, in addition to the substitution of agricultural practice, inspections in the places are indispensable.

4. Conclusions

Commending environmental facets is an individual and mainly collective need, which must be externalized to society, leaving the "walls" of academies and multiplying with social groups, to enable greater awareness of environmental issues.

The results presented for the Epitácio Pessoa reservoir are very important for the broader understanding of some problems facing the reservoir today, as well as revealing a concern regarding the environmental integrity of the Epitácio Pessoa Reservoir and the need for the improvement of agricultural practices.

Finally, this work also reveals the impacts that occur in a way not so "visible", but that the elimination or mitigation of them are essential for the improvement of the environmental quality of the watershed, as well as the maximization of productivity in a sustainable way.

References

[1] ALMEIDA, José Américo de. As secas do Nordeste. 2.ed. [s.l.]: Coedição da Fundação Casa José Américo e da Fundação Guimarães Duque, Coleção Mossoroense, v. CLXXVII, 1981.

[2] BRAGA, B.; HESPANHOL, I.; LOTUFO CONEJO, J.G.; BARROS, M.T.de.; VERAS JR. M.S.; AMARAL PORTO, M.F.; NUCCI, N.L.R.; JULIANO, N.M.A.; EIGER, S. Introdução à engenharia ambiental. São Paulo: Prentice Hall, 2002. 305p.

[3] BRITO, F. B. CONFLITO PELO USO DA ÁGUA DO AÇUDE EPITÁCIO PESSOA (BOQUEIRÃO) – PB. Dissertação de Mestrado – Universidade Federal da Paraíba, 2008.

[4] GOOGLE MAPS. [Boqueirão - PB]. Nota (vista superior do açude Epitácio Pessoa - PB). Disponível em: < https://www.google.com.br/maps/place/Boqueir%C3%A3o+-+PB/@-7.5051759,36.2159158,12674m/data=!3m1!1e3!4m5!3m4!1s0x7a94c371eeaa34b:0x942d45bfbd87f823!8m2!3d-7.4965076!4d-36.1545404>. Acesso em: 10/05/2018.

[5] CUNHA, Sandra Batista da, *et al*. Avaliação e perícia ambiental. Rio de Janeiro: Bertrand Brasil, 2010. 286 p.

[6] DUPAS, Gilberto, *et al*. Meio ambiente e crescimento econômico. São Paulo: Editora UNESP, 2008. 298 p.

[7] CRISPIM, Diêgo Lima. Estudo da situação hídrica da população rural do Município de Pombal – PB. Pombal. Dissertação apresentada ao Programa de Pós-Graduação em Sistemas Agroindustriais da Universidade Federal de Campina Grande – PPGSA/UFCG, 2015. 106 P.

[8] FRANCISCO, Paulo Roberto Megna *et al*. Classificação climática de Köppen e Thornthwaite para o estado da Paraíba. Revista Brasileira de Geografia Física, v. 8, n. 4, p. 1006-1016, 2015.

[9] FREITAS, M. A. de e SANTOS, A. H. M. Importância da água e da informação hidrológica. In: FREITAS, M. A. de (Org). O estado das águas no Brasil. 2. impr. Brasília, DF: ANEEL/SIH/SRH; MME, 1999, 334 P.

[10] GALHARTE, C. A.; CRESTANA, S. Avaliação do impacto ambiental lavoura-pecuária: Aspecto conservação ambiental no cerrado. Ver. bras. Eng. Agríc. Ambiente, v. 14, n. 11, Campina Grande, nov., 2010.

[11] GERMAN ADVISORY COUNCIL IN GLOBAL CHANGE (WBGU). World in transition: The Research Challenge. Annual report. 1996, Berlin: Springer Verlag, 1996.

[12] IBGE. Instituto Brasileiro de Geografia e Estatística. Censo Demográfico 2010. Rio de Janeiro: IBGE, 2010. Disponível em: <http://cod.ibge.gov.br/el8>. Acesso: 05

maio. 2017 às 12h:00m.

[13] LOURENÇO, Joaquim Carlos. Degradação ambiental por disposição irregular de resíduos sólidos urbanos: um estudo de caso na mata do Louzeiro – Campina Grande-PB. In: Recuperação de áreas degradadas: conceitos, temas e casos. Curitiba: CRV, 2016.

[14] OECD (2007). Integrating Science and Technology into Development Policies – An International Perspective.

[15] ROCHA, Ana Paula Trindade, *et al*. Manejo ecológico de bacias hidrográficas no semiárido brasileiro. Campina Grande: EPGRAF, 2011. V. 1, 332 p.

[16] SEABRA, G.; MENDONÇA, I. (Org.). Educação ambiental: Responsabilidade para a conservação da socio biodiversidade. João Pessoa: Editora Universitária da UFPB, 2011.

[17] SILVA, Ederivaldo Arruda. A cidade das águas: A sustentabilidade do açude Epitácio Pessoa – Boqueirão-PB. Campina Grande, 2006.

[18] SPAROVE, Gerd. *Et al*. A revisão do Código Florestal brasileiro. São Paulo: CEBRAP, 2011.

[19] VALLE, Cyro Eyer do. Qualidade ambiental: ISO 14000. São Paulo: Editora Senac, 2002.