

# Environmental Conservation Proposal (PCA) for the Casa Nova/BA paleodunar complex: a study with fishermen and riverine people from the São Francisco River

Izabel Pesqueira de Araújo Ribeiro<sup>1</sup>; Reinaldo Pacheco dos Santos<sup>2</sup>; Clecia Simone G. R. Pacheco<sup>3</sup>; Márcia Bento Moreira<sup>4</sup>

<sup>1</sup>Degree in Chemistry, Federal Institute of Sertão Pernambucano (IFSPE/Brazil); PIBIC CNPq Project Scholarship.

<sup>2</sup>Environmental expert; Member of the Red Iberoamericana de Medio Ambiente (REIMA/Brazil); Graduating in Geography at the University of Pernambuco (UPE/Brazil); Collaborator of the PIBIC Project.

<sup>3</sup>Doctoral student of the Postgraduate Program [Doctorate] in Agroecology and Territorial Development (PPGADT) at the Federal University of Vale do São Francisco (UNIVASF/Brazil); Researcher at the Federal Institute of Sertão Pernambucano (IFSPE/Brazil); Coordinator of Red Iberoamericana de Medio Ambiente/Brazil (REIMA A.C.); Coordinator Project PIBIC CNPq.

<sup>4</sup>Coordinator and Advisor of the Graduate Program [Doctorate] in Agroecology and Territorial Development (PPGADT) at the Federal University of Vale do São Francisco (UNIVASF/Brazil).

**Abstract**— This work presents the results obtained from the execution of the Project entitled “Proposal for Environmental Conservation (PCA) for the paleodunar complex of Casa Nova with fishermen and riverine residents of the São Francisco River”. The objective was to prepare an Environmental Conservation Proposal (PCA) for that area, with the construction of the PCA and the elaboration of a Management, Control, Revitalization and Environmental Conservation Plan, based on the analysis of the natural and anthropogenic processes that permeate the ecosystem, interpreting the causes and consequences of the existing socio-environmental impacts, aiming at training inhabitants and fishermen on the riverside. It is a sustainable environmental technology that will be built from the knowledge and study of the area, its categorization and the indications proposed by the community (riverine and fishermen) of each area in the paleodunar ecosystem. The methodological bases that support such research are based on the Geosystemic Theory recommended by Sotcheva (1977) and, the Ecodynamic Method elaborated by Tricart (1977), in addition to the GTP Theory (Geosystem - Territory - Landscape) defended by Bertrand and Bertran (2007), in the method the Geoecology of Landscapes (Rodriguez et al, 2010), the National Environmental Policy (1981), the National Environmental Education Policy (1999), and the Bardin Theory (2011) aimed at analyzing the content and discourse of the participants.

**Keywords**— Environment, Society, Nature, Paleodunas, Brazil.

## I. INTRODUCTION

Most of its length, the Caatinga ecosystem is characterized by a hot and semi-arid climate (BSh), strongly seasonal, with less than 1,000 mm of rain/year, distributed in an irregular way. In contrast to the low and erratic rainfall, the potential evapotranspiration is very high, ranging from 1,500 to 2,000 mm/year.

As a result of this natural dynamic, the vegetation is subject to seasonal water deficiency, aggravated in the years with prolonged drought. Despite the harsh conditions, the caatinga biome presents a surprising diversity of environments, provided by a mosaic of vegetation types, (tree and shrub, dry and humid forest,

executioner, open formations with dominance of cacti and bromeliads, among others), in the areas of the highest and most varied relief.

The paleodunar complex in the municipality of Casa Nova in the State of Bahia/ Brazil, part of the Ecoregion Dunas and Veredas of the Lower Middle São Francisco, and belonging to the Environmental Protection Area (APA) Lago de Sobradinho. This complex has suffered numerous degradations over time, and is currently much more intensified, due to the overvaluation of tourism and trade. However, it is essential to demonstrate to the surrounding community, the riverside dwellers, fishermen and constituted authorities of the municipality, the origin

of this ecosystem, how it took millions of years to form, and how it will be impossible to be recovered, if the necessary measures are not taken now. In addition, the complex is an “open sky” laboratory for studies related to paleoenvironments, paleoventos, paleoeras and paleodunas.

By ecoregion, it is called a relatively large unit of land and water delineated by the biotic and abiotic factors that regulate the structure and function of the natural communities that are found there, therefore, it is a geographic block that encompasses several biological systems, diverse among themselves, but that differs from others in that they have large biotic processes that connect them in some way (VELLOSO; SAMPAIO; PEREYN, 2002).

According to Velloso; Sampaio and Pereyn (2002) the caatinga ecosystem is subdivided into eight ecoregions, namely: 1. Campo Maior Complex; 2. Ibiapaba Complex - Araripe; 3. Northern Country Depression; 4. Borborema Plateau; 5. Southern Country Depression; 6. São Francisco Dunes; 7. Chapada Diamantina Complex; 8. Raso da Catarina.

In this sense, this research aimed at the construction of an Environmental Conservation Proposal for the Casa Nova paleodunar complex, through the elaboration of a Management, Control, Revitalization and Environmental Conservation Plan, based on the analysis of the natural and anthropogenic processes that permeate the ecosystem, interpreting causes and consequences of the

existing socio-environmental impacts, aiming at training inhabitants and fishermen on the riverside.

The methodological bases that support such research are based on the Geosystemic Theory advocated by Sotchava (1977) and, the Ecodynamic Method developed by Tricart (1977), in addition to the GTP Theory (Geosystem - Territory - Landscape) defended by Bertrand (1997), in Politics National Environmental Policy (1981), the National Environmental Education Policy (1999), and Bardin Theory (2011) aimed at content analysis and participants' discourse.

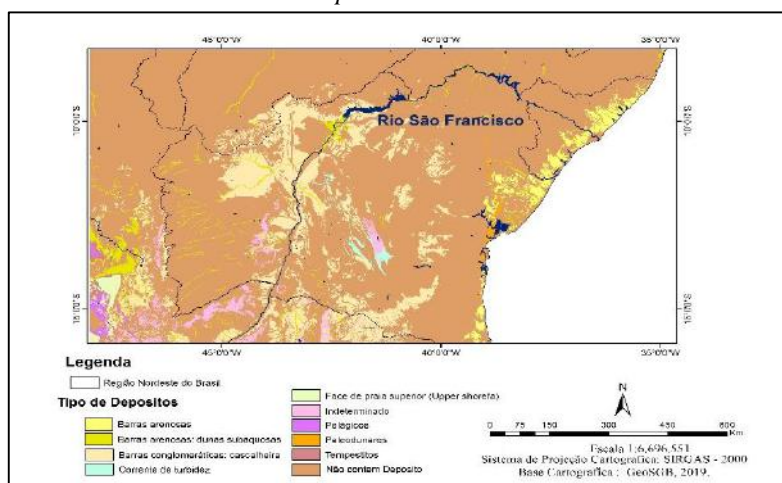
The main results found point to the essential need to demonstrate to the surrounding community, to the riverside dwellers, fishermen and constituted authorities of the municipality, the origin of this paleo-ecosystem, how it took millions of years to form, and to suggest suggestions on how it will be impossible to implement measures urgent conservation of the area through the environmental impacts already caused in the researched paleo-ecosystem, aiming to mitigate the impacts arising from the lack of socio-environmental management in the respective area, being urgent the implantation of a PCA.

## II. MATERIALS AND METHODS

### Location

The paleodunar complex in the municipality of Casa Nova in the State of Bahia/Brazil, part of the Ecoregion Dunas and Veredas of the Lower Middle São Francisco, and belonging to the Environmental Protection Area (APA) Lago de Sobradinho.

Map 1 – Research Location



Source: Pacheco (2020)

The municipality of Casa Nova/BA, is located at latitude 09°09'43 "S and longitude 40°58'15" W, in the Integrated Administrative Development Region (RIDE) of Polo Petrolina/PE and Juazeiro/BA. It has a semi-arid tropical climate, with an average annual rainfall of about

485 mm, with an average annual temperature of 25.4°C. Its altitude is 417 m (IBGE, 2010).

### Research Typology

The methodological bases that support such research are based on the Geosystemic Theory recommended by Sotchava (1977) and, the Ecodynamic Method elaborated by Tricart (1977), in addition to the GTP Theory (Geosystem - Territory - Landscape) defended by Bertrand and Bertrand (2007), in the method the Geoecology of Landscapes (Rodriguez et al, 2010), the National Environmental Policy (1981), the National Environmental Education Policy (1999), and the Bardin Theory (2011) aimed at analyzing the content and discourse of the participants.

In 1973 Sotchava introduced the term geosystem to trace the physical-geographical sphere as a system. According to this author, geosystems are natural territorial system that are distinguished in geographic surroundings, in different dimensional orders, generally in the regional and topological dimensions. They are subsystems of geographic coverage, being itself a planetary-level geosystem (SOTCHAVA, 1977). Thus, geosystemic treatment aims, a priori, to integrate through a stage of analysis of natural and man-made variables.

Tricart's ecodynamic method, on the other hand, represents a relevant feasibility of applying the systemic method for the study of the dynamics of physical landscapes. For Tricart (1977, p. 32) "an ecodynamic unit is characterized by a certain dynamics of the environment that has more or less imperative repercussions on biocenoses". It also complements that "the concept of ecodynamic units is integrated into the concept of ecosystem".

However, environmental research for the geographer implies an understanding of the relationship between society and nature, taking into account the systemic method to explain about the elements that make up the geographical landscape, which results in a dynamic unit and its interrelationships between the physical elements, biological and anthropogenic. It was in this perspective that Bertrand and Bertran in 2007 developed a new conceptual framework for geosystem, which he called GTP (Geosystem - Territory - Landscape), where both can be analyzed separately, but are intrinsically integrated.

According to Rodrigues et al (2010), Landscape Geoecology provides the necessary foundations for the elaboration of theoretical and methodological bases of environmental planning and management. Therefore, it subsidizes the construction of models, such as the one built above, aiming at the incorporation of sustainability in the eco-environment management process, as in this case, dunes.

In this way, the theories described above served as a founding element for the elaboration of this project, o it understands that the basis of support for any research

needs to be supported by renowned theorists who have already validated research on this theme.

Starting from these premises and, according to Triviños (1987, p. 101), "the instruments used in the research, the questionnaire, the interview, among others, for the collection of information, are illuminated by the concepts of a theory". Based on this statement, it is important to emphasize that this research will use interviews with social actors, in addition to analyzing various aspects of its ecodynamic profile.

Based on the objectives, the aforementioned research is presented as descriptive, which aims to observe, record, analyze and correlate phenomena or facts, without interfering in the analyzed environment, being the most used type of research in the social sciences (VIEIRA, 2002; MALHOTRA, 2001).

However, as for the purposes, it is exploratory and activist, because it aims to carry out a bibliographic survey and interviews, in addition to providing greater familiarity with the problem, all of which is followed by an inventory. Thus, it is an exploratory, descriptive and activist research.

Exploratory because no scientifically produced information was found to meet the needs of the proposed research. Descriptive because it aims to meet and describe the actors of a specific market as well as understand their behavior for the formulation of strategies, as well as portraying the socio-environmental impacts that the ecoregion Dunas do São Francisco has been suffering for decades (VERGARA, 1988, p. 35). Activist because it also aims to inventory the paleodune region so that there is a preservation and restoration of the entire area affected by natural and, mainly, anthropogenic actions.

The object of this investigation is a geomorphological microportion of the northeastern semiarid (the paleodune fields), more precisely located in the Municipality of Casa Nova/BA, making this geographical boundary with the State of Pernambuco.

Based on these assumptions, the following path was traced to achieve the proposed objectives: initially, the theorists who approach the theories that served as a basis were read, as well as the authors who approach the processes that give rise to fields of fluvial coastal paleodunas. For that, there was a choice of scientific articles published in Scielo, Google Scholar and some books by renowned authors that deal with these issues using the following keywords: "paleodunas", "geosystemic", "semiarid", "ecosystems", "ecoregion". After reading, filing and discussion, he went on to field research.

In the field research, there was a systematic analysis of four parameters considered crucial: surface

structure of the landscape, land use, vegetation and surface processes. For each of the parameters mentioned, a categorical level of balance corresponds, numerically defined, in order to measure the intensity of the diagnosed processes in a macroscopic way, according to the classification of Tricart (1977). These levels will be categorized in an increasing order of environmental instability: 1. Stable areas; 2. Intergroup areas; 3. Strongly unstable areas. After searching for data in loco, they will be analyzed and discussed, where the obtained results will tell the level of stability of the research focus area.

For analysis and discussion of the research, the data obtained in the field were used and a comparison was made between the data found in the field and that discussed by the theorists listed as the basis for such research. That done, the PCA was developed for the paleo-ecosystem.

In addition, environmental actions were promoted on the spot with the participation of the riverside community involved in the research. Finally, the real situation of this fluvial landscape is concluded, thus

tracing the profile of the landscape and its degree of stability, perpetuated by an inventory so that there is a preservation and restoration of the degraded paleodune area, o it is one of the natural postcards from the Vale do Submédio São Francisco and why not say, from the Brazilian Northeast.

### III. RESULTS AND DISCUSSIONS

The results of the obtained natural impacts indicate that the area of the studied paleodune fields has the three levels of stability recommended by Tricart (1977): stable, with dense vegetation cover (Figure 1a); intergrades that are in a transition phase between the stable and unstable environment (Figure 1b); and strongly unstable, presented in a degradation stage, without consistent vegetation cover and vulnerable to anthropogenic impacts (Figure 1c). For each environment characterized, a strategic plan for coexistence sustainability was indicated, that is, a proposal for the conservation of the ecoregion.

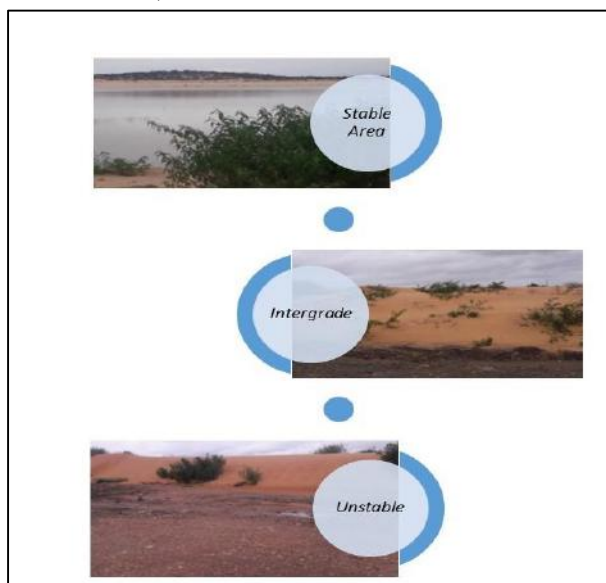


Fig.1: Categorization of Areas

Source: Pacheco (2019)

As for anthropogenic impacts, the following impacts were verified through on-site research (Figure 2):

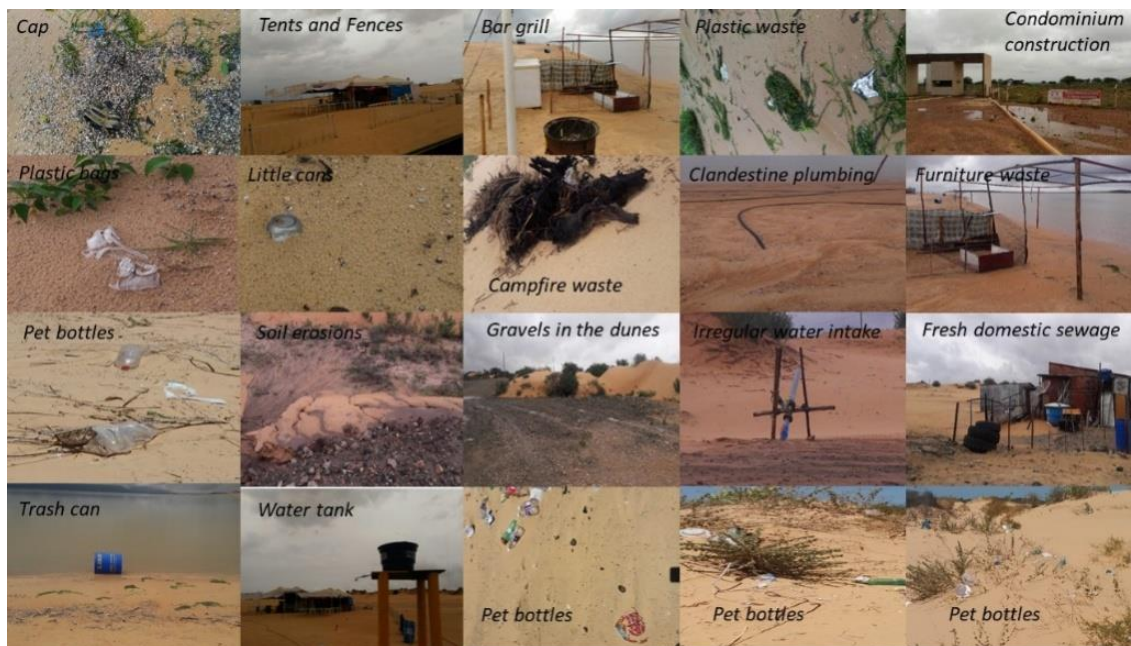


Fig.2: Anthropogenic impacts

Source: Pacheco (2019)

Regarding the environmental actions carried out in the Paleodunar Complex, the following was done: 1. Placement of recyclable dumps in the area of the Dunas of Casa Nova by the students of the school partner in the project; 2. Placement of environmental awareness plaques

in the Casa Nova Dunes area by students from the partner school; 3. Planting of native vegetation seedlings by riverside dwellers and fishermen in the Colony of Fishermen Z 42, as shown in figure 3.



Fig.3: Environmental actions in loco

Source: Autores (2020)

In addition, there was a mobilization of the riverside fishermen community in the Colony of Fishermen Z42 of Casa Nova-BA, where they were discussed with them about the origin and relevance of the

paleodunar complex, as well as the São Francisco River for their economic survival. It also addressed the need for specific actions in loco, aiming at the conservation of local nature.



Fig.4: Explanation at the Fishermen's Colony

Source: Autores (2019)

There was also an analysis of social discussions at the meeting. Bardin (2011, p. 170) points out the discourse as “all communication studied not only at the level of its elementary constituent elements (the word for example)

but also and above all at an equal and superior level, to the phrase (propositions, statements, strings)”.

Finally, an Environmental Conservation Plan (PCA) was drawn up for each area [stable, intergrade and highly unstable] categorized in the complex.

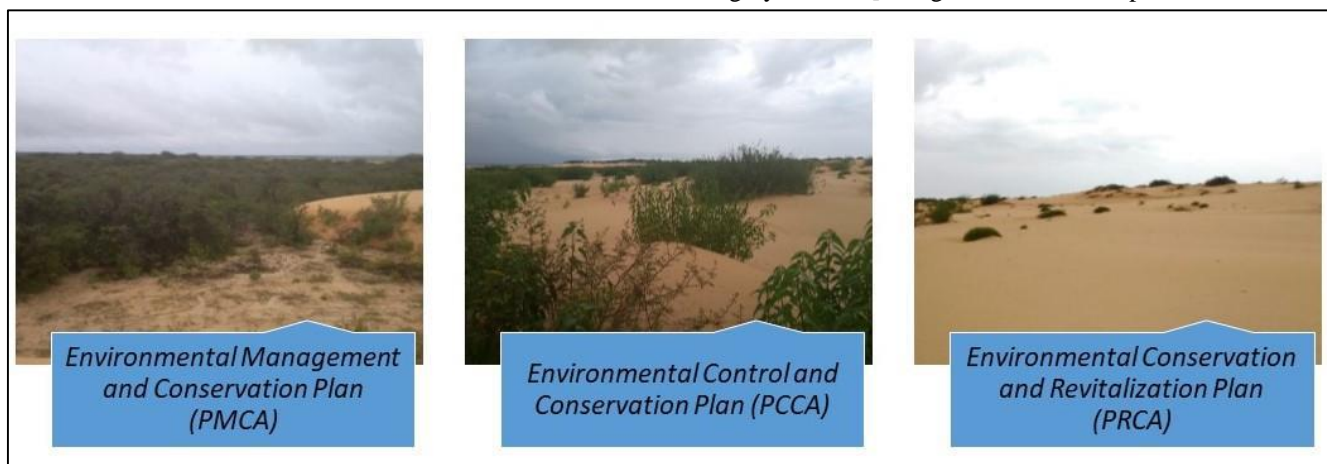


Fig. 5: PCA for the categorized área

Source: Pacheco (2019)

From analysis and observation in loco, it was possible to make an evaluation of the chosen area, characterizing it according to the classification of environments by Jean Tricart (1977). According to Tricart, the environment can be classified ecodynamically as

follows: a) stable means, b) intergraded means, c) strongly unstable means.

For Tricart (1977, p. 35) a stable medium or the notion of stability “applies to the modeled, to the atmosphere-lithosphere interface. Modeling evolves

slowly, often in an insidious way, hardly noticeable. Mechanical processes act little and always slowly ”. Therefore, only precise measures, difficult to carry out, can put them in evidence. Morphodynamically stable media are found in regions with a series of conditions:

- Vegetation cover sufficiently closed to oppose an effective brake to trigger the mechanical processes of morphogenesis;

- Moderate dissection, without violent incision of water courses, without vigorous sapping of rivers, and slopes of slow evolution;

- Absence of volcanic manifestations capable of triggering morphodynamic paroxysms of more or less catastrophic aspects (TRICART, 1977, p. 36).

Based on these assumptions, it is possible to state that the weaker the dissection intensity, the greater the complexity of the model and the soil, because the conditions will favor the permanence of relics. In this sense, it is not possible to visualize any stable cut in the researched place, on the contrary, below we show a small cut of an intergrated area, according to the characterization of Tricart and that is part of the studied object.

It is also worth mentioning that the area of the Dunes of Velho Chico or “Paleodunar Complex of Casa Nova” is in a regrettable degenerative situation, due to the civilizing culture of the tourists who visit the area, making intervention necessary through the application of the PCA so that there is conservation and regeneration of the devastated area.

#### IV. CONCLUSIONS

About half of the landscape has been degraded by human action and 15% to 20% is in a high degree of degradation (with risk of desertification). “The region lost its natural wealth without generating wealth for the local population, still one of the poorest in the country”, says biologist José Maria Cardoso da Silva, from the Federal University of Pernambuco (UFPE).

It can be concluded that the coexistence of the surrounding population with the eco-environment dunes is not sustainable and, therefore, there is no real concern with conservation. Many of them understand that dunes are just heaped sand and do not even know that they live in an area of environmental protection, and that they need to take care of the natural environment where they are inserted as social subjects. It is essential to have an intervention on the conservation of sand, before the implementation of what CONAMA (2012) [23] Resolution n. 10, December 1988, in its article 6.

It is crucial to consider the applicability and / or improvement of Environmental Education (EA) in the curriculum of local schools, considering that this is an

important tool to mediate the relationship of residents with the environment. Finally, it is of fundamental importance for the APA to implement the proposed conservation management (inventory the area in question) suggested for the three environments (characterized) existing in the ecoregion, in order to conserve what is still possible from the natural aspects and restore what it is already in an advanced state of environmental degradation.

Therefore, it is of great relevance to deepen our knowledge, in practice, about the ecosystem that we have in the Region in which we operate (Northeast), as well as to unveil the geomorphological, microclimatic, floristic and fauna diversity, in addition to diagnosing the socio-environmental impacts that such ecoregions of the caatinga have been suffering for decades, due to the natural and mainly anthropogenic action, in addition to inventorying this region so that there is a preservation and restoration of its ecosystem.

#### REFERENCES

- [1] SOTCHAVA, V. B. (1977). O estudo de geossistemas. São Paulo: Instituto de Geografia USP. São Paulo: 51 p. (Métodos em Questão, 16).
- [2] TRICART, Jean. (1977). Ecodinâmica. Rio de Janeiro, IBGE, Diretoria Técnica, SUPREN, 91p.
- [3] BERTRAND, G.; BERTRAND C. (2010). Uma Geografia Transversal e de Travessias: o meio ambiente através dos territórios e das temporalidades. Maringá: Mossoni.
- [4] RODRIGUEZ, J. M.M., SILVA, E. V., CAVALCANTI, A. P. B. (2010). Geoecologia das Paisagens: uma visão geossistêmica da análise ambiental. Fortaleza: Educações UFC.
- [5] BRASIL. POLÍTICA NACIONAL DO MEIO AMBIENTE (1981). LEI Nº 6.938, DE 31 DE AGOSTO DE 1981. Disponível em: [http://www.planalto.gov.br/ccivil\\_03/LEIS/L6938.htm](http://www.planalto.gov.br/ccivil_03/LEIS/L6938.htm). Acesso em: 15/02/2020.
- [6] BRASIL. POLÍTICA NACIONAL DE EDUCAÇÃO AMBIENTAL (1999). LEI Nº 9.795, DE 27 DE ABRIL DE 1999. Disponível em: [http://www.planalto.gov.br/ccivil\\_03/leis/19795.htm](http://www.planalto.gov.br/ccivil_03/leis/19795.htm). Acesso em: 15/02/2020.
- [7] BARDIN, Laurence (2011). Análise de conteúdo. São Paulo: Edições 70, 229 p.
- [8] VELLOSO, A. L.; SAMPAIO, E. V. S. B.; PARAYN, F. G. C. (2002). Ecorregiões Propostas para o Bioma Caatinga. Recife: Associação Plantas do Nordeste/Instituto de Conservação Ambiental The Nature Conservancy do Brasil.
- [9] INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). IBGE CIDADES. (2010). Disponível em: <https://www.ibge.gov.br/cidades-e-estados/ba/casa-nova.html?>. Acesso em: 15/02/2020.

- [10] TRIVIÑOS, A. N. S. (1987). Introdução à pesquisa em ciências sociais: a pesquisa qualitativa em educação. São Paulo: Atlas.
- [11] VIEIRA, V. A. (2002). As tipologias, variações e características da pesquisa de Marketing. Revista da FAE, Curitiba, v. 5, n. 1, p. 61-70, jan./abr.
- [12] MALHOTRA, N. Pesquisa de marketing. 3.ed. Porto Alegre: Bookman, 2001.
- [13] VERGARA, S. C. (1998). Projetos e relatórios de pesquisa em administração. São Paulo: Atlas.
- [14] BRASIL. MINISTÉRIO DO MEIO AMBIENTE. RESOLUÇÕES DO CONAMA (2012). Conselho Nacional de Meio Ambiente (Brasil). Resoluções do Conama vigentes de 1984 a 2012. MMA. Brasília/DF: 1126p.