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Management of Protected Areas and sustainable use of Caatinga Biodiversity in Brazil

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ABSTRACT*: The use of the Brazilian Caatinga biodiversity has not been done in a sustainable way, which has caused irreversible environmental impacts. The geodiversity of this biome is an important component of the natural heritage existing here, but it lacks studies that explore mainly the characteristics of the landscape and its conservation forms. The present work aims to discuss the relevance of the sustainable use of the natural resources of the Brazilian Caatingas, as well as to present a proposal for conservation of protected landscapes in Brazil. The present research aims at elaborating and proposing conservation plans for protected landscapes, essentially those with a high degree of vulnerability, such as the river dunes that accompany the course of the São Francisco River. The methodology is based essentially on Geosistemic Theory, Ecodynamic Method and GTP Theory. Therefore, it is crucial to develop conservation measures for protected environments, since the landscapes are products and records of the geological evolution of the planet and integrate the planet, as well as corroborate for the sustainable use of the biome. Therefore, it is indispensable to understand the urgency of the adequate management of protected areas in Brazil, essentially those that safeguard environmental indicators of paleoeras, paleoclimas and paleoventos.*

KEYWORDS–*biodiversity, geodiversity, caatingas.*

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I. INTRODUCTION

The Northeastern Semi-arid is a region characterized by strong sunshine reaching about 2,800 hours/year. It presents high temperatures (the averages vary between 23 ° and 27 ° C) and the rainfall regime is marked by irregularity, with concentrated precipitations in a short period of three months on average. This reality determines high rates of evapotranspiration, configuring water deficit in almost every region, with areas totally susceptible to degradation (SCHENKEL; MATALLO JUNIOR, 2003) [1].

The vegetation of the Caatinga does not present the green exuberance of the humid tropical forests nor the dry aspect of the desert physiognomies, suggesting a decrease in the diversification of the flora. To uncover your assets, a more diagnostic look is crucial. Only in this way is it possible to denote its biodiversity, its geosystemic relevance and its intrinsic beauty (LEAL; TABARELI; SILVA, 2003) [2].

In this atypical scenario some dune fields are known, known as Dunes and Veredas of Lower São Francisco Low, which represents one of the most important inventories of paleoenvironmental changes, mainly paleoclimatic, during the Quaternary of the Brazilian Northeast. This importance comes not only from its origin, extension and thickness, but also as a manifestation of drier climates than the current one, which interfered strongly with the evolution of the fauna and flora there. Thus, the studied dunes represent inheritance of more arid climates in the area, having its history linked to the question of the previous climatic variability, which resulted in the existing features (BARRETO, et al 1996) [3]. In addition, they are part of one of the modalities of protected areas in Brazil, which are the Environmental Protection Areas (APA).

The objective of this article was to demonstrate the ecodynamics of the studied landscape, aiming to analyze the social actors' conception regarding their relationship with the eco - environment, aiming to understand how the use and management of protected caatinga occurs, and to analyze from the discourse of local residents about the necessity of conservation of this geoenvironment, representative of climatic changes in Northeast Brazil.

The methodology used is based essentially on the Geosystemic Theory (Sotchava, 1977) [4], the Ecodynamic Method (Tricart, 1977) [5] and the GTP Theory (Bertrand; Bertrand, 2007) [6] to present conservation measures for protected environments.

Thus, caatingas are very endangered in Brazil, since much of its surface has already been greatly impacted by human use and occupation, and it lacks much more effective measures in relation to the conservation of its protected areas and their diversities. On the other hand, dune paleoenvironments also suffer numerous anthropogenic impacts and tend to lose their original characteristics very quickly, thus signaling the loss of geomorphological and palynological identity, which are so relevant to understanding their genesis and evolution during geological ages. Therefore, the progressive anthropization of the natural habitats in the Caatinga obliges us to delimit areas ideal for the conservation of this ecosystem, denominating them of protected areas.

II. BRIEF LITERATURE REVIEW

2.1 Paleodunas In Caatingas Brasileira

The semi-arid Caatingas, similar to other Brazilian formations, present many atypical characteristics among the meteorological paradigms: high solar radiation, low cloudiness, high annual average temperatures, low relative humidity, high potential evapotranspiration, and above all, low and high precipitation levels. irregular, limited (REIS, 1976) [7]. There are frequent cataclysms (dry and full), which have shaped all kinds of existing life, especially Caatingas. However, it is the prolonged absence of precipitation for consecutive years that characterizes the Brazilian semiarid region (NIMER, 1972) [9].

According to Prado and Gibbs (1993, p. 63) [9] "the province of the Caatingas belongs to the Pleistocene Arc, which must have originated from climatic changes in South America during the Upper Pleistocene", and that oscillates from the semiarid interior of the northeast to southeastern Brazil, in the convergence of the Paraguay and Paraná rivers, in southeastern Bolivia and northwestern Argentina, and extends sporadically in dry valleys in the Andes of Peru or the west coast of Ecuador.

According to Souza et al (2005) [10], two palynological records reveal vegetative and climatic changes in the caatinga region of the Northeast: the continental record of the caatinga of the field of fossil dunes of the. (BA) studied by De Oliveira, Barreto and Suguio (1999) [11] and the marine sediment record, obtained about 90 km east of the city of Fortaleza (CE), researched by Behling (2000) [12].

The first record, which is of interest of this research, made with sediments dated 10,990 A.P. reveals according to the author mentioned the climatic conditions very different from the current one. According to Souza et al (2005) [10].

From the Pleistocene/Holocene transition to about 10,540 years A.P., the climate of the region was humid and relatively cooler than today, favoring the establishment of an exuberant tropical forest with floristic affinity with the forests of the Amazon and those of the Atlantic Coast. The pollen spectra of this period represent the first botanical evidence for the debated forest corridor between the Amazon and the Atlantic forest, which may explain the great floristic affinity between these two ecosystems. A gradual dissection of the landscape eliminated this type of vegetation until about 6,790 years A. P. (p. 68).

On this premise, it is possible to affirm that the establishment of the modern vegetation of caatinga, known in the present time, is dated in the field of dunes of Bahia in 4535 years A. P. according to the above-mentioned affirmations of Souza et al (2005) [13].

The paleodunas fields in thesis are surrounded by the Southern Country Depression, being the South diagonal limit is totally defined by the São Francisco river and, the Sudoeste part is limited by Serra do Estreito (BA), being that the greater part of the ecoregion is the west of the São Francisco river, with a total area of 36,170 km².

The origin of the mentioned dunes is still a sufficiently discussed clothing in the scientific environment. However, some researchers believe that the same were created by the São Francisco river itself, which from the excavation of its bed created the sediments (sands) that were accumulating and being transported by the SE-E winds. However, according to Velloso, Sampaio and Pereyn (2002) [14], these dunes were formed by the Southeast winds, which moved the sandy sediments to the dune areas, starting from the estuary and dystrophic quartz sands deposited on the natural beaches of the river, in its meanders, carried by constant winds.

It is important to note that in the dunes area, the predominance of caatinga vegetation due to the dense sandy soils of the dunes and the semi-arid climate (JACOMINE et al., 1976) [15]. The caatinga can be subdivided into hypo xerophilic (tree) and hyper xerophilic (shrub and herbaceous), being the first one has higher humidity, is dense and greener, developing preferentially in the vicinity of the São Francisco river, with variable density and low aspect It is closed. The second one, is less dense, extends over the eolic deposits and resembles a vegetation of transition between the caatinga and the deciduous forest, presenting species like grasses.

In geological terms, the area of the dune fields in focus is located in the peripheral depression of the middle São Francisco river, with altitudes varying from 400 to 800 m, where features related to sedimentation were analyzed for sedimentological and morphological characteristics, post-depositional modifications and past paleoventric patterns (BARRETO, 1996) [3].

Therefore, the potential of these dunes in extension reflects the combination of several effects, ranging from the high energy of the winds, abundant sand supply and aerodynamic resistance offered by the local vegetation, besides the erosion, transport and sedimentation work elaborated by the river São Francisco.

2.2Protected Areas in Brazil

According to Almeida (2016) [16], recent studies published in the journal Science, scientists evaluated the floristic relationships between separate areas of dry neotropical forests in 835 localities, investigating a large database of species from hundreds of areas of Tropical Dry Forests in Latin America. The analysis of the arrangement and grouping of this catalog of species, mainly arboreal and shrub, recognized 12 floristic clusters, according to the map below (ALMEIDA, 2016) [16].

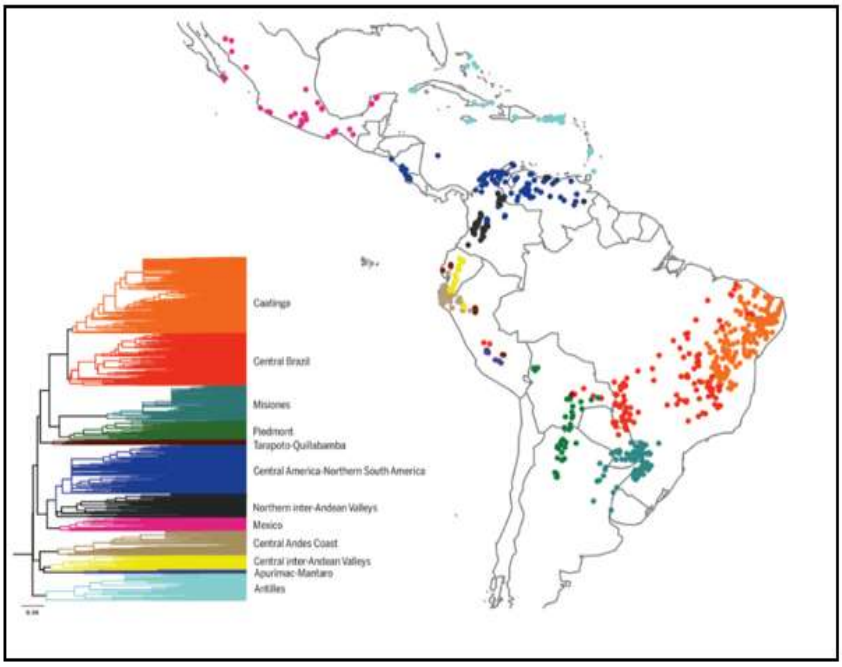

Fig. 1. Map of Tropical Dry Forests in Latin America
Source: DRYFLOR 2016. *Science*

According to the author, the figure above indicating 12 (twelve) clusters, can be summarized in only two more extensive: the South Synchronous, formed mainly by the Caatinga, Central Brazil, Misiones and Piedmont clusters; and the north synchronous, formed by the other groupings (ALMEIDA, 2016) [16]. In this sense, the author still draws attention to the need for conservation of these forests.

In terms of conservation of dry tropical forests, the main implication of these results is that, given the heterogeneity and uniqueness of the various localities studied, conservation efforts need to be regionalized. Thus, the various countries need to develop conservation policies that take into account the unique character of these biomes in their various locations (ALMEIDA, 2016, p. 03) [16].

In the case of Brazil, this was one of the countries that later joined the initiative to protect its natural environments, essentially the dry tropical forests, such as the Caatingas. Historical records indicate that both the Portuguese crown and the Imperial government have undertaken some initiatives aimed at the protection, management or control of certain natural resources.

It is possible to mention two relevant examples in Brazilian lands about the intention of environmental conservation, which are the "Regimento do Pau-Brasil" published in 1605 and the Royal Charter of March 13, 1797 (CARVALHO, 1967 [17]; MIRANDA, 2004) [18]. The first one, should be considered as one of the first laws of Brazilian forest protection, which established limits data to the practice of brazilwood in the colony:

First of all, it will be well, and Mando, that no person may cut, nor have the said Brazil wood cut, by itself, or its slaves or Feitores its, without express license, or written of the Moral Provider of My Fazenda, of

each one of the Capitanias, in whose district is the forest, in which it is cut; and what the contrary will do will result in the death penalty and confiscation of his entire farm (RAMOS, 2009, p. 90) [19].

The second, the Royal Charter described the need to take precautions for the conservation of forests in the State of Brazil, and prevent them from being destroyed (CARVALHO, 1967) [17]. This decree, among other measures, was aimed at preventing the unauthorized cutting of certain species of trees whose wood is considered "hardwood", such as cedar, mahogany, jacaranda, among others, was an important resource for the metropolis. Based on this assumption, it is important to state that in Brazil, we have 54,129,600 hectares of Integral Protection Area (API) and 104,146,100 hectares of Sustainable Use Area (AUS) according to the National Register of Conservation Units (CNUC). The Caatinga biome has 1,004,900 hectares of API and 5,362,400 hectares of AUS, according to figure 2 (CNUC, 2016) [20].

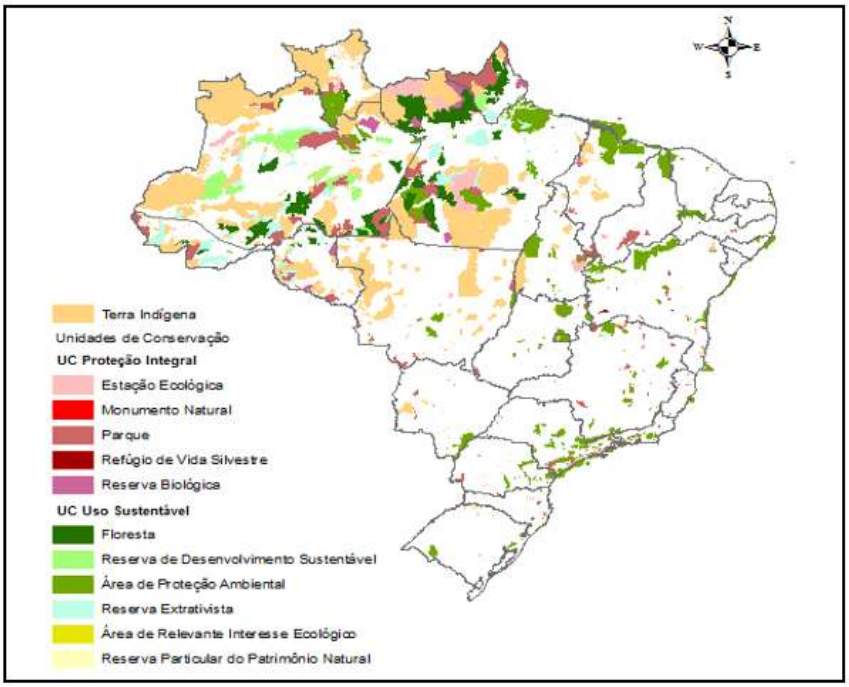

Fig. 2. Map of Conservation Units
Source: MMA (2014); FUNAI (2014)

In the researched caatingas, there are Conservation Units, called APA Dunas and Veredas of the Low-Middle São Francisco river, instituted by Decree n. 9,957 of March 30, 2006, issued by the government of the State of Bahia/Brazil.

The Decree was created based on Law No. 3,858, dated November 3, 1980, Federal Law No. 6,902, of April 27, 1981, and Resolution No. 10 of December 14, 1988, of the National Council of the Environment (CONAMA), considering the uniqueness of the geological formations of dunes and trails of the Lower São Francisco a unique occurrence in the Northeast of Brazil and, understanding that its natural characteristics, of exceptional scenery, are of great value for the development of the ecological tourism of this region, besides the singularity of its biotic attributes, with occurrences of different species of fauna and flora. These characteristics justified the creation of the decree described above (PACHECO, 2014) [21].

III. MATERIAL AND METHODS

The surveyed area is located northwest of the State of Bahia, between the latitudes of 10º00 'and 11º00' S and longitudes 42º30 'and 43º20' W, occupying part of the municipalities of Remanso, PilãoArcado, XiqueXique and Barra, distancing about 700 km from Salvador. It is part of the São Francisco Dunes Ecoregion (Figure 3) and the Environmental Protection Area (APA) of Dunes and Veredas of Lower São Francisco river (VELLOSO; SAMPAIO; PEREYN, 2002) [14].

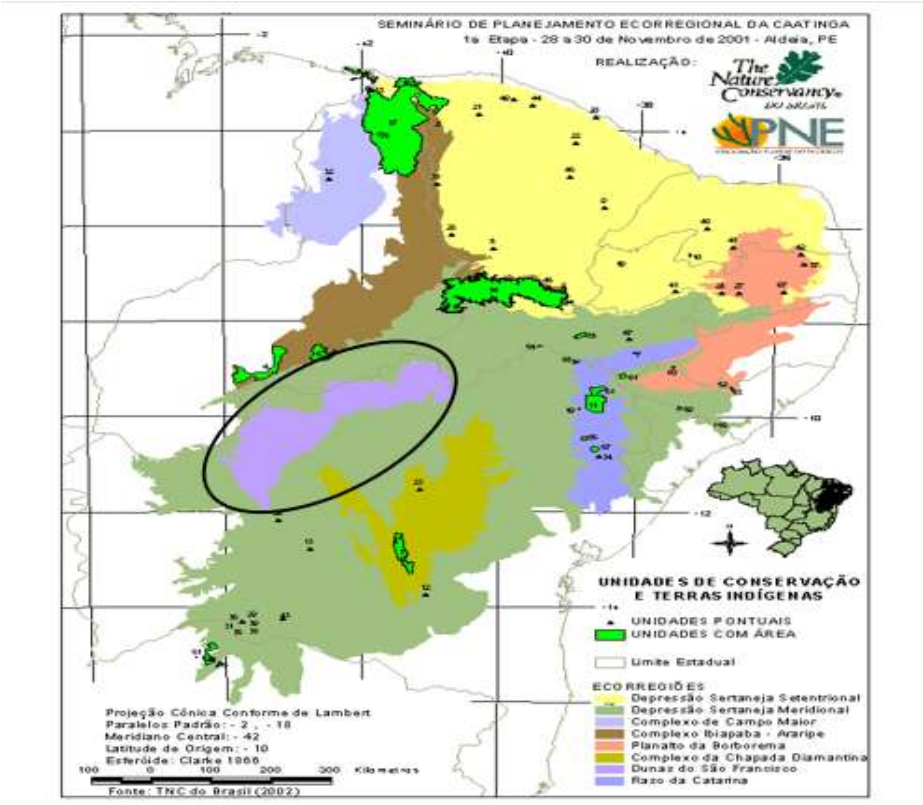

Fig. 3. Search Location
Source: TNC of Brazil (2002)

Thus, the methodology used in the research is based on the Geosystemic Theory advocated by Sotchava (1977) [4], which was elaborated to apply the Systems Theory to environmental studies, complemented by it, and in the Ecodynamic Method/morpho dynamic approach elaborated by Tricart (1977) [5]. The GTP (Geosystem - Territory - Landscape) method of Bertrand and Bertrand (2007) [6] was also used to analyze the environmental dynamics of the study area and to elaborate conservation proposals for the area. O método utilizado para caracterizar a área está embasado na ecodinâmica de Tricart, onde os meios são caracterizados em: stable, intergrades, andhighlyunstable. For the analysis and elaboration of the proposal of conservation of the paleoenvironment, the GTP theory advocated by Bertrand was used, which tries to understand the interactions between different constituent elements to analyze the dialectic existing between the landscape, the territory and the geosystem. And for the analysis of the local actors' conception, the Discourse Analysis of Bardin (1977) [22] was used.

In this way, the research was initially done in the office, through a literature review that addresses the central theme of the work. Then, the field research was carried out from July to December 2013, with monthly visits to the dunary fields, aiming to make an ecodynamic analysis of the area and analysis of the subjects' conception in relation to the ecoregion, through a semi-structured interview. The interpretation of the data was in agreement with the proposed theories.

IV. RESULTS AND DISCUSSIONS

The results of the natural impacts obtained indicate that the area of the paleodunar fields studied presents the three levels of stability recommended by Tricart (1977): stable, with dense vegetation cover (Figure 4a); intergrades that is in a transition phase between the stable and unstable medium (Figure 4b); and strongly unstable, presenting at a stage and degradation, without consistent vegetation cover and vulnerable to natural and anthropogenic impacts (Figure 4c). For each characterized environment, a strategic plan for sustainable coexistence was indicated, that is, a proposal for the conservation of the ecoregion.

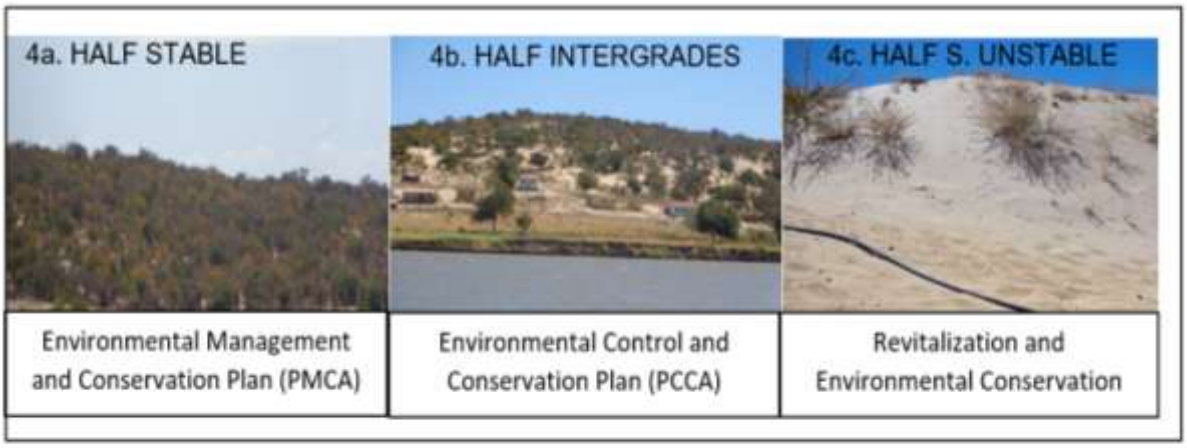

Fig. 4. Characterization of the area in the tricart'ana design
Source: Pacheco (2014)

Regarding the anthropogenic impacts, it was verified through in situ research and interview with the social actors, that great are the impacts existing in the paleoenvironment, and few are those that identify with the environmental territory and understand as something to be conserved.

A total of 06 (six) questions related to the time the interviewees lived in the region, their coexistence with the dune fields and the São Francisco River, and to inquire about their knowledge about the implementation of public and environmental policies preservation of the area. In all, 50 (fifty) people of both genders (female and male) were interviewed. Thus, a graph was constructed for each question/answer.

1. Are you a resident of this region?

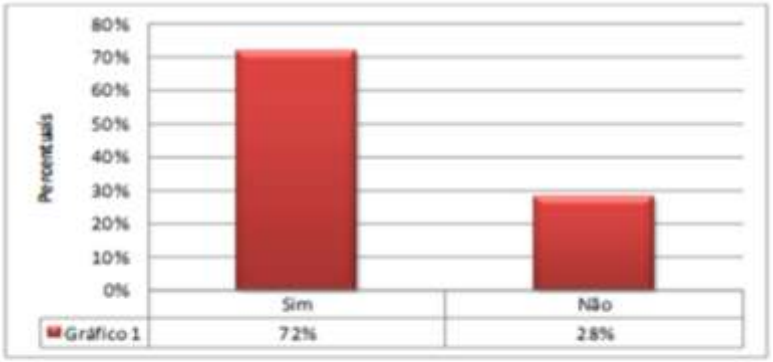

Fig. 3. Natural heritage
Source: Pacheco (2014)

Of those interviewed, 72% answered yes when asked if they resided in the region surveyed. However, 28% said they were not residents of the area. The significant difference between the resident majority in loco is then perceived.

2. How long have you been living there?

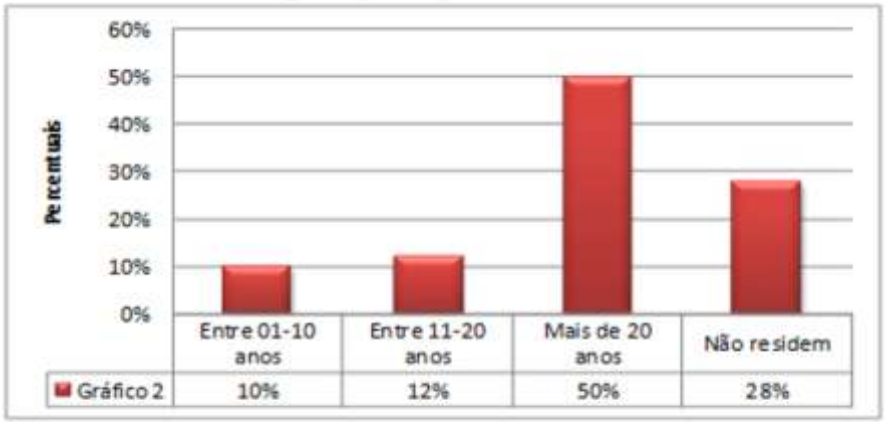

Fig. 4. On-site residence time
Source: Pacheco (2014)

When asked how long they lived in the area, 10% of respondents said they had between 01 and 10 years of age and 12% said they lived there between 11 and 20 years. Already 50% said they have lived in the region for more than 20 years. The others (28%) stated that they did not live in the area. Thus, it can be seen that the majority of respondents reside in the region and, with a considerable time, what is deduced to provide greater knowledge about the reality of the region under discussion.

3. In your conception what do the dune fields represent?

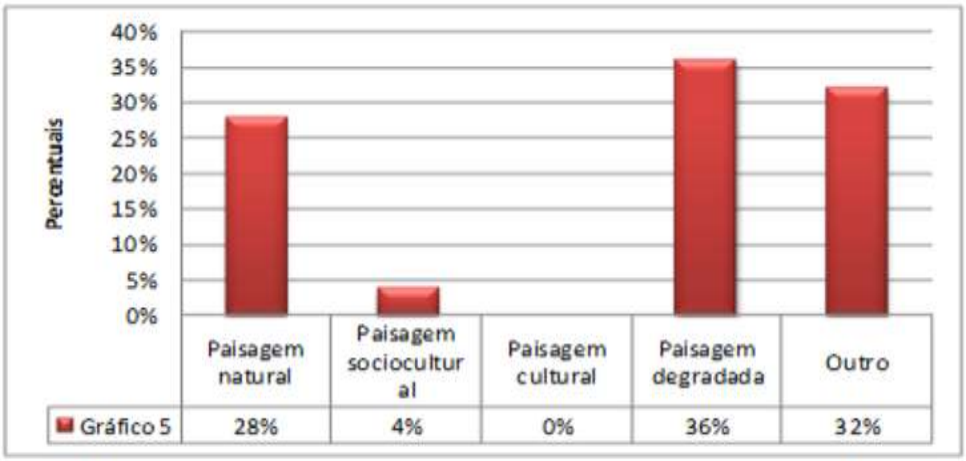

Fig. 5. Value of the dune landscape
Source: Pacheco (2014)

Of those interviewed, 28% said they saw the dunes as a natural landscape; 4% understand this area as a socio-cultural landscape and 36% understand it as a degraded landscape. Of the total number of respondents, none understands the dune fields as being a cultural landscape. Finally, 32% opted to see the region with another perspective - an obstacle to obtain water from the São Francisco River - since it represents a natural barrier that limits the community that lives in the surroundings, to the São Francisco river.

4. Do you consider that the living of the resident population around the dunes and the São Francisco River, with these environments, is:

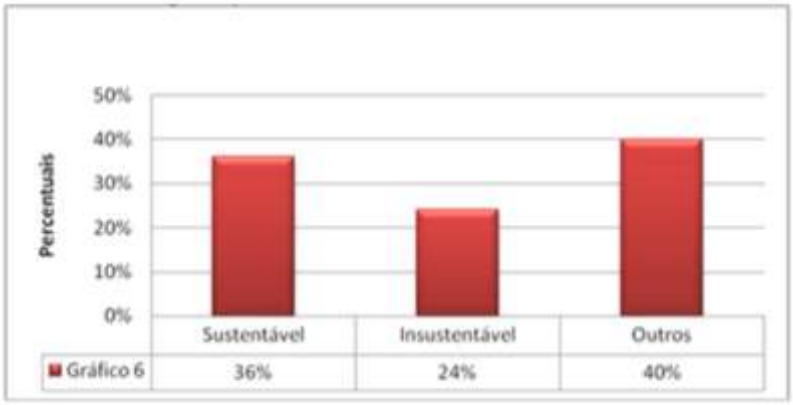

Fig. 6. Living with natural environments
Source: Pacheco (2014)

About 36% of the interviewees understand that the coexistence of the local subjects with the thesis environment is sustainable. Already 24% see this relationship between social subjects and the natural area as unsustainable. However, 40% consider other issues. According to 26% of the interviewees, the relation is of total exploration and, they pointed out the causes that would be - removal of sands and pollution of the river and, 14% also considered a relation of exploration, pointing to the removal of wood and water from the river, for to exploit unduly with irrigated agriculture, degrading the vegetation of the river bank to plant also grasses for cattle.

5. Do you know that these dune fields are part of the San Francisco Dunes and Veredas Environmental Protection Area (APA)?

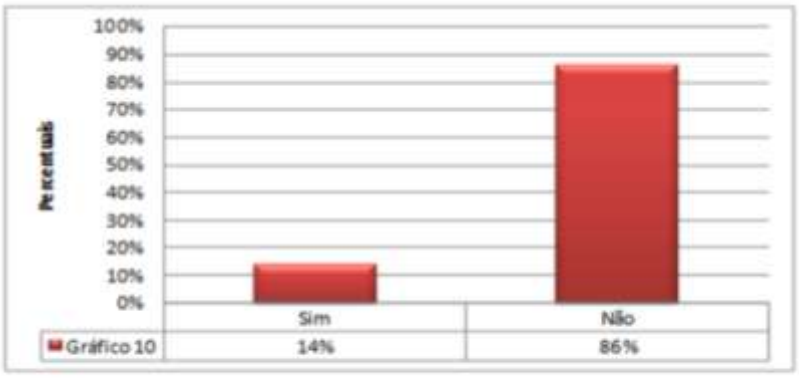

Fig. 7. Knowledge about APA
Source: Pacheco (2014)

When questioned about the area's membership in the APA Dunas and Veredas do São Francisco, 14% said they were aware of the fact, although they saw no advantage in this. However, 86% stated that they never heard that the area was protected and, justifying by saying that they never saw any inspection on the said landscape.

In this sense, it is possible to affirm that there was no public hearing with the surrounding community, when the creation of the area in the APA occurred, thus indicating the little concern of the public power in effecting the preservation of the place, being that the community would be one of the most responsible in preserving and denouncing any aggression in this area.

5. Do you feel that you belong to this ecoregion?

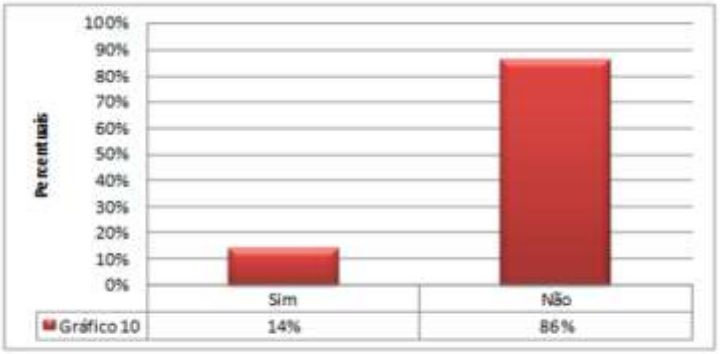

Fig. 8. Belonging to the territory
Source: Pacheco (2014)

Of the 100% interviewed, 86% stated that they do not have the sense of belonging to the ecoregion, justifying the disorders caused by the dunary fields to their daily lives. Already 14% said they feel that they belong to the eco-environment and would like to contribute in some way to preserve them, but do not know how to proceed.

4.1 Proposed Conservation of Protected Areas in Brazil

In this sense, in the stable environments complex relations are established among these diverse conditions, including mechanisms of compensation and self-regulation. Tricart (1977) [5] also points out that in the majority of regions climatic oscillations were enough to generate physiognomic changes in the vegetation cover, which in turn influenced the morphogenetic systems.

Therefore, for the various varieties of stable media, the principle of conservation should be to maintain a dense vegetation cover with effects equivalent to those of the natural vegetation cover. However, stable whole reserves are not exempt from the ecological imbalances that can trigger geodynamic imbalances.

However, in the intergrades the morphogenesis-pedogenesis interference modalities vary according to two criteria: a) the qualitative one, which takes into account the distinction between the morphogenic processes that affect only the soil surface and do not alter the succession of horizons in the profile and , those that act on the thickness of the soil or in a more important part that will consequently disrupt the arrangement of the horizons; b) quantitative, which considers that when instability is weak, pedogenesis gains advantage with a whole series of terms of transition to stable means. But if these advantages are not preserved, the transition may be to unstable means.

Finally, the unstable means where the landscape is almost or totally without vegetation covering that can assure the processes and natural dynamics, causing the loss of quasi-sands by the wind erosion and the loss of particles by rolling or salting, by the absence of the vegetation cover. In Tricart's (1977) [5] conception, the morphodynamic work carried out in the semi-arid regions, but specifically, in the Brazilian Northeast, where heavy storms are repeated a good number of times per century, is superior to what is done in hyperarid regions where these storms are uncommon.

The characterization made is understood as relevant not only to punctuate the impacts found in loco, but also to present a management plan and conservation of the area, based on the GTP (Geosystem-Territory-Landscape) theory of Bertrand and Bertrand (2007) [6], aiming at the conservation of paleoenvironmental fields. From this perspective, the following conservation plans were drawn up:

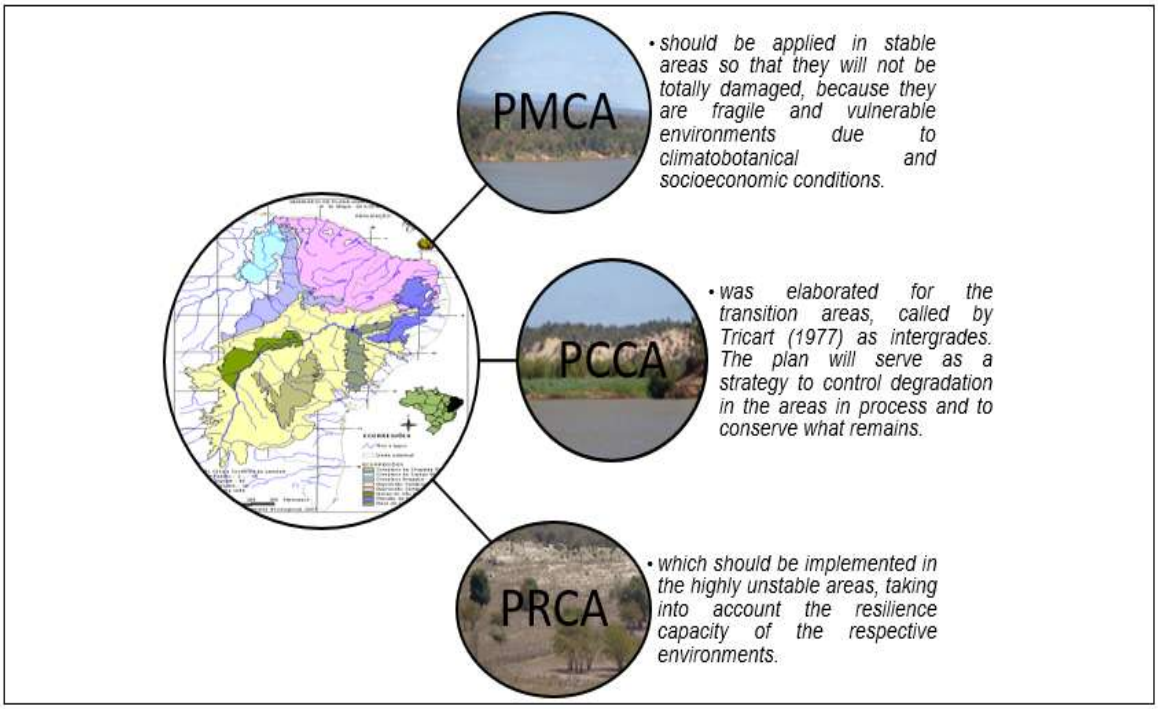

Fig. 9. Conservation plan for dune areas
Source: Pacheco (2016)

It is important to note that the plans mentioned in Figure 9 (Management and Conservation, Control and Conservation, and Environmental Recovery and Conservation) can only be implemented with the agreement of those responsible for the APA management, in partnership with the Municipalities where the dune fields, affected by direct and indirect environmental impacts. In addition, it is fundamental the joint commitment of the municipalities that are part of the APA and of the community that lives in the surroundings of the dunaries, since it is these social actors who are living together in this context, and can contribute in a positive way to this awareness. It should be emphasized that the present model can be implanted in any unit or protected area, not limited only to dune areas.

V. CONCLUSION

It could be concluded that the coexistence of the surrounding population with the dunaresecoambientes is not sustainable and, therefore, there is no real concern with conservation. Many of them understand that dunes are just heaped sand and are not even aware that they live in an area of environmental protection, and that they need to take care of the natural environment where they insert themselves as social subjects.

It is essential to have an intervention regarding the conservation of the sands, prior to the implementation of what CONAMA (2012) [23] Resolution n. 10, of December 1988, in its Article 6. It is crucial to consider the applicability and/or enhancement of Environmental Education (EA) in the curriculum of local schools, considering that this is an important tool to mediate the residents' relationship with the environment.

Finally, it is of fundamental importance the implementation by the APA management of the Conservation Proposal suggested for the three environments (characterized) existing in the ecoregion, aiming at conserving what is still possible of the natural aspects and restoring what is already found in an advanced state of environmental degradation.

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REFERENCES

[1]. SCHENKEL, C. S.; MATALLO JÚNIOR, H. (Org.) Desertificação. 2. ed. Brasília: UNESCO, 2003, 82p.
[2]. LEAL, I. R.; TABARELLI, M.; SILVA, J. M. C. da. Ecologia e conservação da caatinga. Recife: Ed. Universitária da UFPE, 2003.
[3]. BARRETO, A. M. F.; PESSENDA, L. C. R.; SUGUIO K..Probable drier Holocene climate evidenced by charcoal bearing middle São Francisco River paleodunes, State of Bahia, Brazil. Anais da Academia Brasileira de Ciências 68, p. 43-48, 1996.
[4]. SOTCHAVA, V. B. O estudo de geossistemas. São Paulo: Instituto de Geografia USP. São Paulo: 1977, 51p. (Métodos em Questão, 16).
[5]. TRICART, Jean. Ecodinâmica. Rio de Janeiro, IBGE, Diretoria Técnica, SUPREN, 91p, 1977.

[6]. BERTRAND, G.; BERTRAND C. Uma Geografia Transversal e de Travessias: o meio ambiente através dos territórios e das temporalidades. Maringá: Mossoni, 2007.
[7]. REIS, A. C. Clima da caatinga. Anais da Academia Brasileira de Ciências 48, p. 325-335, 1976.
[8]. NIMER, E. Climatologia da região Nordeste do Brasil. Introdução à climatologia dinâmica. Revista Brasileira de Geografia 34, p. 3-51, 1972.
[9]. PRADO, D. E.; GIBBS, P. E. Patterns of species distributions in the dry seasonal forests of South America. Annals of the Missouri Botanical Garden 80, p. 902-927, 1993.
[10]. SOUZA, C. R. G.; SUGUIO, K.; OLIVEIRA, A. M. S.; OLIVEIRA, P. E. de. Quaternário do Brasil. Ribeirão Preto/SP: Holos Editora, 2005.
[11]. DE OLIVEIRA, P. E.; BARRETO, A. M. F.; SUGUIO, K..Late Pleistocene/Holocene climatic and vegetational history of the Brazilian caatinga: the fossil dunes of the middle São Francisco River. Chicago: Elsevier Science B.V. Palaeogeography, Palaeoclimatology, Palaeoecology – PALALEO, vol. 152, 319–337, 1999.
[12]. BEHLING, H.; Costa M. L. Holocene environmental changes from the Rio Curuá record in the Caxiuanã region, eastern Amazon Basin. Quat. Res. 53, p. 369-377, 2000.
[13]. VELLOSO, A. L.; SAMPAIO, E. V. S. B.; PAREYN, F. G. C. Ecorregiões Propostas para o Bioma Caatinga. Recife: Associação Plantas do Nordeste/Instituto de Conservação Ambiental The NatureConservancy do Brasil, 2002.
[14]. JACOMINE, P. K. T.; CAVALCANTE, A.C.; RIBEIRO, M. R.; MONTENEGRO, J. O.; BURGOS, N. Levantamento Exploratório- Reconhecimento de solos da margem esquerda do Rio São Francisco, Estado da Bahia. Boletim Técnico EMBRAPA, nº 38, 1976, 404 p.
[15]. ALMEIDA, A. M. As Florestas Esquecidas. Ecologia e Evolução. Darwinianas: a ciência em movimento. Outubro de 2016. Disponível em: <https://darwinianas.com/2016/10/11/as-florestas-esquecidas/>. Acesso em 15 mar. 2017.
[16]. CARVALHO, J. A conservação da natureza e dos recursos naturais na Amazônia brasileira. In: Simpósio sobre a biota amazônica 7, p. 1-47,1967.
[17]. MIRANDA, E. E. Água na natureza, na vida e no coração dos homens. São Paulo: Campinas, 2004.
[18]. RAMOS, E. M. Direito Ambiental Comparado: Brasil-Alemanha-EUA: uma análise exemplificada dos instrumentos ambientais brasileiros à luz ambiental comparado. Maringá/PR, Midiografi II, 2009, 256p.
[19]. CADASTRO NACIONAL DE UNIDADES DE CONSERVAÇÃO (CNUC/Brasil). Disponível em: http://www.florestal.gov.br/snif/recursos-florestais/sistema-nacional-de-unidades-de-conservacao?print=1&tmpl=component. Acesso em: 15, mar. 2017.
[20]. PACHECO, C. S. G. R. Ecodinâmica da Paisagem Paleodunar do Médio Rio São Francisco/BA: em defesa das fronteiras agredidas. (Dissertação de Mestrado). Instituto de Tecnologia de Pernambuco (ITEP). Recife/PE, 2014,153p.
[21]. BARDIN, L. Análise de Conteúdo. São Paulo: Martins Fontes, 1977.
[22]. CONSELHO NACIONAL DO MEIO AMBIENTE/BRASIL. Resoluções do Conama: Resoluções vigentes publicadas entre setembro de 1984 e janeiro de 2012. Ministério do MeioAmbiente. Brasília: MMA, 2012, 1126p.

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