

Revista



## Socioeconomic indicators associated with the desertification process in “Microrregião do Sertão” of Pernambuco state, Brazil

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### ABSTRACT

In all of humankind's history, there has never been as much concern about environmental issues as it has today. Within this theme, it is worth highlighting some issues such as: the climate change process and desertification. There are several indicators used to evaluate studies on this process. In order to do so, this study intends to compare the socioeconomic indicators in the Microregions of the “Sertão do Moxotó” and “Sertão do Pajeú”, State of Pernambuco, considered to be low susceptibility to desertification and with severe risk as described in the Map of Areas Susceptible to Desertification and Areas Affected by Desertification, Quoted by the Ministry of Environment. The data show that the absolute population manifests a greater control over natural resources, which ends up intervening in other factors, such as social ones. In this way, this research is expected to help in the elaboration of public policies aimed at adapting the population to future climatic scenarios.

**Keywords:** Environment, semi-arid, soil degradation.

### Indicadores socioeconômicos associados ao processo de desertificação em Microrregiões do Sertão do estado de Pernambuco, Brasil

### RESUMO

Em toda a história da humanidade, jamais se teve tanta preocupação no que diz respeito às questões ambientais como hoje. Dentro dessa temática, merece destaque alguns assuntos como: o processo de mudança climática e desertificação. Existem vários indicadores utilizados para a avaliação de estudos sobre esse processo. Para tanto, este estudo pretende comparar os indicadores socioeconômicos nas Microrregiões do Sertão do Moxotó e do Sertão do Pajeú, Estado de Pernambuco, considerado de baixa susceptibilidade à desertificação e com grave risco conforme descrito no Mapa das áreas Susceptível à desertificação e áreas afetadas pela desertificação, citado pelo Ministério do Meio Ambiente. Os dados mostram que a população absoluta manifesta um maior controle sobre os recursos naturais, o que acaba por intervir em outros fatores, como os sociais. Desta forma, espera-se que esta pesquisa ajude na elaboração de políticas públicas voltadas para a adaptação da população aos futuros cenários climáticos.

**Palavras-chave:** meio ambiente, semiárido, degradação do solo.

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## Introduction

The process of desertification is a type of degradation of the environment that can be caused by both climatic variations and by anthropic actions (ARAÚJO; SOUSA, 2011). This process occurs in fragile ecosystems located in arid, semi-arid or drier subhumid spaces, whose natural climatic change or degradation caused by man has led to increased aridity conditions (Binda, Verdum, 2015).

The climatic variations and the anthropic actions are adjusted creating an environment conducive to the desertification process, which implies erosion causing a decrease in the water retention capacity of the soils, loss of biomass and nutrients. With the most impoverished vegetation cover, solar radiation dries up, even more soil and erosion accelerates, promoting aridity (TRAVASSOS; SOUZA, 2011).

The aridity index (IA) is calculated by the ratio between precipitation (P) and potential evapotranspiration (ET<sub>p</sub>), according to the Thornthwaite climatic classification (1941). According to this index, when the ratio is between 0.05 and 0.20, the climate is considered arid; In the range between 0.21 and 0.50, the climate is characterized as semi-arid; When it is between 0.51 and 0.65, it is considered dry sub-humid and, finally, above that humid subhumid value (MMA, 2007).

The relationship between desertification, drought and the influence of human actions have not yet been fully explained (FERNANDES, MEDEIROS, 2009). Concern regarding the desertification process has been mentioned in several studies, among them in China, Mongolia, Thailand, India, Egypt, Brazil. Some of them describe that climatic factors and human activities have a great influence on the desertification process and that it is necessary to develop methodologies aimed at evaluating the desertification process since it is an ecological, environmental and socioeconomic threat (BAKR et al., 2011; GE et al., 2015; LAMCHIN et al., 2015; VARGHESE; SINGH, 2014; WIJITKOSUM, 2015).

In the Brazilian semi-arid region, the causes of desertification refer to the exploitation of natural resources, undue land-use practices (overgrazing and over-cultivation) and, above all, regional immediacy development models (ARAÚJO; SOUSA, 2011).

It is estimated that in Brazil the areas susceptible to desertification occupy about 1,340,000 km<sup>2</sup> of the national territory, reaching approximately 30

million people. About 180,000 km<sup>2</sup> of these areas are in a severe desertification process and the states of the Northeast are the most affected (MMA, 2007).

In Pernambuco, there is the Cabrobó Desertification Nucleus - the oldest of the four desertification nuclei in Brazil. This nucleus is composed of the municipalities of Belém do São Francisco, Cabrobó, Carnaubeira da Penha, Floresta and Itacuruba and has a population of 21.379,45 Km<sup>2</sup> and 390.207 habitants (MMA, 2007).

Thus, it has been necessary to prepare studies on the analysis of the environmental dynamics and vulnerability of the desertification process in the semi-arid region (SANTOS; GALVÍNCIO, 2013), as well as the need to develop technologies suited to the productive potential of the region together with public policies of Development to the adequacy of the population to the process of desertification (FERNANDES, MEDEIROS, 2009, LAMCHIN et al., 2015, VARGHESE and SINGH, 2014).

One alternative is the association of socioeconomic indicators, the Municipal Human Development Index (IDHM) with the FIRJAN Municipal Development Index (IFDM). Based on the hypothesis that socioeconomic indicators through socio-environmental and anthropic factors intensify the desertification process. The objective was to compare socioeconomic indicators in the Microregions of the Sertão do Moxotó and Sertão do Pajeú, State of Pernambuco, considered to be low susceptibility to desertification and with severe risk as described in the Map of Areas Susceptible to Desertification and Areas Affected by Desertification, cited by Ministry of the Environment.

## Material and Methods

### *Study area*

The Microregion of the Sertão do Moxotó consists of seven municipalities (Arcoverde, Betânia, Custódia, Ibimirim, Inajá, Manari and Sertânia). And the Microregion of the Sertão do Pajeú is formed by seventeen municipalities (Afogados da Ingazeira, Brejinho, Calumbi, Carnaíba, Flores, Igaraci, Ingazeira, Itapetim, Quixaba, Santa Cruz da Baixa Verde, Santa Terezinha, São José do Egito, Serra Talhada, Solitude, Tabira, Triunfo and Tuparetama). According to the classification of Köppen, the climate is of type Bsw h 'also presents,

low rainfall indices (annual averages less than 800 mm). In addition, it is important to note that in the present study, there was a significant increase in the number of rainfall events in the region).

For the accomplishment of the work, the data of the IDHM - Municipal Human Development Index and the IFDM - FIRJAN Municipal Development Index, corresponding to the period of 2010 and 2013 were used.

The HDI is an evaluation composed of indicators of three dimensions of human development: education, longevity and income. The index ranges from 0 to 1, the closer to 1, the greater the human development (Table 1).

**Table 1** - Range of Municipal Human Development (Atlas Brasil, 2017).

Very High	0,800 to 1
High	0,700 to 0,799
Medium	0,600 to 0,699

The IFDM classifies the area according to the following socioeconomic indexes (Table 2).

**Table 2** - FIRJAN Index (Sistema FIRJAN, 2017)

IFDM	
High	≤ 0,800
Medium	0,500 to 0,799
Low	0 to 0,999

The data used for this study were obtained through the following websites: Atlas Brasil, Sistema FIRJAN and on the IBGE website - Brazilian Institute of Geography and Statistics. All data were submitted to the Excel Program for the analysis of the data, and for the elaboration of graphs through SigmaPlot (version 10.0).

### Results and Discussion

The Socioeconomic Indicators change according to the Microregions as presented in Table 3. These results can be clarified through the Population since the Microregion of the Sertão do Moxotó has a larger population compared to the Microregion of the Pajeú Sertão.

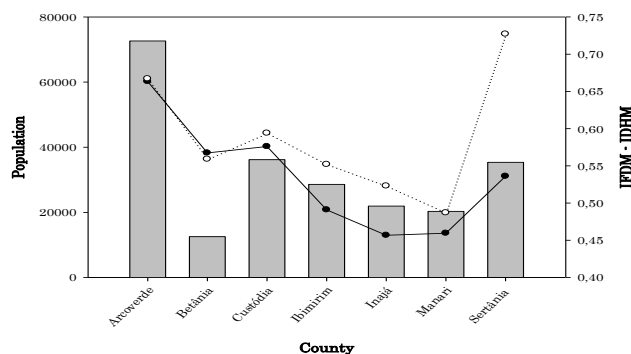
**Table 3** - Socioeconomic Indicators referring to the state of Pernambuco and microregions corresponding to the period of 2010. (IBGE - Brazilian Institute of Geography and Statistics / FIRJAN System, 2017).

Indicators	Pernambuco	Sertão do Moxotó	Sertão do Pajeú
IFDM	0,6473	0,504	0,537
IDHM	0,772	0,523	0,608
Population	1.537.704	32.507,57	21.623,94

In relation to the data of (Figure 1) in the Moxotó Microregion, the most populous municipalities were Arcoverde (73.154), Custody (36.474) and Sertânia (35.521). And the less populous were Ibimirim (28.798), Inajá (22.374), Manari (20.681) and Bethany (12.589). The municipalities of Arcoverde (0,667), Sertânia (0,613) and Custody (0,594) obtained the highest HDI.

The lowest indexes were for the municipalities of Manari (0,487), Inajá (0,523), Bethania (0,559) and Ibimirim (0,552). The municipalities of Arcoverde, Custódia and Sertânia obtained the highest FIRJAN Index with (0,6633), (0,576) and (0,5361) simultaneously.

**Figure 1** - Relationship between the MFID, IDHM and the absolute population of the Microregion of the Sertão do Moxotó, corresponding to the period of 2013.



Source: Author, 2017.

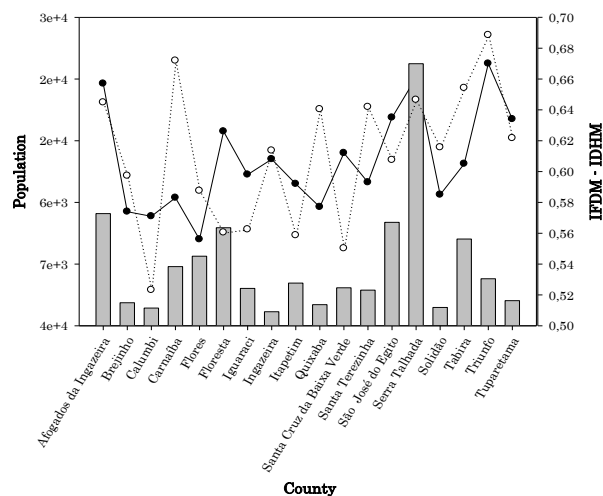
It was also observed that the lowest indices were in the municipalities of Bethany (0,5674), Calumbi (0,5232), Ibimirim (0,4909), Manari (0,4595), and Inajá (0,4568). As shown in Figure 2, the most populated municipalities in the Sertão do Pajeú Microregion were Serra Talhada (84.970), Afogados da Ingazeira (36.866), São José do Egito (33.537) and Floresta (32.152).

The less populous were Ingazeira (4.549),

Calumbi (5.741), Solitude (5.964) and Quixaba (6.812). In relation to the IDHM (Figure 2), the municipalities of Triunfo (0,67), Serra Talhada (0,661), Afogados da Ingazeira (0,657), São José do Egito (0,635) and Tuparetama (0,634), Floresta (0,626) and Santa Cruz da Baixa Verde (0,612) presented higher results.

However, the lowest values of the HDI were for the municipalities of Flores, Calumbi, Brejinho, Quixaba, Carnaíba and Itapetim, with the result (0,556), (0,571), (0,575), (0,577), (0,583) and (0,585) respectively. The municipalities of Triunfo, Serra Talhada, Afogados da Ingazeira, São José do Egito and Tuparetama (0,6885), (0,6719), (0,6542), (0,6465) and (0,6448). It was also observed that the lowest indices were in the municipalities of Carnaíba (0,5625), Quixaba (0,5605), Brejinho (0,5587), Calumbi (0,5502) and Flores (0,5232).

**Figure 2** - Relationship between the MFII, IDHM and the absolute population of the Microregion of Sertão do Pajeú, corresponding to the period of 2013.



Source: Autor, 2017.

Environmental degradation in semi-arid environments has been increasing and leading to increasingly significant desertification processes, resulting in loss of soil fertility and biodiversity, destruction of natural habitats, and rural exodus (PACHCO, FREIRE. In addition to socioeconomic issues and population-related phenomena and their spatial dynamics (population distribution and density, labor movements, etc.), areas susceptible to desertification can be defined through Geoenvironmental analyzes (clearings in the cover Soil erosion and compaction, etc) (PEREIRA,

NASCIMENTO, 2013).

The vegetation cover is an important indicator for the evaluation of the desertification process, where its reduction can increase desertification nuclei (COELHO; DUARTE; COELHO, 2015).

The clarification through the subsidies provided by the indicators relates to the procedures and how the actions peculiar to the management, political or not, can determine environmental problems caused by the anthropic actions and become a decisive question for the diagnosis of sustainability (SOARES et al., 2011).

According to Lucena; Vanderley; Nobrega, (2016) climatic conditions favor the process of desertification, besides, this process is favored by human actions on the environment.

According to Ribeiro et al., (2016) it is extremely important to prepare studies focused on the desertification theme for the planning of human activities.

### Conclusions

Through the investigative study, we obtained a reading of the understanding with regard to socioeconomic factors and their relationship with the desertification process. It can be concluded that the absolute population manifests a greater control over natural resources, which ends up intervening in other factors, such as social ones. This influence induces the environmental degradation causing a reduction in the conditions of life of the individual, making the region more and more vulnerable to the desertification process. Given this, it is necessary to adopt public policies aimed at adapting the population to future climate scenarios and the desertification process.

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