Australian Journal of Basic and Applied Sciences
2019 March; 13(3): pages 23-30
DOI: 10.22587/ajbas.2019.13.3.4
Original paper
AENSI Publications
Journal home page: www.ajbasweb.com

Environmental Impact Assessment of Serrote do Jatobá Tourist Complex in Pau dos Ferros, Brazil

Laura Teixeira Leite Carlos Peixoto[1], Hudson Toscano Lopes Barroso da Silva[2], Geversson Pinheiro Dias Fernandes de Morais[3], Gustavo Leite Gonçalves[3], Jessica Rafaelly Almeida Lopes[3], Sarah de Souza Cruz Mendonça[4], Tayd Dayvison Custódio Peixoto[5], Francisca Kennia Nunes dos Santos[6]

[1]Agricultural and Environmental Engineer, Environmental Engineering Specialist, Pau dos Ferros, Rio Grande do Norte, Brazil.
[2]B.SC. in Ecology, M.SC. in Geography, Pau dos Ferros, Rio Grande do Norte, Brazil.
[3]Environmental and Sanitary Engineer, Department of Engineering and Technology, Federal Rural University of Semi-Árido (UFERSA), Brazil.
[4]Environmental Engineering Student, Department of Civil Engineering, Federal University of Rio Grande do Norte (UFRN), Brazil.
[5]Agricultural and Environmental Engineer, M.SC. in Soil and Water Management, Pau dos Ferros, Rio Grande do Norte, Brazil.
[6]Environmental and Sanitary Engineering Student, Department of Engineering and Technology, Federal Rural University of Semi-Árido (UFERSA), Brazil.

Correspondence Author: Tayd Dayvison Custódio Peixoto, Agricultural and Environmental Engineer, M.SC. in Soil and Water Management, Pau dos Ferros, Rio Grande do Norte, Brazil.
E-mail:- dayvisonpeixoto@hotmail.com

Received date: 28 January 2019, **Accepted date:** 13 March 2018, **Online date:** 28 March 2019

Abstract

Tourism in a region contributes to its economic growth by increasing the flow of people, heating trade and generating jobs in various sectors of the economy. However, accompanied by this growth there is also an increase in environmental degradation with the emergence of environmental impacts. Environmental impacts affect those who use the site, and a study of these impacts is necessary, in other words, an Environmental Impact Assessment. This study was carried out from July to September 2018, prior to any type of deforestation or construction in the area. The aim of this study was to identify and evaluate the possible environmental impacts generated in the construction and operation phases of the project, considering the physical, biological and anthropic environments. A Tourist Complex will be built, which will be located in the city of Pau dos Ferros, Rio Grande do Norte, Brazil. The methodology that was used is a combination of two methods of environmental impact assessment proposed in the literature, the checklist method and the Interaction Matrix method. The analysis of the impact matrix, related to the construction and operation of the Serrote do Jatobá Tourist Complex, reveals that the project should cause, in total, 133 significant environmental impacts in all its planned phases, 43 in the pre-implantation phase, 57 in the implantation phase and 33 when in operation. Of the total impacts counted, 66 were evaluated as positive and 67 as negative. Through the analysis of the collected information, it was identified that in the phase of implantation of the project the greatest environmental impacts are generated, but in the operation phase, the least adversities will be generated. When comparing the phase of operation with the other phases, it was verified that the adversities are not significant in all the evaluated environments. From these results, it was verified the great importance of the use of methods for the environmental impact assessment, because it made possible the anticipation of the impacts that the Serrote do Jatobá Tourist Complex can cause to the environment, before its implantation

Key words: Environmental impact. Impact assessment. Sustainable development. Tourism. Brazil.

INTRODUCTION

From a greater concern for the preservation of the environment and its natural resources, which are indispensable to human life, laws have emerged in Brazil to support the restricted use of such resources, as well as the occupation of areas by certain types of enterprises that are effectively or potentially polluting.

In 1981, Law no. 6,938 established the guidelines and instruments of the National Environmental Policy, as well as the competencies of National Environmental Council (CONAMA), which were amended by Law no. 8,028/1990, determining the requirement of indispensable information for the evaluation of the environmental impact studies, and their reports, in the case of works or activities of significant environmental degradation.

According to the resolution of CONAMA no. 237/1997, any activity that evidences risks, effectively or potentially causing environmental degradation, must be preceded by environmental studies, in order to obtain environmental licensing by the

Citation: Laura Teixeira Leite Carlos Peixoto, *et al.*, Environmental Impact Assessment of Serrote do Jatobá Tourist Complex in Pau dos Ferros, Brazil. Australian Journal of Basic and Applied Sciences, 13(3): 23-30. DOI: 10.22587/ajbas.2019.13.3.4

competent environmental agency, stating that the activity complies with the legal requirements. This licensing represents the administrative procedure by which the competent environmental agency permits the location, installation, expansion and operation of enterprises and activities that use environmental resources or those that, in any way, may cause environmental degradation.
CONAMA, through resolution no. 01/1986, defines Environmental Impact as any change in the physical, chemical and biological properties of the environment that may affect the health, safety and well-being of the population, social and economic activities, biota, aesthetic and sanitary conditions of the environment and the quality of environmental resources.

According to Moreira (1992) environmental impact represents any change in the environment in one or more of its components, caused by a human action. Wathern (1988) states that environmental impact can be understood as the change in an environmental parameter, in a given period and in a given area, that results from a given activity, compared to the situation that would occur if that activity had not been initiated.

Environmental impacts affect those who use the site, and a study of these impacts is needed, in other words an Environmental Impact Assessment (EIA). In this sense, the EIA appears as a study and identification of the probable environmental effects of a policy, program or project, the proposal of alternatives and measures to be adopted to protect the environment (Gilpin, 1995).
One of the most common tools for EIA is a matrix of environmental impacts. This matrix is composed of two checklists, arranged in the form of rows and columns. In one of the lists are listed the main activities or actions that make up the enterprise analyzed and in the other are presented the main components or elements of the environmental system or environmental processes. The objective is to identify the possible interactions between the project components and the elements of the environment (Sánchez, 2013).

The tourist activity exerts great pressure on the environment, due to the instantaneous demand for natural resources generated by the displacement of many people (Pinho, 2007). According to the author, the destruction of ecosystems for the construction of tourism equipment, as well as the increase of solid waste and liquid effluent production are some of the environmental impacts related to tourism, being of great importance to consider the aspects related to the environmental management of these enterprises in order to reduce the environmental impacts of these activities.

Concerns about these negative impacts are especially focused on the degradation process that can affect the natural resources that are used in its development by the use of tourists and the possibility of irreversibility of this process (WTO, 2003).
There are positive impacts brought by tourism activity, these are notably related to economic gains, usually starting in a short time after the implementation of the enterprise. Other impacts, the negative ones, occur in the long term and originate from the unbalanced growth of eco-tourism activity, mainly affecting the environment (Lickorish and Jenkins, 2000).

Oliveira (2008) states that the quality of the environment, both natural and built, is essential for tourism. However, it is necessary to reinforce that the relationship between tourism and the environment is quite complex. It involves many activities that can have adverse environmental effects and much of these impacts are linked to the construction of infrastructure works, such as highways and airports, and tourist facilities, including resorts, hotels, restaurants, shopping centers, leisure areas, among others, which are fundamental for tourism development.

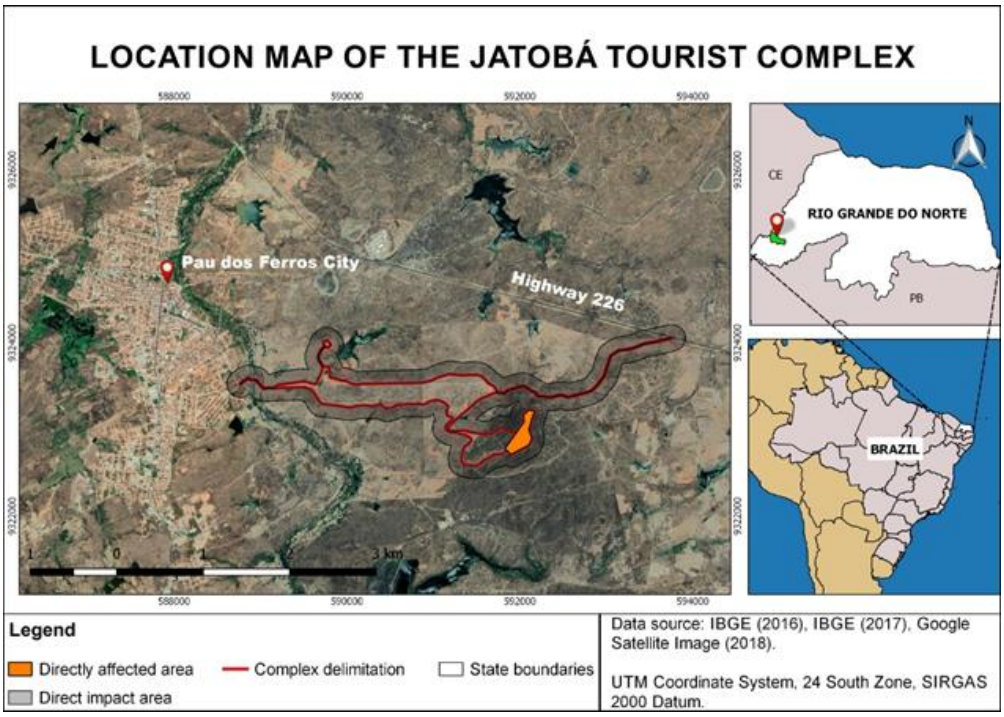
Considering the concern to preserve the environment due to the implementation of the Serrote do Jatobá Tourist Complex, the present study aimed to identify and evaluate the possible environmental impacts generated during the construction and operation phases, considering the physical, biological and anthropic environments.

METHODOLOGY

This study was carried out from July to September 2018. The enterprise to be carried out will be located in the state of Rio Grande do Norte, Brazil, in the rural area of the municipality of Pau dos Ferros, in the Serrote do Jatobá. Located at Latitude 6º07'31" S, Longitude 38º10'24" W, with an average elevation of 315 m, distant approximately 4 km from the city center. The Tourist Complex will have a total area of 7.8 ha and will have as main objective the increase of the local and regional tourist economy, generating jobs and income for the community.

According to the Thornthwaite & Mather climatic classification, the municipality fits the climatic formula C_1dA', that is to say, mega thermal dry sub humid type with little or no water surplus, with average annual temperature of 26,9 °C, very irregular annual precipitation, average of 769.7 mm (Gurgel and Medeiros, 2018).

Citation: Laura Teixeira Leite Carlos Peixoto, *et al.*, Environmental Impact Assessment of Serrote do Jatobá Tourist Complex in Pau dos Ferros, Brazil. Australian Journal of Basic and Applied Sciences, 13(3): 23-30. DOI: 10.22587/ajbas.2019.13.3.4



Graph 1: Location map of the Jatobá Tourist Complex.
Source: Prepared by the author (2019).

Identification and Analysis of Environmental Impacts

According to CONAMA resolution no. 01/1986, the environmental impact studies should analyze the environmental impacts of the project and its alternatives, by identifying, predicting the magnitude and interpretation of the importance of the likely impacts, as follows: the positive and negative impacts (beneficial and adverse), direct and indirect, immediate and medium and long term, temporary and permanent; their degree of reversibility; its cumulative and synergistic properties; the distribution of social burdens and benefits.

Based on an analysis of the Jatobá Tourist Complex and the Environmental Migration, the data related to the enterprise were inserted in the phases of pre-implantation, implantation and operation.

Impact analysis

For the identification and evaluation of the environmental impacts of the tourist complex, a combination of the Checklist method and Interaction Matrix was used. This combination allows us to relate impacting actions to environmental components, thus representing cause and effect relationships.

For the study of the impacts generated by the implementation of the Tourist Complex proposed in the study area, the following were considered:

• Identification of the impacts generated by the enterprise and the physical, biotic and socioeconomic components of the site and its area of influence;
• Description of the environmental impacts generated by the enterprise;
• Qualitative and quantitative assessment of identified and predictable environmental impacts.

In on-site inspections, it was verified that it is a solid land ecosystem, where the effects of anthropic action are visible. The implementation of the Tourist Complex, which is a small business, will have few environmental impacts. The effects of impacting actions should be mitigated by mitigating and compensatory actions.

Key attributes were identified for the identification of impacts, as shown in Table 1.

Table 1: Attributes and their valuation parameters.

Attributes	Evaluation Parameters	Symbol
CHARACTER (Expresses the change or change generated by an action of the enterprise on a given environmental component or factor affected by it)	BENEFICIAL (When the generated effect is positive for the environmental factor considered)	+
	ADVERSE (When the effect is negative for the environmental factor considered)	-
DURATION (It is the record of time, of permanence of the impact after the action that generated it is completed)	SHORT (There is the possibility of reversing the environmental conditions prior to the action, in a short period of time, in other words, that immediately after the conclusion of the action, there is neutralization of impact generated by it)	S

Citation: Laura Teixeira Leite Carlos Peixoto, *et al.*, Environmental Impact Assessment of Serrote do Jatobá Tourist Complex in Pau dos Ferros, Brazil. Australian Journal of Basic and Applied Sciences, 13(3): 23-30. DOI: 10.22587/ajbas.2019.13.3.4

	MEDIUM (It takes a certain period of time before the impact generated by the action is neutralized)	M
	LONG (It is recorded a long period for the permanence of the impact, after the conclusion of the action that generated it. In this degree will also include those impacts whose permanence time, after the conclusion of the generating action, assumes a definitive character)	LP
REVERSIBILITY (It limits the reversibility of the environmental impact as a consequence of this action)	REVERSIBLE (When the action that caused the change has ceased, the affected environment may return to its original state)	R
	IRREVERSIBLE (When the action that generated the change ceased, the affected environment will not return to its previous state)	IR
ORDER (It establishes the degree of relation between the impact action and the impact generated to the environment)	DIRECT (results from a simple cause and effect relationship, also called primary or first order impact)	D
	INDIRECT (When it generates a secondary reaction to the action or, when it is part of a chain of reactions also called a secondary or nth order reaction, according to the situation in the chain of reactions)	I
TEMPORALITY (Expresses the period of the change or modification generated by a project action on a given component or environmental factor affected by it)	TEMPORARY (When the generated effect presents a certain period of duration)	T
	PERMANENT (When the generated effect is definitive, that is, it lasts even when the action that generated it ceases)	P
	CYCLICAL (When the expected effect presents a seasonality of occurrence)	CL
SCALE (Refers to the magnitude of the environmental impact in relation to the geographical area of coverage)	LOCAL (Where the scope of the environmental impact is restricted solely to the area of direct influence where the action was generated)	L
	REGIONAL (When the occurrence of the environmental impact is more comprehensive, extending beyond the geographical limits of the area of direct influence of the project)	RE

Source: Adapted from Sánchez (2008).

RESULTS AND DISCUSSION

Description of Environmental Impacts

The analysis of the Impact Matrix, related to the construction of the Serrote do Jatobá Tourist Complex, reveals that the project should result in 133 significant environmental impacts in all its planned phases, 43 in the pre-implantation phase, 57 in the implantation phase and 33 when in operation. Of the total of impacts counted, 66 were evaluated as Positive and 67 as Negative, representing a percentage of approximately 49.62% for positive impacts and 50.37% for negative impacts (Table 2).

Table 2: Impacts by phases of the enterprise.

Phases	**(+)**	**(-)**	**Total**
Pre-implantation	18	25	43
Implantation	26	31	57
Operation	22	11	33
Total	66	67	133

Source: Prepared by the author (2018).

Pre-implantation phase

During this phase, 43 environmental impacts are predicted, representing 32.33% of the total expected impacts with the implementation of the project. In this phase, impacts of negative character, short duration, and direct order, reversible, temporary and local scale predominate. Concerning the predicted interferences for this phase of the enterprise, 10 impacts on the physical environment, 10 impacts on the biological environment and 28 impacts with influence on the anthropic environment were verified, as shown in table 3.

Table 3: Probable environmental impacts in the pre-implantation phase.

Impacting actions		**Impacted environmental system**			**Impact characterization**					
		Physical	**Biological**	**Anthropic**	**C**	**E**	**R**	**T**	**D**	**E**
Recruitment of personnel	Population Expectation			X	+	D	R	T	S	RE
	Generation of employment and income			X	+	D	R	T	S	RE
	Growth of the trade / services sector			X	+	I	R	T	M	RE
	Greater currency circulation			X	+	I	R	T	S	RE
	Tax collection			X	+	I	R	T	S	RE

Citation: Laura Teixeira Leite Carlos Peixoto, *et al.*, Environmental Impact Assessment of Serrote do Jatobá Tourist Complex in Pau dos Ferros, Brazil. Australian Journal of Basic and Applied Sciences, 13(3): 23-30. DOI: 10.22587/ajbas.2019.13.3.4

Installation of construction site	Landscape changes	X	X		-	D	IR	P	LP	L
	Morphological changes	X			-	D	IR	P	LP	L
	Sound pollution (noise)			X	-	D	R	T	S	L
	Air pollution (dust)	X			-	D	R	T	S	L
	Loss of floristic potential		X		-	D	IR	P	LP	L
	Wild fishing		X		-	D	IR	P	LP	L
	Production of solid waste	X			-	D	R	T	S	L
	Production of domestic effluents	X			-	D	R	T	S	L
	Proliferation of diseases			X	-	D	R	T	S	L
	Potential risks of accidents			X	-	D	R	T	S	L
	Greater currency circulation			X	+	I	R	T	S	RE
	Trade growth			X	+	I	R	T	M	RE
	Tax collection			X	+	I	R	T	S	RE
Opening of access roads	Landscape changes	X	X		-	D	IR	P	LP	L
	Morphological changes	X			-	D	IR	P	LP	L
	Sound pollution (noise)			X	-	D	R	T	S	L
	Air pollution (dust)	X			-	D	R	T	S	L
	Loss of floristic potential		X		-	D	IR	P	LP	L
	Wild fishing		X		-	D	IR	P	LP	L
	Potential risks of accidents			X	-	D	R	T	S	L
	Greater currency circulation			X	+	I	R	T	S	RE
	Tax collection				+	I	R	T	S	RE
Area delimitation	Landscape changes		X		-	D	IR	P	LP	L
	Loss of floristic potential		X		-	D	IR	P	LP	L
	Wild fishing		X		-	D	IR	P	LP	L
	Greater currency circulation			X	+	I	R	T	S	L
	Tax collection			X	+	I	R	T	S	RE
Equipment mobilization	Change in vehicle flow			X	-	D	R	T	S	L
	Risks of road accidents			X	-	D	R	T	S	RE
	Sound pollution (noise)			X	-	D	R	T	S	L
	Air pollution (dust and gases)	X			-	D	R	T	S	L
	Wildlife Escape		X		-	D	IR	P	LP	L
	Trade growth			X	+	I	R	T	M	RE
	Greater circulation of money			X	+	I	R	T	S	RE
	Largest tax collection			X	+	I	R	T	S	RE
Acquisition of material	Growth of the trade sector			X	+	I	R	T	M	RE
	Greater circulation of money			X	+	I	R	T	S	RE
	Increased tax collection			X	+	I	R	T	S	RE

Source: Prepared by the author (2018).

Implantation phase

During this phase, 57 environmental impacts are predicted, which represents 42.85% of the total impacts expected with the implementation of the project. In this phase, the impacts of adverse character, long duration, and direct order, reversible, temporary and local scale predominate. Concerning the predicted interferences for this stage of the enterprise, there were occurrences of 15 impacts on the physical environment; 15 impacts on the biological environment and 36 impacts with influence on the anthropic environment, according to Table 4.

Table 4: Probable environmental impacts in the implantation phase.

Impacting actions		**Impacted environmental system**			**Impact characterization**					
		Physical	**Biological**	**Anthropic**	**C**	**E**	**R**	**T**	**D**	**E**
Area Cleaning	Loss of floristic potential		X		-	D	IR	P	LP	L
	Damage to wildlife		X		-	D	IR	P	LP	L
	Ecosystem change		X		-	D	IR	P	LP	L
	Changing the dynamics of the ecosystems of the Environment		X		-	I	IR	P	LP	L
	Breaking of trophic links		X		-	D	IR	P	LP	L
	Landscape Modification	X	X		-	D	IR	P	LP	L
	Service / income offer			X	+	I	R	T	M	RE
	Trade growth			X	+	I	R	T	M	RE
	Tax collection			X	+	I	R	T	S	RE

Citation: Laura Teixeira Leite Carlos Peixoto, *et al.*, Environmental Impact Assessment of Serrote do Jatobá Tourist Complex in Pau dos Ferros, Brazil. Australian Journal of Basic and Applied Sciences, 13(3): 23-30. DOI: 10.22587/ajbas.2019.13.3.4

Land systematization	Morphological alteration	X			-	D	IR	P	LP	L
	Air Quality Change	X		X	-	D	R	T	S	L
	Noise pollution			X	-	D	R	T	S	L
	Changes in drainage conditions	X			-	D	IR	P	LP	L
	Wildlife disturbance		X		-	D	R	T	M	L
	Offer of services / occupation and income			X	+	I	R	T	M	RE
	Trade growth			X	+	I	R	T	M	RE
	Largest tax collection			X	+	I	R	T	S	RE
Sanitary system	Morphological changes	X			-	D	IR	P	LP	L
	Growth of the services sector			X	+	I	R	T	M	RE
	Greater circulation of money			X	+	I	R	T	M	RE
	Increase tax collection			X	+	I	R	T	S	RE
Electrical system	Landscape changes	X	X		-	D	IR	P	LP	L
	Operational Accident Risks			X	-	D	R	T	M	L
	Risks of accidents at work			X	-	D	R	T	M	L
	Occupancy / income offer			X	+	I	R	T	M	RE
	Trade growth			X	+	I	R	T	M	RE
	Tax collection			X	+	I	R	T	S	RE
Construction	Landscape changes	X	X		-	D	IR	P	LP	L
	Alteration of the local microclimate	X			-	I	IR	CL	LP	L
	Release of dust and particulates	X		X	-	D	R	T	M	L
	Noise emission			X	-	D	R	T	S	L
	Risks of accidents at work			X	-	D	R	T	S	L
	Trade growth			X	+	I	R	T	M	RE
	Tax collection			X	+	I	R	T	S	RE
	Waste generation	X			-	D	R	T	M	L
Ambience	Changes in the original landscape	X	X		-	D	IR	P	LP	L
	Pedological changes	X			-	D	IR	P	LP	L
	Changing biotic conditions		X		-	D	IR	P	LP	L
	Attractiveness for fauna		X		-	D	IR	P	LP	L
	Introduction of exotic species of flora		X		-	D	IR	P	LP	L
	Contracting of specialized services			X	+	I	R	T	M	RE
	Occupancy / income offer			X	+	I	R	T	M	RE
	Trade movement			X	+	I	R	T	M	RE
	Tax collection			X	+	I	R	T	S	RE
Work demobilization	Optimization of the landscape aspects	X	X		+	D	IR	P	LP	L
	Sanitary and environmental control			X	+	D	IR	P	LP	L
	Vector control			X	+	D	IR	P	LP	L
	Risks of accidents at work			X	-	D	R	T	S	L
	Occupancy / income offer			X	+	I	R	T	M	RE
	Local market			X	+	I	R	T	M	RE
	Tax collection			X	+	I	R	T	S	RE
Paving	Landscape modification	X	X		-	D	IR	P	LP	L
	Noise pollution			X	-	D	R	T	S	L
	Air pollution (dust and gases)	X		X	-	D	R	T	S	L
	Risks of accidents at work			X	-	D	R	T	S	L
	Trade growth			X	+	I	R	T	M	RE
	Tax collection			X	+	I	R	T	S	RE

Source: Prepared by the author (2018).

Operation phase

During this phase, 33 environmental impacts are predicted, which represents 24.81% of the total expected impacts with the implementation of the project. At this stage, impacts of a beneficial, long duration, indirect order, reversible, temporary and local scale predominate. As for the interferences predicted for this stage of the project, there were occurrences of 4 impacts on the physical environment; 2 impacts on the biological environment and 27 impacts with influence on the anthropic environment, according to Table 5.

Table 5: Probable environmental impacts in the operation phase.

Impacting actions	**Impacted environmental system**			**Impact characterization**					
	Physical	**Biological**	**Anthropic**	**C**	**E**	**R**	**T**	**D**	**E**

Citation: Laura Teixeira Leite Carlos Peixoto, *et al.*, Environmental Impact Assessment of Serrote do Jatobá Tourist Complex in Pau dos Ferros, Brazil. Australian Journal of Basic and Applied Sciences, 13(3): 23-30. DOI: 10.22587/ajbas.2019.13.3.4

Contracting companies/services	Population Expectation			X	+	D	R	T	S	RE
	Offer of direct and indirect jobs			X	+	D	R	T	S	RE
	Acquisition of specialized services			X	+	I	IR	P	LP	RE
	Opportunity to improve quality of life			X	+	I	IR	P	LP	L
	Change in the population profile			X	+	I	IR	P	LP	L
	Trade growth			X	+	I	R	CL	M	RE
	Tax collection			X	+	D	R	T	S	RE
Goods purchase	Trade growth			X	+	I	R	CL	M	RE
	Currency circulation			X	+	D	R	T	S	RE
	Tax collection			X	+	D	R	T	S	RE
Operation	Changing the local loudness			X	-	D	IR	P	LP	L
	Eco tourism			X	+	D	R	CL	LP	RE
	Development of the region			X	+	I	R	P	LP	RE
	Higher income concentration			X	+	I	R	P	LP	RE
	Growth of the local and regional economy			X	+	I	R	CL	LP	RE
	Tax collection			X	+	D	R	T	S	RE
	Improvement of social indexes			X	+	I	R	CL	LP	L
	Increased flow of people			X	+	D	R	CL	LP	L
Sanitary system	Risk of contamination of water resources	X			-	D	R	P	M	L
	Operational Accident Risks			X	-	D	R	T	M	L
	Contracting of specialized services			X	+	I	R	T	M	RE
road/transport system	Noise pollution			X	-	D	IR	CL	LP	L
	Increase in vehicle flow	X			-	D	IR	CL	LP	L
	Risks of accidents with animals		X		-	I	IR	CL	LP	L
	Risks of accidents with residents of the region			X	-	I	R	P	LP	L
	Localized thermal changes	X			-	I	IR	CL	LP	L
	Alteration of the natural system	X			-	D	IR	P	LP	L
Eletric system	Operational Accident Risks			X	-	D	R	T	M	L
	Risks of accidents with fauna		X		-	I	R	T	M	L
	Offer of infrastructure services			X	+	I	R	T	M	L
	Acquisition of specialized services			X	+	I	R	T	M	RE
	Tax Generation			X	+	D	R	T	S	RE
	Public Sector Growth			X	+	I	R	T	M	L

Source: Prepared by the author (2018).

Analysis by attribute

Regarding the duration attribute, it was observed that 50 (37.59%) are of short duration, 34 (25.56%) are of medium duration and 49 (36.84%) are long lasting impacts. As for the order attribute, the impacts were distributed in 75 (56.39%) of direct order and 58 (43.60%) of indirect order. Regarding the attribute condition or reversibility, 91 (68.42%) are reversible impacts and 42 (31.57%) are irreversible. Regarding the temporality attribute, 81 (60.90%) are of temporary impacts, 41 (30.82%) are permanent impacts and 11 (8.27%) are cyclical temporality impacts. Still of these impacts, in relation to the scale attribute, it was found that 76 (57.14%) will have a local scope and 57 (42.85%) will have a regional scope scale. Of the 67 adverse impacts, the duration attribute shows that 21 (31.34%) are of short duration, 9 (13.43%) are of medium duration and 37 (55.22%) are long-term impacts.

Relation to the order attribute, the expected negative environmental impacts are divided into 61 (91.04%) direct order and 6 (8.95%) indirect order. Regarding the reversibility of the expected impacts, 31 (46.26%) are reversible impacts and 36 (53.73%) are irreversible. By the temporality attribute, the predicted adverse impacts were divided into 29 (43.28%) temporary, 33 (49.25%) permanent and 5 (7.46%) cyclical. Still of these impacts, in relation to the scale attribute, 66 (98.50%) will have a scale of local scope and 1 (1.49%) regional.

Regarding the distribution of the 66 beneficial impacts, it was verified that 29 (43.93%) are of short duration, 25 (37.87%) are of medium duration and 12 (18.18) %) are long-lasting impacts.

Analyzing the order attribute, the expected beneficial environmental impacts are divided into 14 (21.21%) direct order and 52 (78.78%) reverse order. Regarding the reversibility of the expected impacts, 60 (90.90%) are reversible impacts and 6 (9.09%) are irreversible. Temporality attributes were 52 (78.78%) temporary, 8 (12.12%) permanent and 6 (9.09%) cyclical. Still of these impacts, in relation to the scale attribute, 10 (15.15%) will have a local scope and 56 (84.84%) will have a regional scope scale.

Synthesis of results

Comparing the phase of operation with the other phases, it was verified that the adversities are not significant in all evaluated systems, in the Anthropic environment a large number of positive impacts were identified when compared to the negative ones

Citation: Laura Teixeira Leite Carlos Peixoto, *et al.*, Environmental Impact Assessment of Serrote do Jatobá Tourist Complex in Pau dos Ferros, Brazil. Australian Journal of Basic and Applied Sciences, 13(3): 23-30. DOI: 10.22587/ajbas.2019.13.3.4

and in the physical and biological were not observed considerable numbers of negative and positive impacts when compared to the anthropic environment.

Table 6 summarizes the results of the expected impacts with the implementation of the Serrote do Jatobá Tourist Complex, analyzing the phases of the project with their respective actions for each component of the environmental system. It is worth mentioning that the sum of the environmental impacts per system differs from the sum of them in relation to the other attributes, because some impacts have incidence on more than one considered system.

Table 6: Results' synthesis of environmental assessment.

Environmental system	**Physical**		**Biological**		**Anthropic**		**Total impacts**	
Character	(+)	(-)	(+)	(-)	(+)	(-)	(+)	(-)
Pre-implantation	0	10	0	10	17	11	17	31
Implantation	1	14	1	14	25	11	27	39
Operation	0	4	0	2	22	5	22	11
Subtotal	1	28	1	26	64	27	66	81
Total impacts by system	29		27		91		147	

Source: Prepared by the author.

CONCLUSION

Therefore, it was verified that through the Environmental Impact Assessment of the Serrote do Jatobá Tourist Complex, the implantation phase of the enterprise is the greatest negative generator in the physical, biological and anthropic environments due to the great changes in the environment and growth in waste production.

From these results, it is possible to prove the great importance of the use of the methods for the environmental impact assessment, in order to know the impacts that the Serrote do Jatobá Tourist Complex can cause to the environment in each one of its implementation phases.

REFERENCES

BRASIL. Lei no. 6938 de 1981: Dispõe sobre a Política Nacional do Meio Ambiente. 1981.

BRASIL. Lei no. 8028 de 1990: Dispõe sobre a organização da Presidência da República e dos Ministérios. 1990.

BRASIL. Ministério do Meio Ambiente. CONAMA. Resolução no. 01 de 1986.

BRASIL. Ministério do Meio Ambiente. CONAMA. Resolução no. 237 de 1997.

Gilpin, A, 1995. Environmental impact assessment: cutting edge for the 21st century. Cambridge University Press.

Google. Google Satellite, 2018. Pau dos Ferros, Rio Grande do Norte, Brazil. Retrieved from http://www.google.cn/maps/@-6.1171078,-38.1678963,7155m/data=!3m1!1e3 on 10th February 2019.

Gurgel, A. L., and Medeiros, J. F., 2018. Caracterização das condições climáticas de pau dos ferros-RN. Geotemas, (2): 1-16.

IBGE. Instituto Brasileiro de Geografia e Estatística, 2016. Rio Grande do Norte - Malha municipal (SHP). Retrieved from https://portaldemapas.ibge.gov.br/portal.php#mapa219377 on 10th February 2019.

IBGE. Instituto Brasileiro de Geografia e Estatística, 2016. Unidades da Federação (SHP). Retrieved from https://portaldemapas.ibge.gov.br/portal.php#mapa219469 on 10th February 2019.

IBGE. Instituto Brasileiro de Geografia e Estatística, 2017. BC250 – Versão 2017 (SHP - Limites). Retrieved from https://portaldemapas.ibge.gov.br/portal.php#mapa220344 on 10th February 2019.

Lickorish, L. J., and Jenkins, C. L., 2000. Introdução ao turismo. Campus.

Moreira, I. V. D., 1988. EIA in Latin America. In: WATHERN, P. (Org.). Environmental impact assessment: theory and practice. Unwin Hyman, 239-253.

Oliveira, E. S., 2008. Impactos socioambientais e econômicos do turismo e suas repercussões no desenvolvimento local: o caso de itacaré – bahia. Curso de Cultura e Turismo, M.Sc. Tese, Universidade Federal da Bahia. Ilhéus-Bahia, Brasil.

OMT. Organizacao Mundial de Turismo, 2003. Guia de desenvolvimento do turismo sustentável. Bookman.

Pinho, T. R. R., 2007. Avaliação de impactos Ambientais enquanto instrumentos da política ambiental: Aplicação no licenciamento de empreendimento turístico-hoteleiro de Pernambuco. 2007. Curso de Gestão e Políticas Públicas, M.Sc, Tese, Universidade Federal de Pernambuco, Recife, Brasil.

Sánchez, L. E., 2008. Avaliação de Impacto Ambiental: conceitos e métodos. 1. Ed. Oficina de Textos.

Sánchez, L. E., 2013. Avaliação de Impacto Ambiental: conceitos e métodos. 2. Ed. Oficina de Textos.

Wathern, P., 1988. An introductory guide do EIA. In: WATHERN, P. (Org.). Environmental impact assessment: theory and practice. Unwin Hyman, 3-30.