Monitoring of Key Indicators of Sustainable Tourism in the Jalapão State Park/Tocantins: A Case Study of Environmental Indicators

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Abstract—Since the 1980s, global tourism activity has consolidated worldwide to become an important economic contributor, and consequently, the sociocultural and environmental impacts are starting to become evidenced. This raises the need of discussing about actions for sustainable tourism that should be linked not only to the economy, but also to the environment and social aspects. The work that is going to be presented is part of a doctoral research project in Sciences undertaken at the Sao Paulo University, Brazil. It aims to analyze whether the monitoring of the tourism sector with a focus on sustainability is applicable or not, through those indicators, put in a case study in the Jalapão State Park (JSP) conservation unit, in the state of Tocantins, Brazil. This is a study of an interdisciplinary nature that had the deductive method as its guide. We concluded that the key points of the sustainable tourism, when analyzed with the focal point in environmental indicators, are an important evaluation and quantification tool of that activity in the study *locus*. It displayed itself as an adequate tool for monitoring, thus decoding, the main environmental impacts that occur in tourism regions and their intensity, which is made possible through analysis, and has the objective to trace ways to prevent and correct the presented impacts.

Keywords—Economic indicators, tourism, sustainability, Jalapão.

I. INTRODUCTION

AFTER the 1970s, a new look in all social and economic sectors arises with the proposal of a new "reading" of social realities and problems involving production and consumption of goods and services in order to examine sustainable development. The document prepared in 1987 – *Nosso Futuro Comum* (Our Common Future) - places this new development as a process of change in which the exploitation of resources, the orientation of investments, the direction of technological development and the institutional change are in line with current and future needs [1].

The proposal for sustainable development has become a current topic of discussion in all its economic development activities. However, debate about its role in tourism began after the 80's, as the global sector consolidated, presenting results of economic growth and social development, notwithstanding, contradictorily allied to this factor of development, the first negative results of this activity began to become apparent.

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The socio-cultural impacts and consequences on the natural environment started becoming evident, implying a new point of view in the discussions about this activity, denominated as sustainable tourism, which should be linked not only to the economy, but also the environment and society [2]. Thus, studies on sustainable development of tourism activity began searching for an adequate planning model for tourist destinations, and in 1997, the World Tourism Organization (WTO) presented a series of key indicators for sustainable tourism as a proposal for management of activities in the sector. The proposed indicators are: Attractive Protection (AP), Sociocultural Impact (SI) Planning Process (PP), Tourist Satisfaction (TS), Community Satisfaction (CS), Tourism Contribution to the Local Economy (TCLE), Intensity of Use (IU), Pressure (P), Critical Ecosystems (CE), Solid Waste Management (SWM) and the Tourist Trade Satisfaction Indicator (TTSI) [3].

Given the approach of sustainable tourism indicators proposed by the WTO, the work to be presented is part of a research project which aims to analyze the applicability of the monitoring of tourism focusing on sustainability, through these indicators, in a study case of the conservation unit of the State Park Jalapão - PEJ, located in the State of Tocantins, Brazil.

It will be presented, in this article, the results of environmental indicators: Pressure and Intensity of Use. This is an interdisciplinary study that had as guidance, the deductive method.

II. THE REGION OF JALAPÃO

Jalapão is a region with a total area of 53,300 km², formed by the states of Bahia, Piaui and Maranhão and Tocantins, from its territory 34.113,000 km² are in the State of Tocantins, comprising 1/5 of its territory, in the east location of the state (see Fig. 1). In Tocantins land, the park is formed by the municipalities: Rio Sono; Lizarda; Novo Acordo; São Félix do Jalapão; Mateiros; Lagoa do Tocantins; Santa Tereza do Tocantins and Ponte Alta do Tocantins [4].

The reserve has diverse vegetation that makes up the vast tropical savannah of Cerrado. The plants in the region are of great importance and used for ornamental and medical purposes, as well as timber industries. Its fauna is composed by three tundra biomes, considering that it is influenced by Caatinga, Cerrado and the Amazon climate. It is also home to endangered species including jaguars and otters. Considered the document as priority actions for the conservation of

biodiversity of the Cerrado and the Pantanal [5], the region needs a plan in order to be sustainably exploited.
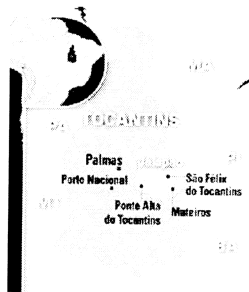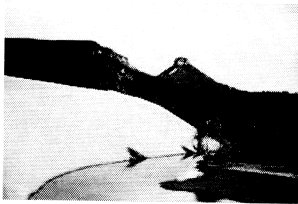

Fig. 1 Map with de Location of Jalapão [4]

Fig. 2 The Dunes

Fig. 3 Serra do Espírito Santo

Fig. 4 Fervedouro das Bananeiras

In Jalapão, through the Federal Brazilian Law No. 9.985 of July 18th, 2000, conservation and ecological corridors units were formed in order to preserve its ecosystem, which is very fragile and rare, and to promote scientific research development and ensure its sustainable use. One of conservation units is the *Parque Estatual do Jalapão* (Jalapão State Park) with approximately 150,000 hectares. It is considered the largest state park, with a fragile ecosystem, with sandy rocks which were formed by marine deposits billions of years ago and representative fauna, home to rare and endangered species [6].

The region has natural tourist attractions, allowing the practice of ecotourism, which has been being exploited for tourism activities in a disordered way, because the efforts aimed at tourism planning have shown inefficiency.

The tourist attractions that this study focuses in the Jalapão State Park (JSP) are the Dunes (see Fig. 2), the Trilha da Serra do Espírito Santo (see Fig. 3), the Fervedouro das Bananeiras (see Fig. 4) and the Formiga Waterfall (see Fig. 5), comprising the tourist attractions considered the most visited in the region due to its uniqueness.

Fig. 5 Formiga Waterfall

III. ENVIRONMENTAL INDICATORS IN SUSTAINABLE TOURISM MEASUREMENT

The sustainable development proposed in the document, Our Common Future, started after the 70s, to become the focus of discussions and reflections of a developing society, imposing a new way of thinking about development, allied not only to economic factors, but also social and environmental.

As a strategy of this new way of thinking, tools emerged in order to "measure" the effects of development on the environment, thinking about the use of resources not only in the present - but also in the future, by the next generations - raises the perspective of sustainability. Hence, the indicators with the proposal to meet these objectives came to light [7].

The indicators would provide subsidies to the formulation of national policies and international agreements, as well as decision-making by public and private players. The proposal also had the purpose of giving greater concreteness and functionality to the concept of sustainability, through the description of the interaction between human activity and the environment [8]. In this context, the planning of development combined with the so-called sustainability starts being constantly discussed and placed as one of the greatest challenges of today's society. This new strand of thought on

management development influenced other debates in sectors also considered economically, socially and environmentally very important, as the activities related to tourism and the environment.

The WTO, realizing the scenario, presents the proposal of sustainable tourism, which is ecologically bearable in the long-term, economically viable, as well as ethically and socially equitable for local communities. It requires integration to the natural, cultural and human environment, respecting the fragile balance that characterizes many tourist destinations, in particular small islands and environmentally sensitive areas [9].

To assist in the management and monitoring of this new tourism, in 1997 the WTO released the indicators key to sustainable tourism:

TABLE I
KEY INDICATORS OF SUSTAINABLE TOURISM

Indicator	Description
Attraction Protection (AP)	It ranks the tourist attraction protection level
Intensity of the Use (IU)	It identifies the intensity of tourist attraction in use by its loading capacity
Social Impact (SC)	It indicates the effect on the tourist community
Control of the Development of Tourism (CDT)	It determines the destination tourism planning level
Waste Management (WM)	It indicates whether there is a treatment and an adequate control of the waste in the municipality that hosts the flow of tourists or not.
Tourist Satisfaction (TS)	It demonstrates the level of the tourist's satisfaction of what is the tourist offered (lodging, restaurant, entertainment, local traffic, responsiveness and attractions)
Community Satisfaction (CS)	It indicates the level of satisfaction of the local community with the tourism.
Contribution of Tourism to the local Economy (CTLE)	It indicates the level of contribution of the tourism to the local economy during seasons
Pressure (P)	It indicates the level of pressure from tourists about the place
Critical Ecosystem (CE)	It indicates the level of vulnerability of the local fauna and flora
Pressure (P)	It indicates the level of pressure from tourists about the place

The tourism sustainability indicators are seen as the activity progress flags and their relations with the community, environmental resources, economy and the tourist [9].

According to the organization, through the tourism sustainability indicators, tourism managers will be better able to identify emergency issues, which will enable the prevention and mitigation; identify impacts, making it easier to create actions before problems occur; support the development of sustainable tourism, identifying limits and opportunities; encourage managers responsibilities, by promoting the adoption of responsible decisions founded by knowledge.

The indicators presented do not have a measurement and assessment methodology for each tourist destination, the managers have chosen the tools they consider reliable in the selection of items that will be part of the indicators, which measurement and evaluation methodologies should follow WTO guidelines [10].

The WTO recommends that the selected items to compound the key indicator proposed should have scores and the

indicators should be classified by minimum grade 0 and maximum 10, for the sake of a more specific understanding of the results.

The concern in measuring the effects of tourism in protected areas has been inciting countries to organize themselves in order to create monitoring mechanisms to ensure the conservation of these areas.

In the case of studies accomplished in Brazil, we can highlight one conducted by the Ministry of Tourism in 2007 (Studies on Competitiveness of the Brazilian Tourism and Proposals of Sustainability Indicators), aiming to discuss the national tourism activity and present indicators that can be implemented in the country, but does not provide methodologies for their application, what demonstrates the need for further studies about application and indicators analysis of tourist destinations in Brazil.

IV. ANALYSIS OF ENVIRONMENTAL INDICATORS IN JALAPÃO STATE PARK

A. Pressure Indicator

For measuring the pressure indicator, the methodology proposed by NEATUS/UFT was applied to the Jalapão State Park [11], as a way of monitoring the environmental impacts in the attractions, with an adaptation of the final measurement to analyze the results according to the study proposal.

The composition of the indicators was divided into two groups:

1) Impacts 1: The environmental impacts considered were those that can be static and do not appear at first glance, and may or may not be recovered with actions in the medium to long term: Exposed roots; Engraved trees; Erosion; Bare ground in the area near the main attraction; Lack of vegetation in the area surrounding the main attraction; Quality of swimming water at the attraction.

2) Impacts 2: The environmental impacts considered that are usually caused by the tourist or the attraction managers and that can be recovered with short-term actions: Fire statistics; Felled trees; Broken trees; Garbage in inappropriate places; Signs of vandalism; Smell of garbage; Smell of urine; Open pit; Presence of debris; Traces of trampling in restricted zones in the dunes, etc.

The monitored impacts were scored by attraction, being placed and analyzed according to the scale proposed by WTO from 0 to 10 points, considering from 0 to 4.9 (unsatisfactory), from 5.0 to 7.9 (satisfactory) and from 8, 0 to 10 (excellent). The evaluation criteria regarding the level of impact can be classified as follows:

TABLE II
QUANTIFICATION OF OBSERVED IMPACTS

Analysis = No impact	10 points
Analysis = Impact found at a low level	7.5 points
Analysis = Impact found at a regular level	5.0 points
Analysis = Impact found at a high level	0.0 points

Concerning the index of swimming water quality from the attractions, water samples were collected, the microorganisms

counting was performed using the Colilert method and for the final analysis, the resolution CONAMA 274/200 [12]. The final results were placed on the scoring scale proposed, being considered:

Monitoring of swimming water quality was not included in the attractions; the Dunes and Trilha da Serra do Espirito Santo, due to the fact that these attractions do not have this resource and impact. The impact of trampling traces was considered only at the attraction, the Dunes.

TABLE III
QUANTIFICATION OF SWIMMING WATER QUALITY INDEX FROM ATTRACTIONS

Analysis = Suitable for swimming	10 points
Analysis = Unsuitable for swimming	0 points

The methodology consisted of a survey with key items to be observed at the attractions (impacts described previously), being conducted at the end of every tourism monitoring periods in the park.

The results of the pressure indicator had as final grade:

$$P = 7.6$$

The indicator showed that the pressures the attractions have been suffering from tourism are in a satisfactory range, when analyzed in a general context.

As we observe when we look at the P indicators of each attraction, it is clear that two groups were formed: the group of attractions that is on an excellent range of pressure, which are the Dunes and Trilha da Serra do Espirito Santo, and the group that is on a satisfactory range of pressure (Fervedouro das Bananeiras and Formiga Waterfall).
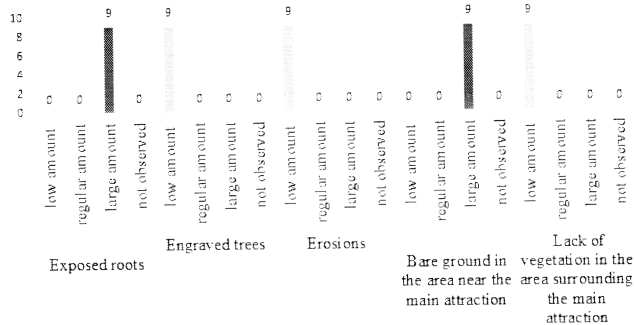

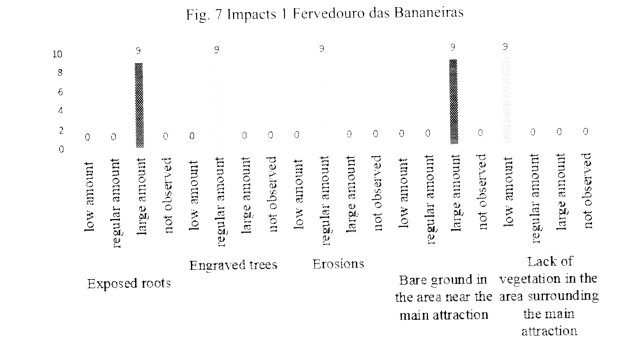Fig. 6 Pressure indicator by attraction
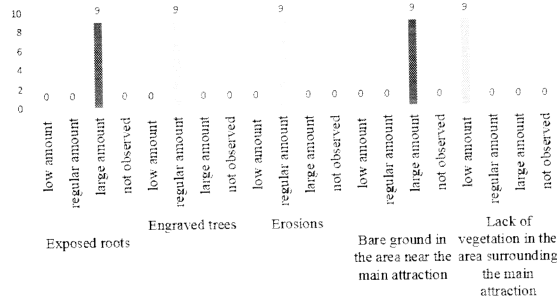

Fig. 7 Impacts 1 Fervedouro das Bananeiras

Fig. 8 Impacts 1 Formiga Waterfall

Concerning the Impacts 1 from the attractions, it was observed that they were more critical in the attractions Fervedouro das Bananeiras (see Fig. 7) and Formiga Waterfall (see Fig. 8), highlighting the exposed roots and bare vegetation area near the main attraction, those impacts were perceived and analyzed as occurring in a large amount.

Regarding the analysis of swimming water quality of the attractions, significant irregularities were not identified according to the proposed methodology, which is shown as a positive factor, nevertheless, actions should be planned for their conservation.

The Impacts 2 were evidenced in the high seasons of tourism, mainly in the attractions, the Dunes, Formiga Waterfall and Fervedouro das Bananeiras, it was noticed nearby these attractions small and regular amounts of garbage and urine smell.

It is necessary to seek for the monitored impacts actions for environmental protection, creating guidelines aiming to decrease the pressure caused by tourism in JSP and reverse the impacts caused by tourism into an adequate range.

B. Use Intensity Indicator (UI)

For measuring the UI indicator, it was considered the tourism carrying capacity studies executed in the main attractions of the JSP, as shown on Table IV [11].

TABLE IV
TOURISM CARRYING CAPACITY FROM THE ATTRACTIONS

Dunes	137 people
Trilha da Serra do Espirito Santo	28 people
Formiga Waterfall	168 people
Fervedouro das Bananeiras	50 people

The entrance of tourists in attractions of JSP was monitored during the periods of high season; it was carried out individually with the measurement of each indicator in the attractions one by one, resulting in an individual analysis and then, an overall analysis. For the calculation of the results it was considered:

Note 1, UI per season (indicator by attraction) is the average of final points by season, considering: Total number of people who have passed per day in the attraction in the season < maximum load capacity of the attraction = 10 points; Total number of people who have passed per day in the attraction in the season > maximum load capacity of the attraction = 0 points.

Note 2, UI Final: Final summation of the UI final averages per attraction / Number of monitored seasons.

Through the existing load capacity in the attractions of JSP, we checked whether it is being respected and the proportion of the current existing tourist flow in the JSP. In regard to the monitored seasons, we can highlight that: February, April/01, June, September, October and November are periods of increased tourist flow, and therefore, it should receive greater attention on the monitoring and conservation strategies at the attractions.

For the final rate of the indicator UI, in which is comprised the average of the sum of each indicator of each attraction, the result was: UI = 7.2.

The overall result of the indicator has shown that JSP attractions have a satisfactory use intensity, hence the flow of tourists have not been causing significant damage, according to the proposed evaluation. However, when the indicators are separated, it is noticed another analysis about the relation of adequate tourism carrying capacity and the tourist flow existent in the high seasons, UI scores were assigned for each attraction, respectively:
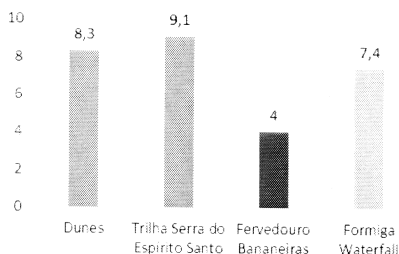

Fig. 9 Use Intensity Indicator per Attraction

The grades presented reinforce the need for individual examination of the UI indicators of each attraction, thus, although the final UI of JSP was recorded at 7.2, considered as a satisfactory assessment, when an evaluation by attraction is conducted, we can see that the Fervedouro das Bananeiras is in a scale considered unsatisfactory in its use intensity.

Consequently, as a monitoring strategy, it should be considered in the evaluation not only the general indicator, but also the individual evaluation of each attraction, aiming to implement actions for the conservation of the environment and improvement of tourism in the region.

Implement the tourism carrying capacity in the attractions is one of the main challenges for conservation units, thus the community living in its surroundings, whose income is directly linked to local tourism activity is always hoping for a larger flow of tourists in order to increase local income, such actions do not match with a sustainable practice when it comes to natural attractions.

In order to control the impact of tourism at natural attractions, we reinforce in this study that guidelines aiming to control visits could be implemented through a system of tourist vouchers. This system consists of a management tourist model, establishing a network of cooperation focusing on sustainable tourism and natural resources, involving the government and the tourism sector [13]. This management strategy is adopted by various international and Brazilian tourist destinations, such as Bonito (Mato Grosso - Brazil) and Foz do Iguaçu (Paraná - Brazil), where the selling of tickets for attraction visits is anticipated, allowing to control the attraction tourism carrying capacity, considering that the tickets sales depend on a maximum limit of people that the attraction can receive.

The attractions use the intensity indicator from JSP, which should also be examined with the monitoring impacts

indicators, in order to obtain a diagnosis of tourist visits flow at the attractions and the impact and consequences.

V. CONCLUSION

The pressure indicator put in place for the purpose of measuring the level of pressure that the attractions are suffering from the visitation flow and based on a criteria for having established the major impacts that may occur in them, showed as being a favorable indicator for its implementation in the place, since through such information it is possible to quantify in what proportion each one of these impacts were found in the tourist seasons and collaborate on mitigation and correction these impacts.

It is valid to point out that the collection of the proposed information in quantity, although it seems a very subjective analysis, it has shown to be the best option to quantify the impacts, as when there was an attempt to measure through the impact score (for example, how many exposed roots are checked on site), it was observed that it was impossible this counting and the error margin found among the researchers who made the count were very large, so they could translate a non-accurate indicator and when it was done a sampling by the quantification in small scales , regular and large, there were uniformity of responses, which facilitated the collection of information and measurement indicator.

By the final Use Intensity indicator, it was proposed a calculation with the integration of the individual UI indicators of each attraction has been proposed, so that there could be a single indicator that represents the use intensity level of the attractions of the JSP, however, it should also be examined the individual indicators aiming to have a real analysis of each attraction, because the overall indicator may be composed of good final scores (as in the case of the attractions scores the Dunes, Trilha da Serra do Espírito Santo and Formiga Waterfall) and bad (as in the case of attraction score Fervedouro das Bananeiras) which turns out "masking" bad scores, whereas it is from a sum of scores that the final average is taken.

Finally, we point out that tourism is still an activity in development and as others, engenders complexes problems, therefore, there should be further researches in order to evolving and developing a so-called, sustainable tourism.

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