Methodologies for Management of Sustainable Tourism: A Case Study in Jalapão/Tocantins/Brazil

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***Abstract*—**The study is in application and analysis of two tourism management tools that can contribute to making public managers decision: the Barometer of Tourism Sustainability (BTS) and the Ecological Footprint (EF). The results have shown that BTS allows you to have an integrated view of the tourism system, awakening to the need for planning of appropriate actions so that it can achieve the positive scale proposed (potentially sustainable). Already the methodology of ecological tourism footprint is an important tool to measure potential impacts generated by tourism to tourist reality.

***Keywords*—**Barometer of tourism sustainability, ecological footprint of tourism, Jalapão/Brazil, sustainable tourism.

I. Introduction

TOURISM development involves the use of natural and constructed landscapes, which already involves a number of factors that contribute to the deterioration of nature. The tourist does not go to the destination, only in search of landscape contemplation. They also seek a structure (lodging, food, transportation, among others) that is responsible for the development, but also by the appearance of environmental and social problems.

The sustainable development of tourism is not a fixed state of harmony, but as a constant changing process in which the changes in the use of resources, investment management and the direction of development at the institutional level are consistent with future and present needs and depend on environmental policy and adequate tourism [5].

Tourism needs to be planned and managed in a sustainable manner. Therefore, it must be prepared an assessment program, supervision and careful measurement that would enable the local population to take advantage of opportunities or adapt to changes.

For Conservation Units (CU) that planning should be even more careful, as serious impacts may be caused due lack of planning and documentary records that guide their use of CU. Although the creation of the CU is an important ally in the quest for preservation of natural resources of the planet Earth, it is observed a number of challenges and problems. Reference [7], [3] point out that the CU created in Brazil have not fully achieved the objectives that motivated its creation by lack of physical structure, supervisory and management staff (many still lack the established management plan).

Therefore, the research concludes that the monitoring should always be done when the primary purpose of planning is to develop sustainable tourism. Therefore, in this article it is proposed a case study in the region of Jalapão / Tocantins, Brazil, which is being applied and analysed two tourism management tools that can contribute to taking decisions of public officials: The Barometer of Sustainable Tourism (BST) and Tourism Ecological Footprint (EF).

The study is under development, this article aims at the presentation of the selected tools and how are they being adapted to the ecotourism local destinations, comprising an integrated proposal for indicators analysis tools that unite the natural attractions of the Conservation Unit "Jalapão State Park" with the community of Mateiros/Tocantins/Brazil.

The methodological procedure was based on a theoretical construct script and researches the parameters of deductive scientific method through a case study.

The proposal is part of the doctoral projects that are developed in association with the Federal Institute of Education, Science and Technology of Tocantins/Brazil and the University of São Paulo/Brazil.

II. Jalapão/Tocantins/Brazil

The Jalapão is a region, which is situated east of the State of Tocantins/Brazil and comprises 1/5 of its territory, occupying an area of 34,113,000 square kilometers, and comprises eight municipalities.

In Jalapão by Federal Law n. 9985 of July 18, 2000, conservation units were formed in order to preserve its ecosystem, which is very fragile and rare, to promote the development of scientific research. One of the Protected Areas is Jalapão State Park having approximately 150,000 hectares [2].

The place offers attractions such as dunes, springs called "fervedouro", waterfalls and rivers, which provide ecotourism, and has been explored in a disorderly way (see Figs. 1-4).

Fig. 1 Dunas

Surrounding by the Jalapão State Park there is the city called Mateiros, with 2478 inhabitants and 9.5 million km^2 [4], considered the main hub of tourist reception.

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Fig. 2 Fervedouro

Fig. 3 Cachoeira do Formiga

Fig. 4 Serra Espirito Santo

Severe environmental impacts are taking place in the Park due lack of local monitoring of tourism, and the need for more studies on tourism indicators that may be used as a tool for monitoring and managing Conservation Units [6].

Knowing the local reality and after research using the main tools of monitoring of sustainable tourism and it is selected for application and analysis in the region the Tourism Sustainability Barometer and the Ecological Footprint , which will be presented in their specificities and proposed adjustments for application in the region.

III. Barometer of Tourism Sustainability (BTS) of Jalapão/Brazil

The Sustainability Barometer is a methodology developed by various experts of important institutes linked mainly to The International Union for Conservation of Nature - IUCN and The International Development Research Centre - IDRC. The leading expert involved in the development of this tool argues that the Barometer was developed in order to measure sustainability, both at global and local level, to deal with government agencies, non-governmental organizations and the decision makers [8]

Indicators are divided into two groups: The ecosystem well-being, which is the trend of ecological function in time (water, earth, air, biodiversity and use of resources), and the human well-being index that is the general level of well-being of society (health and population, wealth, knowledge and culture, community and equity) [1].

The two groups are presented are formed by groups of indicators, and they are compared in a graph which demonstrates the exact evaluation of the system in focus (see Fig. 5).

Fig. 5 Barometer analysis map

The methodology uses a single scale for all indicators. This enables the joint analysis of these indicators, which can be (see Fig. 6): 0≤y≤20 = Poor (unsustainable), red color; 21≤y≤41= poor (unsustainable potential), color Rosa; 41≤y≤60 = average (intermediate), Yellow color; 61≤y≤80 = Fair (sustainable potential), blue; 81≤y≤100 = Good (sustainable), green.

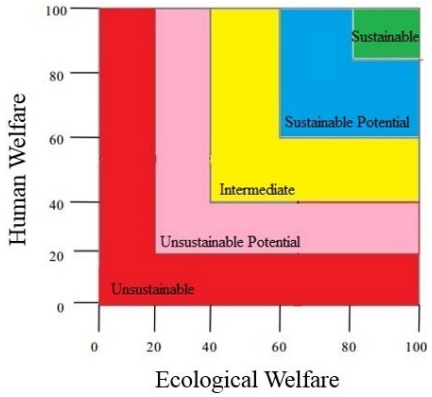

Fig. 6 Barometer Sustainable Tourism

This tool will be applied in Jalapão State Park at the end of the collection of sustainable tourism key indicators proposed by the World Tourism Organization.

The first step executed in the selection of indicators being applied taking as criteria for selection: the complexity of the indicator, period analysis, cost, skilled labor, existing data, necessary materials, transformation into quantitative data in a range of 0 to 10 and the method of application.

The measurement methodologies for each indicator were gathered based on existing studies and the indicators not existing were created according to criteria that took into consideration the specifics of the site.

The key indicators of sustainable tourism selected for the site under study are described below:

The indicators were divided into two groups (that will form two indexes) as BST methodology:

- Human Welfare (society): PP, IC, SI, CS, TS.
- Ecological Welfare (Ecosystem): AP, CE, WM, IA and UI.

The indicators are being applied in the main tourist seasons in Jalapão and information will be collected until the end of 2015, comprising an annual monitoring.

TABLE I
KEY INDICATORS AND METHODOLOGY SUSTAINABLE OF TOURISM

Indicator	Description	Methodology
Attractive protection (AP)	It classifies the tourist attraction protection level.	- Structured questionnaires with key questions are evaluated by specialized technicians.
Intensity of Use (IU)	It identifies the intensity of use of the tourist attraction, through its load capacity	- Input Control tourists in the attractions. - Calculation of the number of tourists visiting the attraction per day for attractive total load capacity
Social Impact (SI)	It indicates the tourist effects on the community	- The number of tourists per capita calculation.
Waste Management (WM)	It indicates the existence of adequate treatment and control of solid waste in the receptive municipality	- Structured questionnaire with questions key to the park waste manager; - Waste Weighing in attraction ; - Analysis of waste generated in the attractive
Tourist satisfaction (TS)	It demonstrates the level of tourist satisfaction with the technical offer (accommodation, restaurants, entertainment, site traffic, responsiveness)	- Structured questionnaires with key questions to answered by tourists.
Satisfaction of the Community (SC)	It indicates the level of tourism satisfaction of the local community	- Structured questionnaires with key questions and are answered by the community of Mateiros.
Tourism contribution to the local economy(TCLE)	It indicates the contribution of tourism to the local economy level in high season	- Structured questionnaire with questions related to tourist spending on site answered by tourists.
Impacts on Attractive (IA)	It indicates the tourist pressure levels on the local	- Questionnaires structured compounds by the description of environmental impacts to be observed at attractive when finalized each season answered by the researchers; - Collection and attraction water analysis
Critical Ecosystem(CE);	It indicates the species level of vulnerability of fauna and local flora	- Structured questionnaire with questions about key species cataloged in the flora and fauna in the park answered by UC manager.
Planning Process (PP)	It determines the level of the destination tourism planning	- Structured questionnaires with key questions to the CU manager

The first analysis tool have shown that the proposed sustainable tourism key indicators has shown a proposal for monitoring the actual tourism activity, giving better to analyze the attractive from the point of view of their use and enabling preventive action to no appearance for future impacts. It was also observed that by monitoring the seasons is has aroused the interest of tourists to know the concepts involving sustainable tourism, and also happens to be an environmental education tool as it shows them that there is an environmental concern.

IV. THE ECOLOGICAL FOOTPRINT (EF) OF JALAPÃO/BRAZIL

To analyze the environmental impacts generated by tourism it can be used another possible indicator. The Ecological Footprint (EF) consisting of his original methodology in a land of consumption matrix considering some major categories of human consumption, such as food, housing, transportation, consumer goods and services and six main land use, namely, land use, degraded environment, gardens, fertile land, pasture and forests under control [9]. The aim of this index is to calculate the area of land required for the production and maintenance of goods and services consumed by a community. In 2002 an adjustment was made for use in tourism [3]. They created a measure to determine the amount of bioproductive land, built land and land of fossil energy needed to support tourism.

Fig. 7 Ecological Footprint analysis map

To carry out this analysis, the authors established four categories of consumption, namely: transport, accommodation, leisure activities and food and fiber consumption. It is possible to use one or more types of land associated with each category [3].

The methodology has known as Tourism Ecological Footprint Method (TEFM) can be categorized according to the following Table II and calculated according Fig. 8:

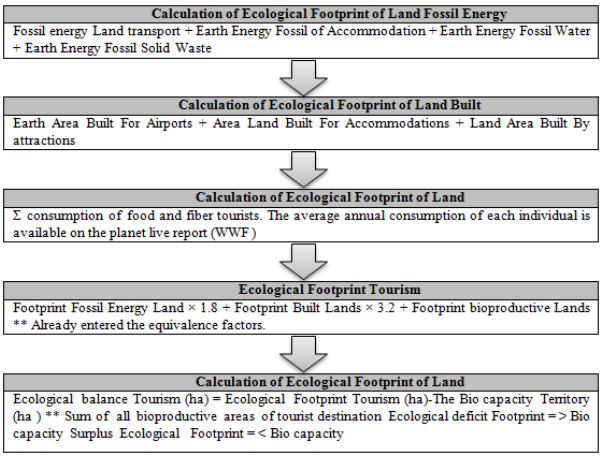

Fig. 8 Procedures for Calculating the Tourism Ecological Footprint

IV. RESULTS AND DISCUSSION

This study elaborated on two tools proposals that are used on managing the sustainable tourism activity globally. The results showed that although the recent debate on how to achieve sustainable development is not yet a consensus at the academia. Efforts to measure activities that seek their achievement from the perspective of sustainability (such as tourist activities) should be recognized and discussed to evolve.

TABLE II
PROCEDURES FOR CALCULATING THE TOURISM ECOLOGICAL FOOTPRINT

Category	Associate Land	Calculation of the Ecological Footprint
Transport	**Built Land**	1) Estimate the total leisure tourists who have been in tourist destination in the year of investigation; 2) Identify the area in hectares of transport infrastructure used by tourists (airports, ports, airfields, Parks parking lots, highways, existing railways); 3) Add up all areas to get the total area of the airport infrastructure; 4) Divide the total area by the number of tourists.
	Land Fossil Energy	Air Transport: 1) Estimate the total number of passengers per flight bound for Jalapão; 2) Estimate the distance traveled by flight; 3) Determine the whole distance flown in passenger- kilometer (p/km) by multiplying the distance flown (km) by total passengers; 4) Multiplying total distance flown (P/km) the energy intensity factor (2MJ/Pkm) for the energy consumption of flight; 5) Convert to GJ the results from item 4; 6) Divide the energy consumption of the flight (GJ) by total passengers to identify the energy consumption per capita; 7) Divide the energy consumption per capita (GJ/cap) by 73 Gj/ha/yr, (yr = year) to determine the amount of land of fossil energy demanded per capita (ha/cap); 8) Estimate the fossil energy land required per passenger, multiplying the result of item 7 by the correction factor to high altitudes, that is, 2.7. Land Transport (adapted from ANDRADE, 2006): 1) Estimate the total number of tourists who visit Jalapão according to the data from the State Tourism Development Agency; 2) To estimate the amount of liters of fuel a vehicle demand in 01 (one) journey (round trip); 3) Multiply the total liters consumed in the month by 2.63 and divide by 1000 to get the total tons of CO_2 emitted (1 liter of gasoline burned releases 2.63 kg of CO_2). 4) For every 1 ton of CO_2 emitted is required 1 hectare area for absorption (IPCC). 5) Divide the total CO_2 found in the previous item (4) per 1 (one ton of CO_2 is absorbed per 1 hectare of land). 6) Divide the value found in the previous item (5) by the total number of tourists who went to Jalapão; Maritime Transport: 1) Estimate the total number of tourists per transportation; 2) To estimate the amount of liters of fuel a ship demands in 01 (one) journey (round trip); 3) Identify how many ships (tourists carriers) dock in the island's port during the period of one year; 4) Multiply the total liters consumed by a ship by the number of ships arriving at the island in the period of one year; 5) Convert the fuel consumption in liters per ton of CO_2, assuming that one (01) liter of diesel releases 0.00315 (t) of carbon dioxide; 6) Divide the total of CO_2, found in the above item (5) to a ton of CO_2 is absorbed by a hectare of land; 7) Divide the value found in the previous item (6) by the total number of tourists passengers who arrived on the island by sea; 8) Estimate the fossil energy land required per passenger, multiplying the result of the above item (7) for 1, 37 (value referring to the overall productivity of land).
Water	**Land Fossil Energy**	1)Estimate the consumption of water in cubic meters at 01room's hotel (consider that the average consumption is 120L / guest / day); 2)Convert to megaliter (MGL) the result of the previous item. 3)Calculate the total CO_2 emitted, turning MGL in tons. Assume that during the treatment process and distribution of the water are released 0.37 tons of CO2 for every MGL of water; 4)Estimate the total occupied hotel beds in a year; 5)Multiply the consumption of water in room's hotels by the amount of the accommodation beds.
Waste Solid	**Built Land**[a]	1) Estimate the total number of beds in hotel infrastructure. 2) Multiply the area of land required for each bed for a total of beds in hotel infrastructure.
Activities Leisure	**Land Fossil Energy**[b]	1) Estimate the total leisure tourists who have been in tourist destination in the year the investigation was carried out 2) To estimate the total area (ha) for the sum of areas built in the tourist attractions of the destination; 3) Divide the total area occupied by attractive by the amount of tourists who have been in Jalapão.
Food and Consuption Fiber	**Bioproductive Land**[c]	1) identify the nationality of the tourists visiting the destination you want to investigate ; 2) Identify the power and fiber consumption of tourists in their origin city during one year; 3) Make the sum of all food consumption values and fibers found within one year; 4) Calculate the average spending by tourists in a year. 5) Divide the value found in item 4 by 365 or 366 (leap year) ; 6) Multiply the value found in item 5 by the average tourist stay at the destination.

a To estimate the area required per bed, considering that the land built amount demanded per bed is 60 m2 in a luxurious lodge 200 m2 , 100 m2 for one to two -star hotels, 300 m2 for three to four-star hotels , 2000 m2 in five star hotels, 300 apartments m2 to 50 m2 for private houses , 15 m2 for boats (already including the harbor area) .

b For the purpose of calculating the footprint for the category activities , Reference [3] took into account only the areas related to the golf courses . Thus, adapted here to area built on the most visited tourist attractions:

c To calculate the power consumption category and fibers , Reference [3] considered that tourists in a tourist destination consume the same types of food and fiber available in the country of origin.

The BST methodological tool allow us to have an integrated view of the tourism system, awakening to the need for planning appropriate actions so that it can achieve the positive scale proposal should seek at least an analysis of potentially sustainable.

Although this tool is an important ally in the integration of indicators and allows a joint vision of the system in view of the human and ecological well-being, crucial information is lost about the individual characteristics of each indicator.

The methodology of Tourism Ecological Footprint is an important tool to measure potential impacts generated by tourism to a given tourist reality. It is believed that use it as a unique research methodology to find out if a tourist activity should or not remain in one region. Because there are other factors about the social impacts that tourism generates, whether positive or negative, that should be considered. But still, this is a relatively new methodology and has been used in studies on the impacts of tourism in a region.

There is evidence that the two methodologies applied in parallel can contribute to improving the knowledge of a given ecotourism area. Therefore, this article will be presented a proposal for adaptation of these tools for use in Jalapão region.

V. CONCLUSIONS

The methodological tools presented become important allies in the pursuit of sustainable tourism as desired. Even if these tools cause many discussions and uncertainties, they are very important because they must be able to motivate tourism managers to think in tourism and sustainability binomial.

They also awaken the desire to develop an activity which is recognized as socially important, is "environmentally clean" and seen as an example of environmentally sound actions.

In this sense, the research seeks to know the tools in its various aspects and verify. These are likely to be used in tourism management in Jalapão region and considering this activity as developing and, like any other, capable of generating complex problems to be identified and resolved so that it can evolve and develop to a so-called sustainable tourism.

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