METHODS AND INDICATORS FOR MEASURING THE IMPACT OF TOURISM ON PROTECTED NATURAL AREAS

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Abstract:
To facilitate tourism development in line with the capacity of ecosystems in a protected area is closely linked to the development of a monitoring system to achieve the accounting and control the flow of tourists. The methods aim different components for evaluation (identification, description and comparison of impacts by using scaling levels, their weight) and supports data collection and classification of environmental impact. In practice, there are a variety of methods for evaluating the impact on the environment. This aspect is dictated by the purpose of the impact studies, the law surrounding these studies and the composition/competence of the evaluation teams. The indicators that measure the impact of the tourism on protected areas are a necessary tool in the design of a sustainable development strategy.

Key words: *carrying capacity, sustainable development, tourism, ecosystems*

JEL classification: *Q26*

1. Introduction

The introduction of monitoring the impacts on protected areas and visitors to these areas of protection is a proactive process, flexible, which leads to decisions related to planning, development and operation of services and facilities. The role of managers is essential as they must meet more several needs of conservation, some new and more educational and recreational opportunities and economic benefits from tourism reaching. Managers need to reduce the conflict between the forces which support the protection of the resources and those which sustain the recreation and tourism.

The necessity of knowledge appears from need to know the evolution of the quality environment components in order to establish and impose the protection and conservation methods, to verify the efficiency of the measures taken. It requires information and rapid assessment of the situation in cases of accidents or incidents caused by humans, therefore the impact on the environment.

2. The exploitation of the international experience regarding the impact of the measuring

In terms of **methods for measuring the impact**, at the moment there are over 50 methodologies for environmental impact assessment. These methodologies are based on numerous and varied methods and techniques derived from scientific disciplines dealing with human impacts on environmental components, natural and social sciences - or in other areas - management, planning and legislation.

In the references, most used methods to measure the environmental impact are:

- **Ad hoc methods.** There are among the first methods used for this purpose, being easy to apply. They provide information only on the areas of manifestation of the potential effects. These methods are used in the early

stages of field research and provide a series of direct and indirect information on environmental issues;

- **The identification methods** are used for the knowledge of alternatives that can be taken into account in case on an evaluation process of environmental parameters;
- **The method of control lists.** The checklists are based on priori judgments issued and a list that includes a hierarchy of factors to be taken into account in assessing the impact;
- **The methods of overlapping thematic maps** have appeared in the 60s. These types of maps permit the identification of the locations and the impacts route;
- **The Geographic Information Systems** (GIS) is a tool for a permanent monitoring and continuous environmental data. With their help it is possible to quantify the cumulative impacts, updating the obtained information by using the remote sensing and supporting the land-planning decisions;
- **The matrix methods**. The matrixes can be used for identifying, analyzing, visualizing and evaluating most of the environmental impacts. A simple matrix is a combination of two checklists: one describes the potential or the existing impacts on the activity (distributed on columns) and the other includes the environmental or socio – economic conditions which can be affected by these impacts (distributed on rows);
- **The data collection methods** become useful when the information collected reflects the cost of the human investment and the environmental components to be affected due to various impacts. Also, by using these methods there will be identified the costs of recovery the quality components of environment that have suffered various degradation;
- **The predictive methods** that are used to predict the magnitude of the impact that the anthropogenic activity may have on the environmental components;
- **The quantitative methods** are used to identify and compare the effects arising in different situations. Applying these methods requires the implementation of standardization and measurements of the impacts;
- **The evaluative methods** are used to identify the category and relevance of the impact of human activity on the environment;
- **The modeling methods** aim to create models regarding the impact on the environment;
- **The simulation models** assume the implementation of the various scenarios that may be encountered in reality in order to promote appropriate management in case of developing an activity;
- **The method of analyzing the size of the impact on the environment** (method Rojanschi). This method, called the rehabilitee method, is one of the most common used in the procedural practice from Romania. The method is based on estimations of the environmental quality indices based on a scale of their creditworthiness.

The global impact assessment is based on the quantitative expression of the state of environmental pollution, based on **the global pollution index** (IPG). The resulting index represents the ratio between the ideal state of the environment (Si) and the real state (Sr), as follows:

$$Ipg = \frac{Si}{Sr} \quad (1)$$

where:
Si = the surface of the ideal state of the environment;
Sr = the area of the real state of the environment.

The results obtained for the IPG permit the establishment and classification of the effects of human activities on a scale regarding the environmental quality.

- **The communication methods** determine the information, consultation and public participation in decisions which concern the human impact on the environment;
- **The methods of taking decisions** which are useful in the process of the correct application of all decisional instruments by decision factors.
- **The managerial methods** involve the administration and proper management of the assessment studies concerning the human impact on the environment.

The choice of the techniques or methods of evaluation depends on: time and logistical resources and financial systems; the purposes of the assessment, the evaluation criteria, the evaluation team and its composition.

3. Categories of indicators measuring the impact of tourism on protected areas

No one can speak of a universally valid system of indicators, it must correspond to the conceptual frame and to meet specific goals, promoted in time and space.

It is difficult to measure the impact that tourism has on the environment due to its complexity (large number and variety of their effects), quantitative and qualitative aspects involved and not least the lack of information. However, over time there have been identified various indicators - in terms of sustainable tourism -offering an opportunity to assess the effects of tourism on the environment and identify the methods to reduce them.

Therefore, **the indicators used in the assessment of a sustainable tourism** are divided in two types:

1. the basic indicators are used in a general way in most tourist regions of the world (table no. 1). They are determined by the requests and meet the need of knowledge in the decisions taken by managers of protected areas;

2. additional indicators, specific to different touristic environments (areas).

Basic indicators for measuring the impact of tourism on protected areas

Table no. 1.

The indicator	Specific measuring instruments
1. the protection of the site	the protection category of the site after the index of the International Union for Conservation of Nature (IUCN).
2. the exercised pressure	the number of tourists who visit the site (in the year / month with maximum inflow).
3. the intensity of use	the intensity of use during peak periods (number of persons and per hectare).
4. the social impact	the report tourists/residents (in peak periods and in the rest period).
5. the development control	the existence of a method to study the environment or specific controls on the planning area and density using.
6. the waste administration	% of wastewater treated site (additional indicators that can determine the structural limits of other site infrastructure capacity, such as water supply).
7. the planning process	the existence of a methodical plan for tourist destination in question (with a component of "tourism").
8. the fragile ecosystems	the number of rare or endangered species.
9. the consumers' satisfaction	the satisfaction level of visitors (using a

	questionnaire).
10. the satisfaction of the local population	the satisfaction of the local population (using a questionnaire).
11. the contribution of tourism to the development of the local economy	the tourism share (%) in the total economic activity.
AGGREGATE INDEXES	
A. the carrying capacity	the aggregate instrument that warns in advance of key factors influencing the support capacity of the site vis-à-vis the various levels of tourism development.
B. the site disturbance	the aggregate mean of measuring the levels of impact on the site (to get to know the natural and cultural features under the effect of cumulative constraints of tourism and other sectors).
C. the interest	the mean of measuring the quality of the features that makes the site attractive for tourism and which can change in time.

Source: Guide à l'intention des autorités locales: développement durable du tourisme, OMT, Madrid, 1999, page 143

The protection of the site is a complex process because, within the same area, the level of protection may be different. Thus, in various national parks, strictly protected areas meet the high degree of conservation and tourist traffic is forbidden, unlike other areas where tourist activity is intense, however, takes place in strictly controlled conditions.

The exercised pressure refers to the number of tourists visiting a certain area, respective the measurement of the pressure level it is subjected a certain area due to the tourism practice. It is determined in this way, using measurements taken at points of entry, the number of tourists visiting the area.

The intensity of use supposes the identification of the potential level of overloading the resources of a natural protected area. In this sense, it can be used as an indicator measuring **the touristic density (Dt) reported to surface** with the following formula:

$$Dt_{\text{in report with surface}} = \frac{\text{arrived tourists}}{\text{surface}} = \text{tourists/km}^2 \quad (2)$$

The touristic density reported to the population shows that the number of tourists visiting the protected area and provides information concerning the respective request level, solutions to be applied so that there will be minimized the environment conflicts.

The social impact represents the number of tourists visiting a protected area reported to the population of the area. In this sense, the social effects of the present tourists in a certain area are measured.

$$Dt_{\text{in report with thepopulation}} = \frac{\text{arrived tourists}}{\text{population}} = \text{tourists/inhabitant} \quad (3)$$

The determination of this indicator helps avoiding social conflicts and the orientation of tourism management strategy so that the impact is minimized.

In the same context it can be determined the touristic intensity with the following formulas:

The intensity of tourist departures during vacations (Itdv):

$$\textbf{the intensity of tourist departures during vacations (Itdv)} = \frac{\text{the total number of departures during vacations (domestic tourism+ tourism transmitter)}}{\text{The population of the transmitting country}} \text{ X } 100 = x\% \quad (4)$$

The intensity of tourist departures abroad (Itda):

$$\textbf{The intensity of tourist departures abroad (Itda)} = \frac{\text{the total number of departures abroad}}{\text{The population of the transmitting country}} \text{ X } 100 = x\ \% \quad (5)$$

or

$$\textbf{The intensity of tourist departures abroad (Itda)} = \frac{\text{the total number of departures abroad}}{\text{the total number of departures during vacations (domestic tourism+ tourism transmitter)}} \text{ X } 100 = x\ \% \quad (6)$$

The tourist intensity is an indicator that provides information on the potential tourism markets, respective the number of tourists who can visit a certain tourist destinations, including the protected natural areas.

The development control involves the identification of how certain projects, tourism development strategies and plans have an impact on the environment. It assumes that actions must be conducted in accordance to the national or regional or local government decisions.

The waste administration is essential to the waste management activities and refers to the percentage of waste which requires specific treatment. In this way the percentage of wastewater treated site and other additional indicators that identify the structural limitations of other infrastructure capacity of the site, such as water supply.

The planning process starts from the premise that many resources used by the tourists are administrated by other sectors such as the touristic infrastructure.

The critical ecosystems - it starts from the assumption that in a protected natural area we meet different categories of species, some of which are rare, threatened or endangered. The attractiveness of vulnerable species is inversely proportional to the degree of vulnerability.

The consumers' satisfaction is determined by questionnaires (to measure the quality of tourist experience and changes in expectations of tourists) and field data collection.

In terms of **aggregate indices**, they are combining the basic and specific indicators of the ecosystem in order to make a single measurement that can be monitored over time.

Once the selection of areas for declaring them as national parks is made, it is necessary to assess the absorption capacity of the visitors so that their operation will not off balance the ecosystem - using the indicator: **carrying capacity** defined as *the level of tourist exploitation of an area that can be supported ensuring a maximum visitor satisfaction with minor repercussions on resources*. This notion assumes that there are limits for tourist exploitation. Therefore, many factors concur to estimate this indicator,

which ultimately depend on administrative decisions relating to the approximate levels of balanced exploitation.

The carrying capacity (C_c) is determined as follows:

$$C_c = \frac{S}{Sa} \qquad (7)$$

where: C_c - carrying capacity

S – surface used by tourists

S_a - average surface

Usually it is measured in m^2/pers. It is difficult to determined, for each case and contains three capacity variables: material, psychological and ecological.

Therefore, it is obtained a **total number of authorized visits per day (V_{td}).**

$$V_{td} = C_c \times K_r \qquad (8)$$

where: V_{td} - total visits per day

Cc - carrying capacity

K_r - rotation indicator

$$K_r = \frac{Nh}{Tav} \qquad (9)$$

where: K_r - rotation indicator

N_h - number of hours/days or how many hours is the area opened for tourists

T_{av} – average time of visiting

The additional indicators complete the basic indicators and they are necessary and customized according to the specificity of each area.

4. Conclusions

The criteria for choosing the methods used to assess human impact on protected areas are nuanced but, generally, they address the following issues: timeliness, repeatability, consistency, economy assessment.

The variety of indicators used both locally and nationally and internationally (macro and micro) emphasizes that sustainable tourism can be measured to some extent, which facilitates the knowledge of normal values, the minimum and maximum limits between which the parameters in question vary. Their overcoming can cause real ecological disasters both in territorial and social terms.

Each region must develop its own list of indicators that respond the best to the actual situation on the field. Finally, for each region, the list of indicators varies from one level of tourist attendance to another.

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