SUSTAINABLE TOURISM DEVELOPMENT IN PARQUE NACIONAL LAGUNAS DE MONTEBELLO, MEXICO

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ABSTRACT

The objective was to regulate the tourist and recreational activities that are developed within the Lagunas de Montebello National Park (PNLM, its acronym in Spanish) with the implementation of tourism carrying capacity (TCC) and limits of acceptable change (LAC). The method applied was Multicriteria Decision Analysis (MCDA) with an interview script to key informants, a field checklist with georeferencing, two workshops with local actors, analysis of satellite images and application of formulas for TCC. Results include the strengths, weaknesses, opportunities, threats (SWOT) analysis of the PNLM, the tourist capacity of sites for simultaneous users. Indicators for LAC were determined. Findings will assist public institutions to design better policies and strategies linked to tourism and sustainability.

Keywords: tourism, sustainability, carrying capacity, Montebello lagoons.

1 INTRODUCTION

In protected natural areas, sustainability implies the combination of ecological, economic and social dimensions, in which tourism is frequently used as a conservation strategy, establishing an explicit linkage between nature and society, since it joins the enjoyment of natural resources with social activities, although it is necessary to ensure the appropriate characteristics of natural resource use, with efficiency, social utility and minimal negative impacts to the environment. As a philosophical and practical proposal, sustainability presents a wide discussion [1], [2], since the analysis depends on the observer and his mental processes, as well as on ethical considerations and social practices related to ecological, social and economic systems.

In recent years, tourism has become one of the main sources of income for the inhabitants of protected areas, defined as "A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" [3, p. 8]. They include nature reserves, national parks, protected landscapes, multiple-use areas and biosphere reserves. In the case of the Parque Nacional Lagunas de Montebello (PNLM), Mexico, lakes and landscapes motivate tourism visitation. The most common activities are excursions, horseback riding, hiking, camping, boat rides and rafting with paddles [4], but the site is suffering from environmental degradation. Therefore, conservation is a fundamental strategy to achieve optimal sustainable tourism use in this protected area, and Tourism Carrying Capacity (TCC) and Limits of Acceptable Change (LAC) are statutory regulations that support this goal.

TCC defines the maximum tourist number that can be supported indefinitely in any natural space without degrading its natural resources. Carrying capacity strategies regarding the ability to access or remain in any public space are fundamental for infrastructure, safety, health, quality, satisfaction, among others [5]. In the scientific literature, research about TCC has been case-focused [6]–[9] with a strong argument about unique situations, limiting the data needed, using mainly physical, economic, and perceptual aspects [10]–[12] as measurable categories with simple operationalization. In all the previous cases, the

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assumption on limits to tourism use is not based on any theory, but on the paradigm of sustainable development and the concept of carrying capacity itself. There is a common thought that inadequate management of visitation could result in overusing the natural resources and degradation of landscapes and environment, and a low quality experience [13], [14].

The main objective was to determine the limit of acceptable change and carrying capacity for tourism-recreational activities within the PNLM, balancing recreational development with ecologic, social, and economic values of the communities involved, supporting the authorities' decision-making process to regulate the use of existing resources. To achieve this, the following data collection tools were applied: interview to key informants; workshops with local actors; satellite images and field checklist. The Anthropocene era, with its values and patterns of social behaviour is a time for opportunities but also for ecological insecurity with problems to be addressed in the ecological, social and ethical dimensions. The sustainable use of nature is of greatest importance.

2 LIMITS OF TOURISM

Sustainable development supports the idea of natural limits for the management of resources, based on the Rule of Environment [15], that refers to the recognition of nature over society, integrating environmental governance with rights and obligations. Then, any tourism activity is restrained and contained by its environment, and TCC and LAC goals are to set a delimitation in the visitors' power over a landscape or natural space, providing the basis for improving environmental governance.

In general, setting a TCC for the conservation of natural spaces with visitation is a complex problem because limits are multidimensional, contiguous, unlineal, poligeneous and heterogeneous, but absolutely real [16], performing several functions of rights, territorialisation and regulation in social and ecological communities. In the case of national parks, limits are a regulatory strategy observed in the form of norms, rules and principles, created to regulate, prevent and control the interactions between tourist and their environment, setting a standard for social behavior in a certain area, in the ecological and social dimensions.

For Ostrom [17], there are default rules (social limits) in hierarchical levels: operational, collective and legal, that could be combined in many ways and are related to the socio-historical context, the available ecological resources, the environment outside one's own space, coherence between use and conservation, supervision and control, as main aspects to avoid overexploitation of natural resources and ensure sustainable management in the social group.

As a management tool, the carrying capacity is an instrument to consolidate the institutional power over a space in the form of pragmatic and cultural dimensions, to guide the relations between nature and social dimensions, especially in landscapes and tourism spaces, in order to offer protection to natural systems and support sustainability. However, it should be noted that it is would be inaccurate to assume that TCC itself would solve conservation problems in all places, even considering the emerging property of tourism: tourists will visit the same places and in general will have the same social behaviour. Management and governance require active participation of stakeholders, so LAC is needed to fulfill the paradigm of coexistence between ecologic and social dimensions in a natural space with tourist use.

Natural Parks present limits as mixed components [18]: natural, institutional, functional, made and transformed in a specific ecologic, social, economic, politic and cultural context, historically defined in spatial and temporal dimensions [19]. In these spaces, tourism is the

new and major force of environmental change, recognized as a serious jeopardy and promoter of environmental degradation, especially in a neoliberal context, where different relationships, priorities and conflicts are transformative elements -symbolic or dynamic [20].

For Howie [21], "carrying capacity by itself is not a goal but a means by which the goal may be achieved" with the paradigm of sustainability. In this context, for public institutions, the limits imposed by a TCC assessment is a legal and symbolic way to confirm a space identity and reaffirm its legitimacy and authority over a place, but also to establish and legitimize cultural transformations needed to conserve nature, in any space that includes a public management with a social use of a territory. Of course, as any provisional solution, the TCC method has its limitations and does not establish optimal conditions for cooperation among stakeholders nor motivates a social group to cooperate mutually for the public interest, as it could be deployed as a tool in favour of political and social groups. So, to enable managers and their stakeholders to achieve conservation goals of natural spaces with social use, TCC must be combined with LAC, to create a participatory model around conservation by regulating and enforcing the natural space, developing "integrated management" strategies.

For any natural park, TCC and LAC could be a positive asset under certain conditions, because they turn a physical condition into a social scarcity by the absorptive limit of its use [22] avoiding quality deterioration by setting surrounding conditions of use into a space or landscape, and supporting economic or recreational development undertaken by stakeholders, aboriginal peoples, and the general public. However, the theory operationalization presents considerable difficulties in practice, despite its widespread implementation through case studies. Furthermore, the economic dependence that tourism implies is a source of socio-ecological conflicts.

In any case, the TCC is considered a mechanism for social control, to achieve conservation or sustainability as a planning and operational key function.

3 METHOD

Conservation of natural space with tourism use is a permanent decision-making issue that requires the evaluation of multiple attributes according to goals and desirable scenario in any natural park. In order to achieve these, a method with multiple criteria must be applied, considering conservation priorities and recreational use with conditions inherently qualitative. This approach, non-standardized or homogeneous process and with human subjectivity [23], is usual to evaluate ecosystems with frequent human interaction, recognizing the interaction between the environment, its processes and tourism. In this case study in Mexico, criteria and standards for setting tourism limits inside the PNLM, Tziscao human settlement and area of influence, depended on data availability in 2016, resources, space boundaries, integrity ecosystem, internal and external social processes, tourism scale of operation and the type of process and activities under study, for developing "integrated management" strategies.

Creating a set of limits for social use of natural resources implies a process structured with ecologic, social and economic criteria. Multicriteria Decision Analysis (MCDA) is the mix of quantitative and qualitative methods commonly implemented to improve analysis in natural spaces, combining hard and soft data, social participation, visualisation, and land management [24], in terms of goals and desirable scenarios. In protected areas with tourism, it is employed to support planning [25] and strategic management for recreation and conservation, as a combination of zoning with Recreation Opportunity Spectrum (ROS), TCC and LAC. In addition to these methods, strengths, weaknesses, opportunities and threats

(SWOT) analysis is also applied for analysing environment and support decision process [26], [27] for seasonal activities, tourist zoning, carrying capacity and other related strategies.

These tools and methods are part of MCDA and represent limits for tourism use and are part of a provisional solution arisen from arguments deduced from hard and soft data, in order to conserve the natural attractions of tourist interest in balance with their social use: it can always be improved, by adding new information [34], balancing ecological and social dimensions in a methodological process where no case is like another, because any NPA is unique and distinctive.

The stages are not necessarily executed in a given order but in parallel, with qualitative and quantitative criteria, and it is possible to carry out an exhaustive analysis that will give a realistic description of tourism impacts over the park. The Analytic Hierarchy Process [28] – last section of the MCDA method – is a technique through pairwise comparisons, between decisions that must be made comprehensively, with the scale of priorities based on the Precautionary Principle and probability of success in the real world.

SWOT analysis is a practical tool, widely documented online, to guide decisions and planning process in both short and long terms, usually applied to develop and implement a strategy in consideration of multiple internal and external factors, with a more analytical MCDA procedure. As a management support, it is directly linked to the desired objectives and goals of decision-makers, and can support other strategic planning tools [29] in accordance with priorities and available options. In this stage, data was collected through interviews with the general management staff, four technicians and three employees of the protected natural area, six local tourist guides, two community leaders and official public information; no numerical or hierarchical analysis was performed.

The ROS [30] is a zoning system for outdoor recreation opportunities based on physical, social and managerial criteria. The combination results in six different ROS categories looking for a balance among ecosystem management, visitors' impacts and their associated experiences. This process combined with Geographic Information Systems (GIS) help managers to identify best potential for land, avoiding conflicts between conservation and tourism activities. Resource inventory relative to sites and features of landscape strategic points (with GPS and satellite data through field walking) were done by a multidisciplinary group of experts in tourism, geography, sociology, administration and ecology. An extensive field trip accompanied by official guides of the national park and two tours with local guides, made it possible to collect data that was systematized, ordered and transferred to a spatial information system, as an effective approach in planning and management a national park. Software applied to manage database and inventory plots of Natural Park was QGIS.

TCC assessment (widely disseminated on the Internet [31], [32]) involves physical, ecological, perceptual and administrative categories through land spaces, degradation of facilities, overuse of natural resources, visual perception of crowding, with a data collection limited to a few measurable dimensions, simplicity of use and adaptability to the model desired, and must be complemented with social aspects to support the triple bottom line of sustainability. The GIS allowed the physical measurement of the space available to visitors, the field trips with the multidisciplinary team determined the restrictive ecological factors. Management constraints were identified through interviews with main manager and technicians. Finally, the corresponding formulae were applied.

MCDA also involves public participation through stakeholders, with LAC, which is highly recommended in tourism activities in natural parks and must be taken into account in the evaluation of management alternatives and strategies design [33], reconciling social perception with a management and conservation process. This is the best approach for addressing problems influenced by ecologic and economic activities with human concerns.

Data was collected through interview scripts with key informants, a workshop with 18 local tour guides, and another workshop with 18 stakeholders (ejidatarios) from Tzsicao (Chiapas, Mexico), both with Participatory Community Maps and Community Experience Track Record, to collect the knowledge accumulated by a select group of habitants in the geographical area. Indicators were selected with criteria of clarity, simplicity, representativeness, practicality, relevance, social verifiability and the standards were set in accordance with scientific literature and social perception.

PNLM is a protected natural area administered by the federal government of Mexico, through the Comisión Natural de Áreas Naturales Protegidas (CONANP, its Spanish acronym), with the presence of field personnel (administrators, technicians, park rangers) together with the Tzotzil ethnic group (Tziscao human settlement), to conserve the lakes and landscapes of this natural area, as well as to obtain benefits through tourism.

The park presents a great richness of woody species, in total 208 varieties; it represents 53% of the floristic composition registered in the region of Los Altos de Chiapas, It is estimated that 73% of the surface of the park is occupied by coniferous and broadleaf forests. The fauna is home to 4% of existing species in Mexico such as butterflies, amphibians, reptiles, birds and mammals [4]. The main economic activity in the area is subsistence farming, based on family labour. Another source of economy has been tourism, due to its attractive landscapes, which caused that people settled in the area decided to start providing tourist services as guide and homemade food selling, the self-employment prevalent ([4], field observation, 2017).

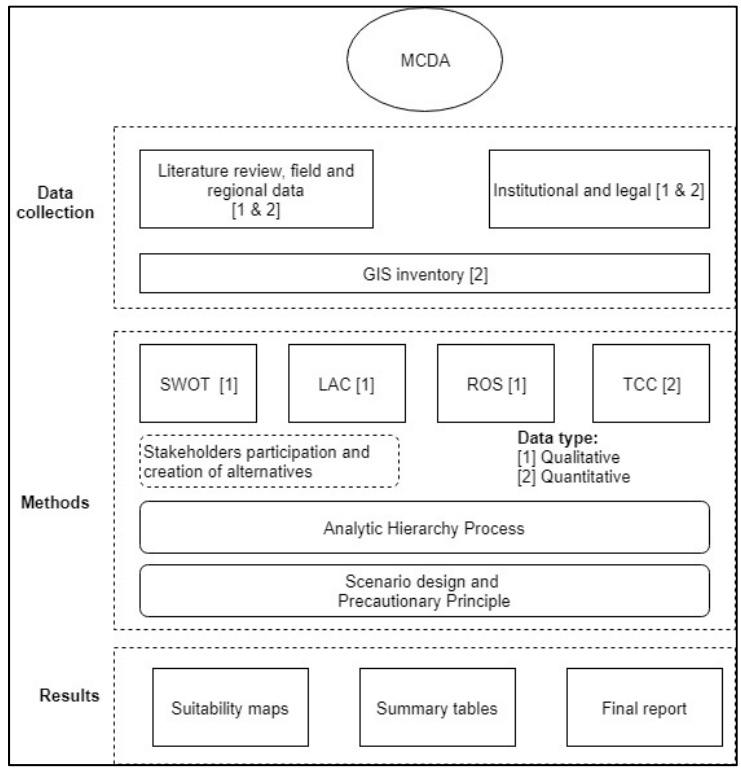

Figure 1: MCDA process for PNLM. *(Source: Authors, 2017.)*

4 RESULTS

According to the information gathered, SWOT analysis found 11 strengths, 11 opportunities, 7 weaknesses and 7 threats. The National Park strengths are: the natural landscapes, high diversity of flora and fauna as attractions, constant physical presence of rangers, while lack of infrastructure and facilities and absence of interpretative strategies, are the major weaknesses. Among the opportunities are: benefits for local communities and improving tourism services; the threats are communal disputes, poverty, lack of environmental education and water pollution in lakes.

According to the desired target image for this National Park, five type 1 recreational units, four type 2 recreational units and one type 3 recreational unit were found in two tourist circuits. The presence of a human settlement that takes advantage of its natural and cultural attractions and, in a certain way, modifies its environment, it is also reflected in the PNLM's classes of opportunities. The GIS identified among 50 and 59 lagoons and lakes of different characteristics and dimensions, with a grand total of 1,043.97 ha, but only five lakes have tourism use and present a dock or berth. The seasonality of the year, the rainfall regime and the absence of denomination for some lakes and lagoons, prevent a more precise quantity from being established.

The TCC measured in non-motorized boats is 59, including lakes and lagoons and in motor boats is zero (0). The assessment found 30 wood raft (Fig. 2) operating in lakes and lagoons of the PNLM, while there are probably about 20 kayaks and 20 canoes, for recreational use (field observation, 2016). There is no motorboat in any lagoon or lake. In practical terms, the current physical operation of the wood rafts is 8/59 and practically no tourist pressure is exerted on the lagoons and lakes. This result is consistent with cultural tolerance to density and other respective safety considerations (minimum or no infrastructure).

Figure 2: Travel with raft wood in PNLM. *(Source: Authors, 2017.)*

The PNLM has two recreational areas (Montebello and Bosque Azul) and four trails for recreational activities of environmental interpretation, for visitors without previous experience: (1) Laguna Aguatinta; (2) Bosque azul-Las Grutas San Rafael; (3) Laguna Ensueño; and (4) Laguna Esmeralda and Encantada. Furthermore, there is an interpretive trail of mid-level experience (Pojoj) and a tourist trail on horseback (Montebello). Since there is a free public highway that passes through the National Park and a human settlement, there is no limit on the number of visitors to the PNLM, but there are limits on every recreational site within the Park. The most restrictive aspects for tourist use are erodibility, type of floor, environmental sensitivity, and difficulty of access. According to these criteria, 2,249 users can make optimal use of the PNLM trails, every day.

LAC study found 20 indicators: three ecological (priority), one psychological (priority), four social (priority), two ecological (secondary), two economic (high school), one of management (secondary), four psychological (secondary) and three social (secondary), with their respective standards. The general opinion of the social actors is that current tourism harnessing is adequate. Although some deer species are no longer seen in the area, this situation has not been caused by tourism and should therefore not restrict visitor access. On the other hand, access to lakes and lagoons that provide water to communities is under permanent control and there are no risks associated with tourism. Tour guides and local leaders argued that current level of daily visitors should be maintained. Table 1 presents the synthesis of the most relevant results.

Once the management scenarios were evaluated (Everything as Usual (EU), Maximise Ecosystem Outcomes (MEO), Maximise Social Outcomes (MSO), Maximise Sustainable Tourism (MST)), the most favourable one to ensure nature conservation and support local communities in the PNLM is MST, according to a desire scenario and Precautionary Principle, based on visitors per day.

Table 1: Main research results. *(Source: Authors, 2016.)*

Method	Category	Result
SWOT	Strengths	11
	Weaknesses	11
	Opportunities	7
	Threats	7
ROS	Recreational unit type one	5
	Recreational unit type two	4
	Recreational unit type three	1
	Tourist circuits	2
LAC	Indicators	20
TCC	Capacity of non-motorized boats	59
	Wood rafts in operation	8
	Trails for tourism	4
	User daily capacity for total trails	2 249

5 DISCUSSION

Management options considering conservation, human multiple needs, and tourism should offer optimal protection of natural spaces. Inevitably, conflicts between different interests or objectives, lead to conflicts and disturbances to the environment. To avoid this situation, in PNLM, Mexico a multiple criteria decision analysis to study the complex issues of tourism management with human settlements and conservation was done in 2016. The Analytic Hierarchy Process accounted a collaborative solution between ecological and social dimensions with a combination of qualitative and quantitative attributes according to multiple objectives, prioritizing optimal conservation of natural resources and a participatory support among members of communities related to this national park. The conservation of natural resources is fundamental to managers as well as to the economic development undertaken by stakeholders and local habitants.

A SWOT analysis, an ROS, a TCC, a LAC with a hierarchical process were done in order to identify operational criteria for environmental planning, assessing the capacity of nature to tolerate tourism interference and set limits for tourism use, based on a non-standardized process. However, this type of evaluation is common for natural parks, to deal with dynamic perspectives, different impacts and objectives with multiple criteria.

As results, the SWOT analysis found 11 strengths, 11 opportunities, 7 weaknesses and 7 threats; the ROS found 10 recreational units of three types and 2 tourist circuits; the TCC for lakes and lagoons is 59 wooden rafts and 0 motor boats, and the TCC for trails and recreational zones is 2,249 tourist daily. The LAC evaluation determines 20 indicators with their-standards, to evaluate tourism impacts and manage visitation into the Park. These results are useful for the park's management, since they indicate that users recognize the existence of limits in nature and identify the impacts associated with tourism use.

The MCDA model proposed to define social limits for tourism use in this natural park had some limitations, not exclusively related to qualitative or quantitative data, but to the isolation of each technique applied, the heterogeneity of data comparability between ecological, social and economic categories, the absence of market value and scientific literature for a combined approach, and the concern about stakeholders' participation once decisions are made, restrict the management scenario. In the theoretical aspect, the recognition that people identify limits to the use of nature implies the development of a consciousness about limits or carrying capacity, so it should be considered the construction of a new model that describes the phenomenon.

Limits for tourism, defined for long-term goals of conservation, although desirable as strategic management, cannot be made on the back of reality, science and pluralism of ideas. It requires an exercise of strong reflection on factors and consequences that are in many ways conflictive: any wrong norm could split communities, create collective conflicts and accelerate the degradation of the environment, in agreement with Ostrom [17], so to avoid over-exploitation, adaptive management with communal support should be proposed to promote a sustainable use of natural resources.

6 CONCLUSION

Tourism has become the most important and fastest growing sector in national park and has a major impact on natural and social environments, with multiple positive and had negative impacts, depending on how tourism is developed and managed. In this scenario there is a need for effective strategies and management plans for sustainability. This research analyzed limits for tourism in PNLM and found that there are ecological, social and legal restrictions for tourism use. The most important are physical, ecological, perceptual and related to human use. Because the administration has limited resources and social collaboration is desirable,

the operationalization of the control of tourist pressure on natural spaces is carried out through the total number of tourists present in each specific area. This system avoids subjective aspects from indicators, that are used as a preventive measure of tourism pressure and allows social transparency, looking for ecosystem stability.

There is no simple answer to the question of how many tourists could visit a natural space, but any management system has to ensure the conservation of the protected area, with the knowledge and resources available, even if there are gaps in the theory or method about sustainability or carrying capacity. There are difficulties to measure limits and there is no clarity about what to consider in a complex system like a natural park; but in any case, the boundaries must be clear, shared and easily understood by locals and visitors.

There is no "magic rule" to identify accurate indicators, as there is no "magic number" to set a balance between cause-effect and achieve or enhance short or long-term sustainability. A participatory process for indicators development is not free from criticism, because it does not assure representativeness about multidimensional impacts. Furthermore, oversimplification may lead to confusing interpretations. However, any strategy without indicators are useless. In any case, sustainability requires objectives and monitoring.

As a management concept, any limit in a natural space – whether ROS, TCC or LAC – represents a form of social cooperation and contributes to building a more sustainable society by confining the visitors' power, consolidating local government and institutions, in the cultural and pragmatic dimensions.

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