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Design and development of a Sustainable Tourism Indicator based on human activities analysis in Inle Lake, Myanmar

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Abstract

Inle Lake encompasses immense cultural and biological features, it is the second biggest Lake in Myanmar and it is home to different ethnic groups such as Intha, Pa-O and Shan people that have been making the lake their source of revenue for several decades. Conversely, some of the activities being performed by these communities have caused diverse environmental challenges for the lake. The risk of losing part of the lake ecosystem, including local endemic fish, snails and migratory birds has been increasing in recent times. Though, there is a lack of leadership and control over these actions. Tourism is one of these key activities that can either be a difficulty or an answer to the lake ecosystem conservation. To analyze the range of actions within the lake, this document develops a methodology that analyzes and places the main hazardous activities in one scheme, it evaluates its social, economic-social and ecological cumulative impacts, and refer the main stakeholders involved in it. The outcome information from the study aims to facilitate information analysis to formulate strategies to switch from harmful activities on the lake towards Sustainable Tourism actions. The research paper indicates the methodology of incorporating data into the indicator table and its value as Sustainable Tourism analysis tool for different stakeholders, the analysis tool aims to be a sample for other case studies analyses.

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1. Introduction: Ecotourism and Sustainable Tourism

The significance of questioning the controversial definition of Sustainable Tourism (ST) (Honey, 2008) and distinguishing it from the term Ecotourism that have been implemented in media as blooming solution to achieve Sustainable Development (SD) (Allen, 1993; Isaacs, 2000; Maclaren, 2002) is fundamental when exploring human activities in tourism and its effects on the Natural Ecosystem. The widely accepted term of Ecotourism (Valentine, 1992; Carter, 1994) defined as: “*Responsible travel to natural areas that conserves the environment and sustains the well-being of local people*” by International Ecotourism Society (TIES) (1990) has been declared incomplete by authors as Ziffer (1989) or Isaacs (2000) due to its insufficiency, thus, this shortened designation tolerates unrelenting abuse of natural resources by mass tourism. Furthermore, Allen (1993), Blamey (2001) Maclaren (2002) and other contemporary authors shaped broader definitions to illustrate the misapprehension between their visions on ecotourism and Nature Tourism. Nonetheless, most of these explanations as well cannot embrace a comprehensive approach for most of the elements related to Tourism and Sustainable Development (Honey, 2008). World Tourism Organization (WTO) and United Nations Environment Program (UNEP) (2005) had defined ST as: “*Tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities*” This definition addresses the three main elements of Sustainability: Economic, Environmental and Social (UN, 1987). Concerning the social component of ST description, WTO-UNEP rationalization is divided into two main factions: (1) the visitors and (2) the host communities. The interrelation between these two target groups with natural environment is critical for the development of SD in Tourism (Koeman, 2002; Pierre, Walter and Reimer, 2011), primarily to address matters as environmental impact reduction, cultural preservation, promotion of community livelihood and visitor satisfaction (Honey, 2008; Fredline, 2006).

This paper investigates the interrelationships between these two social elements, connecting human activities with ecological environment. Inle Lake is selected as a case study in this investigation because of its particular circumstances: it encompass a fragile and rich eco-habitat, there are previsions of vast tourism affluence and the local community is getting disrupted from their usual habits (UNESCO, 2008; BEWG, 2011) This study aims to create an understandable framework to analyze human activities impacts related to ST by defining the critical social indicators involved on it, computing the cumulative impact for the main activity groups and creating strategies and alternatives to implement ST efficiently.

2. Inle lake: Customs that pollute the environment

2.1. Inle Lake in Myanmar: Ecological Significance

The physical heritage, cultural expressions and biological environment of Myanmar are attracting more tourists every year (UNESCO, 2008). This fact has been generating vast international and national tourism investment and speculation that is threatening the ST Myanmar industry (ADB, 2012). A large part of Myanmar, including Inle Lake, is situated within the Indo-Burma Biodiversity Hotspot and is one of the 34 richest and most threatened flora and fauna reservoir on the planet (IID, 2012). There are about 1,027 species of birds, 300 mammals, 425 reptiles and amphibians and about 7000 plants recorded (BEWG, 2011). Thus, it is significant for the country to create a comprehensive framework to develop SD and preserve its natural ecosystem.

Inle Lake, also known as Inlay Lake, is positioned within southern Shan Plateau in central Shan State and is one of the main sightseeing attractions within Myanmar (IID, 2012). The Lake and its environs was converted into a officially protected bird sanctuary in 1985. The Steering Committee of Inle Lake Conservation was formed

in 1992. Additionally, the Lake was designed one of the Earth's 200 most valuable eco-regions in 1998 as well as being designated as ASEAN Heritage Site in 2004 (BEWC, 2011).

2.2. Endangered Endemic Species of Inle Lake

In order to generate appropriate ST measures it is important to identify local eco-habitat elements where tourism actions are executed. The fragile Inle Lake ecosystem is the natural habitat to 9 native fish species in 3 endemic genera, additionally, it is home for above 20 species of gastropods (snails), 2 cyprinid genera (*Sawbwa* and *Inlecypriis*) and 16 of 31 species appear to be endemic in Inle Lake and its surroundings. Fish species include the Inle swamp eel (*Chaudhuria caudata*) and Inle barb (*Sawbwa resplendens*). The Inle carp (*Cyprinus Carpio intha*) is a cultural character of *Intha* community, this fish specie, locally known as *nga-phein* has been an important food for this community until recently (IDE, 2012; ADB, 2006). However Inle carp population has been diminishing in recent times, one of the reasons seems to be the reduction of water clarity due to sediment and eutrophication (Su and Jassby, 2000). Other reason for this native fish declining appears to be about two invasive fish varieties that have been seen in the lake, *Grass carp* and *Labeo rohita* that could deplete native species (Retrieved from WWF, 2013). Furthermore, Inle lake also encompasses an important Birds Sanctuary with 240 bird species recorded (57 forest birds and 43 water fowls). The lake and wetland are the nesting places of endangered Sarus crane (*Grus antigone*) included in vulnerable class species by IUCN Red list (2007). Any activity involving remedial actions without Strategic Environmental Assessment (SEA) in the lake's ecosystem can have irreversible consequences in losing some of these endemic native species.

2.3. Inle Lake Environmental reports: Inle Lake shrinking causes

Recently, numerous environmental reports have been emerging with reference to Inle Lake from different organizations, such as, Asian Development bank (ADB) (2006); Burma Environment Working Group (BEWG), (2011), Institute of Developing Economies (IDE) (2012), United Nations Educational, Scientific and Cultural Organization (UNESCO) (2008), United Nations Development Program (UNDP) (2012), Institute of International Development (IID) (2012) and others. A number of these studies overlap each other in data analysis. Consequently, outcomes are not efficient, generally resulting in wasting economic and human resources whereas the lake eco-system remains being depredated.

For instance, according to an estimation from Sidle, Ziegler, and Volger (2007), from 1935 to 2000, the net open water area of the lake declined from 69.10 to 46.69 km², reducing 32.4% of its capacity. A survey of the lake's dimensions conducted by Myanmar Land Records Department in 2007 revealed that its surface area is about 163.17 km², of which 62.16 km² was open water surface area. Both of these information were published in the year 2007 and have a disparity of 15.47 km² in size. Most likely this gap is produced because both reports didn't mention the climate circumstances in the lake environs and the period of time when it was considered. Indeed, previous analysis from ADB (2006) stated that the lake is situated within a tropical monsoon quarter with three main seasons: rainy, dry, and hot, with different rain patterns that makes the size of the open water area vary. Precipitation exceeds 5cm a month from April until November, its peak point is in August, through characteristic precipitation of 20cm. This rain pattern affects both local community, tourist activities significantly and therefore, lake's reproductive biology. (BEWG, 2011; IDE 2012) Cooperation between report editors can contribute to identify efficiently the overall circumstances within the lake and its environs.

Sources of lake shrinking are also debated, but most of the reports agree that the main reason largely resides on sedimentation. Sidle et al. (2007) analyzed the alterations on the exposed water surface vicinity of Inle Lake,

their analysis states that large quantity of sediments have been deposited on the lake in a short period of time; this is attributable to different human activities. The main sources of siltation are:

- (1) *Deforestation*, There are three main reasons of deforestation on the hills in the catchment:
 - Shifting agriculture, in the upstream
 - Wood fuel, used by local communities
 - Livestock Production
- (2) *Floating gardens*[†]: Typically the gardens are 'shifted' to the edge of the lake after their fertility exhaustion. Thus, this activity contributes notably to the loss of the lake open water area.
- (3) *Residential/Tourism*: Residential and tourism development within the north area of the lake results in the creation and deposition of more siltation because of soil disturbance and their proximity to the lake. Unprocessed sewage discharging, that includes petroleum derivatives and detergents, contribute considerably to the lake ecosystem degradation through sedimentation, turbidity, eutrophication, and pollution (Sidle et al, 2007)
- (4) *Mining*. The Tigyit coal mine, is on the watershed 13 Km from the Lake, it is Myanmar' major open pit coal mine, it generate approximately 2,000 tons of coal on a daily basis. As well, there is a coal combustion energy plant in Tiygit,. Contaminated water from the mine and waste from the power plant run through the Balu creek into Inle Lake. Conversely there not exist relevant assessment on the environmental impacts of this activities on the lake (BEWG, 2011).

2.4. Community Sectors and related Human Activity

Inle Lake is situated in *Nyaung Shwe* Township. It holds 36 village areas, encompassing 444 villages, 32,139 households, and according some reports, an estimated population of more than 160,000 people inside the lake and its environs (IID, 2012; IDE,2012). Population includes diverse ethnic groups (Table1).

Table 1. Population Breakdown from Nyaung Shwe Township, Data Source: UNDP (2008)

Ethnic Group	Percentage
Intha	70%
Pa-O	10%
Bamar	3%
Taung Yo	2%
Shan, Myanmar, Others	15%

The number of individuals residing within the lake is complex to calculate due to diverse reasons such as lack of updated census in Myanmar, undefined lake boundaries and seasonal migration. It is roughly estimated that population that live in inundated areas are between 60,000 and 100,000 individuals (IID, 2012). Large proportions (about 90%) of these households are regarded as rural. The major ethnic group within the lake is

[†] Floating gardens are based on hydroponic farming in floating islands of decomposed grasses, reeds and marsh plants. The islands (locally known as *ye-chan*) are usually around 2 meter (m) wide and 40 m long. By trimming these islands annually, *Inthas* continue floating gardening year-round by growing vegetables. Floating gardening is a very productive and economically beneficial practice. In recent years, a high yield variety of tomato was introduced from Thailand and Inle has become a major production area of tomatoes, supplying the whole country (ADB, 2006; Sidle et al., 2007).

Intha. The income distribution along the township, illustrates that agriculture, specially tomatoes, account for more than half of the income of the lake households (Table 2). Tourism is relatively a new way of income, so it isn't measured as a separate category in this report; hence there are no accurate estimations on that.

Table 2. Income Distribution in the Lake and community involved. Data Source: IDE (2007)

Activity	Income	Community
Agricultural Activities	50%	Intha, Shan, Taungyo, Myanmar, Others
Small Scale production/ Manufacturing	30%	Intha, Shan, Pa O, Others
Local Business	10%	Intha, Shan, Myanmar, Others
Trading	7%	Intha, Shan, Myanmar, Others
Fisheries	3%	Intha, Shan, Others

2.5. *Tourism of Inle Lake*

There does not exist reliable long term data about tourism in the lake, existing accessible statistics are not accurate. Some rough estimations have been made by IID (Figure 1), representing the gaps of dissimilar information sources. They state that in the year 2012 Inle Lake received roughly 300,000 visitors, of which half of them were international. Forecasts predict the number of visitors will double within the following three years (IID, 2012). There have been no imperative needs to address tourism impact in recent years due to the reduced amount of visitors. Previous tourists were believed to have little economic, environmental and social impact. Nonetheless, some opinions estimate that in recent times the tourism industry within the lake accounts for about 50 million USD a year (Personal communication, Joen Kristensen, Director and Representative at Institute for International Development (IID), 2013).

Phaung Daw U pagoda festival is held in September every year, it is a distinguished celebration in the country. There is a large flow of international, national, and regional visitors, they stopover within the lake in this short period of time where all travels and numerous marketplace are happening on the water. Because of the celebration, larger disposal of solid waste is deposited into the lake, contributing to its pollution. This problem can be solved by raising awareness in this rush moment of the year, which can help to extend environmental awareness for the tourists, local communities and social entities involved in it.

There is a need to differentiate the impact from different tourist target groups, such as domestic and international visitors, with its diverse costumes and habits. It is important to raise an enclosed strategy that encompasses the groups' main activities to minimize their impacts. Many of their cumulative impacts are very similar, such as sewage disposal, water footprint and food, usage of motorboats as transportation in the lake (plying of motor boats result in oil/lubricant spillage), etc. However, there exist some cultural differences on tourist activities, including different waste disposal behaviors. International tourists generally are aware of waste disposal habits, whereas local tourists should be well-informed and enforced to practice sustainable waste disposal behaviors. (Personal communication, Achim Munz, Resident Representative at Hanns Seidel Foundation, 2013)

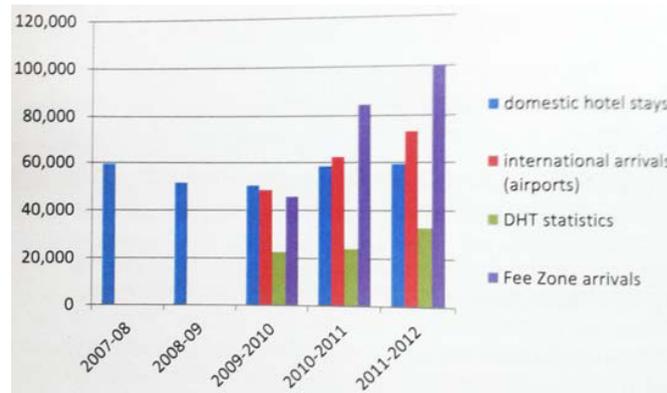


Fig. 1. This graphs illustrate the differences on statistics from four different data indicators on the lake. Source: IID 2012

3. Finding accurate indicator of human activities impact within the lake

3.1. ST Indicator Methodologies and Approaches

Once acknowledged the eco-habitat and social elements within Inle Lake, it is important to recognize the group of people undertaking each activity that is affecting the lake's environment (Table 2). There exist numerous investigations on ST indicators. Several of them failed to formulate a comprehensive approach of all factors involved on ST. A number of studies are focused on the environmental parts of ST as the one by Colin and Jon (2007). Some other investigations carried out a scale to assess the social impact of tourism within communities (Fedline, 2006), however, they failed to address environmental problems of ST. There are some other researches that addressed the complexities of all issues involved on ecotourism, including human activity analysis, but they only provide a limited scope for the case study where they are working on, as Zambrano Et al. (2010) carried out in Costa Rica or Wuver and Attuquayefio (2006) did in Ghana.

Most of these ST studies have been targeted for specific scientist groups, their outcomes are not entirely comprehensible and available for broader audiences, such as tourism industry, environmental advocates, tourists, media and concerned citizens. Ultimately, the focal point of this research paper is centered on the "decision-makers understanding". The decision-makers have the authority to choose the implementation of the policies that will have repercussions on the actions done by local population and tourists of one specific area. This fact will influence on the promotion of specific activities (Tin et al. 2009). Hence it is important to offer this decision-makers precise understandable information to encourage them to take decisions that support ST activities.

For instance, to implement correct measures on ST, it is necessary to emphasize that the major environmental problems in the lake are direct or indirectly caused by human beings, therefore, an association of human-environment should be constantly present to monitor human activities on physical environment. A carrying capacity index should be created and implemented. Carrying capacity in the context of tourism is defined by Cooper (1998) as "the ability of a site or region to absorb tourism use without deteriorating" yet, nowadays there is not existing a unanimously established explanation for it, neither a standard methodical process for assessing it (White et Al, 2006)

The intrinsic challenges in the establishment of carrying capacities are the lack of understanding and consciousness of the concept regarding ST. In a comprehensive method, Koeman (2002) in an assessment report for Vietnam Tourism Ministry, split up Tourism carrying capacity into four branches: Physical, Biological, Psychological, and Social. All are related to the number of visitors/tourists to a site or area.

- (1) *Physical* is the actual number of visitors a site can hold.
- (2) *Biological* is the point at which environmental degradation occurs to the extent that it is irreversible or unacceptable.
- (3) *Psychological* is the point at which the tourists feel the quality of their experience is damaged by the number of other tourists and/or their behaviors.
- (4) *Social* is the level at which the local inhabitants of the site (possibly the tourist attraction themselves) feel disrupted, intruded upon.

Koeman (2002) as well, states that carrying capacities comprise qualitative as well as quantitative features, subsequently, there not exist precise figure for it. However is it essential that an effort is prepared to reach at some evaluation of the carrying capacity of each area, employing the best techniques and information obtainable.

Two main issues need to be addressed in this definition. First, the number of individuals that visit one place is significant (Physical branch), although, the activity that each of them performs on this place should be defined. It is significant to target what kind of tourists are visiting the lake and what activities they execute, trying to measure their cumulative impact. Other significant issue to state is that, current capacity is divided into four branches, but not all of them have same significance. Human-nature dualism should always be concerned, from a SD approach, biological factor should account for great part of the indicator. Every human activity should correspond with its impact on natural habitat.

3.2. ST Comprehensive framework to analyze Inle Lake human activities and its related impact

Human activities influence flora and fauna at numerous diverse stages of biological organization, arraying throughout habitats, communities, populations and individuals. Impacts can vary from small and momentary to harsh and long-lasting (Tin Et al. 2009). Accordingly, human activities measurement consists on a long process that requires uniformity on the analysis where lot of data need to be collected. An applicable study divides the classification of human activities as (1) research studies, addressing some specific subject with short term outcomes and (2) monitoring studies, involving quantifying changes in characteristics of resources over long period of time. (Robert Et al. 2006). A comprehensive ST Activities Indicator should encompass these two areas: (1) capable to explain specific questions in short term that determines the path toward actions and (2) able to be reused in the future when circumstances change and compare their results to predict future trends. The proposed framework in this paper attempts to create a clear methodology to address Inle lake's key human activities and its related impacts. Moreover, it aims to be used as reference for human activity indicator analysis in Tourism areas, flexible enough to acclimatize to other tourism destination studies and determined enough to maintain consistency in the methodology. Hence, every study appraised through this methodology would add value to the analysis tool in a process that follow these steps:

- (1) *Identify the environmental–social problems that affect the lake.* Based on data research, questionnaires, interviews, experiments and related information.
- (2) *Categorize the major human activities* that are the source of environmental-social problems, not necessary by specifying the whole compendium of all activities, but by encompassing a spectrum that can cover the activities that create the environmental-social problems identified previously.
- (3) *Classify which community* or social group is responsible for each activity. Stating a clear identification of the ones that are responsible for the most “pollutant” activities
- (4) *Input all this data in the Human Activities Indicator Table* .By the criteria of Table3,input data on social-ecological cumulative impact in Table 4. Previous analysis would help to categorize
- (5) *Scrutinize* for every negative impact which activities and community of people are related (Table 3) Share it with interested parties, stakeholders and public.
- (6) *Create a strategy* based upon the data analysis, targeting the groups of people that cause the impact, and encouraging them to transform the specific activities that are the source of the hazards.
- (7) *Monitor* its effectiveness by updating the new data on the excel table through the time.

3.3 Indicator framework

Every activity is composed of quantitative and qualitative aspects. Firstly, recognizing the core human activities involved on the lake is essential to retrieve as much as environmental, social and economical data. This is classified in a list that shapes a scope to identify the main environmental degradation causes related to the lake. This list helps to identify the community actions responsible for the environmental problems. The outcome information should include three different types of data: environmental cumulative impacts, human activities and groups of people related to those impacts. All of these records are incorporated in Human Activities Indicator Table (Table 4) according to the criteria of Table 3 to analyze every group of human activities previously categorized.

Table 3. Tool analysis for the lake. Evaluation analysis

Impact	Evaluation	Feedback
Activity helps to reduce impact in this and most of the activities	5	Activity Performs well
Activity that helps to reduce impact in this activity but creates impact in others	4	Appraise other activities' negative impacts
Neutral, circumstances will not change due to activity	3	Neutral,
Activity creates more impact in this activity but create impact others	2	Appraise other activities' positive impacts
Activity creates negative impact in this activity and others	1	Activity need important appraisal.

To quantify the social ecological impacts created, Ecological Footprint (EF) has been chosen as biological indicator due to its major coverage of biological facts. EF is divided here into five elements : bio-reproductive land, bio-reproductive sea, energy land, built land and biodiversity (WWF, 2002). Furthermore, Human Impacts are divided in physical, psychological and social elements (Koeman, 2002). Due to limited time and capacity constraints, the examination of the impact of the activities of Inle lake in this paper, on both biological and social

areas, may not be self sufficient in certain aspects. The objective of this paper is to disseminate the methodology of the usage and understanding of Human Activities Indicator Table (Table 4)

The process of input numbers in the table is very sensitive. A scale should be determined based on quantitative and qualitative information analyzed on this and previous case studies. The basic evaluation data determined for this appraisal is defined in Table 3. This table rates human activities from 1 to 5. Rating 1 means vast degradation of eco-habitat in the activity analyzed and other activities, 2 means negative impact in the activity investigated but other positive and/or neutral impacts in other activities, 3 means that the activity does not present positive or negative impacts when is developed, 4 means the activity analyzed creates good impact in some aspects but negative and/or neutral impacts in other activities, and 5 means that the activity creates good impacts in this aspect and also help to generate good impacts in other parts.

Table 4. Tool analysis for the lake.

Activity Group	Target Groups	% \$	HI	HI	HI	NI	NI	NI	NI	NI
			Physical	Psychological	Social	Biorep. Land	Biorep. Sea	Energ. Land	Built Land	Bio diversity
Floating garden	Intha, Shan, tourists, others	50%	4	4	4	2	2	3	2	1
Shifting agriculture	Pa-o, Intha, Shan	1%	3	3	4	1	2	2	3	1
Fishing	Intha, tourists	4%	4	5	4	2	2	3	3	2
Fuel wood	Intha, Pah-O, Shan,	2%	3	2	4	1	2	1	2	2
Mining activities	Myanmar Government Shan, others.	3%	1	1	3	1	2	1	1	1
Pagodas, temple	Monks, Tourists	2%	3	3	4	2	2	2	2	2
Residential. Building	Intha, Shan , Ministry, others	3%	3	2	4	2	2	2	2	2
Local Manufacturing	Intha, Pa O, others	20%	4	5	5	4	4	4	3	3
Trading	Shan, others	7%	3	3	4	2	3	3	2	2
Hotel	Tourist, hoteliers	10%	4	4	3	2	2	2	2	2
Boat Taxi	Intha, Shan, others	5%	2	5	4	2	2	2	3	3
Other tourism Attractions	Tourism, Shan, Intha	2%	4	4	4	2	2	2	2	2
Bird sightseeing	Tourist, Shan, experts	1%	4	5	4	4	4	4	4	4

Once the data is recorded on the Human Activities Indicator Table (Table 4), its apparent an understandable scope of the key pollutant activities related to tourism in the area, as well as its economic importance, the social communities that are performing each of these activities and the evaluation of the activity impacts that they create. Thus , this table helps to understand the overall situation of the lake. Different target groups can analyze and review the information on the table and add is as a tool to help to formulate strategies to minimize its impact by efficiently know who is creating it with the activities they perform.

As an outcome on the research in Inle Lake human activities we can observe that, for example, cultivating floating gardens is economically and socially beneficial for both local population and tourists. On the other hand, it creates great impacts on bio reproductive land (including wetland) and biodiversity (endemic species risk). The social groups that are involved in this activity (Shan, Intha, tourist and others) should change some patterns of their actions, or either switch to other non-impact activities with similar economical benefits. It should be developed in a way that is beneficial for the local communities, tourism and reduces its impact on the Inle Lake's water resources. Then, the decision makers involved in this activity should examine alternatives to address the environmental and social challenges, one of the alternatives is to encourage Sustainable Tourism, as it is economical beneficial, and can help to preserve the lake eco-habitat. Human Activities Indicator Table can be a tool for decision makers to help understanding the overall social, economical, and environmental situation of the lake while saving time and economic resources. The outcome information can be re-examined during and after implementation of measures, as a result, the evaluation of the lake could be processed faster.

4. Conclusion

Human Activities Indicator Table has been developed in this paper by the measurement of relevant activities related to Inle Lake in Myanmar. The methodology to analyze and incorporate data in the indicator on this case study exemplify the complexity of Inle Lake particular circumstances. Every case study is different, and human activities involved on them fluctuate. To attain this two facts, the usage of this indicator encourages itself to be a tool to compare human activities from different case studies, moreover, it aims to be used as a effective monitor tool by updating applicable information of tourism activities. The analysis of the outcome data can help to implement efficient measures, on the economic, social and ecological situation of the area analyzed.

This document explain the Human Activities Indicator Table as an instructions manual to incorporate data and read it. However, the analysis and methodology to incorporate data on the table should develop further by generating additional standards and case studies data comparison. To do that, the tool its accessible to help to promote Sustainable Tourism (ST) for any party interested in developing it.

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