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The Sustainability of Ecotourism Activities: Development of an Accessible, Applicable, and Efficient Tool for Assessment in the Caribbean Region

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Abstract: *Tourism is one of the fastest growing industries in the world. Ecotourism is increasing in popularity as nations and visitors seek to minimise their impact on the natural environment. The Caribbean, like much of the developing world, lacks monitoring and governmental management of their growing ecotourism industry due to both personnel and resource scarcity. This study aimed to develop a tool for effective management of the Caribbean ecotourism industry. This tool is based on sustainability indicators and includes all onsite activities necessary to facilitate the business of ecotourism. Sustainability indicators were selected via the responses from a community survey, environmental checklist, screening and scoping exercise and semi-structured interviews. A reductionist approach was used to ensure that the indicators met the requirements of both World Tourism Organisation (WTO) and Organisation of Economic Development (OECD). The data were then evaluated for five different scenarios representing demographic and social changes and translated into target plots for efficient assessment purposes. Results from this analysis indicate that sustainability of ecotourism activities in the Caribbean region can be assessed across fifteen indicators among the three core pillars of sustainability: environmental, societal and economic. Sensitivity analysis showed that the assessment tool responded to social and demographic changes and that evaluation of average impact differentials across each core pillar of sustainability could be used to plan for possible future detrimental impacts.*

Keywords: *Ecotourism, tourism, sustainability indicator, target plot, Iwokrama--Guyana, Greencastle Estates-Jamaica*

1. Introduction

Tourism accounts for global revenues of approximately USD 7 trillion per year, and is currently growing at a rate of approximately 25% per year (TIES, 2009). In 2012, the Caribbean welcomed nearly 25 million tourists; 5.4% up from 2011 (CTO, 2013). Tourism is the largest and fastest growing industry in the world, with ecotourism beginning to play a more significant role. In the 1960's, sustainability formed one of the core concepts of ecotourism, which manifested as sustainable tourism (Fennell, 2003). Ecotourism sought to (1) minimise environmental impact; (2) minimise impact on – and maximise respect for – host cultures; (3) maximise economic benefits to the host country's grassroots; and (4) maximise recreational satisfaction to participating tourists (Higham, 2007). A multitude of definitions for ecotourism currently exists and this study uses the definition from The World Conservation Union (IUCN) which states that Ecotourism is "environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to enjoy and appreciate nature (and any accompanying cultural features – both past and present) that promotes conservation, has low visitor impact, and provides for beneficially active socio-economic involvement of local populations" (Brandon, 1996).

Sustainability indicators constitute fundamental building blocks in tourism planning, management and monitoring processes. They provide information on the impacts of tourism development and operations on the environmental and socio-cultural conditions of destinations, as well as on the progress made through management actions. In the context of sustainable tourism development, indicators are information sets used to measure changes in assets and issues that are key for the development and management of a given tourist destination (Yunis, 2004). Indicators are measures expressed in single numbers, percentages or ratios;qualitative descriptions; or existence/non-existence of certain elements concerning environmental,

social and economic issues (OECD, 1993). They are signals of current issues, emerging situations or problems, the need for action and the results of actions. Effective sustainability indicators must be easy to understand, as well as economically and technically feasible to measure (OECD, 2003; Yunis, 2004).

Table 1 shows the types and benefits of sustainability indicators. commonly used indicators for tourism are economically based (including tourism revenues/expenditures, tourism base line data/ statistics). In addition to measuring the success of the tourism industry, these data also provide essential information related to tourist numbers and levels of stress on resources. For example, environmental issues, like water supply or waste (water consumption per tourist or per room, amount of waste produced by tourists in peak seasons), or social issues related to host communities (ratio of tourists and host population in different periods of the year) can only be effectively understood when linked to tourist numbers. According to WTO (2004), the main criteria for selecting sustainability indicators in tourism are:

- The relevance of the indicator to the selected issue
- 2) The feasibility of obtaining and analysing the needed information
- The credibility of the information and reliability for users of the data
- Clarity to and comprehension by users;
- Comparability over time and across jurisdictions or regions: The transferability of any sustainability indicator across time and space is the true measure of its robustness (Muga and Mihelcic, 2008).

This paper describes the creation of a new tool for assessing ecotourism activities based on sustainability indicators applicable to the industry, where ecotourism activities include all onsite activity needed to support the propagation of the ecotourism business. There are several tools that exist for calculating elements of an ecotourism audit (e.g., Biocapacity, ecological footprint), but there is currently no tool to assess sustainability of the industry. Responses from a community survey; environmental checklist; screening and scoping exercise; and semi-structured interviews at two study sites, one in the Caribbean (Greencastle Estates in Jamaica) and one in South America (Iwokrama International Centre for Rain Forest Conservation in Guyana), were used to select sustainability indicators. These indicators were put into target-plots for efficient assessment purposes. Target-plots map various independent variables on a radial scale, making it easy to visually compare combined effects and has been successfully applied to various sustainability spheres (Graedel, 1998; Graedel and Allenby, 1998; McConville and Mihelcic, 2007; Muga and Mihelcic, 2008). Five different scenarios were then applied to the two sites to investigate sensitivities to social and demographic changes.

Table 1. Key Characteristics of sustainability indicators

Benefits from good indicators:	**Type of indicator with examples:**
• Lower risks or costs through better decision-making and planning that identifies limits and opportunities • Prevention of emerging risks and or conflictive issues • Timely identification of impacts and corrective action needed • Performance measurement of the implementation of development plans and management actions • Greater public accountability • Improvement through constant monitoring	▪ Early warning indicators (e.g., decline in numbers of returning tourists) ▪ System stressor indicators (e.g., water shortages, or crime indices); ▪ Measures of the current state of the industry (e.g., occupancy rate, level of tourists' satisfaction) ▪ Measures of the impact of tourism development on the biophysical and socio-economic environments (e.g. indices of the level of deforestation, changes of consumption patterns and income levels in local communities) ▪ Measures of management efforts (e.g., cleanup cost of coastal contamination) ▪ Measures of management effect, results or performance (e.g., changed pollution levels, greater number of returning tourists)

Source: Adapted from WTO (2004)

2. Methodology

2.1 Study Sites

Two study sites representing the geographic extremes of the Caribbean were selected for this assessment. A single Jamaican site and another site in Guyana, South America, were chosen. The Jamaican site is managed by a non-governmental organisation (NGO), whereas ecotourism activities at the Guyanese site are overseen by a government-affiliated, autonomous body. Variation in ecotourism activities between the two sites reflects the inherent differences in their natural environment. Jamaica offers "island-based" activities where the site in Guyana is land-locked, expansive with vast rivers, densely forested, remote and is considered pristine according to Conservation International. Both sites are relatively new to ecotourism, and they share very similar socio-political and cultural heritage. Additionally, both study sites are interested in implementing water-quality programmes. This is especially important for the site in Jamaica, as the local, coastal watershed is vulnerable to the impacts of non-sustainable farming practices.

The steps taken to develop the assessment tool are depicted in Figure 1. Data on the environment, society

and economics was collected at each site. The Jamaica site was visited in August 2008 and the Guyana site in March 2009, and data collected at those times are treated as present state. The information from both sites was then used to identify applicable sustainability indicators through a reductionist process starting with the WTO's extensive list of some 50 indicators and ending with 15. This reduction took account of indicators that are only relevant to the Caribbean case, with further lumping together of like indicators. These 15 chosen indicators were then checked to ensure they covered the three spheres - environment, society and economics - with core indicators represented in each sphere. They were also checked to ensure they satisfied the metrics of the Organisation of Economic Cooperation and Development (OECD). Once selected, questions were grouped to best fit each indicator; and numerical values, based on data collected and our perception, were assigned. Target-plots and sensitivity analysis could then be conducted for various scenarios.

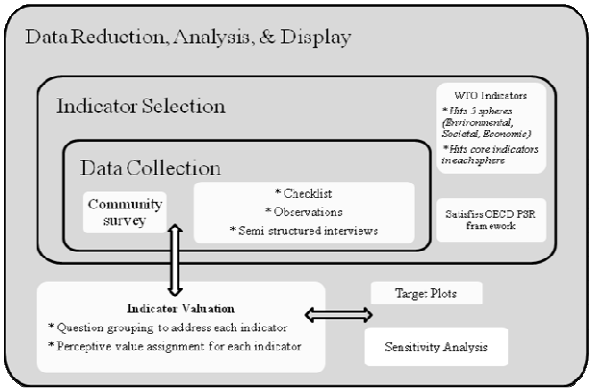

Figure 1. Schematic of the steps taken to develop and apply the assessment tool

2.2 Data Collection

Conventional environmental auditing principles were used to develop two environmental audit tools—an environmental checklist and a Screening and Scoping Exercise. These tools were designed to determine the significance of impacts of onsite activities (past and future). The checklist was developed as a tool to be filled by each site manger and probed into the past and planned onsite activities. Prompts about the physical environment, ecology, human environment and regulatory framework were incorporated into the questioning, which was spread across the core pillars of sustainability. The Screening and Scoping Exercise was designed as a tool to assess current and future impacts of, in consideration of observations, onsite discussions with staff, as well as historical land use/land change (LULC) information obtained from governmental agencies.

A survey instrument was designed to gauge the surrounding communities' acceptance of, and impact on, the ecotourism ventures studied in this work. The main sections of the survey were demographics, tourism and ecotourism involvement of household members, water and sanitation household practices, as well as respondent outlook on ecotourism and tourism potential for their communities (Oppenheim, 1992). To ensure this study did not violate any intrinsic codes of ethics, the survey was put before that University of South Florida's Internal Review Board and approved with exemption status. A non-probability sampling technique (Fink, 2003a, 2003b) was used to select persons for an in-person survey, which excluded managers and senior level staff and members of their households, at the ecotourism businesses.

2.3 Indicator Selection

The two sites considered for this study are at different stages of the tourism planning and regulation process, and this study shows the broad application of the assessment tool. In destinations where a tourism strategy and planning process is already in place (e.g. Iwokrama), focusing on sustainability indicators can help to improve data sources, analyse and report processes. At destinations where a formal planning process has not yet been started, the indicators development procedure can be a catalyst for it (as could be at Greencastle, Jamaica). The WTO's recommended procedure, therefore, contains some basic elements of tourism planning, but suggests a longitudinal-type method of site-specific indicator development. The lack of required data throughout the Caribbean region makes that a difficult task and this paper attempts to create a more efficient way for assessing this particular industry in the region.

The WTO's *Indicators of Sustainable Development for Tourism Destinations* guide was used to select indicators (WTO, 2004). The guide describes around 50 major sustainability issues and recommends indicators for measuring them. Concrete application examples are provided for each issue and about 20 case studies provide complete indicator application frameworks, at different destinations. The sustainability issues are grouped as socio-cultural, economic, environmental, management and global issues; and cover a wide range of topics from the satisfaction of local communities and tourists, to the management of natural resources—water, energy consumption, land use, seasonality, employment, health and safety and the planning process.

The OECD requires business entities to have a healthy balance of measurable state, driving force and pressure indicators that are specific to the business (OECD, 1993). Hence, the shortlisted indicator inventory was also tested with the OECD's Driving force-State-Response (DSR) Framework, based upon the modified (i.e. in consideration of ecotourism) Pressure-State-Response (PSR) Framework for selection of the most crucial indicators to ecotourism activities'

sustainability in the Caribbean. The DSR/PSR matrix developed by the OECD was utilised to assign priority to societal and environmental indicators as well as to define the indicators as either driving force indicators, state indicators or response indicators (Mortensen, 1997; Mannis, 2002). Driving force indicators refer to human activities, patterns and processes that have, or can have impact on any attempt for sustainable development. These indicators typically give an indication of the impacts (i.e., positive or negative) on the condition of the desired level of sustainable development. State indicators, as the name suggests, simply give the state or condition of sustainable development at any given instance; and response indicators refer to options for policy as well as responses to changes in the state indicators (Mortensen, 1997; Greenwood, 2006).

Finally, the group of indicators selected had to satisfy the WTO's core categories of indicators for sustainable tourism which are shown in Table 2 along with their suggested units (where applicable).

Table 2. Core indicators of the WTO for Sustainable Tourism

Sphere	Core Indicator	Suggested measure
Environmental	Waste management	Amount of sewage produced from site and/or receiving treatment (kg/person/month)
		Grey water production/water demand (gallons/person/month)
	Critical ecosystems	Quantified rare fauna and flora (number per specie/hectare)
		Endangered species' presence (number per specie/hectare)
	Site protection	Level of protection of natural resources (comparative measure)
	Stress	Tourists numbers visiting the site (persons/month)
	Developmental planning	Existence of environmental assessment protocol and/or controls over development of site and use densities
	Use intensity	Stringency of use of destination in peak periods (persons/hectare)
Societal	Social impact	Ratio of tourists to locals (person/person/month)
	Planning process	Existence of local and/or regional frameworks for tourism destinations
	Customer satisfaction	Level of satisfaction by visitors (questionnaire based)
	Local satisfaction	Level of satisfaction by locals (questionnaire based)
Economic	Contribution of tourism to the local economy	% of total local economic activity generated by tourism ($/tourist/month)

Source: Adapted from WTO (1996)

2.4 Target Plot Development

The results of the checklist, screening and scoping and community survey were analysed keeping in mind observations and historical LULC for the regions of concern to determine indicators across the tree (3) pillars of sustainability used (such as environment, society and economic). A list of questions were developed for each chosen indicator, and impact factors were assigned for each indicator on a scale of 0 (no impact) to 3 (high impact) in increments of 0.5 for the 'current' state of each site. The scored indicators were then plotted radially and represented in a target plot using Microsoft Excel. The following five (5) scenarios were used to test how this tool responded to changes in demographics and society for each site, taking account of:

1. Plans to improve infrastructure at each site in the next five (5) years;
2. Population increases in the watershed of concern by 50%;
3. Stricter monitoring of environmental laws and regulation by governmental agencies;
4. 50% increase in tourist arrival annually; and
5. 50% reduction in annual tourist arrivals.

For each scenario, a target plot was developed for each site and compared to the respective site's present state. This comparison to the present state allowed an indicator specific sensitivity-type-analysis.

3. Results and Discussion

3.1 On-site Ecotourism Activities

The information highlighted here was obtained through the use of the social surveying techniques (i.e. screening and scoping exercise, semi-structured interviews with site managers, an environmental checklist, a community survey and direct observation).

3.1.1 Greencastle, Jamaica

Greencastle Estate is a privately owned 6.5 km^2 site located on the western side of Jamaica's north coast. From 1950 to 1999, it was primarily used to produce a variety of agricultural products and is in the process of being converted to an ecotourism destination. It offers ridge to coast tourism and attracts the typical ecotourist, the coastal ecotourist, and the sun-sea-and-sand tourist. Ecotourism in the Caribbean is highly seasonal with annual interruptions due to hurricane seasons and extended rainy seasons. The management of Greencastle Estate together with the Board Members of Greencastle Tropical Study Center (GTSC), the not-for-profit NGO that manages the ecotourism activities, lease various parts of the property for several different onsite revenue earning operations that also promote ecotourism. These include Greencastle Orchids, JamOrganiX and the Jack's Bay beach facility, all of which are included in an estate ecotourism tour.

3.1.2 Iwokrama, Guyana, South America

The Iwokrama International Centre for Rain Forest Conservation and Development (IIC) occupies 3,710 km^2 of tropical rainforest and was established in Guyana following the IIC Act (1996) to provide for the sustainable management and utilisation of the rainforest. It has various Sustainable Utilisation Areas (SUAs) with business ventures that include logging, and a butterfly farm.

3.2 Selected sustainability indicators

After screening, fifteen indicators were chosen among the three core spheres of sustainability, namely: Environmental, Economic and Societal. The fifteen (15) indicators all fell into one or more of the core WTO sustainable tourism indicators, i.e., a requirement of the WTO in deciding on sustainability indicators for any form of tourism. These indicator designations, along with the type classification in reference to the DSR model, are given in Table 3.

Table 3. Classification of selected indicators

Indicator	Applicable core WTO indicator(s)	Type of indicator	Unit of measure
Environmental			
Energy consumption/demand	Waste management	Driving force	kWh/day/visitor
Ecological footprint	Use intensity; critical ecosystems	Driving force	Global hectares/visitor
Solid waste generated/recycled	Waste management	Driving force	kg/day/visitor
Biocapacity	Stress; developmental planning; use intensity; critical ecosystems	State	Global hectares/visitor
Potable water demand	Waste management	State	Gallons per day/visitor
Grey water disposal	Waste management; site protection	State	Gallons per day/visitor
Internal environmental monitoring level	Site protection; developmental planning	State	Qualitative measure
Economic			
Operational and management cost	Contribution of tourism to the local economy; local satisfaction	State	$/visitor
Cost to users	Customer satisfaction	Response	$/night/room
Societal			
Community involvement in ecotourism activities	Contribution of tourism to the local economy; local satisfaction	State	Qualitative measure
Tourism revenue accrued to the community	Contribution of tourism to the local economy; social impact	State	$/visitor
Number of local workers employed in tourism	Contribution of tourism to the local economy; local satisfaction; social impact	Response	Population fraction employed/visitor
Integration of tourism into local/regional framework (i.e. laws)	Planning process	Response	Qualitative measure
Certification adoption	Planning process; customer satisfaction; development planning	Response	Qualitative measure
Training of locals for ecotourism jobs	Social impact	Response	Local employee to tourist ratio

Each indicator selected for this study is described below:

Indicator 1 - *Energy consumption/demand*

An audit of the consumption patterns of the facility was used to quantify this indicator and an impact assigned when compared to the average per capita consumption in each location. The energy needs of the ecotourism facility should not be in competition with that of the surrounding communities, and there should be on-going attempts to reduce loads through conservation efforts, by using of alternative energy supplies for example.

Indicator 2 - *Ecological footprint*

Ecological footprint (EF) represents a method that allows for a numerical measure of sustainability. This can be quantified and compared at the level of geographic location, institutions, households and individuals. EF is a composite of a few other tools and assessment approaches (Wackernagel et al., 1999), and many of which were not quantifiable. It is typically measured in global hectares (gha) where one gha represents the equivalent to a hectare of biologically productive space with world average productivity (Patterson, 2005).

According to the introducers of the concept (Rees and Wackernagel, 1996), an EF is simply a measure of the total area of productive land and water required to continuously produce the resources consumed, while assimilating the wastes produced by a defined population in a geographic region. Thus, according to Costanza (2000), EF is of particular importance and usefulness as it agglomerates and transitions complex resource use patterns into a single value.

The template used to assess EF was that as developed by Wackernagel and Rees (1996). The assessment method is a matrix method hinged upon five core consumption categories and six major land use categories (Ryu, 2005). The consumption categories are:

food, housing, transportation, consumer goods, services and wastes; while the land use determinants are: cropland, grazing land, forest, built-up land, fish and carbon assimilating capacity. The actual Wackernagel method to compute the EF value consists of three sections (Kumar et al., 2001). These are:

1) Consumption analysis (i.e., consumption = imports + production – exports)
2) Energy balances (i.e., traded energy = net imports x embodied energy)
3) Summation (i.e., all EF components are added).

It should be noted that if the total area required for supporting the final consumption of a given study population exceeds what is available locally, this would imply that the population in question is adopting the carrying capacity of 'similar' locales (Feng, 2001). The actual EF at each site was calculated by using the EF calculator tool from *Redefining Progress* (2005). In assigning impact factor for this indicator, the *national rankings of ecological footprints* are used for comparison (WWF, 2000).

Indicator 3 - *Solid waste generated/recycled*

In the Caribbean, there are very few legal dumping grounds and many nations are plagued with irregular collection of solid waste by public entities. Thus, one of the promoted activities for ecotourism facilities is reuse of wastes through re-purposing of materials; composting; and/or recycling. Attempts to do these kinds of programmes by ecotourism facilities can greatly reduce the negative impacts of solid waste generation. In order to quantify the actual amount of waste generated, a mass balance has to be computed over time.

Indicator 4 - *Biocapacity*

Biocapacity represents the total extension of ecologically productive land in an area. In other words, it is really the potential capacity to supply natural services from local ecosystems (Patterson, 2005). In the calculation of biocapacity, some level of the existing biocapacity must be considered as untouchable for human use. According to Wackernagel and Rees (1996), 12% of the existing biocapacity needs to be taken as indispensable to account for the conservation of biodiversity. Similar to the calculation of EF, biocapacity calculations were done using the spreadsheet from Redefining Progress (2005).

Indicator 5 - *Potable water demand*

Ecotourism does require a potable water source to meet the demands of guests and staff. Efforts to reduce this demand on municipal supply, especially through alternative means of water supply, are of particular importance when assessing the sustainability of operations. With over 40% of the Caribbean's potable water distributed being unaccounted for, ecotourism facilities are to be careful that their demand does not interrupt the supply to communities in which they reside. A comparison between the ecotourism facility's per visitor water consumption and that of the respective national average consumption can provide a quantifiable indication of impact.

Indicator 6 - *Grey water disposal*

The analysis of this indicator has two dimensions--the method of disposal and the quantity to be disposed of per person. Whether the best disposal practices are adhered to or not will affect the impact, as well as the quantity to be dealt with. Both territories, Jamaica and Guyana, have guidelines for remote areas that mandate the use of septic systems with leach field for handling grey water. As for the assessment of quantity, the 'per person per site' disposal value needs to be compared to the per capita estimate for the host country or CARICOM based estimate.

Indicator 7 - *Internal environmental monitoring level*

To be serious about sustainable tourism there is a need to engage in regimented, scheduled environmental monitoring. A simple audit of the extent of site-specific monitoring programmes can be used to quantify this impact against the typical environmental monitoring needs of tourism facilities, as given in the Environmental Assessment Sourcebook published by the World Bank (1991).

Indicator 8 - *Operational and management cost*

One of the underpinnings of ecotourism is its potential to allow for environmental preservation while earning essential revenue to allow for enhancing of onsite preservation techniques. One way of better achieving this mandate is by reducing operational and management costs. The operational costs associated with ecotourism include the cost of power and water; upkeep of infrastructure; and landscaping. The average operational and management cost per visitor can be compared to that of the Caribbean Tourism Organisation (CTO) for eco-hotels when assigning an impact.

Indicator 9 - *Costs to users*

According to Panda, Mishra and Parida (2004), value is more important than price, but accurate pricing allows for the preservation of the ecotourism product.Pricing of ecotourism products needs to consider inflationary changes in the local and global economies and demand for the product Moreover, there is a need to take account of additional costs that allow for the sustainability of the destination. Thus to get an indication of this impact both number of guests have to be considered with the suggested CTO regional per night pricing suggestions.

Indicator 10 - *Community involvement in ecotourism activities*

The WTO considers community involvement to be almost mandatory for the true sustainability of

ecotourism activities. To measure this impact, the level of community involvement has to be dissected to determine the role of the community in the functioning of the ecotourism activities onsite. The community should have access to analysed information and encouraged to participate in the decision making processes of the area, especially potential impacts in local economies and culture.

Indicator 11 *- Tourism revenue accrued to the community*

The WTO has since 2002 (i.e., the International Year of Ecotourism) promoted ecotourism as a venture for poverty alleviation in remote areas, especially in developing countries. This idea of enhancing ecotourism sustainability in the community has led to several success stories globally which have further promoted the use of this indicator in ecotourism planning. The two main routes that allow for tourism revenues are through direct community partnerships and then through indirect community retailing to accommodate the guests of increased tourism activity in the area.

Indicator 12 *- Number of local workers employed in tourism*

The WTO has listed as a major indicator of the survival of any tourism venture the need for continuous employment of locals to ensure a steady supply of both indirect revenue for the community and potential employees for the onsite ecotourism activities.

Indicator 13 *- Integration of tourism into local/regional framework (i.e. laws)*

For there to be meaningful measures put in place to at least promote environmental sustainability this necessitates some level of reporting. That is of both lessons learnt and future expectations to local and/or regional agencies. These agencies can then inform the legislators as to what legal measures need to be put in place to allow for sustainable development of the industry. This necessitates the internal acceptance and development of sustainability indicators that are monitored with trend analysis; incorporation of environmental training into management's talent pool; as well as infusion of stakeholder participation in planning exercises.

Indicator 14 *- Certification adoption*

Voluntary certification of operations makes a bold statement of dedication to sustainable operations. To attain and keep certification through any of the numerous certifying bodies, the eco-facility will have to undergo and pass continuous environmental audits, many of which are unannounced. Thus any steps towards achieving or ensuring certification is maintained are measures to reduce overall impact of ecotourism activities.

Indicator 15 *- Training of locals for ecotourism jobs*

In order for ecotourism to be truly sustainable, there must be a readily available, trained workforce in the area where the activity is underway. Thus, the ability to offer training and then the actual offering of training needs to be factored in. The frequency of training, accessibility (in terms of cost and schedule) of training to the community members, as well as the certification of the training all can give a measure of the societal importance of the ecotourism activities to the management.

3.3 Overall sustainability of ecotourism activities

Figure 2 shows the sustainability indicators utilised in the analysis of ecotourism activities within respective the three dimensions of sustainability. The impacts of each indicator are on a scale of 0 to 3, where a rating of 0 indicated no impact and that of 3 indicates highest impact. Thus an impact value closer to the center, for any give indicator, is more preferable.

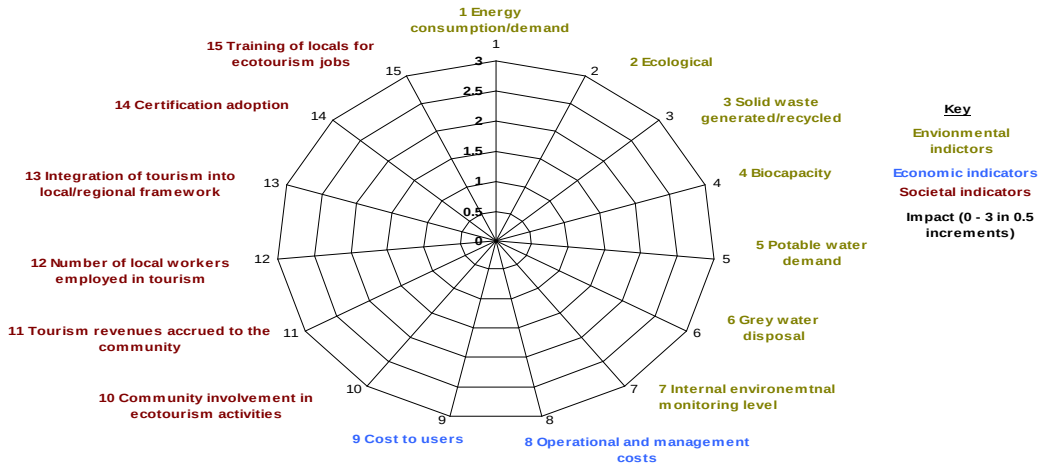

Figure 2. Target plot showing the sustainability dimensions of ecotourism activities and selected indicators

Some of the considerations used in assigning impact factors by indicator are given in Appendix 1. These were used in tandem with the results of the survey as well as the responses of informal interviews conducted and under the assumption that only the planned activities that are reported will be ongoing or have been completed. The list is by no means exhaustive but rather provides an idea of what was considered to make an assessment of potential impact. This was done so as to ensure that impacts inculcated aspects that were beyond simply the comparison of measured indicator values (where applicable) and made more realistic impact values.

These considerations were used in assigning impact values for the chosen indicators for sustainability of ecotourism activities. The values assigned to the present state and the potential values in the event of each scenario are presented in Table 4. Despite most indicators having a quantifiable unit of measure, the assignment of impact values is based highly on perception and must be assigned in consideration of geographic location and scales.

Table 4. Summary of impacts for scenarios compared to present (scenario 0) at Greencastle and Iwokrama

Indicator	Scenarios for Greencastle						Scenarios for Iwokrama					
	0	1	2	3	4	5	0	1	2	3	4	5
1	2.5	3	2.5	2.5	3	2	0.5	0.5	0.5	0.5	0.5	0.5
2	2	3	2	2	3	2	1	1.5	1	1	1.5	1
3	2.5	3	2.5	2.5	3	1.5	0.5	0.5	0.5	0.5	0.5	0.5
4	1.5	2	1.5	1.5	2	1.5	0.5	0.5	0.5	0.5	0.5	0.5
5	2	3	2	2	3	1	0.5	0.5	0.5	0	0.5	0.5
6	3	3	3	3	3	3	0.5	0.5	0.5	0.5	0.5	0.5
7	3	3	3	2	3	3	0.5	0.5	0.5	0	0.5	0.5
8	2.5	2.5	3	2.5	2	3	1	0.5	1	0.5	0.5	2.5
9	2.5	3	3	2.5	2	3	1.5	1.5	1.5	1	1	2.5
10	1.5	1.5	1.5	1.5	1	1.5	0.5	0.5	0.5	0.5	0.5	0.5
11	3	3	3	3	3	3	1	1	1	0.5	0.5	2
12	2.5	2	2.5	2.5	1	3	0.5	0.5	0.5	0.5	0.5	0.5
13	1	1	1	1	1	2.5	0.5	0.5	0.5	0.5	0.5	1
14	2	1.5	2	2	1.5	3	0.5	0.5	0.5	0.5	0.5	1.5
15	2.5	2	2.5	2.5	2	3	0.5	0.5	0.5	0.5	0.5	0.5

For easier visualisation, target plots were used to evaluate the present state as well as the possible state in the event that each scenario arises at the both sites. Based on Figure 3, Iwokrama appears to be the site with the more sustainable ecotourism activities, but this may simply be because of its more pristine present nature. In order to gauge sustained impact, an assessment of the deviations of impact values from the present need to be taken into account. In such a case, a negative deviation is more desirable than a positive one.

Figure 4 shows deviations characterised by sustainability pillar across each scenario for each indicator. In the determination of impact factors with changing scenarios the management structure and influence were assumed to remain as it exists presently. For scenario 5, Iwokrama would experience a greater change in overall impact from its present state than Greencastle despite still always maintaining a greater overall sustainability than Greencastle at present and through all five scenarios. For example, assume that in scenario 1 for Greencastle (i.e., carrying out current plants over the next 5 years), the change in environmental impact is the most crucial component of the sustainability of the ecotourism activities (average environmental impact = +0.5). Measures to reduce

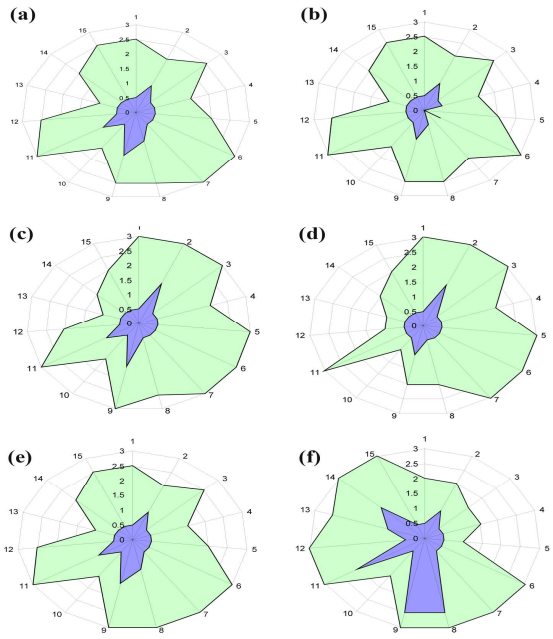

Figure 3. Target plots for Greencastle (green) and Iwokrama (purple) for (a) the present or scenario 0, (b) scenario 1, (c) scenario 2, (d) scenario 3, (e) scenario 4, and (f) scenario 5

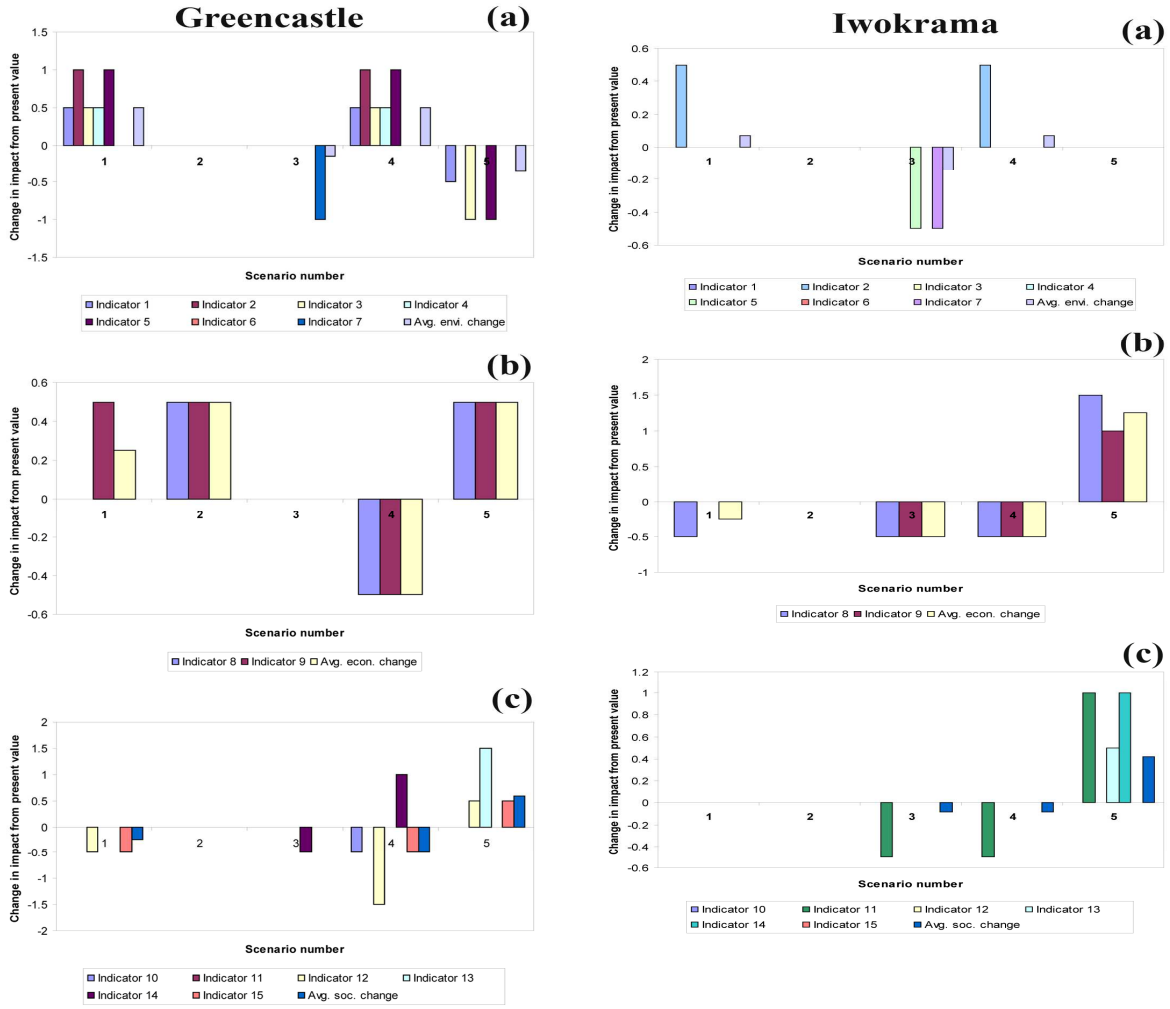

Figure 4. Greencastle's deviations from present impact values for scenarios 1 – 5 by indicator. (a) Environmental indicators; (b) Economic indicators; (c) Societal indicators

impact on the environment should take priority over those to protect economic impact and societal impacts, respectively, if this scenario were to occur and the 5 year plan should be re-examined, possibly using the indicator questions as guides for impact reduction. Therefore, analysis of differential impacts from present values can be an essential planning tool where appropriate plans of action can be pre-determined.

4. Conclusions

This study showed that sustainability of ecotourism activities in the Caribbean could be assessed across fifteen indicators among the three core pillars of sustainability: environmental, societal and economic. The chosen indicators reflect the WTO's set of core sustainability indicators and the PSR framework. Target plots of these indicators were created to represent their combined impact, where each indicator was analysed for impact based on a pool of questions linked to the severity of impact. The assessment tool was able to respond to the changes that it was subjected to. The method allowed for internal determinations of whether the focus should be on mitigating environmental, societal or economic impact based on the average impact differential across each of the three core pillars of sustainability.

The Caribbean, like much of the developing world, lacks monitoring and governmental management of the industry due to both personnel and resource scarcity. Hence, the assessment tool developed in this study provides a manageable tool for the Caribbean ecotourism industry, especially managers of destinations and governmental agencies. McConville and Mihelcic (2007) suggested the inclusion of political cohesion and

cultural effects as two additional pillars of sustainability. Future studies should try to integrate these into the indicator framework for ecotourism activities.

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Appendix 1: Assigning Impact Factors by Indicators

Indicator 1 *- Energy consumption/demand*

- What is the minimum energy requirement for operation?
- Are there any energy saving programmes in place on site?
- Are policies in place to encourage guests to minimise electricity use?
- Is hot water available to guests in showers?
- What is the cost of energy consumption?
- Are there technological fixes in place to minimise dependence on non-renewable fuels? What is the typical bill for the facility when running at full guest load?
- Are the energy needs met by more than one source?
- Are there any plans by government or private ventures to increase gridded power supply in the area?
- Is energy demand reduction at the household level a priority?

Indicator 2 *- Ecological footprint*

- Are buildings constructed to greatly reduce the amount of impervious surface?

- Are buildings built on the ground or above ground?
- Are the above ground buildings able to allow easy access for stormwater to percolate? How much green space has (or have) to be lost in order to erect buildings?
- Are driveways and roadways paved?
- Will any increase in the number of buildings at the site, constructed in a similar manner, increase the ecological footprint of the site?
- Are drains and canals present and impervious?
- Does the site produce any emissions during normal operations?
- If there are emissions, can any of them be considered green house gases?
- What is the rate of emissions?
- Are there any obvious discharges to on site water bodies?
- Are there any activities on site that can potentially lead to toxic run off into waterways?

Indicator 3 *- Solid waste generated/recycled*

- How much solid waste is created on site?
- What it the rate of production of this waste?
- Are there any programmes that are currently being implemented to reduce solid waste generation/promote recycling?
- Is staff being trained in reuse and recycling?
- Does the country/county/parish promote recycling?
- Is there any financial incentive to become involved in recycling?
- What items are allowed for recycling (i.e. glass only, plastics only, both)?
- Is composting encouraged on site?
- Are items that cannot be necessarily recycled at least re-purposed on site?
- Is recycling the norm at the household level?
- Is there any national drive to promote recycling by businesses and households?
- Is guest waste sorted after room collection?

Indicator 4 *- Biocapacity*

- What is the extent of ecologically productive land available?
- What is the total land area of the eco facility?
- Does the area have the ability to supply all its required local ecological resources?
- Does on site activities allow for preservation of biodiversity?
- Is biodiversity compromised during normal operations of the eco facility?

Indicator 5 *- Potable water demand*

- Is potable water required for the day-to-day operations of the ecotourism activities?
- How much potable water is required for daily operation of the facility?
- On average, how much potable water is required per guest daily?
- Is any of the potable water demand subsidised by other water sources?
- Is rainwater harvesting done? Is surface water utilised for non-drinking purposes?
- Is the eco-facility connected for direct treatment plant supply?
- Is the water obtained from a public or private utility?
- What is the cost of potable water?
- Did the eco facility have to input its own lines to gain supply or was there an existing distribution grid in the area?
- Is the potable water supply regular?
- Does the potable water demand exceed the supply schedule (thus necessitating intermediate storage)?

Indicator 6 *- Grey water disposal*

- How is grey water disposed of on site?
- What is the average daily production of grey water from the facility in both tourist low and high seasons?
- Is the disposal system monitored and/or maintained?
- How is the disposal system monitored and maintained?
- Is the grey water disposed well away from surface waters?
- Are there any plans in the works to reduce the amount of grey water produced by the facility?
- With any increase in tourist flow, will the current disposal system be able to handle increased loading?
- How is grey water typically disposed of in the area?
- Is there a national standard for the proper disposal of grey water?

Indicator 7 *- Internal environmental monitoring level*

- Is there a formal environmental monitoring programme adopted?
- If yes, how long has the programme been ongoing?
- What is the frequency of monitoring?
- What parameters are currently monitored?
- Is the monitoring done in-house or contracted?
- Are employees of the eco facility trained to carry out the monitoring?
- Does the facility own equipment to undertake its own monitoring?
- Are the methods utilised standard? Is there an inventory of historical data?
- How is the data analysed?
- Are the results of the analyses used to make any operational changes?
- Are there any plans to strengthen the programme by using more stringent methods or a wider range of parameters?

Indicator 8 *- Operational and management cost*

- Are the operational costs high?
- What are the major drivers of the operational costs?
- What efforts, if any, are currently being undertaken to reduce operational costs?
- What is the current average operational cost per visitor?
- What are the managerial costs associated with daily operations?
- What is the average managerial cost per visitor?
- What is being done to reduce managerial costs?
- Is there any internal auditing team set up to assess these costs?

Indicator 9 *- Cost to users*

- Are any facilities that were used by locals now accessible only by fee due to tourism activities?
- What is the 'per night' cost to visitors?
- Is the 'per night' cost to visitors different in the tourist high and low seasons?
- Are any effort being tried to lower the cost to users?
- Is there a discounted cost to nationals and/or Caribbean natives?
- What are the factors affecting the calculated cost to users?
- Are tourists satisfied with the value for their money?

Indicator 10 *- Community involvement in ecotourism activities*

- Are there any formal or informal partnerships with surrounding communities?
- How long have there been relationships with the nearby communities?
- Does the eco facility sponsor or donate to community initiatives?
- What is the general perception of the impact of tourism on the communities?

- What is the perception of tourist contribution to local culture?
- Are the communities kept updated on plans for sustainable tourism?
- What is the perception of the community with regard to the quality and quantity of the information that it receives as pertains to tourism issues and sustainability?
- Does the eco facility consider the surrounding communities key stakeholders in their tourism venture?

Indicator 11 *- Tourism revenue accrued to the community*

- Does the community perceive that is benefits financially from the ecotourism activities in the area?
- Does the eco facility have any percentage profit arrangement with the community?
- If there is a financial profit percentage arrangement how long has this been in place?
- Are the revenues that the communities obtain from tourism only through non-contractual sales?
- Does the management of the eco facility encourage the patronage of the communities by their guests?

Indicator 12 *- Number of local workers employed in tourism*

- Is the business an equal opportunity employer?
- Does the business provide gainful employment for women?
- Are there any plans to increase the number of local employees in the business?
- Are the majority of on site workers from the surrounding communities?
- Is the average salary of the employees above the national per day average?
- Is the required range of skills needed in employees available locally?
- If yes, are these skills readily available within the surrounding communities?

Indicator 13 *- Integration of tourism into local/regional framework (i.e. laws)*

- What is the number and types of new legislation or amendments introduced to preserve eco site at the local/national level?
- Is there a local government arm that has a mandate of administering tourism in the area?
- Are the applicable laws monitored by governmental agencies?
- Do laws that are currently in place adequately address environmental concerns arising out of tourism operations?
- Does the site have nationally unique flora and/or fauna or environmentally sensitive areas that can influence research and subsequent laws?

Indicator 14 *- Certification adoption*

- Is the area protected by law?
- Is certification of the tourism product important to management?
- Has any efforts been started to try and achieve ecotourism certification?
- Does the business have any other national, regional or international certification?
- Has any past profits been set aside for the attainment of certification?
- Is the business targeting a specific type of certification (e.g. Green Globe, Blue Flag, etc)?

Indicator 15 *- Training of locals for ecotourism jobs*

- Are there any training or scholarship opportunities for locals to become trained?
- In the past has eco facility entered into training of locals?
- Were any of the locals trained by the eco facility able to find employment with that eco facility?
- Does the eco facility send current staff for external remedial or advancement training? Are there any projections to increase the number of trained locals to take up positions in the ecotourism business?
- In how many different areas does the eco facility offer training?

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