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Satish Kumar Bhardwaj
Dr. YSP University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Aditya
Chandigarh University, Gharuan, Mohali, Punjab, India

Apurva Sharma
Dr. YSP University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Rakesh
Dr. YSP University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Correspondence
Aditya
Chandigarh University, Gharuan, Mohali, Punjab, India

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Impact assessment of ecotourism activities in mid hills of Himachal Pradesh, India

Satish Kumar Bhardwaj, Aditya, Apurva Sharma and Rakesh

Abstract
The field study was undertaken to evaluate ecotourism site in mid hill region of Himachal Pradesh. The Pine Eco hills site in Solan district was assessed for sustainability indicators and estimating their carrying capacity based on ecological, economic, social and physical environment. The stakeholders comprising local residents, visitors and tourism officials were interviewed with semi structured questionnaires for ecotourism prospect evaluation. The carrying capacity impact unit analysis of indicators for social, infrastructure and economic aspect obtained were 97.3, 93.5 and 95.5 percent. The effective carrying capacity of site estimated through the management capabilities was achieved at 43 compared to tourist arrival of 28 persons/day far below its capacity. The findings indicated that each component was in its healthiest state and low impact on carrying capacity category. The lack of on-site water availability although indicated a problem about abstraction from groundwater which could be worsened by an increase in tourists visiting the area. The indicators like preservation of landscape characteristics, energy, water and waste management specified on-going problems under each component which hindered the development of tourism activities. Hence, there is current need in the management and tourism development as a road map for implementing sustainable tourism in the area.

Keywords: Sustainability, tourism, indicators, ecological, carrying capacity

Introduction
Eco-tourism is consecrated for preserving and sustaining the diversity of the world's natural and cultural environments. It accommodates and entertains visitors in a way that is minimally intrusive or destructive to the environment and sustains the native cultures in the locations it is operating in. 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 negative visitor impact; and provides for beneficially active socio-economic involvement of local population" (IUCN, 1996). The potential of ecotourism as a strategy for sustainable development was recognized during the Earth Summit in 1992, when sustainable tourism was considered as an environment-friendly economic activity (Gray, 2003) [4].

Himachal Pradesh is among the six Indian Himalayan states, located in the Dhaula Dhar range of the Himalayas, covering an area of 55,673 square kilometres. With its complex geological structures, the state presents a complicated topography with intricate mosaic of mountains ranges, hills and valleys hence has many potential ecotourism sites that attract large number of national and international tourists and is a major contributor to the state's economy and growth. Tourism in the state is one of the major sources of state revenue. In 2015, the state received a record number of 160 lakh tourists. With such a rate of growth, tourism in state is estimated to add 300 crores to GDP annually. The Himalayan ecosystem is fragile; it can be easily unbalanced and destroyed. Thus, suitable management for ecotourism development is essential in order to conserve and maintain a balance in the ecosystem and as well as to develop it sustainably. However, ecotourism also brings positive and negative impacts on economic, environmental, and social-cultural aspects. Inadequate ecotourism management plan can cause negative impacts on community and decreasing eco-tourists and stakeholders'

environmental awareness causing severe environmental degradation that indirectly leads to natural habitat destruction. Ecotourism therefore should be developed properly by understanding few factors such as the sustainability indicators and the carrying capacity (Nag, 2013) [7].

One of the important starting points in the management process of nature based tourism has to be a consideration of the carrying capacity of the local area in social and economic terms as well as the natural environment itself. Carrying capacity of sustainable tourism is based on the balance concept between ecological damage loading and recovery capacity. It is determined so that the relevant tourist activities should be managed not to break the re-generable recovery capacity of ecosystem (Lee, 2011) [6]. Since, ecotourism provides a sustainable solution towards handling mountain community upliftment through a participatory mode between the different stakeholders involved. By generating economic opportunities for conservation of natural resources and wildlife, and creating awareness among people to protect nature to maintain a balanced ecosystem it acts as an effective tool for sustainable development. Therefore, the present study was undertaken to evaluate ecotourism sites for sustainability and estimate their carrying capacity based on the ecological, economic, social and physical environment.

Materials and Methods

Study area

The mid hill region ranged between 800-1600 m amsl of the state however is a popular tourist destination since it harbours a great variety of natural and cultural attractions such as mountains, monasteries, lakes, hot springs, etc. The study was undertaken at Pine hills eco camp ecotourism site in Solan district at 1502 m amsl and 31.0498°N, 76.9182°E falling in mid hill region to assess the sustainability of ecotourism sites and their potential for ecological restoration. The study site was spread over an area of 20266 m^2 suitable for tourism however, for intensive recreation it was limited to 17834 m^2.

Indicators of sustainable ecotourism

Evaluation of the ecotourism sites in mid hill region of Himachal Pradesh indulged in hiking, trekking, rope hurdle and adventure tourism such as mountain biking, mountaineering was done for sustainability indicators through questionnaire method. The factors selected as indicators of sustainability were land ecosystem, landscape/naturalness, topography, accessibility and community characteristics. Surveys and data collection for various stakeholders was conducted during the year 2016-2017. The respondents for the stakeholder survey were selected by the random purposive sampling method of survey by taking into consideration factors like purpose of visitation and their knowledge about the study area and impacts in general related to tourism activities. The stakeholders like local residents, visitors, entrepreneurs and tourism officials were selected randomly for survey within the 3 km of the tourism concentrated area.

These indicators also presented an estimation of threshold of visitors that can be taken at the destination and were based on the assumption that the number of people agreeing to the impact statement was directly proportional to the severity of impact (Table 1). The impacts of tourism on the indexes were at first evaluated by indicator quality unit (IQU) and multiplied by the proportional importance of each index in forecasting the impact by parametric importance unit (PIU). The PIU of each indicator was calculated from the arithmetic mean of scores of the indicators to accurately predict the impact on the component. Multiplying the IQU with PIU of each indicator will give the carrying capacity impact unit (CCIU) of that indicator. The rating was done as follows (Bhattacharya and Sankar, 2007) [2]:

- High Importance- These were the indicators that directly indicated the impact as well as the chances that the occurrence was only due to tourism activity. These impacts were directly observable and the cause effect relationship could be easily created.
- Medium Importance- These were indicators that directly indicated the shock, but the prospect of tourism activity being the sole causative factor was doubtful. Thus, these indicators were of medium importance.
- Low Importance- These indicators were indirect signs of an impact and were not directly observable or quantifiable.

Table 1: Selected indicators of sustainable ecotourism at the sites

Criteria	Site Selection Indicator	Spatial Resource Indicator
Receptivity	• Preservation of natural features. • Prosperous small businesses run by the local community. • Areas designed for interaction between locals and visitors. • Thriving accommodations with welcoming and motivated staff.	• Presence of permanent settlement • Vegetation cover and characteristics. • Presence of resource related activities. • Naturalness of leisure activities. • Landscape characteristics • Local community aspect.
Capacity	• Evidence that tourism does not harm the ecosystem. • Limiting the number of visitors. • Evidence of paths and trails.	• Accessibility • Naturalness of leisure activities.
Compliance	• Minimum development where natural area • Clean and simple public facilities	• Infrastructure, services and facilities. • Energy efficiency • Efficient water management • Waste management

The survey responses were received and categorized to create a valid and reliable list of structured and Likert type-closed ended questionnaire items. The methodology for calculating scale rankings adapted to transform to Relative Importance Index was used as recommended by Deeppa and Krishnamurthy (2014) [3] for each of the indicators and ranked accordingly. The RII derived to summarize the importance of each indicator:

$$RII = \frac{\sum W}{A \times N}$$

Where
W = weighting as assigned on Likert's scale by each respondent in a range from 1 to 5, where 1 = no impacts, 2 = negligible impact, 3 = marginal impact, 4 = moderate impact and 5 = major impact.
A = Highest weight
N =Total number in the sample.

If no respondents say there is an impact on the positive indicator, the value of IQU value of "1" was given. If 1-10 percent of the people considered there was an impact, then the value assigned was 0.9, similarly for 11-20 percent it was 0.8, for 21-30 percent value was 0.7 and so on finally for 91-100 percent a value of IQU as zero (Bhattacharya and Sankar, 2007) [2].

Calculation of carrying capacity: The methodology employed in the study is an integrated method for calculating the carrying capacity as suggested by Bhattacharya and Sankar (2003).

Physical Carrying Capacity (PCC): Maximum number that can fit on the site at any given time and still allow people to be able to move.

$$PCC = A \times \frac{V}{A} \times Rf$$

A = available area for use (m^2), D = tourist density (tourists /m^2), Rf = Rotation factor (No. of visits/day)

Effective Carrying Capacity (ECC): Maximum number of tourists that is permitted by the local environmental conditions and management capacity without influencing the tourists demands.

$$\text{ERCC} = PCC \times \frac{100 \times Cf_1}{100} \times \frac{100 \times Cf_2}{100} \times \frac{100 \times Cf_3}{100}$$

Cf (corrective factors or limiting factors) are factors which have negative impact on tourism activities and are assessed by limiting threshold which is used for identifying impact level of a factor (%) and can be determined by:

$$Cf = M1/Mt$$

M1: limiting magnitude of variable, Mt: total magnitude of variable

Man power capacity
To study the man power capacity i.e. the number of employees working in ecotourism site to conserve and protect, it was calculated as:
FM = [(imc-amc)/imc] × 100
imc = number of ideal man power for tourism sustainable management.
amc = number of existing man power
For data analysis and interpretation from the field and the expert opinion survey, MS Excel and SPSS-20 were used.

Results and Discussion

Sustainability assessment

Ranking of relevant indicators for each indicator under each environmental component provided the crucial first tier platform for assessing the carrying capacity. The total carrying capacity impact unit for ecological aspect as resulted from the step-by-step methods of estimation and calculation was 95.5 percent or 0.955 (Table 2). The sign '+' and '-'as notation to each indicator showed the positive or negative impact due to activity. The CCIU analysis of indicators for social, facility/ infrastructure and economic aspect were obtained to be 97.03, 93.5 and 95.5 percent, respectively. Thus, signifying that the most effected component among the four of the ecotourism site due to tourism activities was facility carrying capacity, which has been cut by approximately 7.0 percent considering if a total undisturbed condition is 100 percent. Considering the negative impacts under the facility carrying capacity component, the major area to focus while constituting sustainable development of the area will be a solid waste accumulation and littering problem due to leftovers by the visitors. The results are in corroboration with the findings of Sharma (2016) [9] who assessed the total tourism carrying capacity with regard to tourism activities in Kerwa catchment area of Madhya Pradesh and indicated that that the most effected component due to tourism activities was visitors' experience carrying capacity.

Table 2: Indicator quality unit and carrying capacity impact unit of different carrying capacity components

Impact Indicators	IQU	PIU	CCIU	RII
Ecological				
Solid Waste accumulation and littering (-)	0.90	15.12	13.61	0.87
Road degradation and vehicular traffic (-)	0.90	10.46	9.41	0.83
Noise generation and pollution due to activities (-)	0.90	9.23	8.31	0.85
Tourism has enhanced scenic beauty (+)	0.98	12.04	11.79	0.83
Promoted cleanliness and hygiene (+)	0.98	17.09	16.75	0.7
Encourages conservation of woodlands and wilderness areas (+)	0.99	18.12	17.94	0.78
Total carrying capacity impact unit for ecological aspect	95.50			
Social				
Enhanced functioning of local governing institutions (+)	1.00	18.16	18.16	0.76
Facilitated contact with the outside world/ culture sharing (+)	0.99	17.70	17.70	0.82
Tourism has helped in preserving local art and culture (+)	0.99	28.94	28.94	0.84
Total carrying capacity impact unit for social aspect	97.03			
Facility				
Water or other natural resource scarcity (-)	0.99	30.0	30.0	0.77
Site congestion or loss of aesthetic appeal (-)	0.90	18.2	18.2	0.80
Total carrying capacity impact unit for facility aspect	93.53			
Economy				
Tourism has created more jobs for the local people (+)	1.00	17.07	17.07	0.85

Responsible for additional income (+)	1.00	32.26	32.26	0.87
Has improved standards of living of the residents (+)	0.92	28.90	28.90	0.87
Total carrying capacity impact unit for economy aspect	95.51			

The Relative Importance Index (RII) was computed for each sustainability indicator to identify the most significant one among the receptivity, capacity and compliance criteria. The importance index of each cause was calculated as a product of both frequency and severity indices of each factor. The present study thus provided the set of indicators that will help to recognize on-going problems and purpose corrective actions and pin-pointing negative impacts under each component which hinders the development of tourism activities. But overall, the result so obtained ensures that each component carrying capacity is in its healthiest state accordingly to the standards set for the study lies in the low impact on carrying capacity category. The results are in accordance with the findings of Shah *et al.* (2014) [8] who identified and ranked the key factors affecting the project level productivity in the construction industry.

Carrying capacity of the ecotourism sites

To evaluate the carrying capacity for tourism development in the study area, ecological capability and suitability of the area for outdoor recreational use was defined.

Utilizing TCC model to define the carrying capacity of ecotourism site in three levels:

Physical Carrying Capacity

Area suitable for tourism (A)

Location of the study site was 20266 m^2 that area suitable for tourism (A) for intensive recreation was 17834 m^2.

Appropriate space for displacement of tourists (V/a)

This was considered as a space the visitors need to be able to move without encountering other persons. For each visitor in the site, the pertinent space was considered as 10 m^2.

Time required for each visit during a year

It was calculated through dividing the amount time usable in day for visitors on the mean time of a visit.

Duration of usability of the site

The number of visit hours per day on site, considering the limited tents in the area was not more than 24 hours.

Visit duration

Thus, the duration for the ecotourism site visit was 24 hours and average time required by tourists for touring and visiting various attractions of the region and resting was about 9 hours which represents the maximum number of hours to visit the area by tourists. This will decrease the tourist carrying capacity in the study site.

Physical carrying capacity according to the formula is as follows

Person per day

PCC = 17834 × (1/10) × (24/9)
= 4755.7

Person per year

PCC = 4755.7 × 365
= 1735842.6

According to the estimation of carrying capacities, firstly for estimating the physical carrying capacity, the appropriate area for tourism was considered as 17834 of Pine Eco hills ecotourism site with class two intensive use capabilities. Then, the tourist dislocation optimum space was considered as 10 m^2 of site for each person. Also in this report the number of visits or duration of usability of study site per day is 24 hours tourist presence in the area. According to the field visits of the tourists, duration of visit or mean time required by tourists to tour and visit was considered about 9 hours. Thus physical carrying capacity of study site forest was estimated as 4755.7 persons/ day.

Real Carrying Capacity

Limiting factor- the number of rainy days

From 365 days of the year, in average about 196 days in the site are rainy when tourism activities are actually impossible for ecotourism.

CF = (196/365) × 100
= 53.7

Limiting factor - the number of frost days and cold days

Among 365 days of year, in average about 89 days in the site are frost and winter days.

CF = (89/365) × 100
= 24.3

Limiting factor - the number of very hot days

Of 365 days in a year, in average about 25 days have very hot sun.

CF = (25/365) × 100
= 6.84

According to the set of achieved CFS, real carrying capacity of study site was estimated as follows:

Person per year

RCC = 4755.7 × [(100-53.7)/100] × [(100-24.3)/100] × [(100-6.84)/100]
= 4755.7 × (0.463) × (0.757) × (0.9316)
= 1552.8

Person per day

RCC = 1552.8 × 365
= 566778.8

Then to estimate the real carrying capacity, the limiting factors, including the number of rainy days, the number of frost/cold days, the number of very hot days/ year were multiplied in physical carrying capacity. According to the formula, real carrying capacity was estimated as 1553 persons/day. As expected, taking the limiting factors and its influence on the Physical Carrying Capacity (PCC), Real Carrying Capacity (RCC) will be under estimated compared to the value calculated in the Physical Carrying Capacity.

Effective Carrying Capacity

This type of capacity is known as the maximum visitors of a place the available management has the ability to handle them

sustainable. To study the effective carrying capacity the management capabilities in the region were used. These capabilities are divided to two parts:

Man power capacity

FM = [(10-3)/10] × 100
= 70

Expenditure budget capacity

Personnel costs: In studying the expenditure budget rate of the area, according to the interview performed to the experts of the ecotourism site, at present the salary of the workers, it is estimated at 10 lac rupees per year.

Investment costs

Consumption costs per year

Electricity	:	40000 rupees
Water	:	25000 rupees
Food	:	75000 rupees
Fuel	:	25000 rupees
Waste management	:	10000 rupees

Effective carrying capacity

Person/ day

FM = [(175000-100000)/175000] × 100
= 42.86

Person/ year

ECC = 566778.8 × [(100-70)/100] × [(100-42.86)/100]
= 97157.22

Finally, the effective carrying capacity of study site was estimated through the management capabilities including man power capacity and expenditure budget capacity and by multiplying it in the real carrying capacity, effective carrying capacity with 43 persons/ day was achieved (Fig 1).

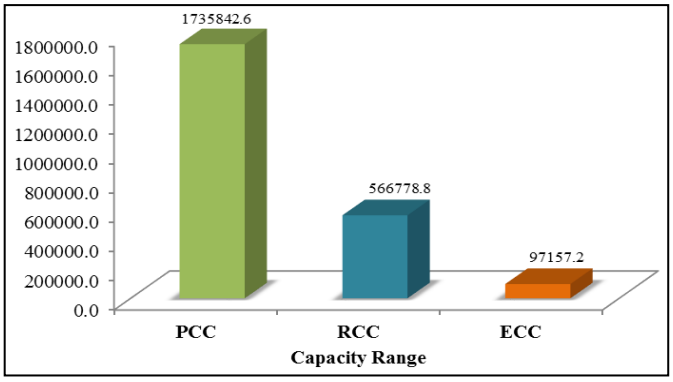

Fig 1: Comparison between Physical, Real and Effective Carrying Capacity of the study site

Finally, taking the management capabilities in the Chewa ecotourism site, effective carrying capacity i.e. the number of person management site has the ability to provide service for the tourists, which was underestimated compared to the real carrying capacity. Also the visual observation performed in the area and according to the study on available facilities, it was apparent that there were service facilities and infrastructures as well as suitable manpower for management and providing tourism services. Therefore, effective carrying capacity is in a good level. However, there was lack of suitable communication network in the area for easy access of tourists to the forest lands which decrease the usability hours of this area. The lack of on-site water availability also indicated a problem about abstraction from groundwater which could be worsened by an increase in the number of tourists visiting the area. Similar studies on the effective carrying capacity have also been conducted by Lagmoj *et al.* (2013) [5] who concluded that effective carrying capacity was in low range due to lack of required facilities and infrastructures as well as manpower for management and providing tourism services for tourists in Khorma Forest, Iran.

Conclusion

The study clearly illustrated that the carrying capacity of Chewa ecotourism site is still in its infancy stage as the decrease in the percentage due to tourism activities is under low impact category set. The current total perceived decline in carrying capacity that measures for the tourism activities was found to be 97 percent with a slight decline of 3 percent from the original. The results therefore obtained can be used as a benchmark for the further evaluation and analysis of the tourism area over a period of time. The site offered a natural landscape of forest lands, climate, with calm atmosphere which attracts the tourists to this tourism area and appropriate tourists facilities expedited to sufficiency of carrying capacity in this regard. It is worth mentioning that effective carrying capacity can further be improved through suitable planning to provide the required infrastructures, facilities, services and skilled man power.

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