# ASSESSMENT OF ENVIRONMENTAL IMPACT OF TOURISM ACTIVITY AT SITABANI TEMPLE OF JIM CORBETT TIGER RESERVE

[1]Parmendar Singh, [2]Vijay Shridhar, [3]Kusum Arunachalam
[1]Junior Research Fellow, [2]Assistant Professor, [3]Professor & HOD
School of Environment & Natural Resource (SENR)
Doon University, Dehradun, India

**Abstract:** Sustainable eco-tourism policies should be implemented to gain maximum benefit from the tourism activities so that minimal environmental impact should be observed. This study was aimed to assess the impact of tourism on the day of Mahashivratri in Sitabani temple area that is open for one day in a year for public use and observing significant number of tourists at the study site. The present work involves the estimation of carrying capacity and Carbon-di-oxide emission from burning of fossil fuel and fuel wood. The result unveils the actual number of visitors visiting this temple that is much higher than the real carrying capacity of the area. The number of tourists visiting the site was 10000 in the year 2017 and 12000 in the year 2018 in a single day where as the real carrying capacity of the area is 5560 visitors/day. The results show that after 6 hours of fuel burning within the opening time period of the temple, the $CO_2$ emission was found to be significant with 754.185 kg in 2017and 891 kg in 2018. The emission from diesel generators was 23.04 kg and 30.72 kg in year 2017 and 2018 respectively. Thus, it is concluded that holistic approach with balance between positive and negative aspect should be considered and sustainable tourism industry should be developed.

**Key words:** Tourism; Carrying capacity; Emission; fossil fuel; fuel wood; diesel generator

## I. INTRODUCTION

Initially in the human development tourism was for religious matter but now tourism has itself became religion. It is vast area exploring new dimensions. It brings a sense of enjoyment and happiness among people as human has always seems to be dazzled towards nature. The purpose of it has always been different for different place and people. It can be for business, education medical, leisure and recreation. Earlier at the time of human evolutiontravelling to new places was for searching natural resources required for human population survival, there after it became idea of exploration business and recreation activities. This has made tourism an industry experiencing constant growth and finding new diversified area not explored earlier.

Tourism is globally recognised economic activity and is one of the sectors contributing significantly to the global economy (World Trade Organization, 2016). According to world tourism organization 1323 million people travelled in 2015 compared to 25 million in 1950. It has global impact on economy contributing upto 10.4% in the global GDP, generating 9.9% of global employment directly or indirectly and has generated $1/5^{th}$ job in this sector in the last decade. It has uttermost share in GDP of many countries like Macau (43.9%), Maldives (41.5%) Aruba (28.6%), Seychelles (21.3%) (Nag, 2018).Some of the counties enjoy status of being hub of spiritual tourism, attracting huge number of tourists from the global much higher than their own population like Saudi Arabia and Vatican. According to UNWTO it was estimated that 300-330 million people travelled various religious sites in each year. Saudi Arabia attracted 14.3 million people in 2012 (The World Bank, 2018)and 4.3 million people visited Vatican City alone for their religious faith. It is one of the largest service sectors in India, which is contributing 6.23% in the total GDP of the country along with 8.78% share in the total employment. India observesarrival of more than 5 million foreign and 562 million domestic tourists annually. Tourism industry generated approximately100 billion USD in 2008 and is expected to rise 275.5 billion USD with annual growth rate of 9.4%. The campaign like “Incredible India” developed by the Ministry of Tourism nodal agency for developing policies for the promotion of tourism in India. (Indian Mirror, 2019)

Tourism in India is mainly composed of domestic peopletravelling for religious and pilgrimages purpose. Many religious philosophies of Hinduism, Buddhism Islam and Sikhism are rooted in India. Even more, these religious philosophies give multiple religious denominations through the divine and philosophical messages separately far from the centre (UNWTO, 2011).Approx every part of India is centre of some or the other religion popular in the country. Like Dharmasthala Jain temple in Karnataka, Christian churches like Se Cathedral and Santa Cruz Basilica in Goa, Buddhist centres like Mcleodganj in Himachal and Mahabodhi in Bihar, Parsis temple Iranshah Atash Behram in Gujarat, Islamic center Azmer Dargah in Rajasthan, Hazrat Nizamuddin in Delhi, Hazi Ali Maharashtra Hindu temples Sabrimala in Kerela, Balaji in Rajasthan, Puri temple in Orissa, Gaya in Bihar, Sidhhivinayak in Maharashtra, Kedarnath, Badrinath, Yamnortri, Gangotri, also other four Kedar temples and many more places all over the India.

Uttarakhand state is a unique tourist destination with excellent opportunities for development of a diverse range of products involving nature, spirituality, adventure, leisure etc. to satisfy a tourist 's desire. Uttarakhand state promotes spiritual tourism through its religious diversity and heritage (Phukan, 2014).Uttarakhand is also centre of many Hindu Shrines like Badrinath and Kedarnath attracting huge number of tourists throughout the country.Number of tourists visited in Uttarakhand in 2000 was 11.37 million which increased to approx. 37 million and is expected to rise around 71 million in 2028 (Uttarakhand Tourism Policy, 2017). Although economic impact of tourism is positive but not uniform in terms of societal and environmental impact (Huttasin, 2008).

It depends heavily on an authentic socio-cultural environment and an unspoiled natural environment (Holden, 2000). But unlike most other industries, tourism is essentially based on a good environment that should be preserved for developing tourism, and therefore this sector should concern about proper protection, preservation and further development of nature, in its own interest (Williams & Shaw, 1999).It is now a major area of concern to academicians, Government, industry and public at large. It is significant not just because of the enormous impact it has on people's lives and on the places in which they live, but it is significant because of its size – in terms of the number of people traveling, employment, income generation both in the home & host economies and its environmental impact (Naveenchandra, 2015). This is very logical to assess the direct and indirect impact of tourism on societies. It is mean of promoting territorial resources but it also driving forces that will also affect natural environment of the area, increase in demand of natural resources, effecting species diversity and increase in the suffering from pollution of different types (Mihalic, 2000). In initial days tourism in India was mostly for fulfilling religious faith. Visitors who goes to holy places as pilgrims were humble sensitive and had respect for nature and local inhabitant of the area. In return they were welcomed with open heart with all assistance and cooperation. In that case there was nothing ineliminable that may have tantalized resentment from the denizens. But in the present tourism attitude is different.

The exponential growth of touristnumbers and their spread to previously quite remote regions of the world has highlighted the potentially paradoxical character of nature-based tourism (Petrosillo et al., 2006). It generates land degradation, air and noise pollution, littering, trampling and the alternation of ecosystems (Mason, Tourism Impacts, Planning and Management, 2008). It can lead to pollution of water resources and damage/disturbances to the wildlife habitat (Mason, Tourism Impacts, Planning and Management, 2003).

Impact of touristic activities in the undisturbed areas are change in land use land cover, unplanned urbanization and new actors come into play by acquiring land, changing pace of resources exploitation, creating infrastructure for increasing accessibility, an increase in volume of tourist so does the production of waste, and an amplification of local inequality (Drumm & Moore, 2005); Cañada & Gascón, 2007; López & López, 2008). It has also been analyzed in some places that tourist some time deliberately or unknowingly generate large amount of waste in the area thus possessing a threat to wild animals. (Archer, 2005).

The present research work is based on rigorous survey work undertaken to observe the number of visitors, identify the impact of increasing tourism activities in and around Sitabani zone near Corbett Tiger Reserve (CTR) and assess the tourism carrying capacity of Sitabani temple. The ultimate aim is to provide an indicator of the devastating impact of insensitive and unsustainable tourism on wildlife.

## II. STUDY AREA

### 2.1 Corbett Tiger Reserve: Sitabani zone

#### 2.1.1 Geography and climate

The study was conducted in Sitabani zone of Corbett Tiger Reserve. The Corbett Tiger Reserve is situated at the foothills of the Western Himalayas in the civil district of Nainital and Pauri Garhwal in Uttarakhand, India at Latitudes 29.4074°N - 29.4078°N and longitude 78.2156°E - 78.2160°E. The altitude of the region ranges between 360 m (1,181 ft) and 1,040 m (3,412 ft). The temperature may vary from 5 °C (41 °F) to 30 °C (86 °F) during the winter and some mornings are foggy. Summer temperatures normally do not rise above 40 °C (104 °F). Rainfall ranges from light during the dry season to heavy during the monsoons.

#### 2.1.2 Natural vegetation and current land uses

The area of the National Park was increased from 323.75 $km^2$ to its present size of 520.82 $km^2$ in 1966 (Bisht et al, 2016). The area of the Reserve was further increased to 1288.32 $km^2$ by adding 301.18 km2 of Sonanadi Wildlife Sanctuary and the remaining 466.32 $km^2$ as buffer area. The vegetation in these western Himalayan foothills consists mostly of dry and moist deciduous forests dominated by sal tree, scrub savannah and alluvial grasslands. Based on visual interpretation of (IRS 1B/LISS II/ FCC, 1994) remote sensing data, 13 types of vegetation classes have been documented in CTR (Pant and Chauhan, 2000). The CTR is rich in faunal diversity, with 50 species of mammals, 575 species of birds, and significant tiger and elephant populations (Chape et al., 2003).

Sitabani zone falls in Nainital district of Uttarakhand and has geographical and ecological characteristics of the Sub-Himalayan belt. It comprises an entire hill of the Kumaon Himalayas and is flanked on three sides with dense Sal forest connecting it to the famous Jim Corbett National Park. To the north, it is connected to the Oak and Rhododendron Himalayan mountain forests of Nainital forest division and the western boundary is etched by a sub-tributary of the Kosi river. Broadleaved deciduous forest, riverine vegetation, scrubland, grassland form a varied topography inhabited by rare wildlife. The reserve gets above 600 species of resident and migrating birds throughout the year. Being a part of the trans-Himalayan birding corridor, the reserve gets both plain and mountain birds during latitudinal and altitudinal migration patterns. (Sitabani Wildlife Reserve, 2019). The forest and Sitabani temple are located around 10 kms and 22 kms away from Ramnagar. It is well known for elephant and jeep safari and there is constant migration of wildlife in between Sitabani and the adjacent Jim Corbett National Park. The accommodation consists of tents, forest rest houses and hotels in Ramnagar.

**2.1.3 Walking trails in the Sitabani temple**

Religious tourism is one aspect of tourism industry, which has spiritual attachment with the destination. Temple is one of architecture of national importance conserved by Archeological Survey of India. Sitabani temple is located in Jim Corbett Tiger Reserve having religious importance and beliefs. The temple is the most popularly visited site of the CTR. It has the length of 200 meters and can be visited by the tourists without guide and park officials. The major attraction of the site is its religious importance and it is located in between the buffer zone of Corbett Tiger Reserve.

## III. METHODOLOGY

Present study site was selected because of the presence of significant human activities in small area of about 4000 $m^2$ .The study was conducted on Mahashivratri on 24 February 2017 and 13 February 2018. The duration of the field study was short as temple is open for one day throughout the year. A questionnaire-based primary and secondary survey was conducted to collect data through structured interviews and personal observation methods. The survey respondents include the shopkeepers and tourists. Tourist respondent were asked about their vehicle types, fuel consumption rate, total time required for coming to the temple for worshiping and going back. Shopkeepers were interviewed about the type and amount of fuel consumed in their activity. In this study carrying capacity of the area, carbon emission from the fuel wood burning, green house gas emission from the diesel generators and emission from vehicles were estimated.

### 3.1 Tourism Carrying Capacity (TCC)

Carrying capacity is the number of individuals those can be supported in a defined area within the limits of available natural resources and with degrading cultural, economic, natural and social environment of the place (The Global Development Research Centre, 2019). Middleton and Hawkins (1998) defined as, level of anthropogenic activity which can be accommodate without deteriorating the area or adversely affecting the native community or the quality of visitors experience declining.
According to (World Tourism Organization (UNWTO), 2017) TCC can be defined as, the maximum number of individuals that can visit a tourist place in a same period of time, without destructing physical, economic, socio-cultural environment and an unacceptable decline visitor's satisfaction.
In this paper, tourist carrying capacity is calculated as physical carrying capacity (PCC) and real carrying capacity (RCC). The relationship between PCC & RCC shows PCC is always greater than RCC (Arias, et al., 1999).To estimate of the PCC and RCC, following assumptions were made:
To measure PCC of Sitabani temple area, following criteria are considered:

1. Visitors going along the track connecting the entry point and Sitabani Temple.
2. A person requires a minimum 1 $m^2$space to move freely.
3. The mean time needed is 2.5 hours for people coming by vehicle and 3.5 hours by walk. For this study average time of 3 hours has been used.
4. The open hours to visitors in Sitabani temple are from 8:00 to 16:00 hours i.e. 8 hours a day only on day of MahaShivratri.

### 3.2 Physical Carrying Capacity (PCC)

It is the maximum number of tourists that an area can actually be able to support. In this case it is the maximum number that can fit on the site at any given time and still allow people to be able to move freely (Mowforth and Munt, 2015).
The physical carrying capacity is the maximum number of visits that is possible to admit during a day.

$$PCC = A^* V/a^* RF \quad (3.2)$$

Where; A is available surface, V/a is the area used per person (i.e. 1 $m^2$) and RF is the rotation factor i.e. number of times the site can be visited in each day. RF = Hv/Tv. Where: Hv: Opening period, Tv: Average time of visit

**3.3 Real Carrying Capacity (RCC)**

The real carrying capacity is the maximum number of visits that is possible after applying a series of correction factors to the PCC. These factors are defined according to the characteristics of the site, considering physical, ecological, social and managerial variables (Arias, et al., 1999). To determine each of the factors field surveys were accomplished. The correction factors considered for this study were:

(i) Effective sunshine hour
(ii) Erodibility

The general equation applied was:

$RCC = PCC * 100 - CF_1/100*100-CF_2/100*...100-CF_n/100$ (3.3)

Each correction factor was calculated applying the next equation

$CF = (M1/M2) * 100$

$CF_1$-$CF_n$ are the corrective factors, they are expressed as a percentage

M1 = limiting magnitude of variable

Mt = total magnitude of variable

**3.4 Carbon Emission from fuel wood combustion**

Fuel wood has been under use in different shop in the area. To assess carbon content of the wood burning using Juwarkar et al. 2011 estimate that 50% of biomass in any tree species is considered as stored carbon component i.e. half of the biomass is called as carbon storage of the trees.

Carbon Sink (Kg or tons) = Biomass x 0.5 C. (3.4)

Carbon-di-oxide ($CO_2$) generation after combustion of Carbon present in the wood was done using molecular weight formula method i.e. 12 gram of carbon produce 44 gram of $CO_2$. That means 1 gram of carbon will produce 3.67 gram of $CO_2$.

**3.5 Carbon Emission from Diesel generator**

Fuel consumption by generator totally depends on the quality of engine it has. Rated power by diesel generator was 2.0 KW. Reported range of emission factors in different literature was found to be around 2.4-3.5 kg $CO_2$/litre. In this study, 3.0 Kg $CO_2$/litre were used. Carbon emission in kg$CO_2$/day and kg$CO_2$/kWh was done.

## IV. RESULTS AND DISCUSSION

### 4.1 Total number of vehicles

Visitor and traffic congestion exist in many tourist destinations and national parks that have been greatly impacted by this problem. Based on the survey done, the total number of vehicles observed in Sitabani temple are 965 in 2017 which increased to 1107 in 2018 (Table 1). The mode of transportation observed at the study site were private vehicles, rental cars, tractors and buses which dictates the tourist's movements. The huge volume of traffic causes environmental impact like air pollution from vehicle exhaust and vegetation damage along over flow parking areas (Sidles et al, 1997) and social impacts that degrade the overall experience such as honking horns and blaring radios.

**Table 1: Total number of vehicles in Sitabani zone in 2017 and 2018**

| Type of vehicles | Number of vehicles in 2017 | Number of vehicles in 2018 |
|---|---|---|
| Two-wheeler | 600 | 700 |
| Three -wheeler | 80 | 85 |
| Four- wheeler | 250 | 280 |
| Truck | 5 | 8 |
| Tractor | 20 | 22 |
| Bus | 10 | 12 |
| Total | 965 | 1107 |

**4.2 Physical carrying capacity (PCC)**

This is maximum number of tourists that can be physically accommodated in a defined area over a duration (Lagarense, 2011). It is expressed as:

PCC = A* V/a * RF (4.1.1)

Where A = area available for public use

V/a = one visitor per meter square

RF = Rotation factor (number of visits per day)

To measure PCC of Sitabani temple area, following criteria are considered:

1. Vehicular movement and walking are only allowed for one day throughout the year
2. At least 2.5 hours is required for person travelling with vehicle and 3.5 hours are required for people coming by foot. The average visit time is 3 hours.
3. Temple is open for 8 hours and only one day i.e. on Mahashivratri of the year.

Total length of road from entry point (Teda village) to temple (Sitabani temple) = 21.0 km

$$\text{Rotation Factor (RF)} = \frac{\text{Opening Period}}{\text{Average time of one visit}} \quad (4.1.2)$$

$$\text{RF} = \frac{8}{3} = 2.66$$

**PCC = 4000*1*2.66 = 10640 (visits/day)**

**Correction factor applied on PCC for estimating RCC.**

**Erosion factor**

Total length = 21 km

Medium erosion = 5 km

Weighing factor = 2

M1 = 5*2 = 10 km

M2 = 21 km'

Cf1 = (10/21) *100 = 47.61

**Effective sunshine hours:**

Total years of sunshine hours = 365*8 = 2920

Cf2 = (8/2920) *100 = 0.27

It was noticed that the maximum number of visitors that the Sitabani temple can physically conserve is about 10640 persons per day and considering growing visit to the temple, the number of visitors in 2017 is about 10,000 persons per day that increased to 12,000 persons per day in 2018. It was also observed that the number of visitors visiting the site in 2018 exceed the maximum permissible number of visitors to the study area and it is about 1.12 times higher than the permissible number that is 10,640 (Fig 1).

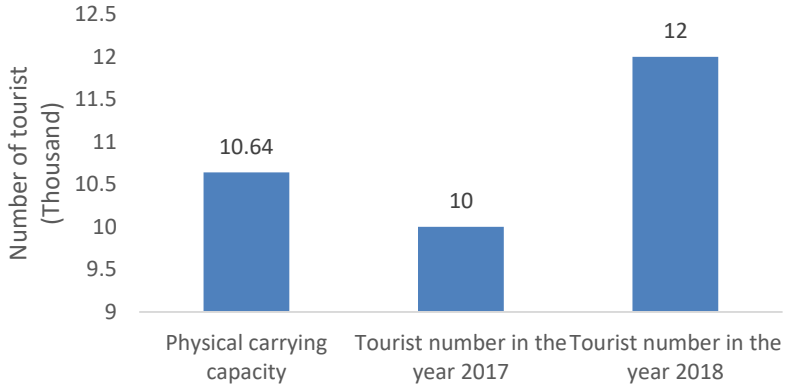


Fig 1: Permissible Versus Current Number of Visitors: A Comparative Analysis

The finding from the comparative analysis exhibits that there is some potentiality of causing environmental degradation and other negative environmental impacts such as: loss of biodiversity, changes in climate pattern even if it is open for only one day throughout the year.

### 4.3 Real Carrying Capacity

It is the maximum permissible limit of the visit to the site. To calculate the real carrying capacity, 2 corrective factors related to the climate conditions of Sitabani temple have been determined at first which includes effective sunshine hours and erosion factors.

$$RCC = PCC – Cf1 – Cf2……. Cfn \quad (4.2)$$

**RCC = 10640 * 100-47.61/100 * 100-0.27/100 = 5560 visit /day.**

It was estimated that the number of visitors is much higher than the real carrying capacity of the area. Carrying capacity of the area is not fixed, it can be increased with technological intervention. Carrying capacity of any area decreases due to environmental degradation caused by over population of the area, leading to shrinkage of carrying capacity leaving the place no longer to support even the number of people it was supporting earlier. No place can carry higher number of people for longer time then its carrying capacity (The Global Development Research Centre, 2019).

Carrying capacity of system can be expressed in many ways. Keeping multidimensional aspect of impact of tourism, it is necessary that different aspect of carrying capacity like natural and social system should be considered as discussed by researchers like Poskova, 2002; Saarinen, 2006. If tourism in anyhow depended on natural socio-cultural activities of the local inhabitant of the area, infrastructure for tourism development, these carrying capacities are labeled as physical carrying capacity, organizational carrying capacity, socio-cultural carrying capacity etc.

(Manning, 2002) concluded that in determination of carrying capacity of the area, it is the decision of management authority based on the target determined for conservation and protection of the natural environment. Saveriades, (2000) stated carrying capacity is not a scientific concept but it can be seen as possible limits which must be considered as guidelines. These guidelines can use to along with other supplementary measures to maintain and increase the carrying capacity with some technical and managerial inputs.

### 4.4 Carbon emission from fuel wood burning

During the study, it was found that total number of shops using fuel wood is 15 in 2017 and 18 in 2018, and the wood used throughout the day of operation is 27 kg for different purposes. (Traditional cuisines sold at Sitabani temple) (Table 2).

**Table 2: Total fuel wood consumption by shops in Sitabani Temple area in different years.**

| Year | No. of Shops | Wood Used/hour (kg) | Average (kg) | Wood used throughout day of operation (kg) | Total fuel wood used(kg) |
|---|---|---|---|---|---|
| 2017 | 15 | 4-5 | 4.5 | 4.6*6= 27 | 27*15 = 405 |
| 2018 | 18 | 4-5 | 4.5 | 4.5*6 = 27 | 27*18 = 486 |

Assuming 50% of fuel wood weight as carbon and 1 gram of carbon produces 3.67 gram of carbon-di-oxide. Considering complete combustion of fuel wood, carbon emission from burning of wood would be:

**Table 3: Carbon emission from per Kg of fuel wood consumed.**

| Year | Total fuel wood used(kg) | Carbon present in the fuel wood (kg) | Carbon emission per kg of fuel wood (kg) |
|---|---|---|---|
| 2017 | 405 | 405*0.5=202.5 | 202.5 * 3.67 = 754.185 |
| 2018 | 486 | 486*0.5= 243 | 243*3.67 = 891 |

With the help of this study, it was analyzed that fuel wood which is consumed during the opening period of temple emits carbon through fuel wood burning. The carbon emission per kg of fuel wood (kg) after 6 hours of operation is 754.185 kg of carbon in 2017 and 891 kg of carbon in 2018 in a single day (Table 3). Keeping in mind the environmental impact, the above calculated value may not be significant but considering 365 days of the year, it will be much higher to contribute in green house gas generation.

### 4.5 Carbon emission from diesel generator

#### 4.5.1 Diesel consumption by diesel generator

A Diesel engine set (a unit of diesel engine and governor) is a device which converts fuel (diesel oil) energy into mechanical energy in diesel engine and subsequently converts mechanical energy into electrical energy in a governor. The diesel engines are used for both stationary and mobile applications. Diesel engines currently find applications in most heavy-load mobile and in many stationary power-generation units, because of their high torque output, size flexibility, durability and fuel efficiency.

The efficiency of diesel generator depends on its thermal and mechanical efficiency of the generator. Thermal efficiency is dependent on diesel oil quality. The mechanical efficiency that is around 80-85% for diesel engine and electrical generator efficiency that is around 95-98%.

**Table 4: Fuel consumption and carbon footprint of diesel generator in the year 2017 and 2018**

| Year | Power of diesel generator | Number of generators | Efficiency | Fuel consumption | | Total fuel consumption | | Carbon footprint $CO_2$ emission | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Liters/day | Liters/ Kwh | Liters/ day | Liters/ Kwh | Kg/day | Kg/Kwh |
| 2017 | 2.0 | 3 | 0.52 | 2.50 | 0.42 | 7.68 | 1.26 | 23.04 | 3.78 |
| 2018 | 2.0 | 4 | 0.52 | 2.50 | 0.42 | 10.24 | 1.68 | 30.72 | 5.04 |

During the analysis, it was observed that $CO_2$ emission from diesel generator used in the Sitabani temple was found to be 23.04 kg $CO_2$/day in 2017 and 30.72 kg CO2/day in 2018. The estimated energy cost by burning fuel would be 460.8/day in 2017 and 614.4/day in 3 hours of operation which is much higher than the current tariff in the state of Uttarakhand along with emission of $CO_2$ by diesel burning.
Therefore, electricity power should be considered (as this place already has 24*7 power supply), in place of fuel wood and diesel generator which is much cheaper, and pollution free compared to this mode of operation. (Table 4).

## V. CONCLUSION

Due to its religious importance, Sitabani temple is one of the most attractive destinations in Jim Corbet Tiger Reserve and a huge number of pilgrims visit this destination during Mahashivratri once a year. In the light of the many tragedies at pilgrim destinations in India on certain religious occasions in the recent past, the importance of assessing the carrying capacity of site for more scientific sustainable tourism management and development is essential. The local administration should monitor the site for the proper management of the site.A holistic approach must be considered while assessing the affect of tourism in any region. Assessment should not only be focused on monitory terms but also on affect it had on socio-cultural and environmental terms. More effort should be made to assess the total cost of development of tourism as an industry due to its dependence on natural resources of the area. Relation between tourism and nature should be much more balanced. Approach should be adopted considering the carrying capacity of the area and resources it going to be utilized by tourism sector whose over exploitation will cost much. A hanging approach looping between both positive and negative should be considered for sustainable development of tourism activities.

## ACKNOWLEDMENT

The research was funded by G.B. Pant National Institute of Himalayan Environment & Sustainable Development, Almora under the project National Mission on Himalayan Studies and is supported by Doon University, Dehradun.

## REFERENCES

1. (2011). *UNWTO.* Madrid: World Tourism Organization.
2. Archer, D. (2005). Fate of fossil fuel CO2 in geologic time. *Journal of geophysical research, 110*.
3. Arias, M. C., Mesquita, C. A., Méndez, J., Morales, M. E., Aguilar, N., Cancino, D., . . . Turcios, M. (1999). *Capacidad de Carga Turística de las Áreas de Uso Público del Monumento Nacional Guayabo,Costa Rica*.
4. Drumm, A., & Moore, A. (2005). *Ecotourism Development : A Manual for Conservation Planners and Managers: An Introduction to Ecotourism Planning* (2 ed.). (A. Singer, Ed.) Nature Conservancy.
5. Holden, A. (2000). Winter tourism and the environment in conflict: The case of Cairngorm, Scotland. *international Journal of tourism Research, 2*(4), 247-260.
6. Huttasin, N. (2008). Perceived Social Impacts of Tourism by Residents in the OTOP Tourism Village, Thailand. *Asia Pacific Journal of Tourism Research, 13*(2), 175-191.
7. *Indian Mirror*. (2019). Retrieved from http://www.indianmirror.com: http://www.indianmirror.com/indian-industries/tourism.html
8. Juwarkar, A. A., Varghese, A. O., Singh, S. K., Aher, V. V., &Thawale, P. R. (2011). Carbon sequestration potential in aboveground biomass of natural reserve forest of Central India. *International journal of agriculture: Research and Review, 1*(2), 80-86.
9. Lagarense, B. E. S. (2011). Stakeholder Involvement in Waterfront Planning and Development in Manado, Indonesia.
10. López-Bonilla, L. M., & López-Bonilla, J. M. (2008). La capacidad de cargaturística: revision crítica de un instrumento de medida de sostenibilidad. *El periplo sustentable, 15*, 123-150.
11. Mason, P. (2003). *Tourism Impacts, Planning and Management.* Burlington, MA, US: Butterworth Heinemann.

12. Mason, P. (2008). *Tourism Impacts, Planning and Management.* New York, USA: Routledge.
13. Manning, R. E. (2002). How Much is Too Much? Carrying Capacity of National Parks and Protected Areas. *Monitoring and Management of Visitor Flows in Recreational and Protected Areas*, (pp. 306-313).
14. Middleton, V. T., & Hawkins, R. (1998). *Sustainable tourism: A marketing perspective*. Routledge.
15. Mihalič, T. (2000). Environmental management of a tourist destination: A factor of tourism competitiveness. *Tourism management*, *21*(1), 65-78.
16. Mowforth, M., & Munt, I. (2015). *Tourism and sustainability: Development, globalisation and new tourism in the third world*. Routledge.
17. Nag, O. S. (2018, June 7). *World tourism atlas*. Retrieved from www.worldatlas.com: https://www.worldatlas.com/articles/10-most-visited-countries-in-the-world.html
18. Naveenchandra, C. B. (2015). *Shodhganga.* Retrieved from http://shodhganga.inflibnet.ac.in: http://shodhganga.inflibnet.ac.in/handle/10603/97098
19. Pásková, M., Zelenka, J. (2002). Výkladový slovník cestovního ruchu. Praha: Ministry of Regional Development.
20. Petrosillo, I., Zurlini, G., Grato, E., &Zaccarelli, N. (2006). Indicating fragility of socio-ecological tourism-based systems. *Ecological Indicators*, *6*(1), 104-113.
21. Phukan, H. (2014). A Study on Tourism Logistics in the Spiritual Sites of Haridwar and Rishikesh in Uttarakhand. *International Journal of Emerging Technology and Advanced Engineering*, *4*(9), 165-170.
22. Saarinen, J. (2006). Traditions of sustainability in tourism studies. Annals of tourism research, 33(4), 1121-1140.Research, 33(4), pp. 1121-1140.
23. Saveriades, A., 2000. Establishing the social tourism carrying capacity for the tourist resorts of the east coast of the Republic of Cyprus. Tourism Management, 21(2), pp. 147-156.
24. Sidles, Darla. (1997). Changing the Way People Use Parks. Natural Resource Year in Review, Planning and Preservation. National Park Service. [On-line], Available: www1.nature.nps.gov/pubs
25. *Sitabani Wildlife Reserve*. (2019). Retrieved from http://www.sitabaniwildlifereserve.com: http://www.sitabaniwildlifereserve.com/index1.html
26. *The Global Development Research Centre*. (2019). Retrieved from www.gdrc.org: https://www.gdrc.org/uem/footprints/carrying-capacity.html
27. *The World Bank*. (2018). Retrieved from www.worldbank.org: https://data.worldbank.org/indicator/ST.INT.ARVL?locations=SA
28. *Uttarakhand Tourism Policy*. (2017). Retrieved from http://uttarakhandtourism.gov.in: http://uttarakhandtourism.gov.in/sites/default/files/tenders/document/uttarakhand-tourism-draft-policy-2017.pdf
29. Williams, A. M., & Shaw, G. (1999). *Tourism and Economic Development: European Experience, 3rd Edition.* Europe: Wiley.
30. *World Tourism Organization (UNWTO).* (2017). Retrieved from www.unwto.org: http://cf.cdn.unwto.org/sites/all/files/pdf/a22_10_i_b_report_on_the_international_year_of_sustainable_tourism_for_development_2017_en.pdf
31. *World Trade Organization*. (2016). Retrieved from www.wto.org: https://www.wto.org/english/res_e/booksp_e/anrep_e/anrep16_e.pdf