

## Ecological and Economic Impacts of River Based Recreation in River Ganga, India

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**Abstract:** The present study was carried out between 36 Km stretch of River Ganga from Rishikesh to Kaudiyala in Uttarakhand state of India to understand the ecological impacts of river rafting and camping on the adjoining forests and economic growth within the area. This article has largely relied on field survey for vegetation analysis, wildlife survey, structured questionnaire for economic survey and secondary data collected from different government departments. It is interesting to note that number of camping and rafting agencies have increased from 27 in 2004 to 105 in 2008-09 and number of tourist have also increased from 17063 in 2004 to 76368 in 2009-10. Findings indicate some negative ecological impacts of river rafting and camping and the positive impact on local economy. Negative ecological impacts include damage to nearby forests and disturbance to wildlife, while improvements in local economy has come through income generation and employment opportunities to local people

**Key words:** River rafting • Camping • Ecological impacts • Economy

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### INTRODUCTION

Informal studies of recreational impacts on the environment across the globe had been conducted occasionally since at least 1920's [1]. It was not until the 1960's that more rigorous recreation ecological studies were conducted. By 1980's, research was accumulating on disturbance of animal species by recreational activities [2]. Despite hundreds of studies worldwide, little progress has been made in generalization and formulating principles regarding recreational impacts on the ecology and economy. The share of mountain based recreation in the global tourism market has been estimated in the range of 15-20% which generate between 70 and 90 billion US \$ per year. Hiking, camping, rafting, mountain biking, wildlife viewing and other forms of non-consumptive recreations are in great demand [3]. On the other hand, ecologists, social and NGO activists are voicing concerns in terms of ecological and environmental impacts on the surrounding areas due to these activities. Tourism attracts people into an area of exceptional history, beauty and grandeur. Hence, it means an inflow of people that includes (i) tourists, (ii) investors/entrepreneurs, (iii) artisans and (iv) jobseekers. As a result, there is increased congestion as

more residential and commercial establishments are built. An area limited in size then struggles to support the ever-increasing number of people. With increased population and infrastructure, a settlement once pristine and fresh starts to become degraded [4]. Studies in Nepal have shown that tourism of any kind does not necessarily lead to economic development and conservation of nature unless this industry is linked with poverty alleviation, environmental conservation and regeneration and the empowerment of the local communities [5]. The river rafting and camping has promoted economic activity, increased the use of local resources (rivers and forests) and helped in infrastructure development but people in India associated with these activities have paid no attention on ecological impacts around the area. Very few studies [6, 7] related to river rafting and camping in USA and India in terms of ecological, economic and social impacts have so far been carried out, but none of them have investigated total impacts on the area.

Recreational services like river rafting and camping have been classified as intangible but they are nonetheless highly valued in terms of ecotourism by people in all societies [8]. The present study deals with the river rafting and camping which is being conducted



Fig. 1: Study area map showing the Rishikesh- Kaudiyala stretch of river Ganga

with private sector participation under the guidelines of Ministry of Environment and Forests, Government of India along the Ganges from Rishikesh to Kaudiyala. River rafting and camping started in 1990's when two sites were established: Shivpuri to Kaudiyala and Byasi by Garhwal Mandal Vikas Nigam (GMVN), which is a public sector undertaking. In addition to these two sites, privately owned companies also established two other camping sites one at Brahmpuri and other at shivpuri during the 90's. The government of Uttar Pradesh gave formal permission for the establishment of temporary camps along the river in 1993. The Ministry of Environment and Forests expressed their opinion that camping does not cover the purview of the Forest conservation Act and is an ecotourism activity. The Ministry of Environment and Forests further states that it is necessary to have a management plan for this area to lay down guidelines to

regulate camping [9]. The objective of this study was to assess ecological and economic impacts of the river based recreation.

**The Study Area:** The Study area is located in the Garhwal region of Indian state of Uttarakhand which lies between  $30^{\circ} 4' 27''$  N -  $30^{\circ} 7' 23''$  N and  $78^{\circ} 29' 59''$  E -  $78^{\circ} 18' 51''$  E between Rishikesh and Kaudiyala along the Badrinath National Highway number 58, surrounded by broad leaf forest of sal (*Shorea robusta*) and covers a road distance of 40 km and river distance of 36 km. Study area map is given in the fig. 1.

**Methodology:** There are two sides of any development activity, positive impacts and negative impacts. In this study positive impacts include: creation of employment, generation of revenue (both to government as well as raft

and camp owners) and negative impacts include: loss of standing tree volume and decline in the population of wildlife. Benefits from any development activity can be easily measured in terms of economic indicators like generation of employment and revenue. Because the course of river rafting and camping is surrounded by forests and wildlife, which are measurable indicators, therefore these indicators were selected to see ecological impacts of river rafting and camping on the adjoining areas.

**Floral Study:** For measuring the ecological impact of river rafting and camping on vegetation of the adjoining forest areas, a floral study was carried out. A total of seven transects were laid in the entire study area. Each transect had a length of 1000meters from the rafting and camping site in increasing altitudinal gradient and 200-300 m around rafting site. Transects were spatially distributed so as to minimize the autocorrelation among the vegetation. In each transect five quadrats (each of 10mx10m) were laid at 200 m interval along the altitudinal gradient. Within each 10x10 m quadrats, 5x5 m quadrats were also laid for recording shrubs and saplings. The vegetation data collected were analyzed for density, frequency and abundance according to standard formula [10]. Tree species diversity was determined by using Shannon Wiener information function  $H'$  [11]. Concentration of dominance (CD) was measured by Simpson index [12].

**Wildlife Study:** Visual monitoring for wildlife was done once before the start of river rafting and camping (September) in the study area using village trails for sampling, as no animal trails were present. The trails started from the base of the rafting and camping sites and towards the adjoining forests along altitudinal gradient. Intensive search for mammalian species and signs of their presence such as scats, pugmarks, claw marks, pellets, hoof marks, scrapping and vocalizations were carried out. Almost all the existing trails around the camps and the rafting routs were searched during morning and evening for three hours. And during the season (October-April) of rafting and camping, search were repeated 4 times at an interval of 15 days. Since all the areas surveyed were dotted with human habitations and some part by rafting and camping agencies, information from local people, rafting and camping agencies was also gathered through interview regarding the presence/absence of major mammalian species, hunting and poaching pressures and attitude of local people towards wildlife.

**Economic Survey:** Information on the camps and rafting sites were collected from the office of the Divisional Forest Officer located at Munikireeti and Directorate of tourism, Government of Uttarakhand located at Dehradun. Survey for primary data was conducted along the stretch between Rishikesh to Kaudiyala. In order to understand the economic benefits from river rafting and camping, the adult males and women of adjoining villages located near the camping and rafting sites were interviewed. The survey was conducted using a questionnaire, followed by informal and formal meetings and group discussions with stakeholders and villagers. Employees working in rafting and camping sites were also interviewed.

## RESULTS

**Status of Vegetation:** The dominant tree species of the study area were *Acacia catechu*, *Anogeissus latifolia*, *Bauhinia vahlii*, *Bombax ceiba*, *Ficus religiosa*, *Shorea robusta*, *Holoptelea integrifolia* and dominant shrubs were *Artemisia roxburghiana*, *Lantana camara* and *Euphorbia royleana* etc. A total of 18 tree species were found in the area 500 meters away from the river bed. Phytosociological analysis of tree species 500meters away from the camping zone indicates maximum frequency for *Ficus religiosa* (58.33%) followed by *Acacia catechu* and *Bauhinia vahlii* (50% each). Only 8 tree species were present near camping and rafting sites with maximum frequency for *Ficus religiosa* (17.86%) and lowest (8.33%) for *Melia azedarach*. The total value of  $H'$  and CD were 2.6 and 0.2198 for the area 500meters away from camping zone, while it was 1.6 and 0.07 near the camping zone (Table 1). Seven species of shrubs/seedlings were found 500m away from camping zone with highest frequency for *Holoptelea integrifolia* (50%) and lowest for *Ziziphus mauritiana* (6.25%). The total value for  $H'$  and CD were 1.42 and 0.792 respectively. While only 4 species were recorded near camping zone with highest frequency for *Holoptelea integrifolia* (46.7%) and lowest for *Artemisia roxburghiana* (6.67%). The total value for  $H'$  and CD were 0.805 and 0.138 respectively (Table 2). This also indicates that plant diversity is higher away from camping zone as compared to camping zone which clearly indicates disturbance around camping zone.

**Status of Wildlife:** A total of six wildlife species were recorded from different transects in the study area. These were Goral (*Nemorhaedus goral*), barking deer (*Muntiacus muntjak*), leopard (*Panthera pardus*), wildcat (*Felis bengalensis*), Macaques (*Rhesus macaque*) and

Table 1: Status of Tree species at 500m away from Camping zone and near Camping zone

Tree species	500m away zone		Near camping zone	
	Frequency (%)	Density/100m <sup>2</sup>	Frequency %	Density/100m <sup>2</sup>
<i>Acacia catechu</i>	50	0.68		
<i>Adina cordifolia</i>	7.14	0.07		
<i>Dalbergia sissoo</i>	3.57	0.04		
<i>Anogessius latifolia</i>	35.71	0.54	16.67	0.25
<i>Bauhinia vahlii</i>	50	0.57	16.67	0.17
<i>Bombax ceiba</i>	39.29	0.61	25	0.33
<i>Cassia fistula</i>	3.57	0.07		
<i>Ficus religiosa</i>	58.33	0.75	17.86	0.29
<i>Grevillia robusta</i>	3.57	0.04		
<i>Holoptelea integrifolia</i>	10.71	0.14		
<i>Mangifera indica</i>	21.43	0.29	16.67	0.17
<i>Melia azedarach</i>	7.14	0.07	8.33	0.08
<i>Psidium guajava</i>	3.57	0.04		
<i>Shorea robusta</i>	46.43	0.86	16.67	0.25
<i>Toona ciliata</i>	28.57	0.39	16.67	0.25
<i>Tamarindus indica</i>	4.08	0.02		
<i>Azadaracta indica</i>	4.08	0.02		
	H'=2.6, CD=0.220		H'=1.6, CD=0.070	

Table 2: Status of Shrubs/Seedlings at 500m away from Camping zone and near Camping zone

Shrubs/seedlings	500m away zone		Near camping zone	
	Frequency (%)	Density/25m <sup>2</sup>	Frequency (%)	Density/25m <sup>2</sup>
<i>Acacia species</i>	12.5	1		
<i>Grevillia robusta</i>	6.67	0.13		
<i>Holoptelea integrifolia</i>	50	0.88	46.7	1.13
<i>Artemisia roxburghiana</i>	25	1.75	6.67	0.53
<i>Lantana camara</i>	46.7	10.67	18.8	2.31
<i>Syzygium cummini</i>	13.3	0.4	12.5	0.19
<i>Ziziphus mauritiana</i>	6.25	0.63		
	H'=1.4, CD=0.792		H'=0.8, CD=0.138	

Table 3: Status of Wild animals in the study area before and after River Rafting and Camping

Transect Location	Transect name		Name of species found					
			Ghoral	B. Deer	Leopard	Wild cat	Macaque	Langur
Kaudiyala	Rimo Expedition	B	+●	+●	+●	+●	+*	+*
		A	+°	-°	-°	-°	+°	+°
Singtalli	Questral adventure	B	+●	+●	+●	+*	+*	+*
		A	+°	-°	-°	+°	+°	-°
Singtalli	Camp David	B	+●	+●	+●	+*	+*	+*
		A	-°	-°	-°	+°	-°	+°
Shivpuri	Snow Leopard	B	+●	+●	+●	+*	+°	+*
		A	-°	+×	+×	-°	+°	-°
Shivpuri	Wonder lust travelers	B	+●	+●	+×	+×	+*	+*
		A	+°	-	-	+°	-°	-°
Malakhandi	Garhwal Himalayan exploration	B	+●	+●	+●	+×	+	+
		A	-°	-°	-°	-°	+°	-°
Bhrahmapuri	Dream life adventure	B	+●	+●	+×	+*	+*	+*
		A	+°	+	-°	-°	-°	-°

Note: += Presence; B = before starting of river rafting and camping; - = Absence; A = after starting of river rafting and camping. \*= Direct sighting, ●=(Farooquee *et al.* 2008), ° = Villagers statement, ×= Pug marks

langur (*Presbytis entellus*), whose presence before and after the start of rafting in the area has been shown in table 3. Displacement of wildlife might have occurred around the area due to bright colour of tents, rafts, loud music and lights around the rafting and camping sites. Some species of wild animals present in the area before rafting and camping were not visible in the area after rafting and camping had been started. Presence and absence of wild life in some places were based on visual monitoring of scats, pugmarks, claw marks, pellets, hoof marks, scrapping and vocalizations and in some places it was based on statement by villagers, employees of rafting and camping agencies as these people were habitual of seeing wild life in this area.

**Two Decades of Functional Growth of Rafting and Camping:** River rafting and camping along the river Ganga are conducted on both sides of river along the National Highway number 58 from Rishikesh to Byasi in Uttarakhand. Sporadic growth of new camping sites and rafting companies have come after 2000 especially after the formation of new state i.e. Uttarakhand. As compared to eight camping sites at four locations in 1997, by the year 2008-09, 105 camping and rafting sites have been established. Out of 105 operators, 24 registered operating firms provide both camping and rafting facilities and 81 companies have only rafting facilities. The camping facilities are spread over ten locations with maximum number at Singtalli (a place in between Byasi and Kaudiyala). The total area on the Ganga bed allotted to different camping operators is 183,510 m<sup>2</sup>. While on the right side of Ganga, habitations exist but on left side no or few habitations exist and it is surrounded by forests.

The tariff rates for rafting are fixed by the Govt. of Uttarakhand and are acceptable by the raft operators. The average rate for one person on a single stretch of 12-15 km is Rs. 500. In 2007, 600 local residents within the vicinity of this area were provided contractual jobs. The average income of these people varied from Rs. 2000 to Rs. 3000 per month plus free boarding and lodging. The Forest Department income includes beach royalty at the rate of Rs. 3-5 per m<sup>2</sup> from the camp operators and a raft tax of Rs. 2500 per raft per season. The income to the tourism department is also Rs. 2500 per raft per season. The major share of income from this sector goes to the camping and rafting companies of Uttarakhand and Delhi.

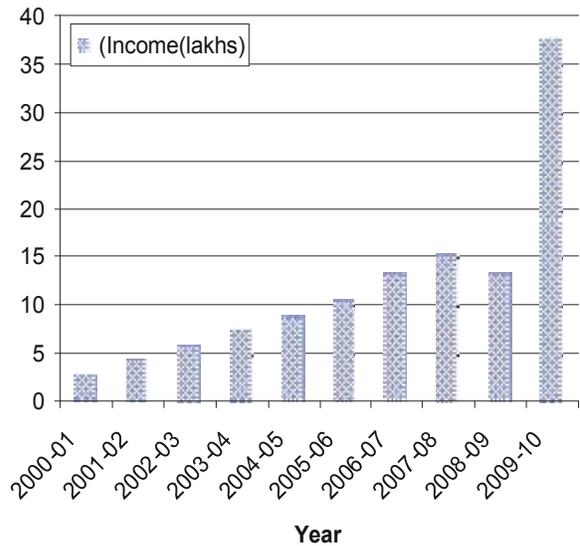


Fig. 2: Year wise income generated

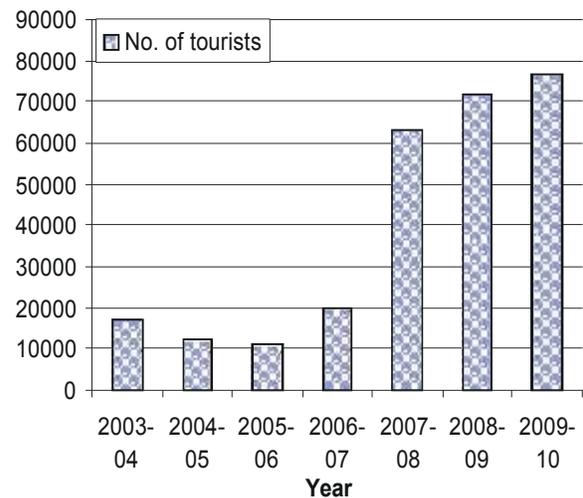


Fig. 3: Year wise growth of tourists

**Resource Flow in Temporal Scale:** Rafting and camping on the river Ganga from Rishikesh to Kaudiyala is seasonal and subject to fluctuations in weather and climatic conditions. It is interesting to note that number of sites have increased from 27 in 2004 to 105 in 2008-9 and number of tourist have also increased from 17063 in 2004 to 76368 in 2008-09 (Fig 3). Total tax (rafting and camping) paid to government has increased from Rs. 3,50,000 in 2004 to Rs. 1800017 in 2008-09 (Fig 2), however the year 2005-2006 experienced drastic decrease in the tax paid to the government due to less number of tourists.

The mean beach area allotted to the camping operators in 2003-2004 was 5,595.8 m<sup>2</sup> and by 2006-2007 it increased to 7,262.9 m<sup>2</sup>. The mean tax received by government from the camp operators in 2003-2004 was

Table 4: Category of tourists in terms of year, age, customer class and source of tourists from 2004-2007

Year	No. of Tourists	Age Wise Category of Tourists					Customer Class			Source of Tourists		
		15-25(yr)	25-35(yr)	35-45(yr)	45-55(yr)	Above 55	Business Class	Service Class	Student Class	Outside		
										Uttrakhand	Uttrakhand	International
2004	17063	4778	5801	4436	1706	341	9043	4607	3413	1706	11091	4266
2005	12258	3432	4168	3187	1226	245	6497	3310	2451	1226	7968	3064
2006	6282	1759	2136	1633	628	126	3329	1696	1256	628	4083	1571
2007	19927	5580	6775	5181	1993	398	10561	5380	3985	1993	12953	4982
		15549	18880	14437	5553	1110	29430	14993	11105	5553	36095	13883

Source: (DFO Munikireti) Forest Department Uttarakhand, Directorate of Tourism Uttarakhand and Concerned Camping and rafting agencies

Rs. 24,387.5 and in 2006-2007 it was Rs 28, 9704. Thirty four percent of customers for rafting and camping fall under the age class of 25-35 years. Fifty two percent of tourist who participated in rafting and camping belong to business class (people owing private business), followed by service class (people doing jobs either in public or private organization which is twenty seven percent). Sixty four percent of tourists came from outside Uttarakhand, twenty five percent belong to foreign countries and only eleven percent came from within Uttarakhand state of India (Table 4).

### DISCUSSION

Although few studies have been conducted on economic impacts of rafting and camping [6, 13], but there is only one study in this area which shed light on impact on other aspects of river ecosystem [7]. The impacts of development and marketing are seen worldwide. Similarly the study area before 1990s was undisturbed and after the start of white water rafting and camping it has also come under the threat of human influence. It might take the shape of chronic disturbance if corrective measures are not taken. This type of disturbance does not provide time for the ecosystem recovery and arrest the regeneration of important plant species [14]. The trampling and soil compaction adversely affect the plant growth and development [15]. The sporadic increase of commercial white water rafting and camping has already impacted severely the forest of the narrow Ganga valley from Rishikesh to Kaudiyala. The aesthetic qualities and almost limitless variety of landscapes, the natural environment provides many opportunities for recreational activities, such as walking, hiking, camping, fishing, swimming and nature study. With increasing population and, affluence and leisure-time, the demand for recreation in natural areas ('eco-tourism') will most likely continue to increase in the

future [16]. Human effects on vegetation, animal distribution, abundance and behaviour is presently non visible biologically and non significant [7]. Impacts at the popular rafting sites include loss of vegetation, soil compaction, disturbance in the existing water channels and evidence of use [17]. Trampling eliminates vegetation cover, which reduces inputs of organic matter and percolation into the soil. Displacement of wildlife has occurred in the region. Several species of wild animals are not visible in the area since the time rafting and camping were started in the area. The speed and manner in which a raft approaches wildlife can influence wild life responses [18]. River Ganga has the potential to become the finest sanctuary for the golden mahseer (*Tor putitora*), [19], but its existence is under threat due to continuous rafting for nearly eight months per year.

However, economic transaction of rafting and camping in context to Government and local inhabitants is increasing gradually year after year. Every year more than 500 part time employments to local people such as cooks, drivers, river guides and daily wage labour is being provided. The average income of these people varied from Rs. 2000 to 3000 per month plus free boarding and lodging. 400-500 persons from out side Uttarakhand are also being employed on contractual basis, whose income varied from Rs. 4500-5000 per month plus free boarding and lodging. The Forest Department gets beach royalty at the rate of Rs. 3-5/m<sup>2</sup> from the camp operator and a raft tax of Rs. 2500 per raft per season. The income to the tourism department is also Rs. 2500 per raft/season. The major share of income from this sector goes to the rafting and camping companies from urban areas in Uttarakhand and Delhi. Therefore, policy measures are needed for increasing the regional retention of rafting and camping expenditures and better understanding and coordination between the beneficial and adverse impacts that accompany this type of ecosystem service.

Other positive impacts of rafting include infrastructure development, increased popularity of the region and increased living standards of the people of nearby villages and skill development. Local impacts resulting from white water rafting on the New and Gauley rivers were substantially higher as a result of large number of users and higher average expenditure levels of the users [6]. Similar economic impacts were also reported by others [20]. One study revealed higher expenditure by rafters on the Colorado River through Grand Canyon National Park [13]. However, in present case all rafting related expenditure was not captured by the regional economy and many of the jobs created by the rafting industry were lower seasonal wages.

### CONCLUSION

River rafting and camping influence the economic activity including infrastructure development and regional popularity. There is a mixed feeling amongst villagers regarding the government's decision to allow rafting and camping on the River Ganga, though a majority of villagers are in favour of such activities because they draw direct and indirect economic benefits in terms of seasonal jobs, more sale in restaurants, tea stall and grocery shops. Because of the indiscriminate use of the river beds and adjoining areas, vegetation and the wildlife of the area is facing threat.

The present rate of charges for rafting and camping are without any scientific basis and need to be evaluated from their worth in terms of the services and satisfaction of the customers. To cope up with negative impacts of rafting and camping on the adjoining areas of river Ganga, government of Uttarakhand should put in place some regulations on other recreational activities in adjoining areas. Rafting and camping should not be linked with the trekking in adjoining areas of river. This not only puts pressure on the wildlife but also degrades the vegetation of the area. Local communities may be more motivated to participate to share positive economic impacts. Above all we can say that the river rafting and camping can become a promising ecosystem service only if resource base is used judiciously.

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