CARRYING CAPACITY OF GOVIND WILDLIFE SANCTUARY (AND NATIONAL PARK), UTTARKASHI DISTRICT

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Introduction

One popular approach to visitor management in Protected Area tourism is the 'Carrying Capacity'. Borrowed from the range and wildlife management professions, it was hoped that a maximum number of visitors could be specified, above which appropriate ecological and social conditions could not be sustained. *Caring for the Earth* (IUCN/UNEP/WWF, Anon. 1991), defines environmental carrying capacity as the capacity of an ecosystem to support healthy organisms while maintaining its productivity, adaptability and capability of renewal. Wolters (1991) referred to it as a threshold of human activity, which, if exceeded, the resource base will deteriorate. McIntyre (1993) defines carrying capacity as the maximum use of any site without causing negative effects on the resources, reducing visitor satisfaction, or exerting adverse impact upon the society, economy and culture of the area.

Tourism carrying capacity is a specific type of environment carrying capacity and refers to the carrying capacity of the (biophysical and social) environment with respect to tourist activity and development. Kuss *et al.* (1990) stated that carrying capacity comprises of two main components : a quality environment and a quality

recreation experience. The resurgent interest in carrying capacity as a management framework has its roots in several factors : (i) the increasing *complexity of management, (ii) accelerating* demands on natural resources to provide a wider diversity of goods and services, and (iii) the search for a defensible answer that can be implemented in a wide variety of settings. Butler (1996) argued, "to avoid at least some of the negative impacts associated with visitation, it must be ensured that capacity limits are identified and not exceeded."

Carrying capacity may vary with precise site location. The simple sum of carrying capacities of all sites within a protected area should not, however, be considered equivalent to the carrying capacity of the whole area (Ceballos-Lascurain, 1996). It is also more accurate to refer to 'visitors' to an area, when calculating carrying capacity and not simply 'tourists'. For a Park Manager, even the most casual local visitor must be considered while estimating carrying capacity. *Tourism Planning can benefit* from attempts to define tourism carrying capacity for a specific site or sites since these will offer an indication of the limits and limitations to tourism development. Besides, if visitor satisfaction is to remain at a constant level, the quality of the

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environment visited must be maintained. In general, if the tourism product declines in quality, tourism activity also declines.

Govind Wildlife Sanctuary (notified in 1955), an excellent representative of the Himalayan ecosystem, located at 50 km from Purola Tehsil of Uttarkashi District, is one of the oldest protected areas of Uttar Pradesh State (now in Uttaranchal). For the first time, a comprehensive Management Plan (for the period 1999-2000 to 2008-2009) had been prepared under Biodiversity Conservation Component of U.P. Forestry Project by Parmanand et al. (1999). Since time immemorial, the Sanctuary has been attracting trekker tourists owing to its unique scenic beauty with rolling large meadows, criss-cross streams, high altitude lakes, snow-clad peaks etc. Considering the fragile ecosystem of the young Himalayan Mountain, there is a need to assess the carrying capacity of the protected area, which perhaps may form an input for the managerial plans by park authorities. No such attempts have been made so far, though recommended in the management plan. Hence, to begin with, an attempt has been made to work out the carrying capacity of the Protected Area (PA) and thence to compare the values with the movement of the people within the PA. The feasibility of using such a tool in visitor management is also discussed in brief.

Study Area

Spread over an area of 957.97 km², Govind Wildlife Sanctuary lies in the middle and greater Himalayas at altitudes ranging from 1,300 m to 6,323 m above mean sea level. Considering the biological and geomorphological importance of the area, Govind National Park covering an area of 472.08 km² had been carved out of the Sanctuary in 1990. The area houses a lot of endangered fauna e.g. Snow leopard, Brown bear, Black bear, Musk deer, Himalayan tahr, Serow etc. Vegetation comprises of Ban oak forest, Moru oak forest, moist Deodar forest, Himalayan temperate pastures, Birch-Rhododendron scrub forest etc.

There are about 1,100 km of bridle paths linking 42 villages inside the PA and trek routes joining the places of tourist importance also exist inside the area. For the purpose of this present study, the 10 main trek routes (174 km), which are significantly used by tourists as well as the local villagers, have been selected. The routes are given in Table 1 (see also Fig. 1).

Methodology

(1) A Survey of the area was undertaken during July and September (2000) in

Table 1

Trekking routes of the protected area chosen for the study

Route No.	Route : From - To	Length (km)
1	Naitwad - Kedarkantha	14
2	Naitwad - Dhaula	10
3	Dhaula - Changsil	15
4	Naitwad - Bhitri	6
5	Bhitri - Bhararsar	29
6	Saud - Kedarkantha	14
7	Motar - Kedarkantha	13
8	Jakhol - Bhararsar	27
9	Taluka - Harkidoon	27
10	Osla - Ruinsara	19
	Total	174

Fig. 1
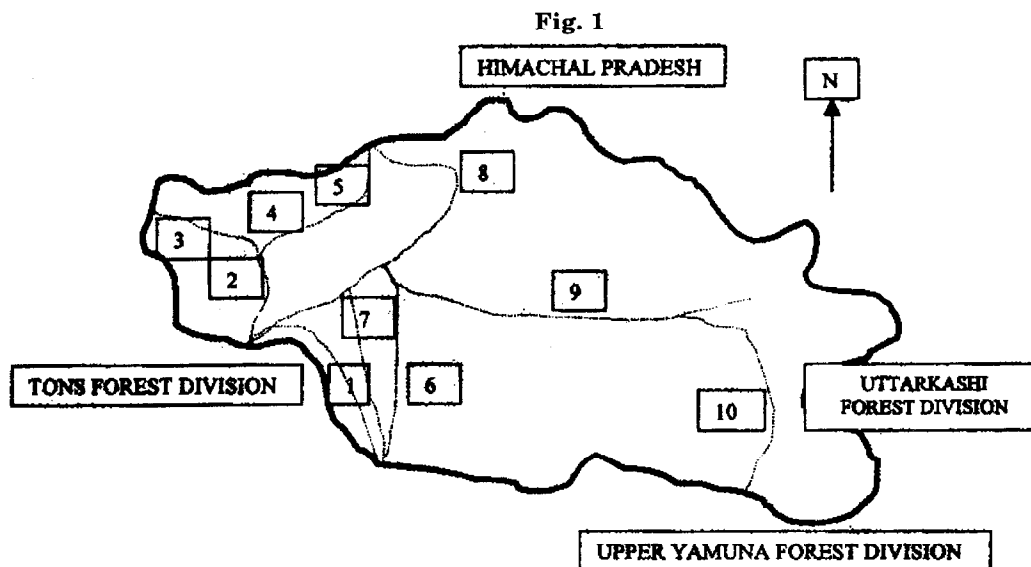
Trek routes of Govind Wildlife Sanctuary and National Park

Govind Wildlife Sanctuary and National Park to collect data with regards to path slopes, texture of soil, eroded areas, landslide areas, rainy days and visitor entries.

(2) Physical Carrying Capacity (PCC) and Real Carrying Capacity (RCC) were then worked out as per the guidelines prescribed by Cifuentes (1992). In order to apply to the present study, some modifications have been made to suit the local conditions. The principles behind the calculation are given as follows :

(i) *Physical Carrying Capacity (PCC)* is defined as the maximum number of visitors that can physically fit into a defined space, over a particular time, and can be expressed according to the following formula :

$$PCC = A \times V/a \times R_f$$

Where : A = available area for public use

V/a = One visitor per 3 m length

R_f = Rotation factor (number of visits per day)

In order to measure the PCC, the following criteria and basic assumptions must be taken into account :

● That in the hilly terrain, a person generally requires 3 m distance gap from another person in order to walk freely (V/a).

● That the available area (A) is determined by the particular conditions of the site; for open areas, the available area might be limited by physical features (rocks, ravines, crevices etc.) and by limitations imposed due to fragility or as a result of the need for safety precautions, in the case of nature trails, space limitations are dictated by tour group sizes and by the distances required between groups in order to avoid interference or mutual disturbance.

● The Rotation Factor (R_f) is the number of permissible daily visits to a site, and is determined thus as :

R_f = (Opening period)/(average time of one visit)

(ii) *Real Carrying Capacity (RCC)* is defined as the maximum permissible number of visits to a site, once the corrective (i.e. reductive) factors derived from particular characteristics of the site have been applied to the PCC. These corrective factors are obtained by considering biophysical, environmental, ecological, social and management variables. RCC may be expressed by the following formula :

$$RCC = PCC - Cf_1 - Cf_2 - Cf_3 - \ldots Cf_n$$

Where C_f is a corrective factor expressed as a percentage. Thus, the formula for measuring RCC is :

$$RCC = PCC \times (100 - C_{f1})/100 \times (100 - C_{f2}) \times 100 \times \ldots (100 - C_{fn})/100$$

Corrective factors are expressed in percentage terms, using the following general formula :

$$C_f = (M_l/M_t) \times 100$$

Where :
C_f = corrective factor
M_1 = limiting magnitude of the variable
M_t = total magnitude of the variable

Results and Discussion

The data in Table 2 shows the number of visitors in the Park from 1996 to 1998.

The area is open for tourists from 15th of May to 15th of October (154 days), out of which about 70 days constitute rainy days. During monsoon, tourism almost comes to a standstill owing to the hazards of landslips and erosion. While calculating the Real Carrying Capacity, corrections for rainy weather, for closure, for difficult accessibility (owing to steep slopes, rocky areas) in each route and erosion factors were taken into account.

The Physical Carrying Capacity (PCC) and the Real Carrying Capacity (RCC), which have been worked out by the methodologies described above for the various routes, are presented in Table 3.

At best, the Physical Carrying Capacity (PCC) represents the load that the ecosystem can carry under static conditions and hence does not serve any

Table 2

Number of visitors visiting the Sanctuary (National Park) during 1996-98

Year	Government officials	Indian tourist students	Other Indian tourists	Foreign tourists	Total
1996	79	200	910	61	1250
1997	108	300	750	150	1308
1998	95	483	768	66	1412
Average					1323

meaningful purpose. The Real Carrying Capacity (RCC) derived under various restrictive natural factors is a more meaningful parameter to be considered for visitor management. The average 'Actual Movement of People (AMP)' comprising both locals and tourists per day on various routes has been compared with the 'Real Carrying Capacity (RCC)' in the graph of Fig. 2.

A perusal of the graph shows that in general, the AMP is apparently within the limits of RCC for almost all the routes except in the case of Route No. 3 (Dhaula-Changsil) where AMP (101) > RCC (98) and Route No. 7 (Motar-Kedarkantha) where AMP (101) > RCC (89), probably due to steeper slopes. In the above two cases, further erosion can be comprehended. In general, can we say that the ecology is still within safe and sustainable limits ? Perhaps not ! Apart

from the local people and tourists, it has also been observed that the transhuman pastoralists 'Gujjars' from the Shiwalik areas have been using the alpine meadows as summer resorts for their 60,000 cattle units to graze, which is in addition to the cattle of the local villagers. Under the given circumstances, Carrying Capacity appears to be an intuitive concept and seems inadequate to address the complexity found in tourism situations. It is therefore, not possible in practice to separate tourist activity from other human activities such as the movement of local people and their vehicles, the Gujjars and their cattle etc. Though carrying capacity can serve as a means of guarding PA resources, it must not become an end in itself. One cannot deduce that such limitation which, is to be imposed, would be effective for sustainable tourism and, in protecting ecological and social conditions in the PA. Further, the concept does not give any picture of the

Table 3

PCC and RCC for the various routes of the Sanctuary (National Park)

Route No.	Length (km)	Average Slope	Soil Type*	Eroded length (km)	PCC (No. of visits per day)	RCC (No. of visits per day)
1	14	1 in 6	C, SL	0.4	2333	473
2	10	1 in 12	M	6	3333	436
3	15	i in 5	C, SL	-	2500	98
4	6	1 in 12	M	5	4000	218
5	29	1 in 5	B, R, SL, C	5	1933	162
6	14	1 in 6	C, SL	-	4000	490
7	13	1 in 5	C, SL, G	3	2166	89
8	27	1 in 6	B, R, L	-	4500	681
9	27	1 in 6	G, SL, C	3	4500	244
10	19	1 in 6	G, SL, C	4	3166	146

Soil Type :
C = Clayey, SL = Sandy loam, B = Bouldery, R = Rocky, G = Gravelly, L = Loam, M = Motorable road.

Fig. 2
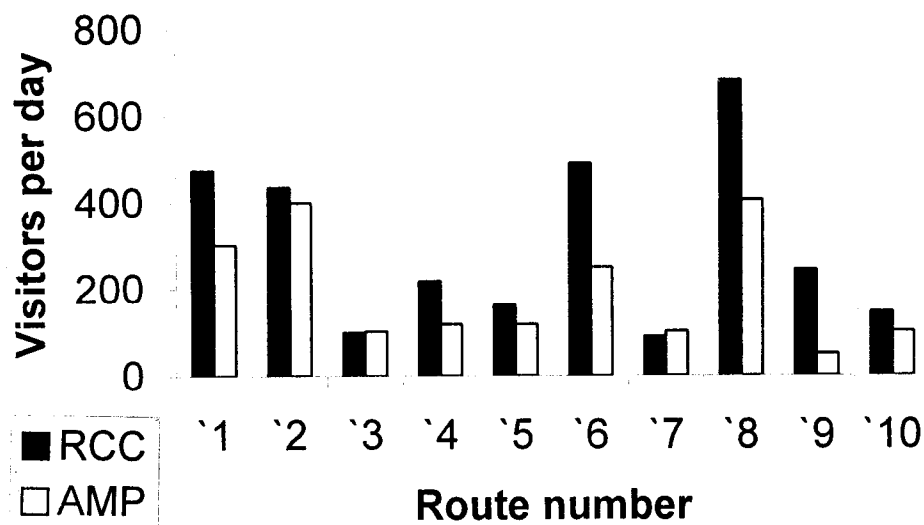
Real Carrying Capacity (RCC) and Actual Movement of People (AMP)
for the different routes

relationship between use and impact. Hammit and Cole (1987) had shown that the relationship between recreation use and biophysical impact is typically curvilinear, with relatively low levels of use leading to fairly high levels of impact. Instead of focussing on the use levels of visitors, management objectives relate to surrounding conditions. Therefore, it would be a more fruitful exercise to define indicator parameters, be they impact on species, visible damage or satisfaction level of users (Clark, 1991). Nevertheless, such analysis may lead to the development of alternative strategies for reducing impacts at particular times and places. The question that need to be dealt with by PA managers would be "What are the appropriate or acceptable conditions for visitation and how do we achieve them ?"

SUMMARY

One of the methods used for visitor management in a Protected Area is the concept of 'Carrying Capacity', which is the maximum use of any site which, if exceeded will result in the deterioration of the resource base. The present paper evaluates Physical Carrying Capacity (PCC = Visitors per day) and the Real Carrying Capacity (RCC = Visitors per day) for Govind Wildlife Sanctuary (and National Park) situated in Uttarkashi District of Uttaranchal. Govind Wildlife Sanctuary (and National Park) houses endangered fauna such as Snow Leopard, Brown and Black Bear, Musk Deer etc. Ten significant routes used by people within the Protected Area have been chosen for the study. On an average, 1323 visitors visit the Protected Area in a year during the tourist season, PCC represents a parameter that the ecosystem can withstand under static conditions. RCC is the capacity under restrictive condition. Two routes, Dhaula-Changsil (AMP =101; RCC = 98) and Motor - Kedarkanatha (AMP = 101; RCC =

89) the AMP has exceeded the threshold of RCC. Steep slopes increase erosion and landslides, local carts and cattle will also use the roads besides tourists. Therefore, while managing reserved areas for ecodiversity and tourism, acceptable change factor should be considered while deciding their parameters.

गोविंद वन्यप्राणि अभयारण्य (राष्ट्रीय उपवन) उत्तरकाशी की वहन क्षमता

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सारांश

किसी सुरक्षित किए क्षेत्र का परिदर्शक प्रबन्ध करने का एक तरीका उसकी वहन क्षमता अभिधारणा होता है । यह उसकी वह क्षमता है जो उसका अधिकतम उपयोग निर्धारित करती है और उससे अधिक उपयोग का अर्थ होगा संसाधन आधार में ह्रास लाना । प्रस्तुत अभिपत्र में गोविन्द वन्यप्राणि अभयारण्य की भौतिक वहन क्षमता (परिदर्शक प्रतिदिन) और वास्तविक वहन क्षमता निर्धारित करने का प्रयास किया गया है । गोविन्द वन्यप्राणि अभयारण्य में हिम तेन्दुआ, काला व भूरा भालू, कस्तूरी मृग आदि संकटापन्न जातियां हैं और यहां आने वाले मार्गों में से दस मार्गों को अध्ययनार्थ लिया गया है । औसतन वर्ष में पर्यटन मौसम में 1323 परिदर्शक वर्ष में यहां आते हैं । भौतिक वहन क्षमता वह परिमाप है जिसे परिस्थिति-संहति स्थैतिक दशाओं में सह लेती है । वास्तविक वहन क्षमता नियन्त्रणकारी दशाओं के अधीन क्षमता है । दो मार्गों धौला-चाइ़ शिल (औसत प्रबन्धकीय परिमाप = 101, वास्तविक वहन क्षमता = 98), तथा मोटार-केदारकंठा (औ॰ प्र॰ परि॰ = 101, वा॰ व॰ क्ष॰ = 89) पर परिमाप क्षमता से कहीं बहुत ज्यादा है । तीव्र ढलानों पर अपक्षरण और भूस्खलन भी हो सकते हैं । पर्यटन के साथ स्थानीय गाड़ियां और मवेशी भी चलेगें ही । अतः जैवविविधता और पर्यटन के लिए सुरक्षित क्षेत्रों का प्रबन्ध करते समय परिवर्तन की स्वीकार्य दशाएं समझने के लिए सूचक परिमाप परिभाषित करना ठीक रहेगा ।

References

Anon. (1991). *Caring for the Earth. A Strategy for Sustainable Living* (IUCN/UNEP/WWF). Gland, Switzerland.

Butler, R.W. (1996). The Concept of Carrying Capacity for Tourism Destinations : Dead or Merely Buried ? *Progress in tourism and Hospitality Research* **2** : 283-293.

Ceballos-Lascurain, H. (1996). Tourism, ecotourism, and protected areas. *IV World Congress on National Parks and Protected Areas*, IUCN Protected Areas Programme.

Cifuentes Arias, Miguel (1992). *Determination de Capacidad de Carga Turistica en Areas Profigidas*. CATIE, Turrialba, Costa Rica.

Clark, J.E. (ed). (1991). *Carrying Capacity : A Status Report on Marine and Coastal Parks and Reserves*. University of Miami/US National Park Service, Washington, DC.

Hammit, W.E. and D.N. Cole (1987). *Wildland Recreation : Ecology and Management*. Wiley, New York.

Kuss, F.R., A.R. Graefe and J.J. Vaske (1990). *Recreation Impacts and Carrying Capacity*. Vols I and II. National Parks and Conservation Association, Washington, DC.

McIntyre, G. (1993). *Sustainable Tourism Development : Guide for Local Planners*. Madrid : World Tourism Organization.

Parmanand, C.P. Goyal and R.L. Singh (1999). *Management Plan of Govind Wildlife Sanctuary and Govind National Park for the period 1999-2000 to 2008-2009*. Wildlife Preservation Organisation, Forest Department, U.P.

Wolters, T.M. (1991). *Tourism Carrying Capacity*. WTO/UNEP, Paris.