Impact of Tourism on Ecohydrology in the Headwater Region of the Beas, Himachal Pradesh

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Abstract

The change in the biophysical system has direct bearing on the hydrological regime of watersheds. The two major factors involved are deforestation and change in both land-use patterns and cropping intensity. The mass felling of trees in the Upper Beas basin during the 1950s and 1960s and the clearing of large tracts of forests have made the ecosystem more vulnerable and have also reduced the biodiversity of the basin. The massive permanent immigration from Lahul, Spiti, and other parts of Himachal Pradesh and the concomitant urbanisation over the last decade have increased the consumption of water, leading to a water crisis within the communities. Similarly, the introduction of irrigation and such changes in cropping patterns as conversion from food crops to vegetables/fruits and other cash crops to support the tourist demand have increased the consumption of water, thereby affecting the local hydrological cycle. This paper describes the process of urbanisation, growth in tourism, and their consequences for the availability and quality of water.

Introduction

Water is an important contributor to the sustenance of life as well as to the socioeconomic development of mankind. The present research has been carried out in the Upper Kulu Valley, Himachal Pradesh, where water resources have historically been utilised and managed for domestic as well as agricultural purposes, either in the form of springs (*kuhl*) or direct sources like rivers and streams. Research findings highlight that the process of urbanisation in the Manali region has brought a significant change in trends in the consumption, supply, and management of mountain water resources.

The Study Area

The study area covers the Upper Beas basin, the northern most part of the Kulu Valley (Himachal Pradesh). Spreading over an area of 120sq.km. it extends between Manali in the south and Rohtang Pass in the north. The elevation ranges from 2,000 to 4,000m. The gradient is steep and the region is typified by a thin layer of mountain soils. The Beas, along with its regional tributaries the Solang, the Manalshu etc, flows in an east-west direction. Climatically, the region lies in the temperate zone. Snow remains for five or six months, with a maximum depth of 1.8 to 2.1m during January and February, and increases as one moves towards Rohtang. The major rainfall occurs in July and August. Cloudbursts are a common feature, causing flash floods. The natural vegetation consists of pine trees with

dispersed grazing land. The proportion of inhabitable area is very low, settlements being scattered in the valleys and on the slopes of mountains. Since it is a tourist centre, the seasonal concentration of tourists is very high.

The Hydrological Profile

The Upper Beas basin has been formed by the Pir Panjal and Dhauladhar ranges of the Himalayas. The valley formed by the Beas up to Kothi is a broad open 'U', with waterfalls pouring into the main valley from hanging valleys on both sides below Kothi. The river plunges into a deep gorge, hardly ten metres wide, descending 300m, and after tumbling down it flows out into a very broad valley.

The Beas is one of the five rivers of Punjab, and the only one among them which lies entirely in India. The Beas River rises from the western slopes of the Beas Rikhi, a peak 4,600m high, one kilometre west of Rohtang Pass. It is a small stream at the source and takes its first water from a spring on Beas Rikhi. A large quantity of water is added in a short distance by the melting of the glacier and snow. As soon as it comes down from its source, two tributaries, the Serinal and Khanernal, join it at Palchan. The water in the river goes on increasing, and at Largi it cuts the Dhauladhar Range. It maintains an average slope of 2.4 per cent up to Largi. In the catchment areas, the chief tributaries on the right are Solang, Manalshu, Phojal, and Sarvani, while on the left are Parbati, Malana, Hurla, Sainj, and Tirthan. Apart from these, there are various other small streams which contribute considerable amounts of water to the Ravi River. Among them the important ones are the Rahni *Nala*, Sagu *Nala*, Chhor *Nala*, Shikar *Nala*, and Prini *Nala*. During winter, the flow of these *nala(s)* becomes very low, but during summer and the rainy season they provide a great deal of water to the river Beas.

Status of Water Resources: Potential and Utilisation

The general trend of the research in hydrology is concerned more especially with the assessment of water resources in terms of water availability and potential, water generating capacity of the land, water flow and discharge, geohydrological balance, anthropogenic impact on water resources, and also the prediction of extreme events such as drought and floods (Tiwari 1995). So far as the water potential of the Kulu Valley is concerned, the main source of surface water is precipitation. In general, the whole Kulu Valley lies in a rainshadow zone and experiences very low annual precipitation. Average rainfall is 11 and 125mm for the months of November and July, the driest and wettest ones, respectively. November is followed by October (15mm), December (23mm), and August (48mm), on the one hand, and the highest rainfall distribution bearing months after July on the other. In a descending order are March, February, and January. Precipitation in these three months takes place in the form of snow. The depth of snow around Rohtang Pass is recorded as about from 3 to 4.5m, while in the lower areas this depth decreases to 0.3 to 0.9m (in and around Manali). The Beas Rikhi Glacier and other smaller glaciers are the sources of about 20 perennial streams, both big and small, and about 18 springs which discharge into the river Beas.

The hydrological potential of any place depends on the complexity of various factors operating in combination in a watershed, such as precipitation, evapotranspiration, overland flow, infiltration, percolation, and sub-surface flow. Since no comprehensive and scientific investigations have been carried out in the region so far as part of a complete hydrological appraisal of the Upper Beas basin watershed, information on baseline hydrological characteristics and also on spatio-temporal aspects of water resources is not available. Even the very general information available on hydrological aspects of the region is not based on proper scientific observations. N*alas* and springs are the main sources of water which can be utilised directly for agricultural and domestic purposes. The springs are the only ultimate source of drinking water in the area. Till the end of the 1990s, these sources were used primarily by villagers for their domestic needs. But since the mushrooming of new hotels and guest houses, most of these sources are being used heavily by the private owners of the hotels, and this has led to acute shortages of water in the villages. Since the consumption of water is greater in hotels than in homes, most of the spring water is supplied through pipes to the hotels. Villages in remote locations fetch their water directly from small streams.

In the agricultural sector, the consumption of water is also very low. Since apple cultivation is increasing by leaps and bounds, the demand for irrigation water is decreasing gradually as agricultural land is transformed into orchards. However, there are about 30 lift irrigation schemes in the Kulu Valley covering the area between the northernmost village, Kothi, and Largi village in the lower part. The general trend of stream water utilisation shows that the small streams (*nala*) are more useful than the main river because of their location nearer to agricultural fields.

Growth of Tourism and Urbanisation

Manali, situated in the beautiful Kulu Valley, has been an important tourist spot since the era of British rule. Till the 1970s, the valley showed a rational distribution of population in terms of carrying capacity. The rise of tourism in Kulu Valley is the result of disturbances in other hill stations of the Himalayas. The major tourist growth started in 1986, when the number of tourists doubled. This brought about a change in the economy and community development. Settlements that included hotels started springing up over the steep slopes, and thus the green 'jungles' were replaced by building construction. This exposure of the surface led to soil erosion. The debris intermingled and flowed into the river water. During 1985-86 there were only ten hotels, and these have increased to a monumental 600 at present. The number of tourists arriving in the valley rose from 11,062 to 67,132 between 1975 and 1991 (Tables 1 and 2). The influx of tourists to the Kulu Valley has disturbed its splendid environment. The number of vehicles increased from 82 in 1969 to 205,185 in 1994 (Table 3).

Table 1: Growth of Towns and Urban Population in the Kulu Valley

Decade	No. of towns	Urban population
1951	1	3,694
1961	1	4,886
1971	2	10,758
1981	3	16,924
1991	3	21,011

Source: District Statistics Office, Kulu.

Table 2: Tourist Flow in Kulu Valley

Year	Total	Domestic No.	%	Foreign No.	%
1975	11,062	10,497	94.9	565	5.1
1976	14,477	13,779	95.0	698	5.0
1977	15,792	14,718	93.2	1,074	6.8
1978	11,003	10,239	93.0	764	7.0
1979	13,310	12,519	94.0	791	6.0
1980	15,306	14,235	93.0	1,071	7.0
1985	22,959	19,974	87.0	2,985	13.0
1987	48,744	41,366	84.9	7,378	15.1
1988	52,745	44,261	83.9	8,484	16.1
1989	57,116	47,359	82.9	9,757	17.1
1990	61,596	50,675	82.3	10,921	17.7
1991	67,132	54,222	80.8	12,910	19.2
2001	158,867	106,663		52,204	(Projected)

Source: Department of Tourism, Shimla

The number of vehicles increases during the tourist season, shattering the serenity and calm of the area. The developmental activities related to urbanisation are the outcome of tourism. The urban settlements in the valley were once very few. With the increase in tourism, urbanisation has also increased simultaneously.

Table 3: Number of Vehicles Coming to Manali

Years	Vehicles	Years	Vehicles
1970	80	1975	93
1980	98	1985	189
1986	814	1987	10,259
1988	10,321	1989	114,117
1990	123,999	1991	137,304
1992	187,364	1993	199,026
1994	205,185		

Source: Department of Tourism, Shimla

Impact on Ecohydrology

It is important to understand anthropogenic interference in the ecohydrology of a region. Apart from the knowledge of water resource potential, it is necessary to know the magnitude of impact that human transformation processes, such as deforestation, agriculture, and the construction of roads, have on the geographical balance (Singh and Haigh 1995). Large-scale deforestation, mainly for fuel and fodder, and poorly and unscientifically managed agricultural practices are some of the major human transformation processes that have been causing reduced groundwater recharge through increased overland flow and declining rates of infiltration. So far as the Upper Beas basin is concerned, the growth of tourism and, consequently, the change in land use practices are the major factors responsible for the negative impact on water resource potential. The water generating potential of the land in channels and springs has reduced gradually in the study area during the last ten years. Information regarding 18 springs was collected by interviewing the people of the area and through direct field work. Out of 18 springs, seven have completely dried up, mainly due to the reduced groundwater generating capacity of the land in the wake of a considerable decrease in infiltration. Besides, as has been reported by the villagers, the overall flow of all remaining springs has been reduced to a considerable extent. Due to increasing tourist activities, water pollution is quite visible in the river Beas. There is no proper planning for waste disposal with garbage lying everywhere along the riverbank. At Manali, open air slaughtering results in large quantities of polluted water being dumped into the Beas River. Many open sewerage channels run into the river through different parts of the town. Since the region is situated at the headwaters of the Beas, the flow of water is very low, and thus even a small amount of pollutants has a serious effect on the stream. Due to the increase in apple farming, the consumption of chemicals, pesticides, fungicides, and other chemical and toxic materials is on the rise. They intermingle and are ultimately flushed by rain from the fields into the river contaminating the water. Though there is not enough quantitative evidence

of water pollution from this source, it may be said that if the spread of orchards and the use of chemicals continue, the time is not far off when the entire region will suffer a severe crisis from water pollution. Also, in this tourist-dominated area, with a highly seasonal concentration of people, the use of polythene bags is very common. The ultimate result of throwing away these bags is seen in the river Beas on both the banks. Finally the water resources of the entire area are affected. A few positive initiatives relating to tourism and other development processes which may be considered for the study area are sanitation and sewerage facilities in the towns of Manali, Kulu, and Bhuntar and water treatment plants in private hotels to create awareness among the rural masses regarding sanitation and hygiene.

Sustainable Tourism Development and Water Resource Management

The Kulu Valley may be defined as a marginal region as the upper reaches are either barren or snow-covered, while the lower region is intensively cultivated. (Gardner 1994). Any type of environmental havoc may damage the sustainable livelihood in the valley. Thus, there is an urgent need to overcome various problems to ensure the well-being of the local communities. The steps listed below warrant consideration in the attempt to lessen the critical eco-hydrological situation. As in other parts of the Himalayas, drinking water supply and sanitation in the Kulu Valley seem to be very pressing problems. It is especially so in view of the tourism-induced urbanisation and the growing number of hotels and houses, which often tend to throw their filth into the river and its tributaries. The absence of any traditional systems of sewerage disposal complicates the problem further. There should be such systems in all villages. Digging *soakpits* (dry latrines), for example, would prove a wise initiative. In addition, the following steps should be considered.

(a) Control on the number of tourists in the Manali area by opening new tourist centres in other parts of the Himachal Himalayas.

(b) Reduction in the use of chemicals, fertilizers, and other toxic chemicals for apple farming by exploring new species of apples which are less vulnerable to diseases.

(c) Restrictions on the overuse of polythene bags in the area so that water pollution in the river can be checked.

(d) Stopping private use of springs. Each and every village should be supplied with tap water for their domestic needs.

(e) Checking the further transformation of land from agricultural to non-agricultural uses.

(f) Restricting agriculture to slopes less than 15° so that hydrological potential can be maintained.

(g) Modification of sewage and drainage patterns in the villages by providing government funding to local communities.

(h) Implementation of a separate garbage disposal programme so that the direct throwing of filth from hotels and markets into the river can be checked.

(i) Construction of village water storage tanks so that the people may constantly have sufficient water.

Concluding Remarks

Tourism has now started adversely affecting the splendid mountain environment of Kulu Valley. Its impact has been deep on its highly sensitive ecosystems. The degradation of the environment and its natural beauty and the transformation of the mono-socioculture of its people have become common features. This continuous onslaught is not being met by a proper planning strategy. The entire Kulu Valley ecosystem has become highly vulnerable. Any further deterioration of the environment may disturb the whole ecohydrological system of the valley. Immediate and urgent measures should be taken to conserve the splendid environment of the valley, with consideration given to its carrying capacity. Controls on the unprecedented growth of tourism, expanded afforestation programmes, provision for *soakpits* and dry latrines, and the proper management of sewage and garbage deposits would be wise steps towards combatting the ecohydrological problem facing the Upper Kulu Valley.

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Plate 1: Massive Construction of Buildings for Hotels and Guest Houses at Manali

Plate 2: Unplanned Disposal of Polythene Bags at Manali