

**TOURISTS' INVOLVEMENT IN SOLID WASTE
MANAGEMENT IN HIMALAYAN TRAILS:
A CASE STUDY IN AND AROUND
VALLEY OF FLOWERS, INDIA**

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ABSTRACT

The study investigates the annual visits of 116,000 tourists to Hemkund Sahib and Valley of Flowers, India, within a four-month season. Most tourist inflow was Sikh pilgrims. Very few visitors (2 percent) came to Valley of Flowers for purely recreational purposes since the flowers in the valley become replaced by weeds. The study region is world-famous for its religious-cum-recreational significance. Unfortunately, these once neat and clean trekking areas have become a solid waste (SW) problem due to absence of appropriate technology for solid waste management (SWM) and the inadequate carrying capacity of existing infrastructures. The 288 g per capita waste generated by the visitors exceeds that in many Indian cities. In a detailed study of visitors' perceptions, 23 percent realized that they themselves were responsible for creating a SW problem. Many of the wastes remained lying in and around trek stalls, apart from rare containers placed either by stall keepers or concerned authorities. Regarding SWM options at local level, some religious tourists agreed to carry back garbage to roadheads if the Sikh priest (*Granthiji*) would issue a religious decree to Sikh pilgrims during prayer. Cold drink bottles and plastics comprised 92 percent of the non-biodegradable wastes (NBW) available for reuse and recycling. The remaining readily biodegradable wastes (RBW) and biodegradable wastes (BW) are suitable for micro-level biocomposting. The common discarding practice by visitors considering things straightway valueless that immediately

turns the things into wastes needs to be given up. The visitors' ingrained habits of discarding once-used items as valueless need to be changed. This study investigates some of the cultural and practical challenges this entails.

INTRODUCTION

Between 1970 and 1994, world tourism grew by more than 300 percent. The world tourism organization (WTO) forecasts that international tourist arrivals worldwide could reach 661 million in 2000 and 937 million in 2010. The developing world's share of international tourist arrivals more than doubled in the 15 years up to 1994 [1]. In the 60s and 70s, many countries in the "South" regarded tourism as a new industry. However, hardly anyone gave thought to the social, cultural, environmental, or economic damage resulting from tourism. The biggest direct environmental problems resulting from tourism are solid waste (SW) disposal and sanitation, given the poor available infrastructure.

The overarching objective of sustainable tourism development is to preserve nature, keep it beautiful, and enhance the quality of life of both the hosts and the visitors. Once an area is spoiled and exploited, not only is habitat destroyed of both wildlife and local people, but visitors are driven away too. Environmental assessment of tourist activity has therefore become essential to sustain development, particularly so in the Himalaya where large numbers of people travel. The Himalaya could be the destination for many more tourists, given environmentally-enlightened management.

The most often overlooked factors in the environmental assessment of tourism and related development are [2]:

- the carrying capacity of a local community to accommodate the development (i.e., availability of health and sanitary facilities and social services);
- early and meaningful involvement of local communities;
- local social and cultural conditions;
- changes in employment patterns and skills, including immigration of secondary workers;
- breakdown of traditional methods of social control and discipline; and
- the possible rise in the cost of living due to inflation.

The visitor's role is very important in generating incomes as well as making the region either filthy or clean. Visitors are important sources for SW generation throughout the study region. The heavy tourist traffic also generates problems of air, water, and sound pollution [3]. The travelers usually come to these heavenly vistas from distant places with pious and sacred spirits to pay respect to their gods, yet their feelings are hurt when they find the place much less beautiful than they had imagined. They themselves sharply realize that wastes should not besmirch the regions of the gods or goddesses, or Hemkund Sahib itself for that matter.

However, could they also be prevailed upon to cooperate with campaigns for proper SWM?

A detailed survey of visitor perceptions was conducted to gauge the potential for public participation in tourism development and environmental management. The symbiotic relationship between tourism, environment, visitors, and a country's people, mandates the need to also ensure that the local host community's perspective is appreciated and factored into the decision making process [2].

In the present study region, every year stalls are constructed and demolished along the pilgrimage routes to meet visitors' food and drink requirements. The local villagers of Bhyundhar (summer village) or Pulna (winter settled village) consider themselves the owners of marginal-quality forest land along the trek routes. These villagers construct the stalls and hire those during season. It is the combination of these stalls and the flood of pilgrims that plays the major role in generating SW throughout the treks (Govind Ghat to Hemkund Sahib or Valley of Flowers; see Figure 1). Stalls include restaurants (*Dhavas*), shop stalls, and tea stalls. Stalls are manned mainly by outsiders from the adjacent localities of Joshimath, Chamoli, etc. These shops are the major sources of cold drink (take-away) bottles, litter, rubbish, and plastic. Shops do not have waste containers. The surroundings appear dirty and filthy, and smell foul. No stalls are allowed to be constructed on the route to Valley of Flowers since its declaration as a national park. Wrappers, empty cigarette boxes, and other small waste items are common on the trek between Ghangariya and Valley of Flowers.

Visitor discards cause insanitary conditions throughout the region. These same wastes, if managed properly, could be converted into resources that would benefit the many unemployed residents. Sound management of garbage involves participation of each agency or person concerned in source-segregation, proper collection, transportation, and environmentally safe disposal—and in recycling and reuse [4], and provision of sufficient infrastructural carrying capacity [5-9]. Naturalists and conservationists have increasingly warned against the apparent impact of tourism on a fragile alpine ecosystem [10-12] through exploitation of flora and fauna, indiscriminate uprooting of medicinal herbs, illegal cutting of grass, overgrazing, etc. The world famous flowers of the valley have begun to be replaced by weeds, especially polygonum (*Polygonum polystachyum*) [13, 14]. Yet despite all these adverse impacts, tourists have not been told to bring back the wastes they generate from their food and drink packaging. The rubbish is found strewn on both sides of the trek trail that mostly remained concealed or curtailed by the bushes and weeds. Not even one waste container exists in the border or center parts of the valley. This high degree of human interference also may convert the area into an extensive cold desert by hampering the growth of flowers and plants. Efforts of the forest agency to cut the polygonum cannot keep up. Indeed, in some places the piling of cuttings brings forth even more luxuriant growth. Similar SW management problems are found in China, Nigeria, Ethiopia, Kenya, and elsewhere [15].

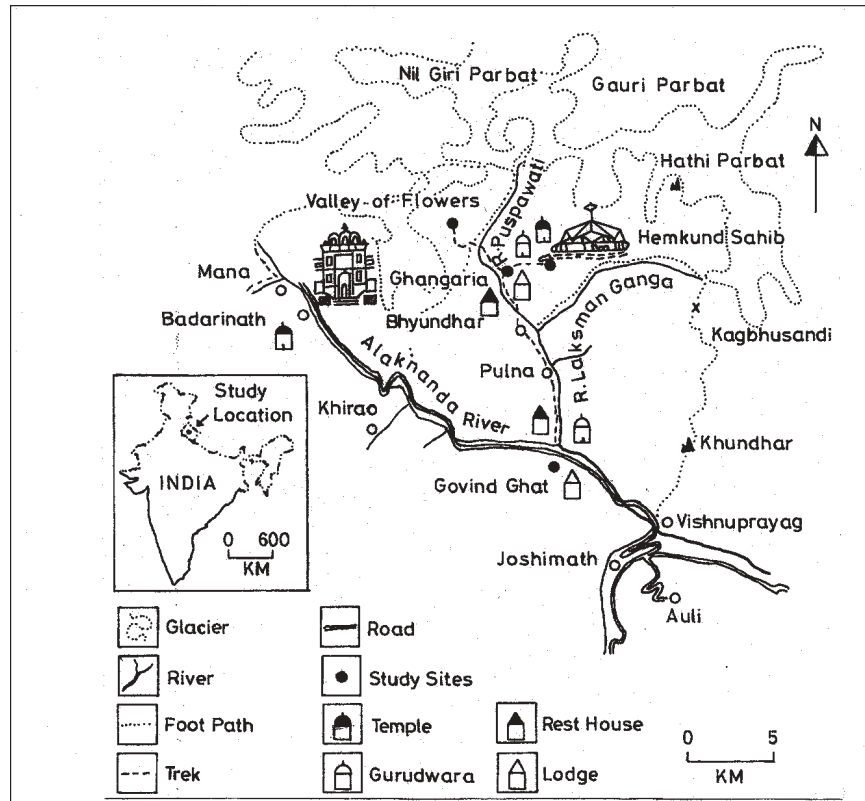


Figure 1. Geographical location of the study sites.

STUDY REGION

The study region in and around Valley of Flowers covers four main locations: Govind Ghat (1828m), Ghangariya (Govind Dham; 3048m), Valley of Flowers (3000-3600m), and Hemkund Sahib (4329m) linked by three trail routes (Figure 1). Trek's begin at Govind Ghat, on the road to Badrinath, a famous Hindu shrine. There is a beautiful Gurudwara (Sikh temple) with lodging and food available. A bridle trek leads to Valley of Flowers (17 km); a short diversion from the main trek passing through Ghangariya goes to Hemkund Sahib (19 km). One can walk the two-day journey to Hemkund Sahib and the three-day journey through Valley of Flowers. By way of illustration, the first day is a 13 km walk from Govind Ghat to Ghangariya, where accommodations are available in Sikh Gurudwara, Lodges and Forest Rest house.

WASTE COMPOSITION REVIEW

The environmental awareness that has crystallized in recent decades brought to light some of the adverse impacts of disposing of wastes in landfills and incinerators in the United States [e.g., 16]. Many studies of household SW were carried out [17]. High standard living leads to higher quantities of plastic packaging, short-life novelty items, and food waste. A recent world review placed Canada first in municipal solid waste (MSW) generation ($2.7 \text{ kg person}^{-1} \text{ day}^{-1}$), followed by Switzerland (2.6 kg), France (0.9-2.5 kg), the United States (1.6 kg), the Netherlands (1.6kg), Germany (1.1 kg), Japan (0.9-1.1 kg), and India ($0.5 \text{ kg person}^{-1} \text{ day}^{-1}$) [18].

It is instructive to compare waste stream compositions internationally. For example, in France, out of the total waste generation of 735 million tons (1984), 17.8 million tons were household wastes, 150 million tons industrial wastes, and 568 million tons organic wastes. Of the total household refuse, predominant waste materials were paper board (20 to 35% by weight), and animal and vegetable wastes (15 to 35 percent). Wastes there are landfilled (39.7 percent) and incinerated (26.5 percent) for energy recovery; remaining household wastes are recycled mechanically, by composting, chemically (e.g., by pyrolysis), or by methane production [18, 19].

Recycling and environmental inspection is of great potential significance in lacking in resource-poor countries [20, 21], where legislation has assigned more emphasis on recycling, an increasing role of the private sector in waste collection and disposal, an increasing reliance on market forces (e.g., [22, 23]), and attention to new ways to process recalcitrant kinds of solid waste (e.g., [24]). Aspects of solid waste management in resource-poor areas are portrayed in a detailed study of Accra's municipal solid waste management system [25], where per capita generation is 0.5 kg a day [26].

Other solid waste studies in the developing world in particular showed that ~90 percent of Asia's refuse is crudely dumped [27], as in metropolitan Istanbul where 400 MT/day is collected [28]. A study conducted in west Java and Indonesia elaborated efforts to establish a master plan in a Far East city. The nature of wastes generated and the current inefficient methods of collection and disposal dictated design parameters and decision options [29]. China's population growth and industrial development have increased the amount of MSW by 2.6 times from 1982 to 1992 [30]. The amount of its industrial waste has increased at an average rate of 5 percent per annum since 1981 [31]. The per capita residential SW generation in China was $0.736 \text{ kg day}^{-1}$ in 1992. On average, Wuhan, Tianjin, and Beijing waste composition is 45.13 percent food wastes, 1.7 percent plastic, 0.8 percent leather and plastic, 3.6 percent textiles, 4.3 percent paper, 1.1 percent metal, 1.57 percent glass—and 43.5 percent dust, stones, and ceramics [32]. The present methods of MSW disposal in China are simple landfilling generally in low lying lands, mountain valleys or beaches. This landfill is simply covered with soil

and plants, with the advantages of low cost, easy handling, and large disposal capacity. Other principal methods are composting and sanitary landfilling. Much industrial waste is discharged into rivers, lakes, and seas, or simply deposited near the manufacturing plant.

In India, MSW generation in four major metropolitan cities has risen somewhere remarkably. In 1997, waste generation in Mumbai was 536 MT/day, followed by Delhi (400 MT/day), Calcutta (369 MT/day), and Chennai (312 MT/day) [33]; by 1994, these figures were 580 MT/day for Mumbai, 388 MT/day for Delhi, 350 MT/day for Calcutta, and 268 MT/day for Chennai [34]. (The 1994 plague outbreak in Surat dramatically affected its waste generation [35].) Per capita waste generation in Calcutta, Mumbai, Delhi, and Chennai was recorded at 0.383, 0.436, 0.475, and 0.657 kg day⁻¹, respectively [33]. This waste generation in four metropolitan cities exceeds even in some other Indian cities such as Kanpur (0.640 kg), Kochi (0.640 kg), Lucknow (0.623 kg), and Surat (0.600 kg), etc. [33].

In general, SW generated in small, medium, and large cities and towns of India is about 0.1 kg, 0.3-0.4 kg, and 0.5 kg capita⁻¹ day⁻¹ respectively. In India, the fraction of recyclables varied from 13 to 20 percent; compostable material runs from 80 to 85 percent. In typical municipal waste streams ~45 percent is readily biodegradable, including about 40 percent composed of vegetables and leaves and 5 percent grass and paper. The NBW constitutes ~2 percent. The remaining portion of MSW is either stone and ashes (~42 percent) or miscellaneous (~11 percent). Some 91 percent of MSW on average is disposed by landfilling. The landfill sites are usually uncontrolled dumps, not sanitary landfills (SLF). Domestic, commercial, industrial, and hospital wastes are dumped together [33]. Studies have shown the impact of waste dumps. At one landfill site at Hyderabad, soil showed high alkaline, exchangeable sodium, and other levels [36].

SWM involves interplay of six functional elements—generation of waste, storage, collection, transfer and transport, processing, recovery and disposal [37]. Battacharayya, Titus, and Bhide are of the view that recycling of wastes should be given priority in waste management plans and land disposal should be avoided as much as possible [38]. This is particularly true in hilly topography, where wastes are usually dumped into flowing river water due to lack of suitable and adequate land. Such rivers remain almost the only sources of drinking water in the mountains. Urban SW from Indian cities has low calorific and high moisture content with high percentage of non-combustible materials, hence it is generally unsuitable for thermal technologies [39].

SURVEY METHOD

Three hundred fifty-one visitors who had already completed their visits and observed the trekking region thoroughly were interviewed at Govind Ghat in 1996 in July (131 visitors), August (119), and October (101). Respondents were queried regarding:

- places initially intended to visit and visited; perception whether garbage problem exists in the area and of its extent; and groups thought responsible for SW problems in the region;
- willingness to bring back their garbage to the road head;
- willingness to make a token payment as an environmental tax if affordable; and
- existing status of toilets and their level of cleanliness.

A sample questionnaire is in Appendix 1.

A thorough census survey of visitors coming downwards from Hemkund Sahib-Valley of Flowers was carried out to derive actual number of inflow. Returning visitors were taken for census to facilitate the perception surveys since some were among these for interviewing. This study was continuously done for 129 days equivalent to almost a tourist season in a year (from 19 May to 24 September 1996) at the entry of district council office, Govind Ghat.

Some sample studies to derive age structures of visitors were also carried out in 1995 (67 days) in July (17 to 21), August (1-31), and September (1-31). Similarly, the study was again repeated during 1996 (for 26 days) to verify the age group of visitors in June (14-30), July (1-7), and September (23-25). This estimation however excludes the data for about a month out of the whole annual season.

The visitors going specifically to the Valley of Flowers were taken in June 1993 for July, August, and September from the National Park entry office of forest office, Ghangariya.

VISITORS' SALIENT FEATURES

Impacts of tourism development are not confined solely to the structural changes associated with such developments in a particular locality. They are also related to impacts that occur as a result of large numbers of tourists within a particular community, variations in the number of visitors with varying seasons, and their age groups, etc.

Visitors' Flow

Visitors' number have been noticed to be increased by ~291 percent for the last 15 years since 1981 when total incoming visitors were estimated at 40,000. According to continuous monitoring in 1996, total visitors visiting Hemkund Sahib and Valley of Flowers were recorded collectively more than 1 lakh and 16 thousand (Figure 2 and Table 1).

The maximum visitors were recorded during June. This is the peak month for visitors because of pleasant weather in the hills. Besides, most of the visitors belonged to government servants, business individuals, student, and agriculture occupations. School children on summer vacation usually accompanied by their parents. Out of the total visitors, June accounted for about 43 percent visitors of the

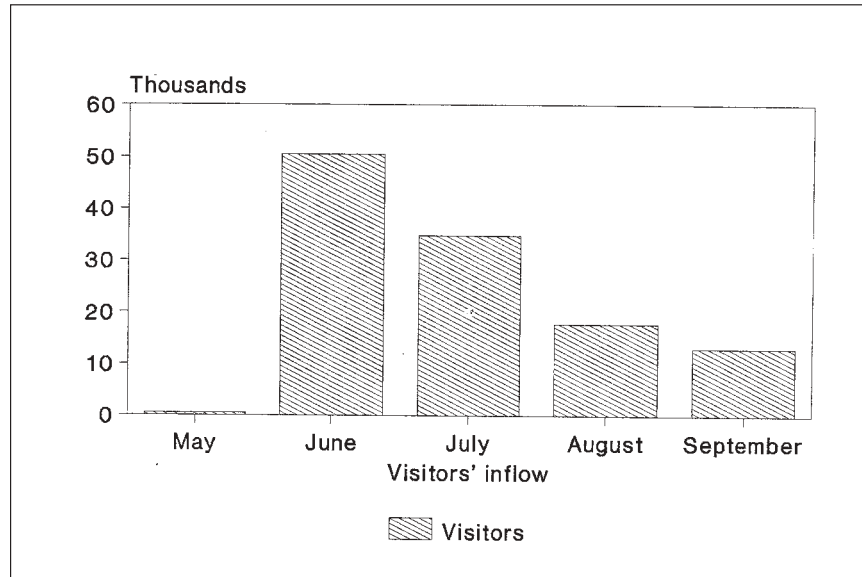


Figure 2. Visitors' monthly inflow pattern.

Table 1. Visitors^a Inflow in Hemkund Sahib and Valley of Flowers During the Season of 1996

Month	Numbers	Percent
May ^b	450	0.39
June	50,488	43.38
July	34,762	29.86
August	17,685	15.19
September ^c	13,007	11.18
Total	116,392	100.00

^aIncludes also the tourists going to Valley of Flowers.

^bData was from 19th to 31st May, 1996 just after a week when Hemkund Sahib is opened.

^cData was up to 24th September, 1996 when Hemkund Sahib remained nearer to closing.

whole season. This month was followed by July and August. The minimum flow of visitors was recorded either in season's beginning (May) or in its closing month (September) every year.

Considering the data obtained in 1993, total tourists who visited Valley of Flowers were not more than 2 percent only. Total tourists who visited Valley of

Flowers could touch up to 2014 tourists season⁻¹ (Figure 3 and Table 2). This is only because of ever eroding beauty of the valley due to continuous degeneration of flowers and widespread regeneration of weeds. Regarding to know the purpose of the visits to Valley of Flowers, 95 percent tourists had an aim of recreation or pleasure. Tourists go into the valley with great zeal and enthusiasm but when reached, they found the valley with scarce flowers but with more weeds. This might be either due to continuous desertification of flowers or little knowledge of

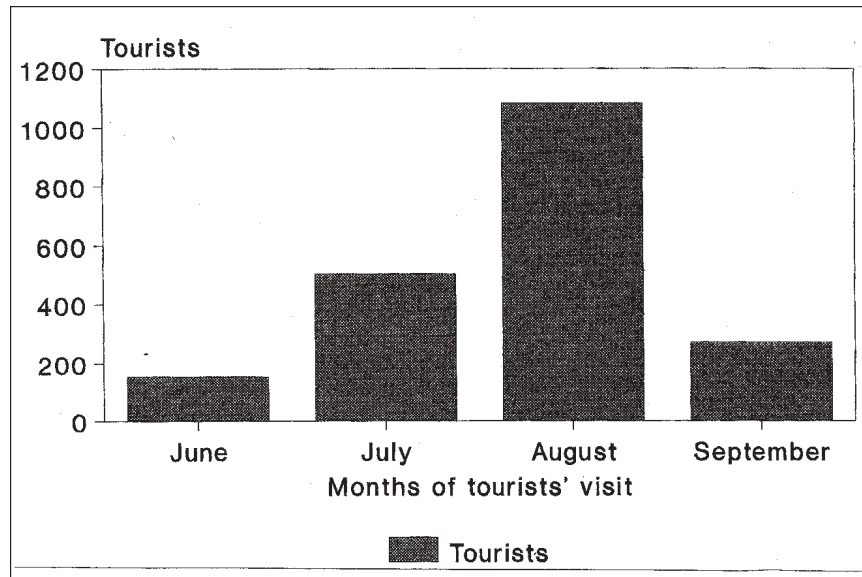


Figure 3. Visitors' trekking to Valley of Flowers from total inflow in Hemkund Sahib.

Table 2. Visitors' Inflow in Valley of Flowers Recorded at Entry Point Ghangariya in 1993

Week	June	July	August	September
0-7	0	66	338	99
8-14	20	75	251	83
15-21	54	84	183	55
22 & above	81	279	312	34
Total	155	504	1084	271

visitors about flowering season. On the onset of monsoon season (normally starts after mid-June) the entire valley becomes one of the natural gardens when countless flowers begin to bloom in succession. The best season to pay a visit to the Valley of Flowers is from mid-July to mid-August (depending on oncoming monsoon) when flowers of this valley are in full pageantry. The valley remains in bloom for more than three months. The hue starts by mid-October, and the autumn bids farewell to flowers in the valley when entire vegetation remains dormant for the next six months.

August is the month when maximum tourists visited the valley because it is the best season for flowering in full swing. Approximately 60 percent of the tourists visited Valley of Flowers during August. Occupation wise, when distribution of tourists visiting to Valley of Flowers was noticed, the service individuals constituted the highest share of 49.10 percent, educational group—20 percent, and tourists belonging to other professions such as doctors, non-technical, political workers, and unemployed persons and others by 18.4 percent. Business persons were recorded as the minimum, i.e., 12.50 percent [40].

Visitors by Age-Group

To know the age group of visitors, data were obtained from different sampling periods/years. It was derived from the average values of different sampling years that out of the total visitors about 87 percent visitors belonged to above twelve years, ~11 percent in between one to twelve years and ~2 percent < 1 year of age who visited to Hemkund Sahib and Valley of Flowers (Table 3). Specifically speaking about Valley of Flowers, more than 97 percent tourists have been found in the age group of 25 to 50 years [40].

Table 3. Age Group of Visitors Going into Hemkund Sahib and Valley of Flowers in 1995 and 1996

Month/Year	Sampling days	Age Group (Years)			Total
		< 1	1-12	> 12	
July	17-21	137	1,237	10,834	12,208
August	1-31	155	2,079	24,047	26,281
September	1-31	63	1,128	15,291	16,482
Total (1995)	67	355	4,444	50,172	54,971
June	14-30	889	4,492	34,817	40,198
July	1-7	284	1,770	1,209	3,263
September	23-25	14	193	1,478	1,685
Total (1996)	26	1,187	6,455	37,504	45,146

It was found from the analysis of age structure of visitors that the majority of visitors were of more than 12 years of age. It might be because of long way trekking up to 19 km from Govind Ghat to Hemkund Sahib. It is also indirectly indicative that maximum waste generation is due to relatively high consumption and intake which is fact in case of youth and aged people rather than children. This might be one of the most important causes influencing more SW generation.

Regional Influx of Visitors

A survey of 351 visitors showed that considerable number of visitors, however, initially used to intend to visit both of the places—Hemkund Sahib and Valley of Flowers. However, this intention could not be put into practice by most of the visitors while they completed their visit up to Hemkund Sahib. This journey remained indeed very adventurous while visitors have to climb relatively high, steep hills. They usually tired of their journey up to Hemkund Sahib, so could not visit the second day up to Valley of Flowers.

It was found that out of 351 visitors, ~72 percent visitors were interested to go to Hemkund Sahib but, in actuality, about 92 percent visitors were able to go. Accordingly, ~28 percent of visitors intended to go to both Hemkund Sahib and Valley of Flowers, but in practice only ~6 percent of visitors could successfully make it. No visitor was found to be intended to trek Valley of Flowers, but in reality 2 percent of visitors even went to the Valley. It is the essence that visitors who come with religious spirits in the region are the maximum Sikh pilgrims. However, there are very few pilgrims/tourists attracted by Valley of Flowers due to disappearing flowers and increasing litter problem (Table 4).

EXTENT OF SW PROBLEM

First, whether SW problems exist in the region was assessed based on visitors' perceptions. The majority of visitors as well as stall keepers admitted that there was a widespread problem of SW (Figure 4). Places in and around Valley of

Table 4. Areas of Visitors' High Influx In and Around Valley of Flowers

Places	Places Initially Intended	Places Actually Visited
Valley of Flowers	0 (0.00) ^a	7 (2.00)
Hemkund Sahib	252 (71.80)	324 (92.30)
Both	98 (27.92)	20 (5.70)
Can't Say	1 (0.28)	0 (0.00)
Total	351(100.0)	351 (100.0)

^aValues in parentheses are of visitors' percentage.

Flowers depicted that about 27 percent and 23 percent of visitors placed SW problems under serious and moderate conditions, respectively. About 13 percent of visitors found Govind Ghat with minor category of problem. The majority of visitors (about 29 percent) could not reply to any of the questions inquired (Table 5).

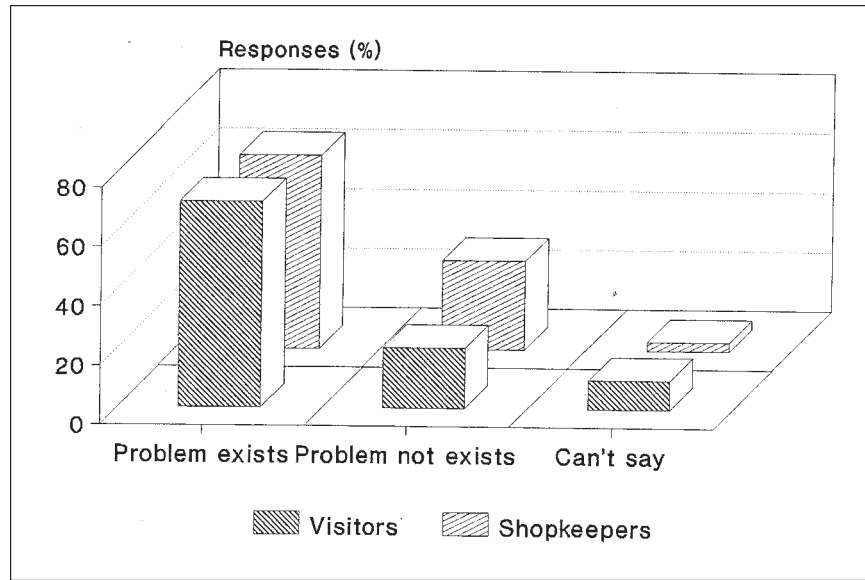


Figure 4. Perceptions of visitors and stall keepers regarding existing SW problem (after Kuniyal et al., 1998, p. 308).

Table 5. Visitors' Perceptions Regarding Extent of Garbage Problem In and Around Valley of Flowers

Problem Extent	1 ^a	2	3	4	5
Serious	0 (0.00) ^b	28 (7.98)	75 (21.37)	95 (27.07)	175 (49.86)
Moderate	1 (0.28)	35 (9.97)	141 (40.17)	81 (23.08)	34 (9.69)
Minor	3 (0.85)	84 (23.93)	27 (7.69)	47 (13.39)	16 (4.56)
No Problem	1 (0.28)	46 (13.11)	2 (0.57)	10 (2.85)	0 (0.00)
Not Exist	0 (0.00)	47 (13.39)	8 (2.28)	14 (3.99)	4 (1.14)
Not Applicable	0 (0.00)	1 (0.28)	1 (0.28)	1 (0.28)	1 (0.28)
Can't Say	346 (98.58)	110 (31.34)	97 (27.64)	103 (29.34)	121 (34.47)
Total	351 (100)	351 (100)	351 (100)	351 (100)	351 (100)

^a1 = Valley of Flowers; 2 = Hemkund Sahib; 3 = Ghangariya; 4 = Govind Ghat; 5 = On the treks.

^bValues in parentheses are in percent.

The trekking areas were suffering from serious garbage problems that was reflected by ~50 percent of visitors. This problem was followed by moderate, minor, problem does not exist, and no problem perception classes based on visitors' responses. About 33 percent of visitors could, however, remain without response. About 40 percent of respondents rated SW problem under moderate at Ghangariya but about 21 percent of visitors classed this problem serious. ~28 percent of visitors remained again silent and could not tell anything.

Since there are very few visitors who could visit to Valley of Flowers, so majority of responses (i.e., ~99 percent) could not rate the problem for the Valley of Flowers. Nearly 1 percent of visitors who could categorize the garbage problem under minor.

Hemkund Sahib was the place where ~24 percent of visitors primarily placed the problem under minor, while ~10 percent of visitors could visualize it under moderate and ~8 percent under serious. The maximum responses from about 31 percent visitors could not be responded. The maximum responses which remained unanswered were either belonging to poor educational category or lacking in understanding about the problem.

SW GENERATION THROUGH COMMODITIES' SUPPLY

SW generation visitor⁻¹ came 288 g day⁻¹ [13, 14]. From 129 days of visitors' census, it was estimated that 902 visitors day⁻¹ visited these places during the season. The waste generation due to visitors and other activities estimated to be 29.33 MT/season (113 days or about four months) in a year [13, 14]. Trek stalls' contribution in it reached ~51 percent. Within major SW categories, NBW comprised 96.32 percent of which cold drink bottles, plastic (including polythene), and metal recorded 68.48 percent, 25.48 percent, and 2.06 percent, respectively [13, 14]. In other words, these waste constituents were worth for reuse and recycling. The BW identified category showed 3.65 percent contribution in the total SW generation. However, RBW was negligible.

COMMUNITIES CONCERNED WITH SW PROBLEM

One of the most peculiar things regarding visitors' perception was that the majority of them (about 23 percent) considered themselves solely responsible for causing garbage problems under first ranking analysis. ~15 percent of visitors recognized stall keepers responsible for creating garbage problems. However, ~17 percent and ~12 percent visitors could tell local people and government responsible. Gurudwara Management Committee (GMC) was told responsible by 5 percent visitors, and ~29 percent respondents could not again answer (Table 6).

Considering the average results from first to sixth ranging perceived by the visitors, it was derived that there was not a single community group to whom total responsibility could be placed or thought responsible for creating SW

Table 6. Solid Waste Management Participatory Groups (SWMPGs)
Concerned with Creating the Garbage Problem
In and Around Valley of Flowers

SWMPGs	Ranking of Visitors' Perception					
	I	II	III	IV	V	VI
Shopkeepers	51(14.53) ^a	67(19.09)	43(12.25)	49(13.96)	36(10.26)	17(4.84)
Visitors	80(22.79)	69(19.66)	48(13.68)	35(9.97)	22(6.27)	2(0.57)
Local people	58(16.52)	68(19.37)	50(14.25)	46(13.11)	30(8.55)	1(0.28)
Government	42(11.97)	39(11.11)	62(17.66)	68(19.37)	37(10.54)	0(0.00)
GMC	19(5.41)	9(2.56)	51(14.53)	47(13.39)	105(29.91)	0(0.00)
Pony owners	1(0.28)	0(0.00)	2(0.57)	4(1.14)	11(3.13)	0(0.00)
Can't say	100(28.49)	99(28.21)	95(27.06)	102(29.06)	110(31.34)	331(94.30)
Total	351(100)	351(100)	351(100)	351(100)	351(100)	351(100)

^aValues in parentheses are in percent.

problems in the region. Shopkeepers, visitors, villagers, and government all were proportionately rated by ~12 percent of visitors on average for garbage problems except GMC (~11 percent). ~1 percent responsibility went to mules/ponies for excretion along the trek and halt areas at Govind Ghat, Ghangariya, or treks between these spots. One of the largest sections of ~40 percent visitors could, however, not answer.

SANITARY INFRASTRUCTURE STATUS

Availability of Toilets

The three major centers, Govind Ghat, Ghangariya, and Hemkund Sahib, and the treks connecting these centers from one halting place to another were selected for knowing the existing status of toilets and their present state of being cleanliness for the users (or visitors). Govind Ghat, the gateway to Valley of Flowers and Hemkund Sahib, was rated by about 55 percent visitors under sufficient. At the same time, about 25 percent of visitors admitted that the existing toilet facility was insufficient (Table 7).

On the way, about 64 percent of visitors observed non-availability of toilets; whereas about 12 percent of visitors realized their presence insufficient. Only about 7 percent of visitors found this facility sufficient along the trek. This assessment made by visitors also seemed to be true. Everywhere on the way there is an acute problem of toilets. Stall keepers and visitors have to practice open air defecation along the route or near the river.

Table 7. Existing Status of Toilets at Different Halt Areas and on the Trek for Visitors

Status	Existing Visitors' Responses ^a			
	Govind Ghat	On the Way	Ghangariya	Hemkund Sahib
Sufficient	196 (55.84)	65 (18.52)	109 (31.05)	84 (23.93)
Insufficient	75 (21.37)	67 (19.09)	185 (52.71)	86 (24.50)
Non-existent	27 (7.69)	166 (47.29)	5 (1.42)	125 (35.61)
Can't say	53 (15.10)	53 (15.10)	52 (14.82)	56 (15.96)
Total	351 (100.0)	351 (100.0)	351 (100.0)	351 (100.0)

^aValues in parentheses are in percent.

At Ghangariya, a night stopover point for incoming and outgoing visitors, an assessment made by visitors showed that ~55 percent felt toilet facility insufficient, whereas ~27 percent visitors rated this facility under sufficient. Hemkund Sahib, the main religious center in the lap of Himalayan snow-bound peaks, was found to be with a mixed type of assessments made by the visitors. About 24 percent of visitors of one section rated the toilet facility sufficient and ~23 percent of visitors found their numbers insufficient, ~36 percent could place them under non-existent, and ~16 percent could not say anything.

Cleanliness Status of Toilets

Regarding the cleanliness status of existing toilets, responses from the visitors were also obtained under some of the classes made. It was found that at Govind Ghat ~45 percent of visitors responded that toilets were not clean due to few staff and ~34 percent of visitors could find them clean.

On the way, about 25 percent of visitors again rated the toilets to be unclean due to inadequate staff. ~36 percent of visitors were of the view that toilets were not clean due to inadequate water. There was only ~5 percent of visitors who could feel no problem of toilets on the treks since they were practicing open air defecation. This class was assessed with underdeveloped stages that could not assess whether toilets were needed or should be made. Since this section of visitors was mostly from rural backgrounds who never have used toilets and accustomed to practice open air defecation in rural localities.

At Ghangariya, ~39 percent of visitors perceived toilets unclean again due to insignificant number of sweepers, whereas about 25 percent of the toilets were found clean and 24 percent observed unclean due to inadequate water. At Hemkund Sahib, the majority of visitors (about 34 percent) could not respond. ~29 percent could say the toilets were clean. About 23 percent and ~18 percent

visitors could assess that toilets were not clean either due to inadequate staff or insufficient water supply.

ENVIRONMENTAL TAX TO REVAMP SWM

There is an acute shortage of funding for tackling solid waste collection, transportation, and disposal. Visitors' willingness to contribute if any environmental tax is imposed on entry into the valley was assessed to generate funds through little and to keep the surroundings neat and clean. About 70 percent of visitors agreed to pay the tax while entering into the Valley or Hemkund Sahib from Govind Ghat (Figure 5).

The majority of visitors (~43 percent) was willing to pay Rs 5 (i.e., about rupees (Rs) 39 = 1 US\$ then) visitor⁻¹ while entering into Hemkund Sahib/Valley of Flowers at Govind Ghat. The next stood Rs 10 visitor⁻¹ on which about 13 percent of visitors were ready. ~6 percent of visitors were found ready to pay Rs 6 visitor⁻¹. ~4 percent were willing to pay Rs 50 but ~26 percent were at the same time not willing to pay any of the amount. However, ~4 percent of visitors could not respond either. It is the essence that visitors were realizing the garbage problem in

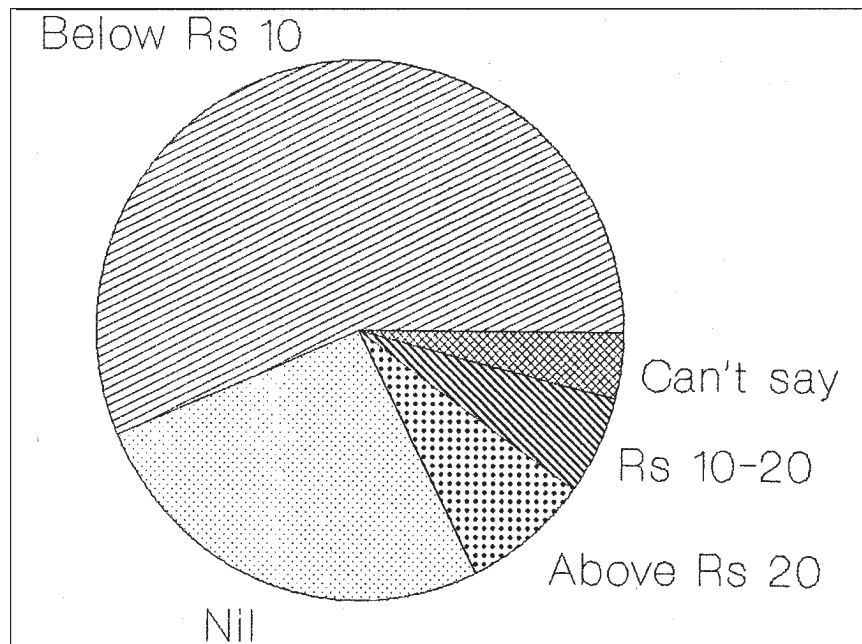


Figure 5. Willingness of visitors to pay environmental tax to upgrade infrastructural services for SWM.

their surroundings. So, the majority of them as one of the important participatory groups in SWM stood to pay money according to what they could afford to keep these religious cum tourist places clean and sacred.

SWM OPTIONS

A complete assessment as perceived by the visitors was made concerning SWM. Visitors among others were an important participatory group considered in SWM options. The carriage problem in trekking areas is not uncommon. However, the wastes could not decompose need to bring back. Otherwise this would remain lying over the region, destroy and hamper the growth of plants and flowers and ultimately be injurious to visitors, people, and domestic animals. With the similar views, visitors were asked if they could cooperate in this direction if needs in future. Bringing back the self-generated garbage during trekking up to road head (Govind Ghat) by the visitors, about 38 percent could agree to do so; whereas ~57 percent could not support the idea and ~5 percent of visitors remained silent.

The next option put before the visitor was about knowing the favor regarding bringing back self-generated garbage up to Govind Ghat if they were provided bags to carry garbage. This option was favored by 51 percent visitors but ~44 percent of the visitors could not support the option and about 5 percent again held their tongue.

As a part of mass initiatives in bringing back garbage from these destinations (of pilgrims/tourists), participation level of visitors in this connection was also assessed. And it is interesting that ~77 percent of visitors willed and strongly supported this SWM option.

The majority of visitors belonged to pilgrims and their supports were examined by religious spirits. Visitors were asked if *Granthiji* had told them during *Ardaas* that each of them should carry back garbage to Ghangariya/Govind Ghat, ~73 percent of visitors strongly favored the idea to do so (Figure 6). However, ~26 percent of visitors could not even support the idea and ~4 percent could have to be held up without any of the response.

SWM REGULATIONS AT INDIAN LEVEL

National Plans for SWM at Indian level are under way to improve better MSW management. Administrative, technical, financial, and legal issues' deliberations are considered for feasible means of SWM. Foreign investment in garbage management has also been appreciated. The prime initiatives and effects by various Ministries have been many of the important attempts to resolve the problem within the country. National waste management council (NWMC), Environmental Engineering Research Institute (NEERI), Policy Paper prepared by the Central Public Health Environmental Engineering Organization (CPHEEO) of

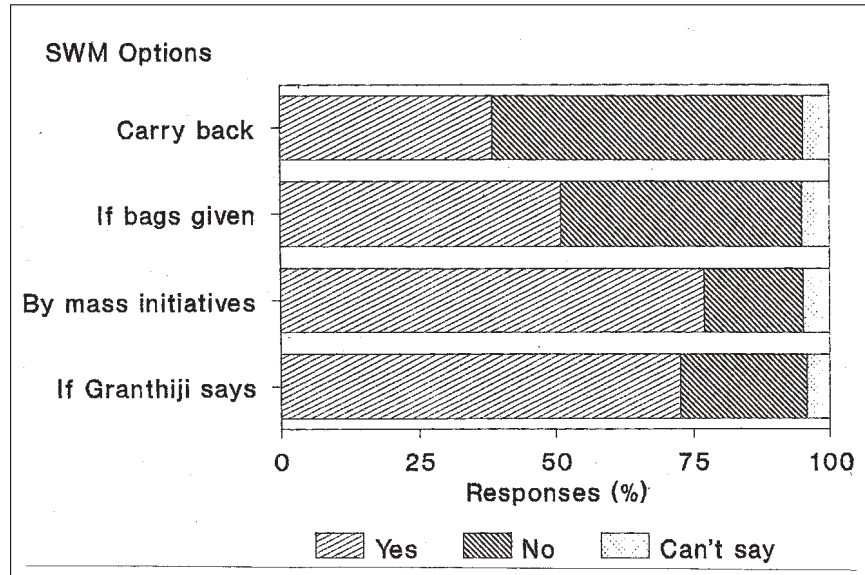


Figure 6. Willingness rating of visitors to particular suggested SWM options (after Kuniyal et al., 1998, p. 310).

the Ministry of Urban Affairs and Employment (MoUAE), Government of India, and High Powered Committees at Government of India level, Master Plan for MSW in the form of interaction with municipal authorities and other concerned Ministries (organized by the Ministry of Environment and Forests (MoEF); and Central Pollution Control Board (CPCB) stepped up some of the important steps to evolve a strategy for the municipal SWM. Besides the Federation of Indian Chambers of Commerce and Industry (FICCI), high powered committees also proposed a background paper on SWM accompanying round table organized on 5 June 1995 in New Delhi. An interactive workshop on National program on sanitation and environmental Hygiene was also conducted in April 1995 for concrete SWM at country level [33].

Under the features of the existing laws, Municipal Acts are supposed to be the first legislations across the country after dealing with environmental pollution due to MSW. However, environmental pollution is not to be dealt with under municipal enactments. The dealing provisions in particular are to prevent or to suppress the nuisance which is aimed at combating at local level. The Uttar Pradesh Municipal Corporation Act, 1959 and the Karnataka Municipal Corporation Act, 1976 are relating to SWM. A central level as well as state level departments, that is CPCB and State Pollution Control Boards (SPCBs), are also empowered administratively to take action for persuading the civic authorities in

proper management of SW. However, the direct responsibility of management of SW is on the local municipal authorities.

Despite, for various non-governmental organizations (NGOs) in the country took various steps in managing MSW. Along with this, non-availability of adequate funding is also one of the important constraints in improving better infrastructure on the way of municipal SWM. The Ministry of Urban Affairs and Employment in its draft policy paper has projected a sum requirement of Rs 5,230 crores (or ~133 crores US\$) by 2025 for proper SWM [33].

CONCLUDING REMARKS WITH SWM RECOMMENDATIONS

1. During peak season, there is inadequate accommodation and less infrastructural facilities particularly at Ghangariya. Out of 129 days of visitors' census, it was estimated that on average 902 visitors day⁻¹ crossed the gate of Govind Ghat for Hemkund Sahib and Valley of Flowers. This is high inflow and more than double at a time from available infrastructural point of view for visitors, ponies, pony owners, and Nepalese porters. Between 1981 and 1996, visitors increased 19.4 percent per annum. This inflow pressurized the available limited infrastructures up to their optimum carrying capacity. As a result, many environmental problems specifically relating to wastes and sanitation become problematic and hazardous. Along with emphasizing to the creation of infrastructures and amenities, pilgrims' inflow can be regulated with certain number at a time at Govind Ghat according to the availability of accommodation, water supply, toilets, and other basic amenities at the major halting point—Ghangariya. After returning the first lot of visitors, the second lot could be allowed to enter into the region. This pressure on local resources could be lessened and a holistic relationship between nature-tourists-infrastructure could be established. Therefore, this inflow could be regulated by GMC at Govind Ghat after making some provision by regulating visitors' traffic for the betterment of living and ideal feeling of visitors in the religious cum recreational places of the region.

2. Since the majority of visitors were youths and adolescents, their age group could be helpful in carrying back their own generated garbage. During downward trekking to Govind Ghat as ~73 percent visitors had already admitted to carry back their wastes if *Granthiji* would have been passed a religious decree to them during *Ardaas*. However, taking part in a mass initiative is also agreed with the majority of voices but it is at the same time, a time taking job that would require a lot of time, concentration and coordination amongst authorities, visitors, and other concerned participatory groups. Therefore, carrying back their own generated garbage by the visitors up to Govind Ghat could be a viable option for implementing SWM. A committee named Solid Waste Management Committee (SWMC) can be established at a proper place of Govind Ghat where collected waste could be handed over by the visitors to some deputed personnel. There should be at least three *Safai Karamcharis* (sweepers) led by a *Safai* (sanitation)

inspector who jointly has to work under strict scientific guidelines from some of the SWM expert [13]. The garbage brought back could be segregated for recycling and reuse potential. The wastes could be turned into resource under the purview of district administration. Solid waste reuse center (SWRC) should run with “no profit and no loss” basis in the interest of keeping a clean environment and healthy personnel.

3. Since immemorial, this whole region was primarily known for its beautiful flowers in the valley. However, now there is very few (~2 percent inflow) visitor opted to go to valley due to fewer flowers but rich weeds. According to the observations made, polygonum's (*Polygonum polystachyum*) cutting and placement by forest department was lacking scientific skill within the Valley of Flowers [13, 14]. Polygonum seeds might be scattered here and there in the Valley and next year these seeds automatically would continue to germinate and grow more and more. There might be two options in managing polygonum weeds [13]. First is not to interfere in any form in the valley including the cutting and dumping of polygonum weed. Second option may be weed composting from polygonum and others. In place of polygonum cutting, it might be uprooted without damaging other adjacent flowering plants and can be piled within a compost pit after designing it at some place/corner of the Valley. Green manure can be produced and applied back to flowers from not only polygonum but also from alike other weeds in the Valley. This would be a viable management option for weeds' SW.

4. Accordingly, toilets were found insufficient at Ghangariya on top followed by Hemkund Sahib, Govind Ghat, and on the way. Visitors themselves realized that SW problem, no doubt, is at the top among other environmental problems facing the region then. Place wise problem was rated serious on the treks, Govind Ghat, Ghangariya, and Hemkund Sahib. It is again interesting that visitors considered themselves responsible on top for creating garbage problems followed by local people, shopkeepers, and government.

5. Maximum waste is cold drink bottles. If cold drink bottles are reused ~68 percent SW problem could be resolved and managed. One could earn 25 paise bottle⁻¹ (100 paise = 1 rupee; 35 rupees = 1 US\$ then; excluding charges of sacks) if those were to sell to some dealer at Govind Ghat [13, 14]. Accordingly, 25 percent of the problem of plastic again is possible to be managed by way of cultivating a habit of reuse amongst the users. If kept well in subsequent years and so on, the same plastic could again be reused by stall keepers through bringing back with them after closing of every season. If both of the problems of take away drink bottles and plastics could be managed as suggested above, 96 percent of SW problems caused from supplying waste prone items could be managed in the study region. The remaining 4 percent SW problem pinpointed from BW (3.65 percent) and RBW (0.03 percent) is either due to packaging cartons of milk, biscuits, chips, or vegetable and food wastes. BW could further easily be managed by way of reusing and repackaging purposes [13, 14]. RBW could be collected at one place, away from the camp site and might be used for enriching soil nutrients either for

flowering or agricultural crops by way of micro level biocomposting practices. Everything should be treated as a resource, not as a waste.

6. A complete elimination of SW problems from the region could also be made possible, if one solid waste management fund (SWMF) at the local level was opened. This should be directly governed by district administration with its cent percentage utilization for SWM activities [13]. This funding will inevitably accelerate the rate of money generation which ultimately be used for developing and managing infrastructural facilities in adequacy to the every group in the region. Visitors had already agreed to pay some of the easily affordable amounts as an environmental tax to keep the environment clean and green in the religious places like Hemkund Sahib. To make this funding more rich and viable, along with visitors every other participatory group would have to participate. Shopkeepers, GMC, villagers (having shop stalls on the treks), local government, NGOs and other national or international donor agencies would have to be organized and worked together under an umbrella. This will make SWMC functioning relatively more active for SWM implementation not only in the tourists' places of the Himalaya but also in similar beautiful mountainous spots of the world. Many of the inadequate facilities in the hills hamper only because of less funding and its proper utilization. So that SWMF will add fuel a fire either creating more *Safai Karamcharis* for scientific and resource oriented SW minimization at its source, reuse, recycling, energy recovery, and disposals or making toilet sanitation facilities or developing a plan for proper drainage of sewage effluents.

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APPENDIX 1

A Sample of Questionnaire for Visitors' Survey

1. Name:
2. Nationality/State/City:
3. Sex
4. Age:
5. Profession:
6. Education:
7. Length of stay (number of nights spent with date and time of arrival and departure):
8. Social Status:
(a) High (b) Upper middle (c) Middle/lower middle (d) Low
9. Belong to: (a) Rural (b) Urban
10. Did you travel up to Govind Ghat by:
(a) Car (b) Scooter (c) Bus (d) Truck (e) Other (specify)

11. Place(s) intended to visit initially:
(a) Valley of Flowers (b) Hemkund Sahib (c) Both
12. Place(s) visited
(a) Valley of Flowers (b) Hemkund Sahib (c) Both
13. Do you think a problem of garbage in this area?
Yes/No/Can't say
14. If yes, what is the extent of problem in your opinion?
i) Valley of Flowers ii) Hemkund Sahib iii) Ghangariya iv) Govind Ghat
v) On the way
A- Serious B- Moderate (noticeable) C-Minor (not noticeable)
D- No problem perception E- Problem does not exist NA- Not Applicable
15. Who should be concerned with the garbage problem (ranking)?
a. Stall keepers b. Visitors c. Local people d. Government e. Gurudwara Management Committee
16. As a visitor what are you willing to do?
a. Willing to carry back your generated garbage to Govind Ghat?
Yes/No
b. Will you do it if you are given bags to carry back?
Yes/No
c. Are you willing to help bring other garbage back from Valley of Flowers/
Hemkund Sahib as a part of mass initiative?
Yes/No
d. Would you do if *Granthiji* (Sikh Priest) tells you during *Ardaas* (prayer)
that each of you should carry back garbage to Ghangariya/Govind Ghat?
Yes/No
e. If a per person entry fee (half charges for minors from age 5-12) is levied at
Govind Ghat, how much are you willing to pay?
Rs 100 / 50 / 25 / 10 / 5 / Nil
17. In your opinion what is the extent of toilet problem?

	Place	Sufficiency	Cleanliness
	_____	_____	_____
i) Govind Ghat			
ii) On the way			
iii) Ghangariya			
iv) Hemkund Sahib			
	Sufficiency: A- Sufficient, B- Insufficient, C- Non-Existent (should be built)		
	Cleanliness: A- Clean, B- Not clean due to inadequate staff, C- Not clean due to inadequate water or water related problem		
18. Any other comments, if any.

Thank you very much for your kind cooperation

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