An Assessment of Solid Waste Management through Public Participation in the Valley of Flowers National Park, Uttaranchal

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By

Shiva Garg

Supervised by

DR. V.P. UNIYAL

Dr. V. P. Uniyal
Scientist

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Certificate

This is to certify that **Ms. SHIVA GARG**, a Post Graduate student of Gurukul Kangri University, Haridwar has completed the dissertation work entitled "**An Assessment of Solid Waste Management through Public Participation in the Valley of Flowers National Park, Uttaranchal**" during her placement for dissertation at Wildlife Institute of India, Dehradun during Jan – Mar, 2006. The field work and research work for this dissertation were carried out under my supervision at the Wildlife Institute of India.

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*C*ontents

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Summary

Solid wastes are unwanted materials disposed of by man. These non-gaseous and non liquid residues result from various human activities. These cause pollution in water, soil and air. Rapid industrialization, population explosion and poor management have caused aggravation of the problem into "third pollution".

Himalayas have always attracted tourists, scientists, meditators, students and trekkers alike owing to their tranquility, peace and unique flora and fauna. But a vastly anthropocentric attitude and misuse has resulted in wide spread abuse of the fragile ecosystem. Solid waste problem in the area is on an all time high. Valley of Flowers National Park which was newly declared a World Heritage Site is under threat of solid waste nuisance due to proximity to Hemkund Sahib pilgrimage site. If this problem is not addressed within preventive time, we may lose some of the choicest gifts of the Mother Nature.

Public participation and community involvement serve as the best remedies to any problem. Joint Forest Management Committees known as Eco Development Committees have done a remarkable work in solid waste management in the area. Such pioneer work by community serves as model for other Himalayan tourist places suffering from similar solid waste problems.

1. Introduction

In the past decades, science fiction (horror) writers used to spawn monsters from putrifying garbage dumps- usually the creature was catalysed by a violent electrical storm acting on the rotting mass of waste. Our times have a way of making science fiction come true- the monster is here! One arm is the sheer volume of Solid Wastes, the other is the environmental contamination resulting from improper interment of wastes in landfills, and the third is the rising cost of disposal. To tackle this 'monster' we need to identify it, its origin, its dynamics, impacts and characteristics. Thus arises the question, what is Solid Waste?

1.1 Solid Waste (SW)

Solid Wastes are unwanted materials disposed of by man, which can neither flow into streams nor escape immediately into the atmosphere. These non-gaseous and non-liquid residues result from various human activities. These cause pollution in water, soil and air (Misra and Mani, 1993).

Waste is an unavoidable consequence of satisfying man's needs for food, water, air, space, shelter, and mobility. In any material process, by product recovery or recycling can substantially alter waste quantity and quality, but all processes eventually produce some waste (Swarup *et al*, 1992).

Though generation of SW is not a new phenomenon, it has acquired a danger status of being "third pollution" after air pollution and water pollution with progress in industrialization and population explosion. Earlier the major constituents of SW were domestic wastes and agricultural residues which are both biodegradable. Since there was much fallow land, SW could be conveniently disposed of on ground or in pits covered with layers of earth. However, since 1960s, not only has the quantity of SW increased but its quality has also changed. Though rural wastes continue to be mainly made of domestic and agricultural wastes, wastes from urban areas and the industrial units contain diverse types of materials which include toxic and hazardous materials.

SW is generated because of human activities. Depending upon their origin, the wastes could be grouped under four heads namely agricultural wastes, domestic wastes, municipal wastes and industrial wastes.(Table 1.1)

1.1.1 Agricultural Wastes

In India, the main sources of agricultural wastes are wheat straw, paddy straw, maize straw, sugarcane trash, rice and wheat bran, maize cobs, left overs from pulses etc. There has been a great increase in the generation of crop residues and allied wastes. The total production of agro-residues and by products during 1985 was estimated to be 320 million tonnes.

1.1.2 Industrial Wastes

Huge amount of industrial SW are usually produced by different industries. The estimated SW of industrial origin contribute only 10% of the total wastes generated, the bulk is liquid

1.1.3 Domestic and Municipal Wastes

There are different sources of the Municipal Solid Wastes (MSW): domestic, market community facilities etc. The amount of MSW generated is dependent on the public- habits which can vary from country to country and even among towns e.g. the per capita production of MSW is much greater in the USA in comparison to other Western countries as well as Asian countries. In India, per capita MSW production in metropolitan cities is significantly high in comparison to the towns and villages. Average MSW production is about 0.33 kg/capita/day in India.

Table 1.1 Solid Wastes produced by Human Activities

	Human activities	**Example of wastes liberated**
1	Agricultural	Plant remains, processing wastes, animal wastes.
2	Domestic	Garbage, rubbish, wastes produced at home from cooking etc.
3	Municipal	Street sweepings, wastes from schools, offices and other institutions.
4	Industrial	Wastes produced by mining operations, manufacturing and construction works.

(Source: Misra and Mani 1993)

1.1.4 Waste Characteristics

The waste characteristics in developing nations vary considerably from that in developed countries. The United States, with only 4.6% of the world's population, produces about 33% of the world's SW (Miller, 2004).(Table 1.2). About $1/5^{th}$ of India's total population lives in urban agglomerations and generates approximately 15 million tonnes of SW every year (Misra and Mani, 1993).

An important and increasing component of domestic refuse has been *plastic* waste. About 100 g per week of waste plastics have been thrown away per dwelling, but the nuisance caused by waste plastics is far greater than suggested by the moderate quantities involved. Plastics do not rot. Although they can be burned, PVC (polyvinyl chloride) is particularly objectionable in that it forms highly corrosive hydrochloric acid when burned. It is even possible for highly poisonous phosgene to be introduced (Misra and Mani, 1993).

Table 1.2 Some typical MSW generation rates

Country	**Kg/capita/year**
Australia	690
France	530
Germany	590
Italy	510
Japan	410
Portugal	440
Spain	650
Sweden	470
Switzerland	660
UK	580
USA	730

(Source: OECD, Pocket World in figures, 2005)

The density of SW in India is very high (300- 560 kg/ cubic m.). The metal content is less than 1%. The average calorific value of urban SW is low (1500 kcal/ kg). The per capita generation of SW in Indian cities ranges from 0.15 to 0.25 kg/day (Bhide and Sundaresan, 1983).

1.1.5 Classification of Solid Wastes

SW can be classified into various heads as given here under:

a)Garbage : Putrescible (decomposable) wastes from food, slaughter houses, canning, and freezing industries etc.

b)Rubbish: Non-putrescible wastes, either combustible or non-combustible. Combustible wastes would include paper, wood, cloth, rubber, leather, and garden wastes. Non-combustibles would include metals, glass, ceramics, stones, dirt, masonry and some chemicals.

c)Ashes : Residues (such as cinders and flyash) of the combustion of solid fuels for heating and cooking or the incineration of SW by municipal, industrial and apartment house incinerators.

d)Large Wastes:Demolition and construction rubble (pipes, plumber, masonry, brick, plastic, roofing and insulating material), automobiles, furniture, refrigerators and other home appliances, trees, tyres etc.

e)Dead animals:Household pets, birds, rodents, zoo animals, etc. there are also anatomical and pathological wastes from hospitals.

f)Sewage Treatment Process Solids: screening, settled solids, sludge.

g)Industrial Solid Wastes:Chemicals, paints, sand, explosives etc.

h)Mining Wastes:'Tailings', slag heaps, culm piles at coal mines etc.

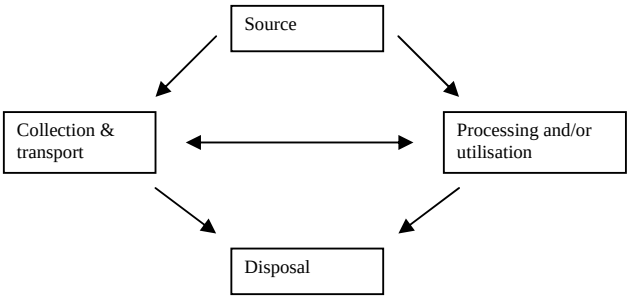
i)Agricultural Wastes:Farm animal manure, crop residues etc.

1.2 Solid Waste Management (SWM)

Rotting organic refuse is not only aesthetically unpleasant but attracts predators, and carried by these, bacteria thrive in warm, moist, rotting garbage spreading malaria, viral fever (dengue), plague etc. (Coverstory, Sunday, 1994). The incident of plague in Oct, 1994 in Surat city pressed everyone to think over SW problem. If this problem is not tackled within preventive time, it may create other dreadful, hazardous and incurable problems.

The proper disposal of SW derived from any source is dependent on management practices. A management system must be developed and described that incorporates many diverse factors. Those factors considered may include economics, engineering, land use ordinances, environmental regulations, geography and sociology. A Solid Waste Management (SWM) system that could optimize these parameters would be designed based on figure 1 (Shukla and Srivastava, 1992).

Figure 1 A Solid Waste management System



SWM involves interplay of six functional elements- generation of wastes, storage, collection, transfer and transport, processing, recovery and disposal in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics and other environment considerations and that also is responsive to public attitude (Bhide and Sundaresan, 1983). Over 90% of SW is disposed of in landfill sites. Sanitary landfilling is the main method used in the West but crude dumping is very common in developing countries (Ambrose, 1983). Landfilling leads to contamination of ground water eventually because of

leachates. Many countries will have to suffer from existing landfillling practice in the near future. By 2010, almost all of England will be suffering from a landfill shortage (Read *et al*., 1996). Another widely used method of disposal is incineration but it often results in air pollution and thus loses out preference. The commonest method adopted in India is dumping-either in ponds or on land. A practice of Collection, Transport and Disposal (CTD) is followed by municipalities. SW are stored till a sizable amount accumulates which may be transported using vehicle of suitable size. When the quantity of SW to be managed is relatively small then collection, handling and short distance transport is done manually. However, mechanical devices like bulldozers and cranes may be used when quantity is large. To transport solid Waste over a short distance, wheel barrow may be used. Vehicles commonly employed are open body trucks and flat bed trucks. Nearly 75-80% of all collected residential and commercial SW are sent to open dumps, less than 10% is buried in sanitary landfills, a small amount is dumped into the sea and the remaining is converted to obtain energy and recover metals (Mishra and Mani, 1993).

Tourism is one of the fastest growing industries in both developed and developing countries as a tool for economic activity and development. Developing countries see tourism as the opportunity to earn scarce foreign exchange and to generate employment (Mc Laren, 1994). The Himalayas owing to their majestic snow clad peaks, deep gorges, fertile valleys, bountiful rivers and unique climate have always attracted meditators, philosophers, poets, scientists and trekkers alike. This is also contributing significantly to economy. In the 1960s and 70s, tourism got a nitro-fuel booster from all quarters. Nobody gave any thought to social, cultural, environmental and economic damage resulting from tourism. One of the biggest problems arising out of these activities is the SW problem in sensitive areas of Himalayas and other similar mountainous tourist spots at the global level. It becomes especially imperative to address the situation urgently considering the fragile ecosystem of the dynamic Himalayas. A sensible and all round management of garbage calls for involvement and participation of each individual or participatory group for complete segregation at source, proper collection, transportation and environmentally sustainable diposal along with sustainable practices of reuse and recycling (Kuniyal *et al*., 1998).Waste disposal has become the greatest problem before mankind. This waste degrades the quality of human health and accelerates the deterioration of the environment in alarming proportion (Chattwal, 1987).

Recycling of wastes should be given priority in waste management places and land disposal should be avoided as far as possible (Battacharayya *et al*., 1996). It is specially true in hilly topography where due to scarcity of adequate lands, wastes are usually dumped either close to river beds or into the direct flowing river water which remains the source of drinking water in the surrounding settlements. In the Himalayan region, the SWM problem is considerably aggravated around tourist destinations.

In a nutshell, the most important aspects of SWM in developing countries are related to the problem of (1) effective shortage in generating premises, (2) collection, (3) efficient transportation of the waste to disposal sites, (4) lack of proper disposal sites except river beds or valleys, (5) lack of co-ordination between related research institutions and administration and (6) inadequate SWM funding (Kuniyal *et al*., 1998).

Under the present study, the SW problem begins at Govindghat from where the trek to Hemkund Sahib starts. Every year all the treks get littered with cold drink bottles, plastics, wrappers and other wastes spoiling the pristine beauty. The fragile alpine ecosystem of Valley of Flowers National Park (core zone of Nanda Devi Biosphere Reserve) is extremely susceptible to the after effects of tourist activity. The Eco Development Committees are the major players in the collection and transport of the wastes from the area. The SWM in the area is based on the fundamentals of community participation. It has been quite successful since its inception in 2001. The present study aims to assess the role played by the community in SWM in the area and to determine the mechanism of SWM followed by the Eco Development Committees.

2. Objectives

The study has five main objectives :

1) To assess the Solid Waste Management (SWM) practices adopted by the Eco-Development Committee.
2) To assess the role played by community involvement and awareness in SWM.
3) To estimate the nature and production rate of the SW in the area
4) To assess the recycling and reuse potential of the SW generated in the study area.

5) A study of the environmental dispositions of participatory groups and their attitudes toward SWM.

3. Review of Literature

Man, in small numbers, can be tolerated as a parasite in the biosphere. When man's numbers and activities occupy a significant portion of the biosphere, the problem of waste assimilation, and even continued life, become paramount. Davis (1965) proposed that the environmental impacts of waste often are magnified by virtue of increased human densities resulting from urbanization, the net effect of which is not only increased domestic waste, but decreased areas of the natural environment available for waste discharge.

The Solid Waste Committee of the National Research Council in its report stated in 1970- " Much of the problem of Solid Waste Management derives from the continued reluctance of those concerned to come to grips with it and apply existing technology systems and organizational know-how to its solution and above all to pay for these services." Forster (1973) warned that " increasing numbers and densities of visitors and increasing pressures for more accommodation of tourism are threatening some of the most meaningful natural and historic resources of the world's national parks and equivalent resources."

A detailed report on utilization and recycling of waste (research, development and extension requirement) was submitted in 1975 by the National Committee on Science and Technology of the Government of India. Although over two and a half decades old, this report along with some research papers constitutes the only available information on the extent and nature of wastes available and the R&D efforts in progress as also possible on the subject. The basic rational on which the report has been based is "what is waste to one industry may be raw material for another."

Foin *et al.* (1977) conducted investigations of impacts of visitor use in two areas of Yosemite National Park, California during summers of 1973 and 1974. Particular emphasis was laid on trail impact and campground use effects. Sunavala (1981) worked on recycling of municipal, agricultural and industrial wastes to generate renewable sources of energy. Vimal and Tyagi

(1982) proposed organic recycling of wastes to generate energy and employment besides solving environmental problems.

A health survey carried out in Patancheru industrial estate near Hyderabad in 1989 showed that in a sample of 942 persons examined in four villages in the area, 196 had respiratory diseases, 115 had digestive disorders and 111 suffered from skin diseases due to ill effects of wastes dumped openly.

Fagence (1990) proposed that increased pressure and pace of demand of tourism in protected areas has proved planning and management responses to be ill-conceived compromise between conservational values and commercial interest. He gave an inventory of reasons for the commercialization of natural areas. According to him, "in the context of tourism, increasing number of people are seeking new leisure experiences, expecting suitable levels of servicing convenience and comfort, requiring "entertainment" through artificial forms of recreation (eg .power boats, trail bikes) in natural areas, eventually stimulating the introduction of urban facilities such as art festivals, convocations and so on."

Martin and Vysal (1990) examined the relationship between carrying capacity and tourism lifecycle. To them, tourism is an industry with enormous impacts. It is also an industry which has many environmental and social consequences, a thorough understanding of which is vital to those involved with planning, management and policy determination.

Developed in England nearly 145 years ago, plastic is now used for everything from lemonade bottles to equipment for life-saving operations. Cole and Mwanza (1991) declared that when plastic is thrown out to sea, it causes the deaths of upto two million sea-birds each year and as many as 100,000 marine animals. In the same year, Campbell and Campbell estimated that the clean-up of industrial wastes was costing the US alone more than $30 billion per year and the bill was growing at about 15% per year. They merit the use of micro organism to break down wastes over its containment, incineration or tighter landfilling. Finlayson (1996) however, said that there are no simple solutions to reducing wastes. The best solution is a combination that includes biodegradable plastics, plastic recycling and composting.

Swarup *et al.*(1992) postulated the growing use of packing materials as the major source of household waste. The use of paperboard has been growing at an annual rate of 4.5 %. Ishwaran (1994) found that international tourism and global environmental awareness have both grown significantly during the last three decades. Between 1970 and 1990, tourism grew by nearly 300 % and the industry now employs about 7 % of the workers of the world. Environment's role in sustaining the growth of tourism is better appreciated now than any time in the past.

Jain and Kuniyal (1994) studied the SW problem in the Himalayan regions and found that both religious and recreational tourist resorts are going to be extensively and intensively polluted by SW due to inadequate and poor infrastructural carrying capacity. They assessed the environment in and around the Valley of Flowers National Park in 1995 and found "urban slum like" conditions due to indiscriminate waste disposal.

Hockett *et al.*(1995) in their determination of per capita MSW generation in south eastern US found that US currently generates and disposes of almost 200 million tones per year of paper, plastics, yard waste, glass an other materials which are primarily produced by residential, institutional and commercial sources.

Renkaw and Keeler (1996) while working on various SWM options, concluded that in the foreseeable future, no community will be able to do without access to landfill spaces (either located within the community or in some other area). Several attempts have been made to establish a general methodology to solve hazardous waste problems, Wei and Weber (1996) list a sequence of steps for selection of treatment process for a given waste stream.

Herat (1999) while studying the alternate use of SW as a supplementary fuel in cement kilns found that high temperature (>1500 ˚C), long residence times (6-10s) and high turbulence result in complete destruction of a variety of wastes including waste oil, organic solvents, chlorofloro carbons, used tyres, Municipal Solid Waste and sewage sludge and simultaneous recovery of energy and material values.

Kuniyal *et al.(*1998) favoured public involvement in SWM in and around the Valley of Flowers National Park. But English (1996) criticized the public participation process asserting that it increases rather than decreases the conflict between agencies and public and

is unduly time consuming. However, many researchers believe that public participation can help increase trust in government, and in legitimacy, credibility and acceptability of risk management decisions. This increase is driven both by citizens who demand a greater role in shaping the decisions that affect their well being and by agencies that recognize the benefits of involving citizens in their decision making process (Webler *et al.*, 2001; Charnley and Engelbert, 2005).

Kala (2004) recommended management of tourism and people participation and collaboration for strengthening the conservation of natural resources in the alpine meadows of the western Himalayas.

Mani and Kaur (2004) reported that the quantity of biomedical waste (BMW) produced and its inherent nature to contaminate other wastes has made it imperative to effectively handle and treat this waste. They reported that 90% of BMW in India is either dumped along with MSW, dumped into lakes and ponds or is burnt in the open.

Small Grants programme funded by Global Environment Facility and the Country Co-operation Framework-1 Environment Programme Support, seeks to support activities which demonstrate community based approaches that could reduce threats to the global environment. According to their report (2004) the programme is rooted in the belief that global environmental problems can be addressed adequately only if local people are involved, and that, with small amount of funding local communities can undertake activities which will make a significant difference in their lives.

4. Materials and Methods

4.1 Study Area

The Nanda Devi Biosphere Reserve (NDBR) is located at latitude 30˚ 08` N- 31˚ 02` N and longitude 79˚ 12` E – 80˚ 19` E with large altitudinal range 1,800m to 7,817m with unique topography, climate and soil supporting diverse ecosystem, habitats, communities, and richness in species. The high percentages of endemic species richness itself identify the conservation value of the reserve (Uniyal, 2002). The Valley of Flowers (VOF), a most

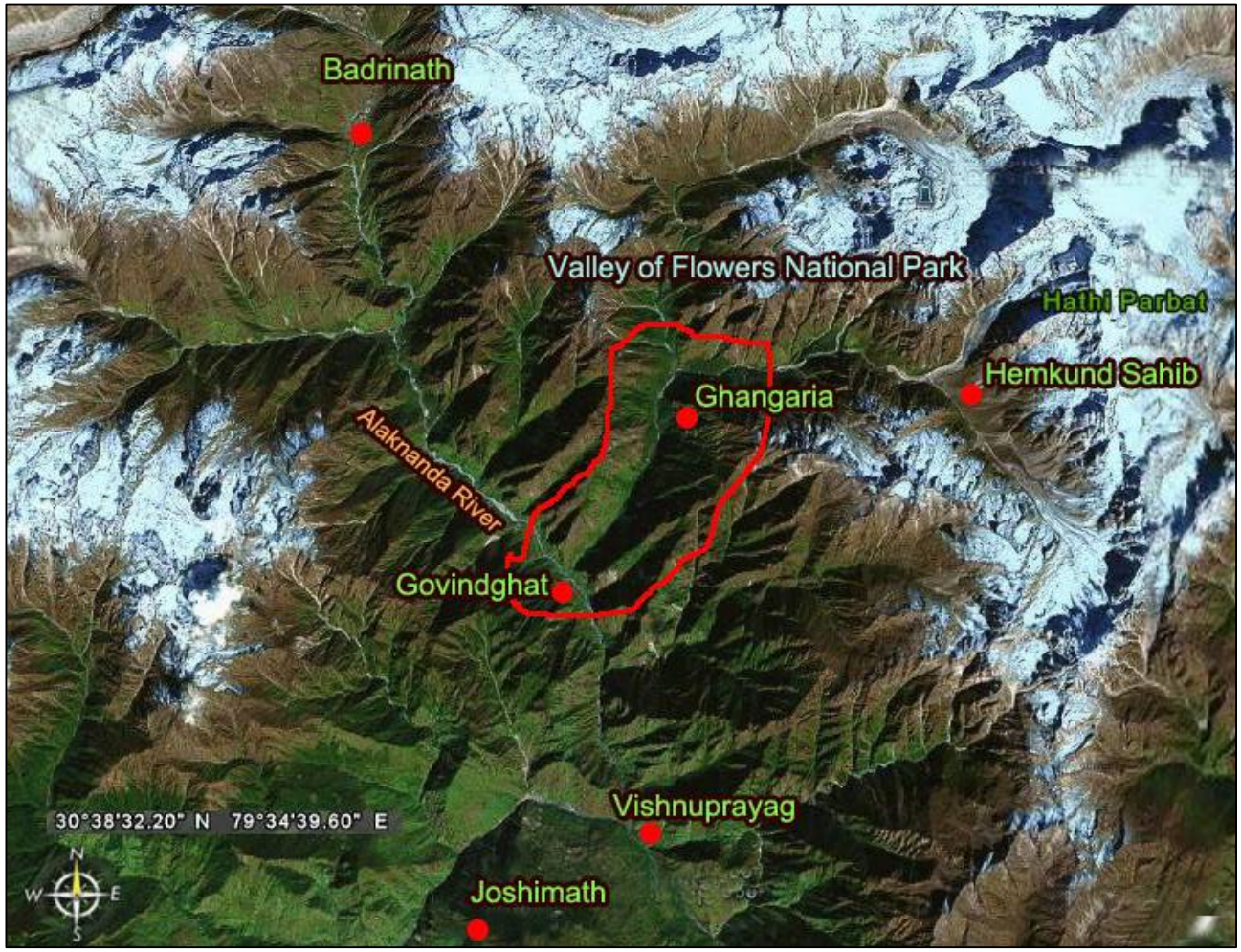
spectacular flowering bonanza from the depths of the earth to the tops of the Himalaya forms the second core zone of NDBR and is included in the list of eight World Heritage Sites by UNESCO with effect from 14 July 2005 (Kala, 2005).

The VOF National Park (87.50 sq. km.; lat 30˚ 41` – 30˚ 48` N and long 79˚ 33` – 79˚ 46` E) is located in Chamoli Garhwal, about 595 km northeast of Delhi in the state of Uttaranchal. Its altitude ranges from 3,200m to 6,675m. The National Park is bounded by Gauri Parvat (6,590m) and Rataban (6,126m) in the east, Kunt Khal (4,430m) in the west, Saptsring (5,038m) in the south and Nilgiri Parvat (6,479m) in the north. River Puspawati, which originates from left bank of Tipra glacier near Bhyundar Khal, flows down through the VOF and joins Lakshman Ganga at Ghangaria and forms Bhyundar river. This river drains into Alaknanda, a tributary of Ganges, at Govind Ghat about 12 km downstream (Kala *et al*., 1998).(Map 1).

The VOF has a highly heterogenous landscape, ranging from low lying flat and gentle slopes to steep slopes, unstable glacial moraines, stream banks, forest meadow edges and snow bound areas. Such a geomorphological heterogeneity has resulted in a rich diversity of flowering plants, which attracts a number of botanists and tourists across the world (Kala, 2005).

The biological significance of VOF lies in its exquisite floral and faunal biodiversity with myriads of alluring flowers. Kala *et al.* (1998) recorded a total of 521 species of vascular plants and a total of 13 wild mammal species within the park and its vicinity. Near the VOF is the sacred place of Sikhs, the Hemkund Sahib situated at an altitude of 4,150m which is sacred to both Sikhs and Hindus. The Sikhs revere this place because Guru Gobind Singh is believed to have actually visited this place and retreated here to meditate. For the Hindus, the lake, known as Lokpal, is the meditation site of Lord Rama's younger brother, Lord Lakshman. The lake was discovered in 1930 by Hawaldar Solan Singh and since then it has become a major tourist attraction. It is also believed that millenia before Rishi Medhara of Durga Sapt Shati of Markandaya Purana had come here for penance and King Pandava of Hastinapur had practiced yoga (Singh, 1989). However, Hindu pilgrims remain very few compared to Sikhs. Every year three to five lac pilgrims visit Hemkund and Lakshman Mandir.

Study Area – Valley of Flowers National Park



There is one major settlement called Bhyundar village near the park with its winter settlement little below called Pulna. The people of the area belong mainly to two ethnic groups- Indo Mongloid people known as Bhotias and Indo Aryans. Garhwali, Kumaoni and Tibetan are the local dialects. The people are very much dependent on tourism in the area. Tourism plays a very important role in the economic development of the area as about 95 % population of the surrounding villages depends on it.

The present study covers mainly the locations of Govind Ghat (1,828m), Ghangaria (3,048m), VOF (3,000- 3,600m) and Hemkund Sahib (4,150m). Govind Ghat is about 39 km from Badrinath Hindu shrine. The first day walk is 13 km from Govind Ghat to Ghangaria. One can hire pony / mule or dandi / kandi. The second day trek is 6 km from Ghangaria to Hemkund or 4km from Ghangaria to VOF. Ghangaria is the night stop over point for the visitors. The whole trek takes three days.

4.2 Methodology

The public's role in SWM is one of the foundation stones for its successful implementation. The participatory groups are, directly or indirectly, related to the problem and are helpful in SWM. The participatory groups are : (i) visitors (include Sikh pilgrims and tourists), (ii) stall keepers on the trek (who come from outside the region also), (ii) Panchayat village of Bhyundar and /or Pulna, (iv) Gurudwara Management Committee, (v) District Administration(DA), (vi) Forest Department, and (vii) Local Shop Owners' Association of the area. The SWM is carried out by Eco Development Committees (EDCs) chiefly EDC Bhyundar and EDC Govind Ghat (Pandukeshwar) formed under Joint Forest Management rule of 2001.

The study extends over a period of two months from Jan to Mar while on-field study was undertaken from 27 Jan to 30 Jan. The first part of the study included perception study of local villagers, EDC members and other participatory groups during the on field study period (27 Jan – 30 Jan) at Govind Ghat, Pandukeshwar and Pulna. Major questions in the study related to their perception regarding extent of garbage in the region, role played in SWM, willingness to work for conservation of environment, sharing of responsibilities, payment of environmental tax and future role. The working of EDCs to establish Eco Tourism was also

studied, how it started, what are the dynamics, who are the actors, what are the conditions for success or failure, what are the motivations, the arguments and the ideology etc.

The second part involved estimation of SW generation in the area, reconnaissance of the collection, transportation and disposal of SW as undertaken by the EDCs. For this a representative number of garbage bags was randomly picked from the main dumping site, segregation of the contained waste done and then average of the whole found by proportion.

5. Results and Discussion

5.1 Findings

Based on the philosophy and rules of Joint Forest Management, 2001 in the buffer and transition zones of the VOF, Joint Forest Management Committees are constituted which bear the name of Eco Development Committee (EDC). Each committee works according to its microplan prepared by the villagers themselves while the Forest Department provides the services of social scientist and staff working as facilitators for the preparation and implementation of this plan. EDC Bhyundar and EDC Govind Ghat (Pandukeshwar) are jointly involved in SWM along the trek from Hemkund Sahib and VOF to Govind Ghat during the tourist season (Jun to Oct).

EDC Bhyundar was registered in 1999 while EDC Govind Ghat was registered in 2004. They are formed by local villagers committed to the conservation and preservation of nature. The chairman of EDC Bhyundar for 2005 is Mr. Pradeep Chauhan and that of EDC Govind Ghat is Mr. U. S. Mehta. EDC comprises of a core committee and an executive body. Anybody can become a member by paying a nominal membership fee of Rs. 100. EDC charges a registration fee from mule owners and porters (dandi / kandi) of Rs. 100. A nominal Rs. 25 per mule rider is also charged while nothing is charged from on foot visitors. Besides, an eco fee is paid by the stall keepers for SWM ranging from Rs. 250 to Rs. 500. Gurudwara Management Committee (GMC) donates an amount to EDCs every year. These inputs constitute the revolving fund of EDCs besides additional income in the form of bank interest, loan interest and sale of mineral water. This income serves to bear the cost of waste

collection along the trek and its transport to main collection site at Govind Ghat and from there to Dehradun for ultimate treatment and disposal. EDC also undertakes various welfare activities in the area. The data for income and expenditure for respective EDCs has been summarized below.

a)Income-Expenditure Data for EDC Bhyundar:

Year	Income	Expenditure	Balance
2003-04	10,41,770.60	8,92,655.00	1,49,115.60
2004-05	14,01,709.00	13,45,364.00	56,345.00

b) Income- Expenditure for EDC Govind Ghat

Year	Income	Expenditure	Balance
2004-05	6,50,590	5,96,939	53,651

5.1.1 Dumping Grounds

During season (Jun- Oct), EDC Bhyundar engages in collection of wastes along the trek from Hemkund Sahib till 11 No. Pillar (13 km) while EDC Govind Ghat collects along Pandukeshwar till Pinola Ghat (6km). There are 12 collection sites from Hemkund till 11 No. Pillar, another five small in Govind Ghat and one at Phayya. All the waste collected along the trek at these 18 sites is then dumped at the main collection place at Govind Ghat.

The 12 collection sites from 11 No. Pillar to Hemkund are: No. 1- *11 No. Pillar*; No. 2- *Pulna*; No.3- *Jungachatti*; No.4- *Dalisar*; No.5- *Thallachatti*; No.6- *Bhyundar*; No.7- *Khwanpul*; No.8- *Ghangaria*; No.9- *Atlakulitalla*; No.10- *Aatlakulimalla*; No.11- *Seeditok*; and No.12- *Hemkund Sahib*.

There are waste bins placed at every km all along the 19 km trek from Govind Ghat to Hemkund. There are two types of bins used – cemented waste pits or invertible drum type.

5.1.2 Waste Generation

Based on estimate, about 2000 tourists visit per day during season(Landscape Management Plan, NDBR). During a roughly five month season from Jun to Oct, nearly three lac visitors come to this place. According to EDC logs, 9180 garbage bags were transported to Dehradun during 2004- 2005 and each bag weighs 4.5 kg on average then nearly 41,310 kg waste was generated during 2004 season. If 344.25 kg waste was generated per day and 2000 tourists did that in a day, then average generation of waste comes out to 0.172 kg / capita / day compared to the nation wide average of 0.35 kg / capita / day.

5.1.3 Waste Collection and Cost

EDCs employ upto 45 sweepers per season to collect wastes generated into bags provided to them. Sweepers are migrants chiefly from Najibabad abd are paid wages of Rs. 5 per bag. Each bag has a capacity of about 4.5 kg. The plastic packing bags are bought on order from Haldwani and Rishikesh at Rs. 12 per bag.

For the running year (2005-2006), according to estimates, EDC Bhyundar would collect upto 3,500 bags while EDC Govind Ghat would collect a total of nearly 5,500 bags.

5.1.4 Waste Transport and Cost

EDC Bhyundar transports collected garbage bags from twelve collection sites along the trek to the main collection place at Govind Ghat. Mules are hired for the purpose which carry upto six bags (i.e. roughly 27 kg) and charge Rs.150 per trip. The garbage bags from collection site at Govind Ghat are then transported by trucks to recycling and treatment plant in Dehradun. A truck carries nearly 600 bags and it costs Rs. 3000 per trip.

For the running year, collection of garbage bags is nearly complet and transportation to Dehradun is awaited due to unavoidable delay.

5.1.5 Waste Segregation and Cost

A representative number of bags is randomly selected from the collection site at Govind Ghat and segregated into various heads viz. plastic bottles, wrappers, glass prone waste, metal prone waste, rubber prone waste, papers, rags, cartons, mud and other garbage. The segregated waste is then weighed and a proportional average is calculated to estimate the percentages of various waste components. This aids in estimating the re-sale value to recycling plants. For this, sweepers are employed on wages of Rs. 100 per day.

For the year 2005- 2006, segregation was attended by the student. A garbage-analysis of 50 bags randomly picked from around 3,500 bags was undertaken. The average weight of garbage bags is 4.42 kg. The % of plastic bottles is 37.72% and of glass prone waste is 2.02%. The data is compiled in table 5.1.

Table 5.1 Garbage Analysis, EDC Govind Ghat for the year 2005-2006

a) Mean weight of the collected SW:

Weight Category (kg)	No. of Bags	Total weight
3	2	6
3.5	6	21
4	21	84
5	16	80
6	5	30
Total	50	221

Mean weight of 50 bags = $\frac{\text{Total Weight of 50 bags}}{\text{No. of bags}}$

$= \frac{221}{50}$

$= 4.42$ kg

b) Percentage Composition of collected SW

Waste Category	No. of Bags	Weight (kg)	% weight
HDPE(raincoat etc)	20	80	40.50
LDPE(wrappers etc)	5	17	8.60
Plastic bottles	23	74.5	37.72
Rubber prone waste	1	5	2.53
Glass prone waste	1	4	2.02
Metal prone waste	1	2	1.01
Mud, rags others	2	15	7.59
Total	53	197.5	99.97

(HDPE= High Density Poly Ethylene; LDPE= Low Density Poly Ethylene)

5.1.6 Welfare Activities and Employment Opportunities

EDC Bhyundar and EDC Govind Ghat have not only provided self employment to the local youth but also a sense of self respect and independence. Women have been equally employed which has empowered them. Uniforms are provided to employees to inculcate pride and honour. Income generated from porter and mule registration, eco fee and bank interest plus the donation from GMC not only meets the expenditure incurred in SWM but generated a reserve used for welfare activities in the area. Insurance and loans are thus provided to villagers and mule owners at lower rates of interest. A share of the income is given to Zila Panchayat besides advertising and other miscellaneous expenditure. Mule owners are paid for their service at the EDC office only when the client is safely dropped on destination. The information is relayed to the office by radio transmitters provided by the Forest Department. This has ensured that visitors are not cheated by mule owners midway. Constant connectivity by radio also helps in providing necessary aid as soon as possible whenever needed.

5.1.7 Participatory Groups' Perception of SWM

The thirteen interviewees consisted of three members of EDC Govind Ghat;two of EDC Bhyundar; Deputy Ranger of Forest Department; Secretary of Local Shop Owners' Association; member of GMC; two sweepers; one mule owner; and two villagers. These

people were selected for the perception study considering their stake in SWM and also the limited population of the area during off season. The questions asked and their responses have been summarized in table 5.2.

Visitors are an important source of SW generation in the area. Due to immense tourist traffic the region faces extreme pressure on air- water quality coupled with stress on the carrying capacity of the ecosystem. The SWM participatory groups (SWMPGs) identify their role in conservation of nature and are willing to share responsibilities under guidance and facilitation of the Forest Department. EDCs provide self sustenance to local youth and women.

Rotting garbage along treks and dumped into Alaknanda is extremely harmful. It spoils the aesthetics of the region and will ultimately lead to various health problems. Stall keepers and visitors willingly pay the eco fees to counter all such harmful effects of SW lying unattended in the area. GMC also aids the EDCs financially as well as by spreading awareness. Nearly all the local villagers are members of EDCs and are aware of the conservation values.

With regard to sanitation, a non-existent situation is found along the trek. District Administration (DA) ought to address the need of public amenities in the area.

Table 5.2 Summary of SWMPGs Perception Study

Questions asked	**EDC**	**GMC**	**Forest department**	**Shopowners' Association**	**Villagers**
Condition of the area before SWM by EDC	Rotting garbage all over the area, mule owners corrupt.	Garbage heaps all around, mule owners cheat visitors.	Garbage dumps, plastics, danger of diseases, stink unbearable.	Dreadful garbage dumps, unhygienic	Rotting garbage, dreadful stink, plastic bottles all around.
How far has EDC succeeded in SWM	The cleanliness is for all to see.	Very clean now	Place is now clean, EDC working very well.	Cleanliness achieved.	Very clean now.
Welfare activities by EDC	Registration of mules, mule-shades, loan facilities, women empowerment, no. of stalls regulated, employment and	No more cheating, overall improvement in living conditions, employment, better	Community participation has resulted in all round welfare of the area.	Evolution of rules and regulations, reduction indrdgery.	Employment, experience, self-sustenance, women empowerment.

	involvement of local community, uniform rates for mules and dandi/kandi.	management during season.			
Role played in SWM	CTD of SW by involvement of the SWMPGs.	Financial aid, sanction by Head Granthji, solving of disputes.	Act as facilitators and oversee the working of EDC.	Eco fee paid most willingly, awareness campaigns attended.	Participate in all the activities of the EDC
Suggestions	Transparency in accounts, no misuse of money, bigger role of women , proper management, accountability of the employees, sanitation facilities still lacking, timely disposal of SW must.	More stringent regulations on mule owners, sanitation and better management required.	Management should be proper accounts should be channelised, no delay in transport should be permitted.	Waste transport, sanitation, drainage, drinking water.	Sanitation, quick transport of SW, transparency of accounts, public amenities to be looked into.
Willingness to work for conservation of VOF	Yes, in similar fashion through participation.	Yes, will aid in every way.	Yes, public participation is must.	Yes, will help and pay tax if needed.	Yes, will work, aid and pay if required.

5.2 Discussion

Eco Tourism encompasses all nature based forms of tourism in which the main motivation of the tourists is the observation and appreciation of the nature as well as the traditional cultures prevailing in natural areas. It is generally, but not exclusively, organized by specialized and small locally owned businesses. It aims at minimizing negative impacts upon the natural and socio-cultural environment. It supports the protection of natural areas by-

a) Generating economic benefits for the host communities, organizations and authorities managing natural areas with conservation purposes.
b) Providing alternative employment and income opportunities for local communities.

c) Increasing awareness towards the conservation of natural and cultural assets both among locals and tourists.

Although Hemkund sahib was discovered in 1930, the major upward surge in tourist population happened after 1980. The garbage had been collecting in the area since then while the management work as evident today began only in 2001. The whole place resembled an urban slum till then. It is difficult to fathom that pilgrimage route could be so littered by those seeking God! Under the aegis of Forest Department, EDCs have done a remarkable job considering that the place which used to be heavy with stink of rotting garbage is now clean.

Moreover, women empowerment is evident from the fact that majority of the men are busy with their own businesses during the season. Local youth is trained to handle EDC work. Registration, reception and interaction with visitors from all over the world is done by them. They also work at accounts and interpretation centre which are all computerized courtesy Forest Department.

5.3 Problems

a) Inspite of being one of the most popular and sought-after tourist destinations of Uttaranchal, Hemkund Sahib and VOF lack basic civic amenities. Facilities like clean toilets, safe drinking water and accommodation are practically nil. Rising demands on local infrastructure like transportation, water supply, waste water collection and disposal, accommodation, healthcare facilities and other services need to be addressed immediately.

b) The fragile slopes of the sensitive alpine region are under stress in terms of carrying capacity. The number o stalls should be regulated by the local administrative authority. EDCs have to bear huge transportation costs. The collected garbage needs to be brought to Dehradun for recycling, treatment and disposal. The costs for this transport runs very high.

c) The garbage bags dumped at various sites need to be collected at main collection site in GovindGhat. This should be done swiftly at the end of every tourist season (Oct). It

should not be neglected because soon it starts to snow at the upper areas and then carrying down the bags is not possible. By the time winters wear off and treks again defrost, it is quite late and rotting of garbage, now nearly four months old, begins. The stink from collected garbage bags is too much and predators begin to sniffle through them. Rising temperatures would eventually further flourishing of bacteria in the garbage which fails the whole purpose of the SWM.

d) Absolute power breeds absolute corruption. It is vital therefore that the executive is made accountable for its actions and transparency in accounts is maintained. The revolving funds are for and by the people. People should be given the right to look into accounts and manage them. The benefits should reach each individual equally.

5.4 Recommendations

The transportation cost can be regulated by employing alternatives in SWM. Since the majority of visitors are youth, their age group could be helpful in carrying back their own wastes. The collected waste could be handed over to sanitation expert at allotted collection sites. The returned waste could be segregated and reused and recycled according to potential under monitoring by the DA. Instead of transporting the waste all the way to Dehradun, alternatives could be found in nearer towns like Deoprayag.

The storage of SW should be convenient for the user and should facilitate safe and efficient collection. Storage devices which prevent access to odours, vectors and emission of excessive odours need to be used.

People trained to handle waste scientifically need to be employed by the EDCs during segregation. Staff should be trained in SWM by a sanitation expert. The problem of plastic could be managed by adopting re-using practice by the users. The use- efficiency could be increased instead of immediately turning the commodities (like rain coats, stall covers, water bottles, etc.) into useless waste.

5.5 Conclusion

EDCs in the area have done a pioneer work in SWM through public participation. Various expenditures have been borne without any outside aids besides undertaking welfare activities which is both remarkable and commendable. Community involvement in SWM has resulted into following-

1) Enhanced mutual co-operation and collective action for the revival of ecological pressures contributing to ecological and social security of the local community, evolution of rules, regulations and sanctions for collective action which can be spread spatially and functionally.
2) Improved confidence levels of the resource- poor and women.
3) Increased trust between agencies and villagers.
4) Contributed local knowledge and experience to supplement that of “technical experts”.
5) Reduction in drudgery and improved quality of life due to employment generation.
6) Development of leadership from amongst resourceless and backward villagers who are the major users of local wealth.

The need is to cultivate clean habits in stall keepers and visitors by making them aware of the hidden wealth within wastes. SWM problems are indirectly a result of the user’s way of life. To diffuse this idea amongst the users, a mass awareness campaign is required where schools and institutes could play a crucial role.

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