# From Mouse Paw to Yeti Foot:

***The Growing Ecological Footprint of Manali, Himachal Pradesh, India***


BY

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# Abstract

Although the population of Earth has historically been rural, the dominant demographic trend in the late twentieth century is urbanization. In terms of sustainability, this shift from a predominantly rural to a predominantly urban world population presents significant challenges. Finding ways to measure and assess the long-term sustainability of cities has become a critical task. Among the methods that have been proposed to achieve this task is Ecological Footprint (EF), or Appropriated Carrying Capacity, Analysis. EF analysis, which was developed by William Rees and Mathis Wackernagel, measures the land and resources a society consumes in order to sustain itself. The EF of a region is the area of productive land required to provide all the energy and material resources consumed and to absorb all of the wastes discharged by the population of the region using current technology, wherever on earth that land is located (Wackernagel & Rees 1996).

The purpose of this study was to use EF analysis to quantify the sustainability of Manali, a rapidly urbanizing tourist centre in the Kullu District of Himachal Pradesh, India. The study looked at changes in the size of Manali's footprint since the advent of mass tourism in the early 1980's; the direct effect that tourists are having on the size of the footprint; and the challenges of applying this analysis in a developing world situation. Data regarding such things as land use, goods and services, and population were collected for the Manali region through local interviews and available written materials.

The results indicate that between 1971 and 1995, the overall EF of Manali town increased from 2,102 hectares to 9,665 hectares, an increase of over 450 per cent. The town's EF is now 25 times greater than its size. This substantial increase is a sign that Manali is moving away from sustainability - environmentally, socially

and economically - and into a situation where it is relying increasingly on outside ecosystems. Since 80 per cent of the increase in Manali's EF was due to tourist consumption, this change also indicates that tourism is having a substantial impact in the Manali area. Monthly EF calculations show that the footprint of Manali waxes and wanes with the tourist population.

On a per capita basis, the footprint of the average Manali resident and its tourists increased from 1.1 to 1.3 hectares, a rise of 19 per cent, over the last twenty years. The bulk of this increase was due to an increased consumption of imported fossil fuels, with the per capita fossil energy footprint for each resident and tourist increasing by 500 per cent. Additionally, while the per capita footprint of Manali residents and tourists rose, the amount of productive land per capita available in the region actually decreased from 0.8 to 0.7 hectares per capita. Although the footprints of tourists, both foreign and domestic, were considered to be the same as those of Manali residents in the study, there is evidence to suggest that their footprint is actually up to 13 times greater than that of the locals. This would dramatically increase the true EF of Manali town.

Based on the results of the EF study, local interviews and a literature review, officials in Manali should be focusing policy and program efforts on: 1. waste management; 2. decreasing fossil fuel dependency; 3. developing eco-friendly tourism and 4. creating an environmental awareness campaign. Addressing these issues would help to reduce the overall EF of Manali and create conditions for long-term sustainability.

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# Section I -

## Introduction

# 1.0 Introduction

There is growing evidence that the battle for sustainable development will be won or lost in urban areas. Statistics show that at the beginning of this century only ten per cent of people lived in cities. By 1960 this value had tripled to 34 per cent of the population and, if current trends continue, 60 per cent of the world's population will be urban dwellers by the year 2025 (Brown & Jackson 1987; Folke *et al.* 1997; Lowe 1991)[1]. Nowhere is this trend more apparent than in the developing world where many cities are doubling every ten to fifteen years, accommodating nearly two-thirds of the developing world's population growth (Bartone 1991; Lowe 1991). An excellent example of this is India, a country which is predicted to house over a billion people by the end of the year 2000. Although this population is still predominantly rural, with only about twenty-four per cent of individuals living in urban areas, India is not immune to global urbanization trends (Abram *et al.* 1996; Gardner *et al.* 1997; Kusey 1996; Pandey, Singh & Singh 1998; United Nations 1995). Indian cities grow by over 600,000 people each month and, as these urban areas swell, they threaten the sustainability of India's natural resources - despite the fact that the average Indian consumes much less than an inhabitant of a typical Western country (Abram *et al.* 1996).

The growth of Indian cities, as well as others worldwide, is a strong indication that urban sustainability is fundamental to global sustainable development. The sheer number of people living in urban areas, however, is not the only rationale for adopting an urban focus to sustainability problems. At the urban level the environmental impacts of human activities often emerge more quickly, more intensely and more acutely than elsewhere. Urban areas require large inputs of natural resources and usually hold major concentrations of polluting activities, such as industrial development, automobile use and waste generation. As a result, these areas may act as early-warning indicators of more deep-seated, broader reaching sustainability crises (Wackernagel 1998; White 1994). In addition, urban areas generally house substantial economic and political power. Worldwide, cities are the largest contributors to Gross World Product and most economic and political decisions are made in cities (Wackernagel 1998). Evidence of the implications this has for sustainability are clear in the implementation of Agenda 21 worldwide. Since the signing of this United Nations convention in 1992, the bulk of associated sustainable development initiatives have been undertaken by city governments, *not* national governments (Piel 1992; White 1994 ).

A predominantly urban world population, however, presents significant sustainability challenges. Urban areas require productive ecosystems outside of their borders to produce the food, water and renewable resources consumed by their residents. They also depend upon ecological systems to absorb wastes and to provide life support services, such as climate stability and protection from ultraviolet radiation (Bartone 1991; Brown & Jackson 1987; Folke *et al.* 1997; Lowe 1991; Wackernagel *et al.* 1993). As cities grow, their consumption of energy and resources, as well as their production of wastes and pollution also increase. This can quickly overtax the capacity of local ecosystems, forcing the city to exert pressure on more distant ecosystems for desperately needed resources and ecological services (Brown & Jackson 1991; Folke *et al.* 1997; Holden 1995). Rapid urbanization can also overtax local administration since urban growth often occurs so quickly that city administrators, frequently faced with a lack of authority to guide land use and a lack of funds to provide basic services, find their ability to provide residents with clean water, sewerage, adequate transportation and other basic services, completely overwhelmed. The result is chaotic and uncontrolled growth which draws on ever more land, water and energy from surrounding

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[1] Note that definitions of urban areas vary. Many institutions use a threshold number like 2,000 inhabitants or, in the case of the Indian government 5,000 inhabitants (Bose 1978). Others argue that even small villages can be 'urban' (Werna 1998).

regions to meet urban demands (Bartone 1991; Brown & Jackson 1991; Gardner *et al.* 1997; Lowe 1991; Pirazizy 1992).

The frequent exploitation of outside ecosystems by cities goes against the tenets of sustainable development and can be risky for city inhabitants. It creates dependence on foreign resources and ecosystem functions over which city inhabitants have little control or influence. It creates the illusion of resource abundance by sheltering cities (or isolated urban areas) from the ecological damage they inflict outside their boundaries. It also creates inequity by exploiting the resources and ecosystem functions of other, often less fortunate, populations (Bartone 1991; Brown & Jackson 1991; Folke *et al.* 1997; Lowe 1991).

These problems, as well as others associated with rapid urbanization, can be particularly harmful in mountainous regions, such as the Himalayas, where they are intensified by the vulnerability of the mountain environment (Kant 1998; Marh 1998; Pandey, Singh & Singh 1998; Pirazizy 1992). In recent history, many such regions have suffered rapid degradation because of human activities, particularly those associated with urbanization, population growth, development and tourism (Ahmad 1998; Kayastha 1998; Marh 1998). Increased incidences of landslides, deforestation, soil erosion, and air and water pollution are all signs of the negative impact humans are having on this environment (Groetzbach 1988; Kant 1998; Marh 1998). These impacts, as well as others, have all been witnessed throughout the Indian Himalayas, which over the last few decades, have experienced both rapid urbanization and tourism expansion. For example, in the mountainous state of Himachal Pradesh, the environmental consequences of urban growth are clearly evident in traditional service centres like Mandi and former hill stations like Shimla.

In order to assess urban sustainability in places like the Indian Himalayas, measurements must be made of the impact urban areas have on the sustainability of their surrounding environments - ecological, social, and economic. Unfortunately, this task has been complicated by the fact that urban sustainability, like its parent, sustainable development, is still a vague concept. There is no single best definition of urban sustainability because it can be very local and situation specific (Maclaren 1996a; Roseland 1992). In general, sustainable communities are those that protect and preserve important resources, decrease unnecessary consumption of global resources and recycle their used resources. Since cities are essentially man-made artifacts, sustainability requires them to strive for the ecological balance and conservation of their natural environment, as well as the maintenance of their built environments. The latter is particularly important to social and cultural sustainability and constitutes a city's unique contribution to the environment (Porter 1993).

Although much qualitative work has been done to assess sustainability in urban areas, few quantitative measurements exist. One of the more interesting quantitative techniques to emerge is Ecological Footprint (EF), or Appropriated Carrying Capacity, Analysis. Developed by William Rees and Mathis Wackernagel, this technique measures the land and resources a society consumes in order to sustain itself. The EF of a region is the area of productive land required to provide all the energy and material resources consumed and to absorb all of the wastes discharged by the population of the region using current technology, wherever on earth that land is located (Wackernagel & Rees 1996). Levett (1998a) has suggested that "..footprinting is the best tool we have yet for measuring and comparing the ecological impact of different activities, places, people or lifestyles". The analysis acknowledges that everyone will have some impact on the earth and suggests that the challenge for sustainability lies in reducing this impact. Small or decreasing per capita EFs indicate that a region is moving towards sustainability, while those that are inordinately large or rapidly growing indicate just the opposite. Urban areas can use EF analysis as a yardstick measurement against which the impact of future developments and growth towards the goal of sustainability can be measured (Wackernagel 1998).

## 1.1 Purpose & Objectives

The purpose of this research was to use EF analysis to examine the sustainability of Manali, a rapidly growing tourist town located in the Kullu District of Himachal Pradesh, India.

The primary objectives of the research were the following:

1. To quantify the historical EF of Manali, prior to the town becoming a major tourist destination;

2. To quantify the current EF of Manali;

3. To analyze the relative importance of each consumption category considered in the analysis to the magnitude of Manali's EF and to the town's overall sustainability;

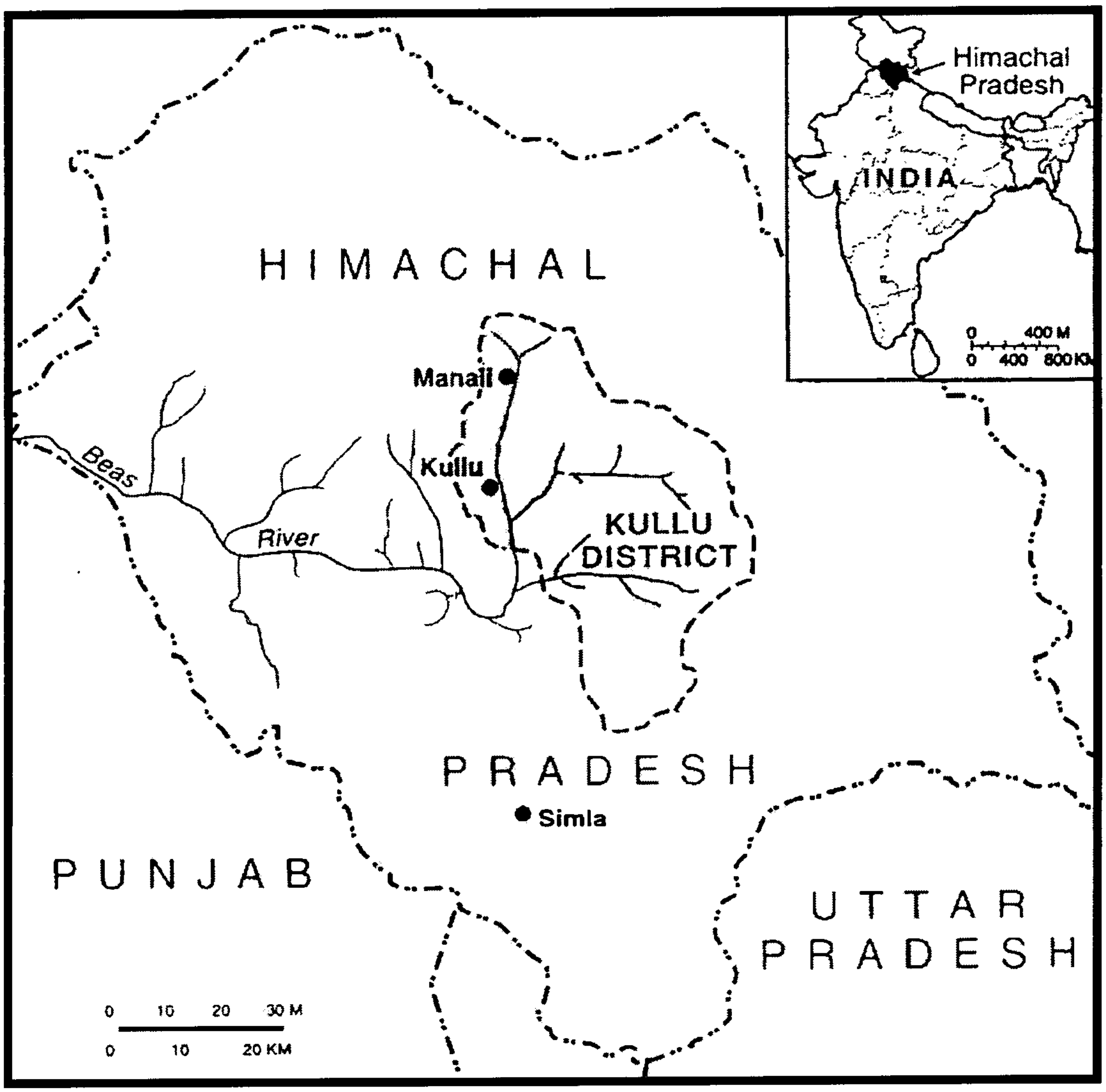
4. To demonstrate how EF Analysis can be used to analyze the impact of various policies and programs on the long-term sustainability of Manali, and;

5. To assess the utility and practicality of using EF analysis to measure sustainability in developing countries and, more specifically, smaller urban centres within these countries.

## 1.2 Scope of the Study

This study took place exclusively in the town of Manali at the north end of the Kullu Valley in the Kullu District of Himachal Pradesh, India (Figure 1.1). Manali was chosen for several reasons. Firstly, it is the main tourist centre in the Kullu Valley. As a result, it has experienced some of the greatest urban growth in the region. Secondly, it is located in the Himalayas and this provides an opportunity to study the sustainability implications of rapid urban growth in the developing world, within the context of a mountainous environment. Finally, research work

**Figure 1.1 The Study Site - Manali, Kullu District, Himachal Pradesh, India**



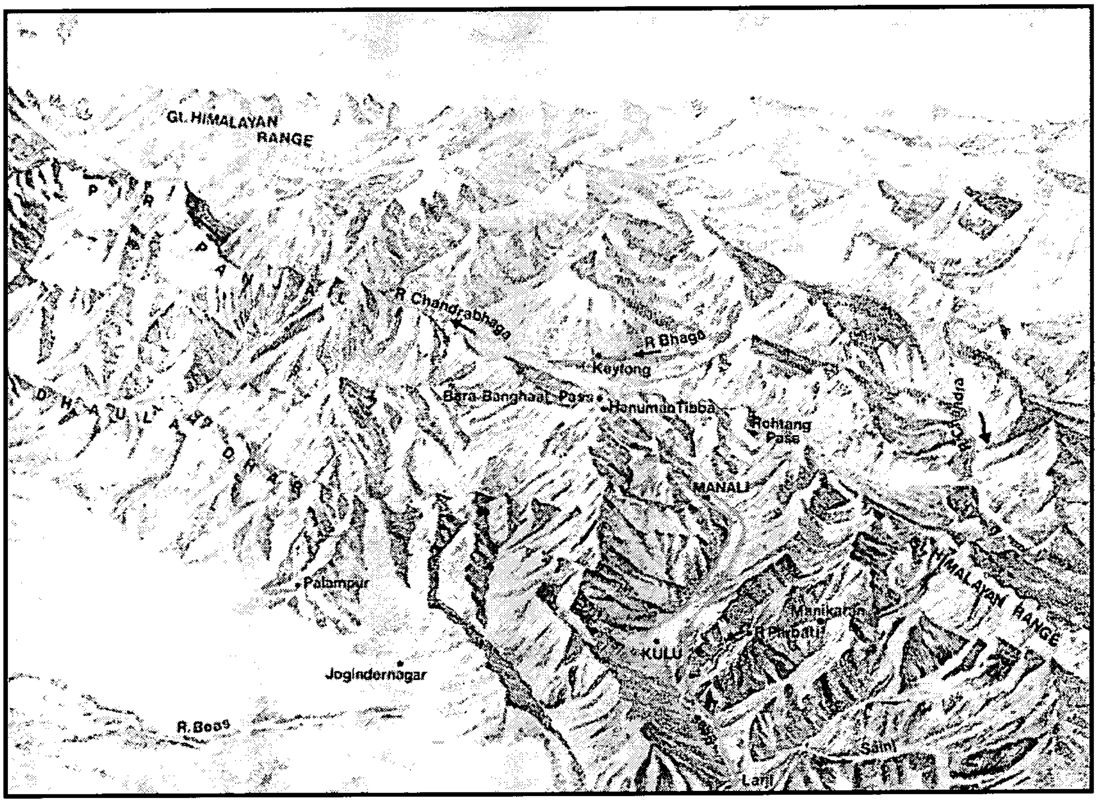
had already been completed in Manali and its outlying areas by professors and students at the University of Manitoba in collaboration with colleagues at the University of Delhi (see Berkes & Gardner 1997). This research provided the background information necessary to develop this project, and acted as a source of information from which to compare its final results.

### 1.3 The Kullu Valley and its Recent History

Bound on all sides by mountain ranges, the Kullu Valley lies in the transitional zone between the lesser and greater Himalayas (see Figure 1.2). It is situated in the headwater region of the Upper Beas River and has altitudes ranging from 1,300 to 6,000 metres. In some regions the valley stretches up to 3 kilometres in width while its length runs approximately 80 kilometres north-south from the mouth of the Larji Gorge, near Mandi, to the Manali area (although to the tourist it extends as far as the Rohtang Pass!) (Abram *et al.* 1996; Director of Census Operations, Himachal Pradesh 1991; Gardner 1995; Singh 1989).

The valley derives its name from "Kulanthapitha", which literally translates to "the territory which marks the end of Kula" - Kula being the socio-religious system of the mainland (Shabab 1996). As such, the Kullu Valley is often referred to as the "end of the habitable world" or the "end of the civilized world" (Chetwode 1972; Director of Census Operations, Himachal Pradesh 1991; Shabab 1996). Throughout its history, the Kullu Valley has attracted many visitors and pilgrims. This is because, apart from its natural beauty, the valley contains many religious monuments and several heroes of the great Indian epics have a close connection with the valley. For example, the Beas, which was originally known as Arjikiya in the Rig Veda and Vipra in Sanskrit, is thought to have been renamed after the author of the Geeta and Mahabarata who sought solitude and re-creation in the river (Gardner 1995).

**Figure 1.2 The Kullu Valley and its associated mountain ranges.**
*(Source: Sharma 1989)*




The Kullu Valley gained importance during the 7th century A.D., with the opening of a trade route between India and Tibet through its lowland. Following a long history of kings, rulers and overlords, the Kullu Valley came under British rule in 1846. For the purposes of easy and profitable management, the British introduced the modern concept of boundaries, such as tehsils and districts. The Kullu district was formed and divided into four tehsils - Kullu, Banjar, Ani, and Nairmand - which, with the addition of the newly formed Sainj tehsil, still exist today (Director of Census Operations, Himachal Pradesh 1991; Pandey, Singh & Singh 1998; Pirazizy 1992; Shabab 1996). The British also introduced modern medical practices, lowering infant mortality rates and increasing life spans. They launched large scale developmental activities, such as road, bridge and school construction, and established the foundation for the valley's now flourishing horticultural industry (Pirazizy 1992; Shabab 1996).

Of particular importance was the construction and opening of the Mandi-Larji gorge road in the 1920's for the purposes of exporting fruit. Up until this point the Kullu Valley could only be reached by foot or by riding ponies along precipitous paths. The gorge road made the valley accessible to motorized vehicles and enhanced communications and prosperity, bringing an end to peace and isolation (Abrams *et al.* 1996; Chetwode 1972). This type of development continued after Indian Independence in 1947 and, as buses and private cars began to travel into the valley, the region was transformed into a popular holiday resort (Pirazizy 1992).

In the past, the mountainous land surrounding the Kullu region, as well as its isolation, demanded that the population density per unit of land be low. This is seen in the historically small, predominantly rural population housed in the valley. The lifestyle led by Kullu's traditional residents was a kind of semi-tribal or small family-oriented life with an economy based primarily on subsistence activities (Berkes *et al.* 1998; Pandey, Singh & Singh 1998; Pirazizy 1992). These individuals lived within the environmentally tolerable limits of the region. They caused little disruption to the environment and maintained the delicate balance of the mountain ecosystem (Pirazizy 1992).

As the Kullu Valley opened up to the outside world, however, the lives of its residents were naturally affected. Increased accessibility, modernization and effective communications encouraged migration and increased population densities throughout the Kullu Valley (Pandey, Singh & Singh 1998; Pirazizy 1992). Unrest in other parts of the Himalayas, mainly in Kashmir and Jammu and adjacent service centres in Uttar Pradesh, Bihar and West Bengal, have served to channel the flow of tourists into the Kullu Valley, a relatively peaceful area. In addition, the Chinese invasion of Tibet in 1950 brought thousands of Tibetan refugees to the region. As a result of these circumstances, the Kullu Valley has faced an even more rapid rate of urbanization and social change than the average for India (Gardner *et al.* 1997).

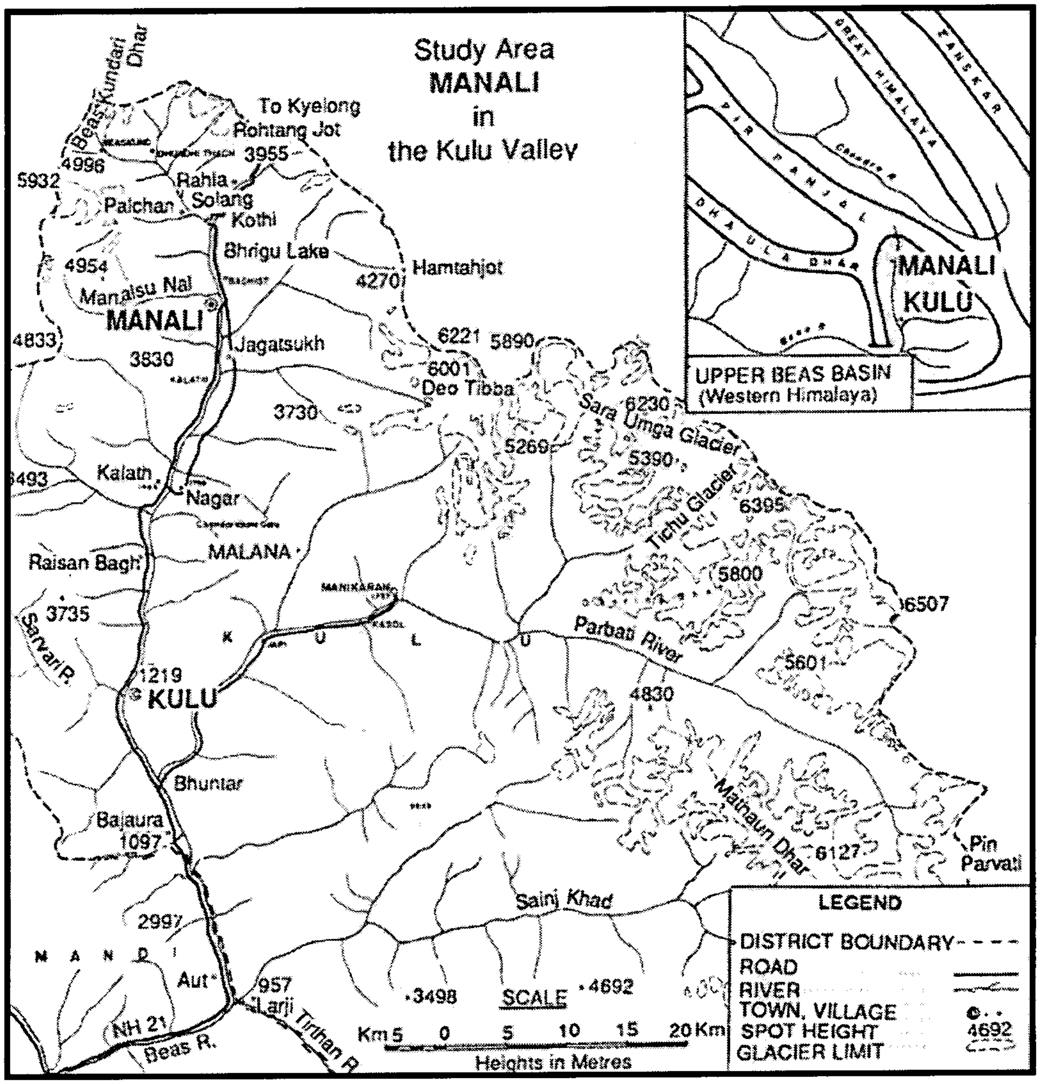
The expansion of Kullu's urban areas has served to increase tourist flow to the Kullu Valley and create new forms of livelihood for its people. Not only is this enticing new residents and workers, but many of Kullu's long-time residents are opting for jobs as hotel operators, trekking guides and shop owners, among others, in exchange for or in addition to their traditional agricultural livelihoods (Chetwode 1972; Pandey, Singh & Singh 1998; Pirazizy 1992). As well, the sheer number of tourists in the valley is placing increasing pressure on its natural resources (Kant 1998). Modern tourism differs substantially from the pilgrimages of the past, as it requires extensive infrastructure and can be the source of copious quantities of waste. In the words of Sunderlal Bahaguna, one of India's most prominent environmentalists:

> There is a vast difference in the mentality of a tourist and a pilgrim. Even the rich when on a pilgrimage live like fakirs. Earlier the visitors were pilgrims and they did not stay. They bought "sattu" (a porridge) which they mixed with water. Now they need tea and fast food. (Interview by Misra 1998).

## 1.4 Manali - A Description of the Study Area

Manali is the main tourist destination in the Kullu Valley. It lies at the valley's north end and is situated at the confluence of the Beas River and the Manalsu Nallah (see Figure 1.3). Sitting at an elevation of 2050 metres from mean sea level and nestled in the Pir Panjal Range of the Western Himalayas, Manali is known for its idyllic mountain scenery, orchards, forests and terraced fields (Abram *et al.* 1996; Berkes *et al.* 1998; Berkes & Gardner 1997; Chetwode 1972; Pandey; Singh & Singh 1998; ). Despite the wonder of its natural setting, however, Manali

**Figure 1.3 Manali at the confluence of the Beas River and the Manalsu Nala**
*(Source: Sharma 1989)*



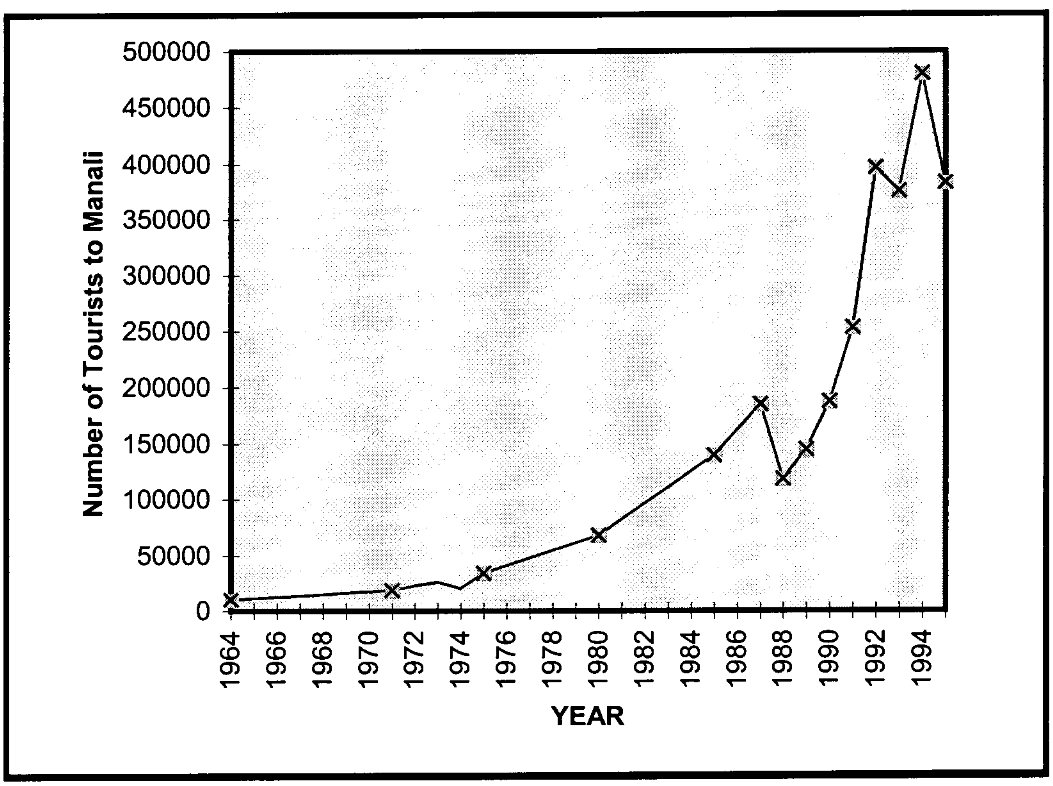

provides an excellent case study for the effects of urbanization on sustainability in a mountain environment.

The village of Manali, originally called Dana, was established as a service centre by British settlers in the late 1800's. Dana, which literally translates to 'fodder', was almost the end point of human settlement in the Kullu Valley and was the last place where travellers could get fodder for their mules before crossing the Rohtang Pass at the head of the Valley (Chetwode 1972; Gardner 1995; Pandey, Singh & Singh 1998; Shabab 1996). The traditional lifestyle led by residents in and around Manali was similar to that in the rest of the valley and based primarily on subsistence activities (Berkes *et al.* 1998; Pandey, Singh & Singh 1998; Pirazizy 1992). This has changed in recent years as a result of the introduction of various fruits to the region by its British settlers, particularly apples. Many local individuals in and around Manali have planted their terraced fields with orchards and the apple has been credited for creating a "revolution in the well-being and prosperity" of local people (Duffield *et al.* 1998; Gardner 1995; Qasim 1996).

Manali functioned as a small, relatively unknown service centre until 1958 when independent India's first prime minister, Jawaharlal Nehru, visited the region. Legend has it that Nehru was overwhelmed by the beauty and serenity of Manali and declared his full support for developing the area's tourist potential. The Himachal Government capitalized on the media publicity and began its own program to develop tourism infrastructure in the region. This development proceeded at a steady, albeit slow pace, until the late 1970's. From that point forward, major changes in the shape and size of Manali began to take place. Small, orchard-based guest-houses began to be replaced by a myriad of hotels ranging from economy to luxury accommodations; the Himachal Pradesh Tourist Development Corporation (HPTDC) established four of its own hotel operations in Manali; and HPTDC, along with other tour operators began to develop and market package tours to the Manali area to domestic and foreign tourists (Gardner 1995; Singh 1989). By 1981, the village had been declared a town, becoming one of only three urban centres in the Kullu Valley. In 1997, the local government became an elected Nagar Panchayat - a form of local government which, according to the Indian Constitution, is reserved for an area "in transition from a rural area to an urban area" (Bakshi 1998; Kusey 1996; Pandey, Singh & Singh 1998).

Manali has rapidly developed into a full blown Indian tourist resort, as evidenced by the following: 18,500 tourists visited Manali in 1971 - in 1995 there were over 300,000 tourists (see Figure 1.4); there was a six-fold increase in Manali's tourist flow between 1985 and 1993; only 82 vehicles passed through Manali in 1969 - in 1994 there were 205,185; in 1975 there were only 2 hotels/guesthouses in the Manali area - in 1998 there were 693; there are more hotels/guesthouses in Manali than in Bhuntar and Kullu, the two other urban centres in the Kullu Valley, combined. These statistics are even more extraordinary when one takes into account the fact that, as a town, Manali is only 3.5 square kilometers in area, has only 7 wards and 5 urban blocks and has a permanent population of only about 3,000 people (Pandey, Singh & Singh 1998; Singh, 1998).

**Figure 1.4: The Growth of Tourism in Manali**
*(Source: Singh 1989 & Himachal Pradesh Tourism Development Corporation 1998(?))*



*(NOTE: The highlighted data points are those for which the data were known. Missing data points have been extrapolated from those that were available.)*

Manali's growth is among the fastest in the Himalayas, largely because of inter-regional and intra-regional political unrest in other tourist areas, such as Kashmir and Uttarkhand (Abram *et al.* 1996; Gardner 1995; Kusey 1996; Pandey; Singh & Singh 1998; Singh 1989). These conflicts have literally funneled tourists into Manali, as it has become one of a handful of alternative tourist destinations in the Indian Himalayas. In addition, the influx of a large number of Tibetan refugees (reputably 4,000) and Manali's location on the only alternative surface transport route to Ladakh, in northern India, have added to its growth.

Some might consider Manali's rapid urban development to be a real boon for a traditionally rural area. In terms of sustainability, however, it is far from successful. As mentioned previously, meeting the demands of the modern tourist industry requires extensive infrastructure facilities which can seriously impact environmental quality. In Manali, new buildings have been hastily and haphazardly erected along frequently flooded river banks and the traditional character of mountain homes is being lost (Abram *et al.* 1996; Gardner 1995; Himachal Pradesh Tourism Department 1993; Singh 1989). The amount of land suitable for development has decreased and areas surrounding Manali, like those surrounding most tourist centres, are annually losing land, trees, grasses and aggregate building materials, and are subject to the leveling of hills and paving of farmland in order to accommodate the tourist sector (Gardner *et al.* 1997; Groetzbach 1988; Kant 1998; Pirazizy 1992). The infrastructure required to provide basic amenities to tourists also has the indirect effect of accelerating the process of urbanization (Pandey, Singh & Singh 1998).

The chaotic, unplanned nature of its development, combined with the speed at which it has occurred, has placed Manali in a situation where it now faces problems of air and water quality and waste removal and disposal (Gardner *et al.* 1997; Kayastha 1998; Lohumi 1998a; Pandey, Singh & Singh 1998; Singh & Tingal 1998). Litter and non-biodegradable wastes, such as water bottles, tetra juice packs, tin cans and plastic bags, proliferate as the number of tourists increases. The ever increasing presence of private vehicles and buses is creating problems of air and noise pollution. New studies indicate that the 'A' quality water entering Manali degenerates to 'B' and 'C' quality as it passes through the town and that levels of suspended particulate matter (SPM) in the air are frequently well above the prescribed level of 100 parts per million (Lohumi 1998b). Indeed, Pandey, Singh and Singh (1998) have gone so far as to suggest that the "...quality and quantity of hotels and guest houses have reduced [Manali] from a tourist destination to an *urban slum*[2] without adequate water or sewerage facilities".

Some might argue that this situation is far from critical given Manali's low population numbers when compared to other urban areas in the sub-continent (e.g. approximately 3,000 in Manali, as opposed to 7,200,000 in Delhi). But, population numbers alone do not tell the whole story (Pandey, Singh & Singh 1998; United Nations 1995). The mountainous environment in this region is extremely vulnerable with an inherently low carrying capacity. It is not naturally equipped with the resources to house large numbers of people and the increased population, coupled with thousands of tourists threatens the already marginal availability of resources (Berkes *et al.* 1998; Pandey, Singh & Singh 1998; Pirazizy 1992).

In addition to environmental havoc, the urbanization of Manali is also leading to rapid social change. A surplus of wage labour and opportunities for seasonal employment are enticing new residents and workers into the area and it is estimated that the population of Manali increases by 10,000 people during the peak tourist season (Town of Manali 1997). Many local residents have had their traditional livelihoods displaced as they opt for jobs in the tourism industry as hotel operators, trekking guides and shop owners (Chetwode 1972; Ham 1997;

[2] Emphasis added.

Pandey, Singh & Singh 1998; Pirazizy 1992). According to local residents, as well as many scholars, the influx of tourists coupled with the urbanization process is eroding the traditional family-oriented values of area residents and replacing them with materialistic values, such as greed and selfishness (Chetwode 1972; Pandey, Singh & Singh 1998; Pirazizy 1992; Singh 1998).

As one Himalayan scientist has remarked, "Tourism is not only the goose that lays the golden eggs… it also fouls its own nest" (Bishop 1988). Today, Manali's economy is almost wholly dependent on tourism and its natural resource base. Considering the environmental vulnerability of this region, it seems only logical to conclude that Manali's exploitation of surrounding and external ecosystems will have to be curbed if its residents wish to restore the once pristine nature of their own nest.

## 1.5 Organization of the Thesis

The opening sections of this thesis were meant to provide insight as to what lies ahead. The thesis itself is organized into five main sections, namely: Introduction, Methods, Results, Discussion, Conclusions and Recommendations. The first section, the Introduction, presents an overview of the project, as well as a review of related literature. The Methods section provides a detailed account of how the EF of Manali was calculated and of the interviews conducted to verify the footprint results and extrapolate potentially viable policies and programs for long-term sustainability in Manali. The Results section provides a brief overview of the results achieved, while the Discussion section goes into greater detail about the implications of these findings. The final section, Conclusions and Recommendations, outlines the main findings of this report and discusses what steps Manali residents and local policy makers can take to reduce Manali's ecological footprint.

# 2.0 Conceptual Background

## 2.1 Sustainable Development

Seen as a means of balancing environmental, economic and social factors, the theory of sustainable development began to appear in policy literature after the International Union for Conservation of Nature and Natural Resources (IUCN) included it as a first principle of their 1980 World Conservation Strategy: Living Resource Conservation For Sustainable Development (Butz *et al.*, 1991). As a theory of development, sustainability elicited the attention of policymakers, environmentalists, scientists and others. The 1987 publication of Our Common Future by the World Commission on Environment and Development (WCED), in particular, brought the concept of sustainable development to the forefront of development literature and political priorities. The WCED provided the standard definition for sustainable development, stating that it is "...development which meets the needs of present generations without compromising the ability of future generations to meet their own needs" (WCED 1987).

Although the WCED definition is generally accepted, it has been criticized for being vague, open-ended and providing no framework or criteria for assessment of "so-called" sustainable development initiatives (Butz *et al.* 1991; Chattopadhyay 199?; Holling *et al.* 1997). Some have even suggested that sustainable development has as many definitions as there are people who use it! (Sarkar 1997). As a result, characterizing and defining sustainable development as a distinct type of development pattern has become a topic of extensive research. Such characterizations tend to fall into two general categories (Slocombe 1992; Redclift 1993). The first of these is the notion that sustainable development entails continued economic growth and resource use, but with fewer environmental impacts and more environmental controls. The alternative view suggests that sustainable development involves fundamental changes in lifestyles, economies, and societies; changes which would require a radical re-thinking of our place in the natural world and our belief that economic growth is always beneficial (Redclift 1993; Slocombe 1992).

The first theory of sustainable development, that of continued economic growth in an "environmentally friendly" manner, sees natural resources solely in terms of their economic potential. The development of these resources is considered to be inevitable - it is strictly a matter of when and how (Holling *et al.* 1997; Slocombe 1992). Proponents of this view balance development and conservation by imposing stricter environmental regulations and encouraging the development of technologies which reduce environmental damage (Slocombe 1992). Critics argue that the balance is weak to nonexistent and cannot be considered sustainable. For many, the simple creation of markets for and the making of profits from limited resources is inherently unsustainable because it lends itself to greed and encourages the continued use and over-exploitation of resources (Hoyt 1994).

Others, such as Costanza and Patten (1995), have argued that sustainability, or the persistence of a system, can only be properly assessed after the fact and that the actions we label as sustainable are really only predictions of what we hope will lead to sustainability. This being the case, it is impossible to accurately determine the types of mitigation measures or environmental regulations necessary to confer sustainability and it is even riskier to count on hoped-for technological advances to maintain resources and provide for a more populous and richer planet (Costanza & Patten 1995; Fri 1992).

Redclift (1993) has suggested that adopting this economics-oriented view of sustainable development is risky since it focuses on mitigating environmental impacts, rather than trying to eliminate the source of the problem - human behaviour and choices. By relegating the problem to one of science and public policy, Redclift (1993) argues that humans are able to avoid the implications of their own actions and those of society and, essentially, accept no responsibility for achieving a balance between conservation and development.

In addition, Butz, Lonergan and Smit (1991) have argued that this first theory of sustainable development fails to account for social factors and alternative world views, focusing strictly on western priorities such as increased material wealth, improved formal education and increased agricultural productivity. They argue that this type of development may be counterproductive because the goals of westerners are not always shared by 'eastern' communities and may even conflict with local conceptions of improvement. As a result, local residents may be reluctant to accept western innovations and, in many instances, may even reject or ignore development initiatives.

The second theory of sustainable development holds that the desired balance between economy, environment and society can only be achieved if fundamental changes occur in our lifestyles, economies and societies. Critical among these are changes to individual and societal perceptions of the ecosphere, as well as a restructuring of our economic system (Cernea 1993; Rowe, 1991; Slocombe 1992; White & Whitney 1992). This theory of sustainable development is much more comprehensive than that previously described as it insists that the link between social attitudes and practices and environmental impacts is equally important to the economy-environment link (Robinson *et al.* 1990). The main starting points for this type of sustainable development are: 1) a recognition that humans play a direct role in the health of ecosystems and; 2) an equal consideration of resources in terms of their economic potential and their benefits when left unexploited (Sarkar 1997; Slocombe 1992). For example, Slocombe (1992) has cited the example of a forest which may have greater value when left as a forest, or natural carbon sink, than if it is exploited for short-term economic gain.

For many, this latter type of sustainable development also involves "re-inventing" our economic system so that it will service ecosystem health, as well as economic or human health (Rowe 1991). Conventional economic systems provide little to no incentive for conservation since resources are usually considered to be free and their use a contribution to wealth (Barbier 1993; Redclift 1993). In addition, these systems are unable to provide for inter-generational equity because of their focus on short term economic gains. The value of a resource is generally considered to be greater if it is exploited today than at any time in the future because of the opportunity to invest monetary profits in alternative income-yielding assets (Barbier 1993). Although this has caused some concern among economists, for the most part they have resisted making a strong break from conventional economic systems. Their solution has been to try and quantify the costs of environmental problems, such as landscape degradation, so that these costs can be included in decision making processes (Barbier 1993; Holden 1990). It is extremely difficult, however, to place quantifiable dollar values on many environmental resources. Economists must find new ways of accounting for the costs of environmental degradation and resource depletion versus the benefits of leaving resources in their natural state (Holden 1990; Redclift 1993). One suggestion as to how this might be accomplished is the elevation of natural resources to the status of an irreplaceable and valuable commodity. This would encourage developers to think of the protection of ecological systems as long-term investments, rather than setbacks to growth (Daly 1994). In so doing, the value of ecological systems will move beyond material/monetary assessments and be considered in terms of their contribution to perpetual human welfare (Sarker 1997).

Conventional economic systems, particularly the market economy, may also discourage sustainable development by limiting the decisions individuals are able to make about their own livelihoods. Loubser (1995) argues that the market economy, in which formal employment is the dominant form of livelihood, relies on supply and demand to partially determine the availability for employment and the level of remuneration. This ultimately leads societies away from sustainability because it does not account for all aspects of life. There is also a strong tendency to externalize social and environmental costs and to ignore the symbolic, cultural and spiritual values of resources (Butz 1996; Korten 1995; Loubser 1995; North American Regional Consultation on Sustainable Livelihoods (NARCSL) 1995). This is particularly harmful to women and can lead to gross gender inequities because it is frequently women who carry out the unpaid, yet critical, social functions of reproduction, management, community caring and household and subsistence production (Antrobus 1995; Swantz 1995). Korten (1995) has suggested that this devaluation of our social economy may be one of the most debilitating effects of the market economy. Rather than encouraging the development and maintenance of family and community relationships to meet basic needs, the market economy fosters livelihoods based on the generation of sufficient income through the market. In so doing, cooperative, non-monetized relationships are converted to competitive, monetized relationships; the institutions of family and community become meaningless; and social capital is eroded.

For these reasons, Cernea (1993) has argued that sustainable development also requires a deliberate consideration of social factors. He goes so far as to say that it is not even possible unless it is "socially constructed". According to Cernea (1993), a central element of sustainable development is recognizing and strengthening the building blocks of social organization which are conducive to enduring development. By identifying these building blocks, which include such things as value and belief systems, systems of resource entitlement, and authority systems, developers can work with them to strengthen or build supportive institutional arrangements. In so doing, communities will have the formal organization, capability and desire to continue functioning in a sustainable manner

(Cernea 1993).

Ultimately, sustainable development is development which explicitly considers environmental, social and economic circumstances. These variables may differ substantially throughout the world and, as a result, how sustainable development is achieved must be altered accordingly. There is no simple cure-all recipe for global sustainability, however, there are certain characteristics which seem to be common to many sustainable development initiatives. According to Chattopadhyay (199?[3]), sustainable development initiatives usually include a combination of one or more of the following objectives:

1. Survival of human beings
2. Survival of all other life forms
3. Satisfaction of basic human needs
4. Maintenance of bio-physical productivity
5. Economic efficiency and growth
6. Preservation of environmental quality and ecosystem health
7. Inter- and intra-generational equity
8. Social justice
9. Self-reliance and people's participation
10. Stabilization of human populations
11. Promotion of values and ethics

Similarly, the North American Regional Consultation on Sustainable Livelihoods (NARCSL) (1995) has suggested that sustainable development requires greater public participation and involvement in policy making; the promotion of equity among generations, ethnic groups and genders; a nurturing of a sense of place and connection to the local community; a stimulation of local investment and a reinvestment of capital into the local community; an elimination of over-consumption of local and global resources; the use of technology that is ecologically appropriate, socially just and that enhances community knowledge and skills; a valuation of non-monetized work as well as paid work and; secure access to opportunity and meaningful activity for all in the community.

## 2.2 Urban Environments and Sustainability

Sustainable development is often written about in terms of rural areas and rural development and yet, as we near the end of the twentieth century, many of the sustainability challenges facing our world will have to be dealt with by urban planners, developers and policy makers. Throughout the last century urban populations have expanded from 15 to 50 per cent of total global population and for the first time in history more people will live in cities and towns than rural areas (Girardet 1998; Rabinovitch 1998). The challenges are even greater for cities in the developing world where the urban population has tripled in the last three decades alone (Rabinovitch 1998). Although much attention has been focused on the world's biggest megacities, such as Bombay and Mexico City, they contain only a relatively small proportion of all urban dwellers. Only about 15 per cent of urban dwellers live in cities with more than 5 million people, while over 60 per cent live in towns and cities of one million or fewer, a proportion which is not likely to change considerably in the future (Livernash & Satterthwaite 1996). Some have even suggested that the role of smaller centres may become increasingly important, especially in mountainous areas, to buffer the flow of migrants from villages to cities; to provide central locations for essential services, such as healthcare and; to act as marketing links between larger cities and local markets (Sharma 1998). Regardless, this massive explosion in urban population has intensified the need to create sustainable urban environments - a need which was not missed by the authors of Agenda 21 who devoted an entire chapter to the development of sustainable human settlements (Piel 1992).

Like sustainable development, definitions of urban sustainability are heavily debated. Some argue that urban sustainability should be concerned only with ecological sustainability as this is the foundation of all economic and societal

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[3] The exact year of this publication is unknown.

development. Others contend that the emphasis should be on the linkages between the natural environment, economic activity in the urban milieu, the built environment, and the human environment (Maclaren 1996b). Ultimately, there is no single best definition of urban sustainability, since it can be very local and situation specific. A more holistic perspective, however, is becoming increasingly popular. This perspective recognizes that trade-offs will have to be made among economic, environmental and social goals and between present and future generations (Maclaren 1996b). In this regard, some have compared a sustainable community to a three-legged stool, with the legs representing the environment, society and economy, respectively, and with the community on top of the stool. For the community to remain sustainable equal weight must be placed on each leg of the stool in order to maintain balance. If one leg is neglected for a prolonged period of time, the stool will become unstable and eventually topple (Canadian Mortgage and Housing Corporation (CMHC) 1995).

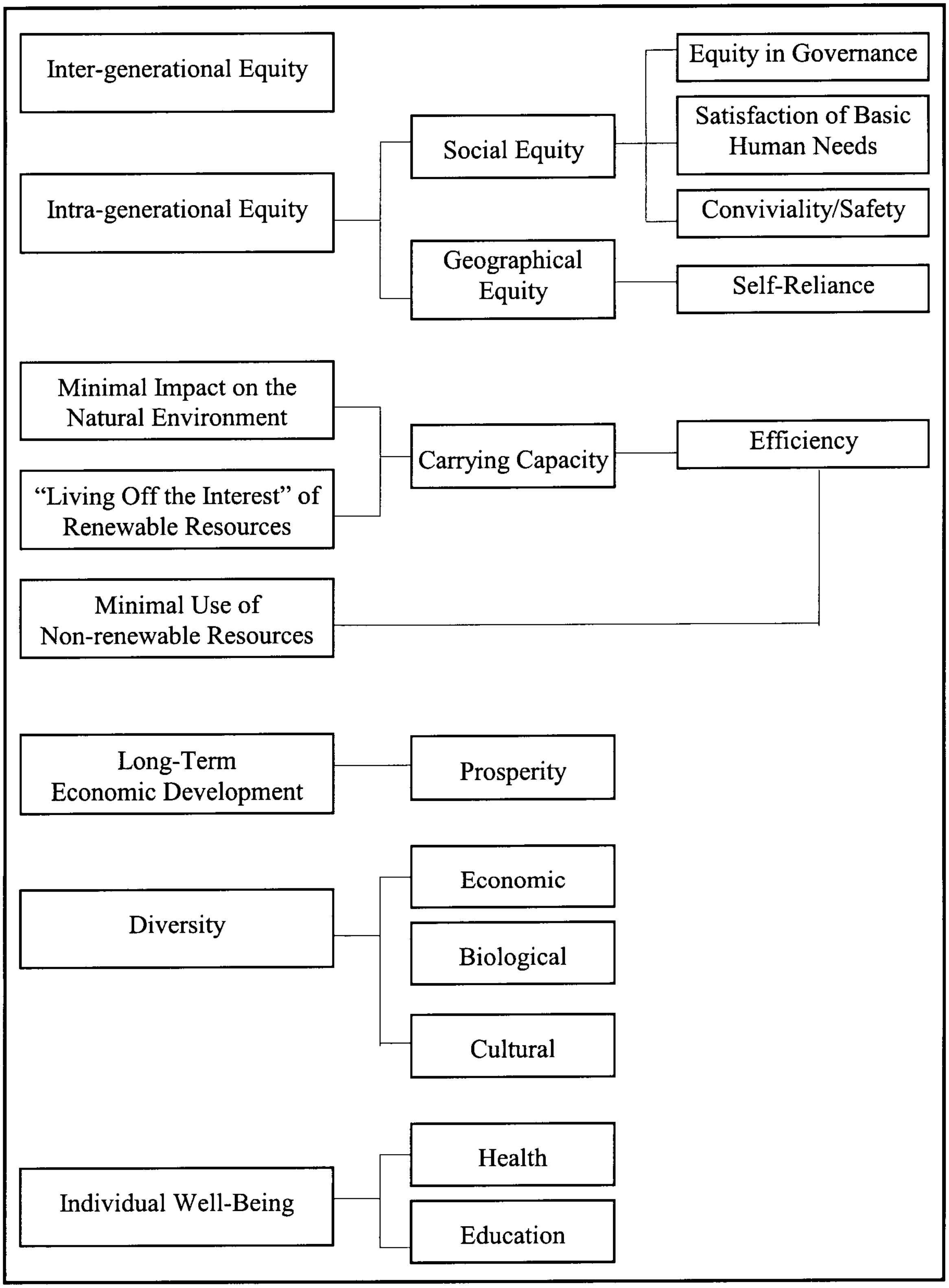
In general, sustainable communities have been described as those that protect and preserve important resources, decrease unnecessary consumption of global resources and recycle their used resources. Holden (1995) has suggested that urban sustainability policies should provide deliberate attention to minimizing natural resource consumption, including space and landscape; rationalizing urban flows such as water, energy, waste and transport; minimizing the pollution of air, water and soil; and increasing or maximizing biodiversity and biomass. Since cities are essentially man-made artifacts, sustainability requires them to strive for the ecological balance and conservation of their natural environment, as well as the maintenance of their built environments. The latter is particularly important to social and cultural sustainability and constitutes a city's unique contribution to the environment (Porter 1993).

Maclaren (1996a; 1996b) has suggested that the main characteristics of urban sustainability are: intergenerational equity; intragenerational equity; protection of natural environment; minimum use of non-renewable resources; economic vitality and diversity; community self-reliance; individual well-being, and; the satisfaction of basic human needs (see Figure 2.1). She warns, however, that there is debate surrounding the relative importance of each of these characteristics and whether all should be included in urban development plans. Instead, she suggests that the list be used as a starting point for municipalities attempting to develop their own conceptualizations of sustainability and specific sustainability goals (Maclaren 1996a; 1996b).

There are several characteristics of urban environments and urbanization that are both advantages and disadvantages in terms of sustainability. According to Negi (1991), urbanization involves the following processes: an increase in the density of persons per unit of area; an increase in the area of towns and cities; an ever increasing impact on the countryside; distinct changes in the way of life of the people and; an increase in environmental problems like air, water and noise pollution. Each of these processes, on its own and in combination with the others, has a myriad of implications for the sustainability of urban environments.

The high density of people per unit area is one of the advantages of city environments in terms of sustainability. This density creates conditions for energy efficiency in home heating and in the development of high quality public transportation systems. In addition, it facilitates the organization of systems for both waste recycling and collecting (Griardet 1998; Satterthwaite 1996). Density, combined with a large city size, also has economic advantages in terms of industrial production. Economies of scale in large cities generate goods and services far in excess of their share of the total population. These 'agglomeration economies' are a product of spatial concentration and urban scale that make economic activities relatively efficient in large urban areas (Rabinovitch 1998; Shukla & Parikh 1996). The higher productivity of urban labour means that wages are higher and employment opportunities are greater. Furthermore, the availability of appropriate institutions and resources means that cities are able to provide their

**Figure 2.1 The Characteristics of Sustainability**
*(Source: Maclaren 1996b)*



residents with the knowledge and skills to become more productive. Many of these economic advantages are so great that some have argued that curbing urban growth in the name of sustainability may be fraught with productivity losses. Such losses would be particularly devastating for the developing world where they would be higher in both magnitude and importance (Shukla & Parikh 1996). Instead, Shukla and Parikh (1996) have suggested that creating higher urban incomes will result in a spontaneous dispersal of individuals in urban areas, a stronger public demand for environmental abatement and greater societal wherewithal to undertake environmental protection as a matter of public policy.

Large city size, while an advantage economically, can also be a disadvantage to environmental and social sustainability. The larger a city, the greater the amount of land which is no longer available for such things as agriculture and forestry. Cities are also notorious for placing heavy demands on their surrounding environments for food, water and energy resources, as well as waste absorption and assimilation - demands which increase as the number and size of cities and towns swells (Bartone 1991; Brown & Jackson 1987; Lowe 1991). Modern cities typically increase their populations on the basis of appropriated resources, leading Rees to describe them as, "...the human equivalent of livestock feedlots" (in Honey 1989). The production systems required to supply the food, water and renewable resources needed to support urban residents are typically located far from city boundaries. This creates the illusion of resource abundance by sheltering cities (or isolated urban areas) from the ecological damage they inflict outside their boundaries (Bartone 1991; Brown & Jackson 1991; Folke *et al.* 1997; Haughton 1997; Lowe 1991; White & Whitney 1992). For example, energy use by large cities is frequently a source of wastes that degrade land and water courses and cause damage to much wider areas through such things as acid rain, global warming and ozone depletion. Urban wastes have a similar effect. Seventy per cent of maritime pollution is reportedly caused by land-based activities, such as inadequate sewerage facilities and industrial pollution being brought from inland streams and rivers into international water bodies (Rabinovitch 1998). Not only is the urban appropriation of resources ecologically damaging to other regions, it also creates inequity by exploiting the resources and ecosystem functions of other, often less fortunate, populations, leaving them with fewer resources for their own support (White & Whitney 1992).

Girardet (1998) has described the metabolism of modern cities as linear, with resources flowing through the urban system without much concern about their origin or the destination of the resultant wastes. Urban development is fueled by resources inputs which are, to a large degree, divorced from concern over outputs. For example, raw materials are extracted, processed and combined to create consumer goods that end up as garbage that cannot be reabsorbed into living nature; fossil fuels are extracted, refined and burned and their fumes discharged into the atmosphere; trees are felled for timber or pulp with few efforts made to replenish the forest. In other words, what goes into the system is not linked to what goes out. Girardet argues that for cities to become more sustainable, we will need to redesign the urban metabolism by 'closing the circle'. Through a circular metabolism, the inputs and outputs of the city are connected. Outputs, such as paper, metals, plastic and glass should be recycled and organic materials turned into compost, thus returning plant nutrients to keep farmland productive (Haughton 1997; Girardet 1998).

Large city size and a dense population mean that, at the urban level, the environmental impacts of human activities often emerge more quickly, more intensely and more acutely than elsewhere. Urban centres may actually act as early-warning indicators of more deep-seated, broader reaching sustainability crises, in large part because of their high concentrations of polluting activities, such as industrial development, automobile use and waste generation (White 1994). Developing countries, in particular, tend to have more compact city forms and more densely packed economic activities because of scarce transportation and housing resources, coupled with the economic advantages of spatial concentration. High population densities tend to amplify the impact of environmental degradation by increasing the number of victims exposed to environmental pollutants. Usually those most affected are the poor and disadvantaged. As well, the concentration of economic activities in these cities tends to increase the density of pollutants. This places a much greater burden on the surrounding environment because damage generally increases more than proportionately to the volume of discharges (Shukla & Parikh 1996). Such damage to nearby resources only serves to undermine urban economic growth since natural resources are the basis of most industrial activity (Bartone 1991).

Finally, urbanization can result in distinct changes in the way people live. Of particular importance is the change from a subsistence-based lifestyle to one which is centred on a cash-based economy. This, in itself, may discourage or even inhibit city residents from practicing the eco-friendly lifestyle of rural areas and encourage them to adopt consumption-oriented lifestyles. For city residents with little to no income, particularly those in countries with scarce welfare resources, the change to a cash-based economy can signal the creation of a desperate struggle to survive. High real estate prices in urban areas and concentrated land ownership mean that these individuals have virtually no hope of obtaining land or housing legally. As a result, an estimated 70 to 95 per cent of city residents in the developing world live in haphazard, unauthorized housing with few public services, poor sanitation and no garbage collection (Lowe 1991). Obtaining food can also be difficult as prices for basic products are frequently inflated in urban areas. In many parts of the world, urban agriculture is now being used to combat this growing problem. For example, in Dar-es-Salaam, one of the world's fastest growing cities, nearly 67 per cent of families are engaged in farming. Not only does this activity provide much needed foodstuffs, but it also provides people with livelihoods (Girardet 1998).

Despite the problems urban environments pose to sustainable development, cities by their sheer prominence present the greatest opportunity to effect positive change. Cities typically house a large proportion of the economic activities which contribute to Gross Domestic Product and many of the political decisions affecting sustainable development are made in cities. Since the 1992 signing of Agenda 21, the majority of sustainable development initiatives have been taken by city governments rather than national governments and, ultimately, over two-thirds of the actions suggested by this convention will have to take place at the local level. Urban areas, as local concentrations of people, are integral to achieving global sustainability - economically, socially, ecologically and politically (Atkinson 1994; White 1994).

## 2.3 Mountain Environments and Sustainability

In addition to urban sustainability, Agenda 21 also calls for a special focus on mountain ecosystems and, like urban sustainability, the achievement of sustainable development in mountain environments is still in its infancy (Ahmad 1998; Berkes & Gardner 1997). What is known is that the sustainability of mountain environments is imperative to global sustainability. High mountain areas cover almost one-quarter of the land surface of the globe and are home to about ten per cent of the world's population. Another 40 per cent or more of the world's population is dependent upon mountain resources for fuel, fodder, timber, energy, water, agriculture, minerals or recreation (Ahmad 1998; Eckholm 1975). According to recent estimates, mountain regions actually provide water for multi-purpose uses to about 50 per cent of the world's population (Singh 1998).

Despite the significance of mountain ecosystems to humanity, their degradation has become a global problem. Experts point to a number of trends as proof of this degradation, including: larger and more frequent landslides; soil erosion; air and water pollution; falling water levels in traditional irrigation systems; lower crop yields when compared to plains areas; diminishing genetic diversity of crops and livestock; decreasing diversity of flora and fauna; increased time collecting fodder and fuel and; higher rates of poverty, unemployment, and migration out of the hills (Allen 1995; Dennistion 1998; Groetzbach 1988; Kant 1998; Marh 1998). Some scientists assign the blame for this degradation to a growing population and the expansion of agriculture into increasingly fragile areas. They contend that the combination of poor farming techniques and overgrazing are causing mass deforestation which, in turn, is leading to high levels of soil erosion, the loss of productive land through heightened landslide incidences and disruptions to the normal hydrological cycle, and disastrous flooding and massive siltation in the plains caused by increased run-off during heavy rains, particularly monsoon rains (Ashish 1990; Eckholm 1975; Ives & Messerli 1989). One Indian scientist has even remarked that:

> ...the problem of disappearing Himalayan forests has less to do with bad forestry and rapacious forest contractors, than it has do with uncontrolled grazing by too many cattle and goats. In the interests of their traditional livelihood, hill farmers are destroying their means of survival and threatening the survival of the nation since the rivers which emerge from the hills are the lifeblood of the northern Indian Plains (Ashish 1990).

In an entire book devoted to the subject, Jack Ives and Bruno Messerli (1989) argue that the hill farmer as the cause of this environmental degradation is a "convenient scapegoat". They contend that the factors leading to the current environmental disaster in mountain areas are inherently more complex and have as much to do with politics, economics and increased accessibility, as they do with expanding agriculture, horticulture, grazing and population (Ives & Messerli 1989). Indeed, since this publication, many have argued that the biggest factors contributing to the demise of these regions are the human activities of population growth, urbanization, commercial forestry, economic development and tourism (Ahmad 1998; Allen 1995; Bahuguna 1989; Kayastha 1998; Rawat & Sharma 1995; Misra 1998). For example, some estimate that the construction of one kilometre of road in the Himalayas requires the displacement of about 40,000 to 80,000 kilometres of debris (Tiwari 1990). This is to say nothing of the developments which occur once the road is in place. Studies throughout the Himalayas and elsewhere have shown that a single road can precipitate the development of all kinds of infrastructure - from hospitals and schools to hotels and tea stalls - in connected villages (Price 1995; Rawat & Sharma 1995). Bahuguna, one of India's greatest environmental crusaders, has suggested that the four most devastating activities to mountain environments are: 1. the building of large dams; 2. mining; 3. deforestation and; 4. luxury tourism (in Misra 1998).

Although the magnitude of human activities in the mountains is often small relative to the surrounding plains area, the unique ecological features of mountain environments make them extremely sensitive to even small disturbances, the consequences of which are often irreversible (Ahmad 1998; Marh 1998; Qasim 1996). The vertical nature of the environment and its steep slopes mean that mountains are home to an exceptionally high degree of diversity with rapid changes in altitude, climate, soil and vegetation occurring over very short distances. Biologically, this high diversity leaves mountainous regions vulnerable to losses of whole plant and animal communities (Denniston 1998). For this reason, the prospect of global warning and climate change is a particular threat. The concern is that the rate of temperature change may be greater than the ability of species to adapt or to migrate to other environments. Despite the fact that migration may only require the movement of a few hundred metres upslope, rather than the few hundred kilometres that may be required in flatter areas, it is possible that even if seeds reached habitats with suitable climatic conditions, soil conditions may be inappropriate (Price & Haslett 1995).

Some have suggested that in order to prevent the loss of mountain species, it is important to maximize not only the area and altitudinal range of protected mountain areas, but also the heterogeneity of their topography and associated sets of conditions of resources, such as soils and microclimates (Price & Haslett 1995). The large diversity of mountain tracts, however, also means that, unlike the plains, the same strategies of development planning and conservation cannot be applied uniformly (Marh 1998). Each area of a mountain region needs to develop its own localized plans if long-term sustainability is to be possible. In this regard, many have argued that the best strategy for sustainable development is watershed planning (Bhati & Swarup 1985; Price & Haslett 1995; Qasim 1996).

Not only are mountain environments ecologically unique but they are also socially and economically unique. Traditional mountain inhabitants, particularly those in tribal societies, have lived primarily in isolation for much of their history. Their unique and independent social systems are now threatened by the onslaught of 'so-called' modernization (Marh 1998). For example, the long tradition of agricultural subsistence in the Kullu Valley with its family-oriented values is now being abandoned in favour of the more materialistic values associated with urbanization and the influx of tourists (Chetwode 1972; Pandey, Singh & Singh 1998; Pirazizy 1992; Singh 1998). Similarly, many of the individuals in the Himalayan valleys who used to rely on crafts to provide additional, non-agrarian, sources of income have been forced to give up this alternative source of livelihood because of competition from manufactured goods (Groetzbah 1988). Although in the long run this type of change is inevitable, Marh (1998) argues that its pace needs to be controlled if environmental and societal degradation are to be avoided. He suggests that the rates at which change can be assimilated vary among regions and societies and often depend on external linkages of the system, particularly economic linkages. Such economic linkages traditionally place mountain areas in an unequal relationship with the surrounding plains, a relationship in which natural resources are stripped from the mountains for the benefit of the plains without adequate compensation in return (Marh 1998). This has tended to increase the dependence of mountain communities on the outside world.

To make matters worse, mountain communities are often marginalized in the process of economic and political decision-making and, as a result, are frequently neglected in terms of development priorities. The reasons for this are varied, but include poor government representation as a result of large political divisions in mountain regions; the perception by plains people that mountain areas are marginal economic and ecological entities and; widespread discrimination among powerful lowlanders who frequently refer to mountain peoples as uneducated, unknowledgable, poverty-stricken "hillbillies" (United States), "oberwalders" (Austria), "kohestani" (Afghanistan) and "bhotias" (India) (Dennistion 1998; Sharma 1995). One of the few beneficial effects of rapid change in the mountain environments is that this perception is starting to change.

Many have suggested that for sustainable development to be possible in mountain regions, government policies and programs will need to be far more localized than is currently the case. In many countries, including India, policies and programs meant to affect mountain development have been created by a variety of government departments which: a) do not communicate with one another about the programs; b) are based in the plains with little communication occurring between those who develop the plans and those meant to implement them and; c) have frequent staff turnovers. The result has been a mish-mash of policies and programs which are inappropriate for the unique cultural and ecological conditions of mountain regions and are infrequently implemented at the local level (Bahuguna 1989; Bhati & Swarup 1985).

An excellent example of this is the development plans created for the town of Manali, the study site, by the District Planning Commissioner for the Kullu Valley in Himachal Pradesh, India. The planner visits Manali once a year, if at all. The development plans produced depict a well-laid out, zoned tourist town which look good on paper, but do not come even close to representing the reality of Manali, and are rarely seen by the local Nagar Panchayat responsible for implementing them.

Unfortunately, examples like this abound throughout much of the world's mountainous regions and have led to the argument that administration in these areas requires a grassroots approach. Bahuguna (1989) maintains that mountain sustainability requires a strengthening of local administrative systems, like the Nagar Panchayats, so that people are inspired to implement plans and projects according to their own needs. Similarly, Denniston (1995) has suggested that the diversity of mountain ecosystems, cultures and adaptive strategies requires a long-term commitment from government personnel so that effective programs can be developed. He also argues that project staff need time and training to understand local ecosystems and stresses, existing natural resources management strategies, cultural mores, community structures and gender roles (Denniston 1995).

### *2.3.1 Tourism, Mountains and Sustainability*

The impact of tourism on mountain sustainability warrants discussion in this paper for two reasons. Firstly, tourism has become one of the most important development schemes proposed for and increasingly implemented in mountain areas, and secondly, the primary focus of this study, the town of Manali, has itself become heavily dependent, economically, on the tourism industry.

In many areas of the world, mountain tourism is espoused as a means of community development which provides alternative livelihood opportunities, diversifies the local economy, promotes environmental care, and simultaneously addresses the twin problems of poverty and environmental degradation (Sharma 1998b; Singh 1989). In India, both state and central governments have declared tourism to be an industry, and have provided the tourism sector with the same concessions and incentives given to the industrial sector. The purpose, for the most part, is to increase foreign exchange earnings from tourism and to initiate the spread of tourism activities into unexplored areas so that the "fruits of development" are dispersed to different regions (Himachal Pradesh Tourism Department 1994 (?); Qasim 1995; State Tourism Ministers Conference 1995). At a 1993 meeting of the Coordination Committee on Himachal Tourism, one member insisted that tourism needs to be the mainstay of the state of Himachal Pradesh and that all their planning should be based on the development of tourism, an industry which "...would provide adequate employment potential and would create economic activity in places where manufacturing and mining are not available" (Himachal Pradesh Tourism Department 1993). Such confidence in the benefits of tourism is not uncommon. However, without proper planning and management, the sustainability of mountain tourism is in jeopardy. Sharma (1995) has compared the development of tourism to fire, "which can be a creator if properly managed, and a destroyer if allowed to take its own course".

The economic benefits of mountain tourism constitute the major justification for its promotion. Tourism is credited with creating employment opportunities for local individuals, stemming out-migration to the plains, generating revenue for government and local communities, encouraging the creation of new businesses and trading opportunities and opening up markets for local products (Kariel & Draper 1995; Raizada 1996; Sharma 1995; Sharma 1998c; Singh 1989). With particular reference to the Himalayas, Sharma (1998b & 1998c) has argued that although there are cases where the economic benefits of tourism have radically transformed a community, such examples are extremely rare. For the most part, the retention of benefits in the host communities is very small. Most of the local jobs created in the tourism industry are menial with very low wages and, due to the nature of mountain tourism, are usually seasonal and subject to significant fluctuations (Sharma 1998b & 1998c). The bulk of earnings from tourism generally flow to large, urban-based tour and travel agents and those who have access to the capital needed to invest in land or tourist facilities (Price 1995; Price

1998; Sharma 1998b & 1998c; Wheat 1997). Such earnings are more likely to end up paying for imported food and other essentials than returning to the areas from where they were derived.

Adding to these economic problems are increases in the prices of goods and services and land values brought about by tourist demand, and an increased dependency on products produced outside of the region. For example, tools, clothing, cooking utensils and other mass-produced items of the urbanized low-land tend to replace indigenously manufactured goods. Contrary to what one might expect, this can actually lead to an increase in poverty because few families have rising income levels (Kariel & Draper 1995; Sharma 1998c). Increased land prices brought about by the demand for new tourism facilities can have a negative impact on agricultural production by encouraging the sale of what is often the most productive land. (Price 1995). This problem is of course by no means unique to mountain environments but it can have the same deleterious effects as elsewhere, and can be more severe because of the general paucity of land that can be effectively cultivated.

From an environmental perspective, well planned tourism development in mountain regions can produce several positive benefits such as improved maintenance and conservation of unique local areas and better physical infrastructure and community facilities, with a resultant enhancement in local living standards (Sharma 1995; Singh 1989). For example, it is quite common for tourist areas to receive hospitals, schools, drinking water and sewerage facilities once tourism has developed. Since it is the pristine mountain environment that is usually attracting the tourists, preserving that environment and the historical and archaeological sites to be found within it, becomes much more important. Tourism can even enhance environmental awareness among local individuals and encourage cleanliness around tourist attractions (Raizada 1996; Singh 1989).

Throughout the developing world and, in particular, the Himalayas, the environmental consequences of tourism development are more frequently negative than positive. As accessibility to tourist centres increases and the infrastructure grows, so too does the number of human visitors and the inevitable impact they have on the environment. The result can be a litany of environmental woes including deforestation and forest degradation; loss of biodiversity in areas with endemic species of flora and fauna; erosion along trekking routes; environmental pollution due to garbage and littering; pollution of creeks and rivers and water bodies; problems of solid waste disposal in resort and trekking areas; and overburdening of the basic infrastructure and sanitation systems of destination settlements (Sharma 1995; Sharma 1998b; Singh 1989; Tiwari 1990). In many resort areas, the build-up of infrastructure occurs at the expense of the natural beauty of the environment - the very asset which is attracting tourists to these destinations (Sharma 1998b).

These environmental problems, however, can not and should not all be blamed on the development of large mountain resorts catering to thousands of environmentally-ignorant tourists. It is estimated that nearly 33,000 kilograms of plastic bottles have piled up in Khumba, the base camp leading to Mount Everest. This is not a route well traveled by the mass tourist. The culprits are climbers and their support parties. These expeditions have also been criticized for their conspicuous use of wood, with some groups taking up to twenty sherpas with them just to fell and carry wood to cook food and provide heat in the chilly Himalayan environment (Rao 1998).

In addition to environmental changes, tourism can also induce tremendous changes in land-use and production systems in mountain areas. The most obvious of these changes are the conversion of forest land to agriculture to meet the tourist demand for food; the encroachment on public open space to build such things as hotels, restaurants and tea stalls; and the tendency to leave land fallow to rent as camping sites. The opportunity for employment in the tourist industry also pulls people away from the traditional maintenance of agricultural land and forests. The result can be decreased crop yields and increasingly unstable mountain slopes (Price 1995). Regarding the Himalayas, Sharma (1998b) has suggested that the impact of tourism on agricultural systems is often manifested in the preference for fruit and vegetable farming as opposed to traditional crops. Tourists pay good money for fruits and vegetables but they are not lining up to buy cereal grains. A similar cause and effect has been noted in the Alps, where tourist demand for dairy products has been responsible for an increase in the production of items such as cheese (Price 1995).

Among the biggest impacts of mountain tourism are those which affect local social and cultural systems. As more and more tourists flock to a region, there is a tendency for the indigenous population to move away from the traditional agricultural lifestyles and adopt an urbanized lifestyle. As a result, many formerly rural valleys have been transformed into semi-urban landscapes. In addition to the urban sustainability problems already discussed, the move to urban living is often associated with an increased crime rate, a decreased desire to assist each other with community tasks, a rise in the value placed on material possessions and money, and an acceptance of the values of visitors (Kariel & Draper 1995). With regards to trekking in the mountains in Thailand, Deardon (1989) has remarked that:

> ...as The Real Thing comes into increasing contact with tourists, it becomes a little less of The Real Thing as the mixing of cultures, values and economy serves inevitably to dilute the strength of the original culture.

On the other hand, tourism can be a mixed blessing for the cultural identity of the affected area. It may actually strengthen local values and traditions as visitors expect to see, and usually photograph, "traditional" landscapes and "traditional" people and buy "traditional" souvenirs (Price 1995). However, it may also have the indirect effect of commercializing culture and handicrafts to the point where religious ceremonies, festivals and art forms lose their traditional meanings (Kariel & Draper 1995; Raizada 1996). In extreme cases, the traditional products which are bought as souvenirs in the tourist destination may actually be produced outside of the region in places where they are cheaper and easier to produce. This is happening in the Kullu Valley, as many traditional items like shawls and Kullu caps are being produced in large cities in the Plains and sold as local handicrafts to unsuspecting buyers in the Kullu Valley (Raizada 1996).

Residents of host communities may also find that they or their family members are spending more time with guests than their families (Kariel & Draper 1995). Typically it is males who are employed in the tourist industry and in areas that still rely heavily on subsistence activities this can be a serious problem, particularly during times of herding or agricultural activities. The female members of the family can face increasing demands on their time and energy and seasonal workers may have to be hired from other regions to do the necessary tasks which might otherwise be left undone (Price 1995). This is certainly the case in the villages surrounding Manali, where workers from neighboring Lahaul and Nepal are hired to assist the women with the apple harvest.

Mountain tourism can also lead to the creation of marked class differences within host communities. According to Price (1995), tensions can appear between those who have recently become wealthy as a result of tourism and those who live more traditional lifestyles; between those who earn enough income to live the desired and more expensive urban lifestyle, and those who cannot; those who are self-employed and the wage-earners; and long term residents and immigrants.

Finding a suitable balance between environmental, economic and social factors in the development of mountain tourism can be fraught with problems. One of the paradoxes, as with tourism in most exotic places, is that the product needs to be consistently protected as it is being marketed. In the past, remoteness, inaccessibility with its associated risks for travel and habitation, a very low level of demand, and the mindset of most pilgrims ensured that the impacts of tourism on the mountain environment were limited (Sharma 1995). This has obviously changed with the advent of mass tourism brought on by safer and easier transportation, greater communication, and higher disposable incomes. Sharma (1995) has argued that in order for mountain tourism to be sustainable in the long run the level of tourism activities must: 1) be compatible with the maintenance and enhancement of the ecological balance, biodiversity and biological resources; 2) ensure that the benefits are broadly shared; 3) be compatible with the culture and values of host communities; 4) strengthen community identity; 5) enhance people's control over their own lives; 6) be economically efficient; 7) relieve pressure on frugal resources and; 8) promote the management of resources for the benefit of present and future needs.

## 2.5 Sustainability Indicators - What Are They?

Having adopted sustainability as a desirable goal, it becomes important to develop measures of sustainable development so that the effectiveness of policies aimed at achieving this goal can be assessed. This is where the role of indicators comes into play. Sustainability indicators attempt to capture important aspects of the broad concept of sustainable development (Hanley *et al.* 1999). They are designed to quantify change, identify processes, and provide a framework for setting targets and monitoring performance, as well as assessing the performance of policies and decisions by measuring changes in the external world, i.e. the environment, economy, society, and human beings themselves (Crabtree & Bayfield 1998; Hardi & Barg 1997). Crabtree and Bayfield (1998) have suggested that, ideally, sustainability indicators should inform on: 1) the stock of environmental capital and its change over time; 2) the impacts of economic activity on environmental capital, through effects on environmental quality, waste emissions, and demands on resources and sinks; and 3) institutional and policy responses.

It is important to note that there is no standardized methodology for measuring sustainability or sustainable development performance (Hardi & Barg 1997). There is also no single measure of sustainable development which is capable of capturing all that is meant by sustainability. Alternative definitions of sustainable development lead invariably to alternative measures of this concept. Each alternative indicator is meant to address a different understanding of what is most important if development is to be sustainable (Hanley *et al.* 1999). Since sustainability means different things to different people, Levett (1998b) has argued that the choice of sustainability indicators is not only a technical decision, but ultimately a value decision, as well. In addition, he suggests that sustainability indicators should be placed within their broader contextual background so that the trends indicated can be properly assessed. As an example he uses the argument that a reduction in pedestrian and cyclist accidents on our highways may mean that the roads are becoming safer; it may also mean that non-motorists are now too terrified to even try and use them (Levett 1998b).

Despite the ambiguity surrounding exactly what constitutes a sustainability indicator, Maclaren (1996b) has suggested that there are certain characteristics which distinguish sustainability indicators from other types of indicators. Firstly, she argues that sustainability indicators are usually more than just a collection of environmental, economic and social indicators, and should include "integrating" indicators that illustrate the linkages among these three domains. She refers to the measurement of ozone-depleting gases as an example of an integrating indicator since the depletion of the ozone layer has multiple impacts, including increased incidences of skin cancer, a subsequent increase in health care costs and, in terms of inter-generational equity, long-term impacts because of the atmospheric lifetimes of these gases. The second definitive characteristic of sustainability indicators is that they are forward looking so that they can be used to measure progress towards achieving inter-generational equity. An excellent example is a trend indicator which describes historical trends and provides indirect information about future sustainability. In addition to measuring inter-generational equity, sustainability indicators should also be able to asses intra-generational equity. That is, they should be able to account for the distribution of conditions within a population or across geographic regions. In terms of environmental degradation, sustainability indicators should be able to distinguish between local and non-local sources of environmental degradation and between local and non-local environmental impacts. Finally, sustainability indicators differ from other types of indicators in the way in which they are developed. Since sustainability is value-laden and context-specific, the selection of sustainability indicators should include input or decision-making from a broad-based, multi-stakeholder group (Maclaren 1996b).

## 2.6 Ecological Footprint Analysis As A New Sustainability Indicator

Among the myriad of sustainability indicators which have been developed, Ecological Footprint (EF) analysis stands out as one of the few which can be used to measure a number of aspects of sustainability. Developed by William E. Rees and Mathis Wackernagel, EF analysis is a tool for measuring local, regional, national and even global sustainability using appropriated land area as its measurement criterion. The EF of a region is the area of productive land required to provide all the energy and material resources consumed and to absorb all the wastes discharged by the population of the region using current technology, wherever on Earth this land is located (Rees 1996; Rees & Wackernagel 1994; Wackernagel & Rees 1996; Wackernagel *et al.* 1993). Estimates of the EF of a region are based on the notion that for every item of material or energy consumption, a certain amount of land in one or more ecosystem categories is required to provide the consumption-related resource flows and waste sinks. Therefore, in order to determine the total land area required to support a particular pattern of consumption, the land-use implications of each consumption category are estimated. These are then summed to determine the population's total EF (Wackernagel & Rees 1996).

### *2.6.1 Ecological Footprint Analysis and its Relationship to Carrying Capacity*

EF Analysis is rooted in the concept of carrying capacity. Carrying capacity is usually defined as the maximum population size of a given species that an area can support without reducing its ability to support the same species in the future. It is usually specified as $K$ in the ecological literature (Daily & Ehrlich 1992; Ehrlich 1994; Geerling & de Bie 1986; Hardin 1986; Rees 1996). Carrying capacity is a function of both the area and the species in question. Thus, a larger or richer area will have a higher carrying capacity. Similarly, a given area will be able to support a larger population of a species with relatively low energetic requirements than one with high energetic requirements (Daily & Ehrlich 1992; Ehrlich 1994).

The traditional definition of carrying capacity, though ideal for game and range management, has proved to have limited use when applied to human populations. Human populations differ from those of other species because our consumption patterns are not fixed solely by biology, but depend on a variety of factors including technology, affluence, trade, and culture (Daily & Ehrlich 1996; Ehrlich 1994; Rees 1996). Humans appear to be able to increase their own carrying capacity by eliminating competing species, importing locally scarce resources and developing more resource efficient technologies (Daily & Ehrlich 1992; Ehrlich 1994; Hardin 1986; Rees 1996: Wackernagel & Rees 1996; Wackernagel *et al.* 1993). This is a dangerous illusion because it has led many to believe that human ingenuity and international trade can override any regional carrying capacity constraints that may arise (Daly 1995; Hardin 1986; Sagoff 1995; Rees 1996; Wackernagel & Rees 1996; Wackernagel *et al.* 1993). Certainly, over the last two centuries, human ingenuity has delivered one miracle after another, steadily increasing the carrying capacity of our planet. There is also no doubt that technological progress will continue to lead to efficiency improvements, resource substitutions and other innovations. It is impossible, however, to predict this future rate of technological progress and, therefore, impossible to conclusively determine the benefits of future technological innovations to sustainability (Daily & Ehrlich 1992; Hardin 1986). The belief that technology will conquer all can also lead to the erroneous assumption that man-made capital is a perfect substitute for natural capital (Daly 1994; Daly 1995; Sagoff 1995; Wackernagel & Rees 1996). As Daly (1995) points out, it is impossible to substitute capital for natural resources - "...saws cannot replace lumber in the construction of a wooden house any more than trowels can replace brick in the construction of a brick house." Trade may also increase global biophysical carrying capacity by lifting the regional constraints that arise from the uneven distribution of natural resources. Unfortunately, exceeding local and regional carrying capacities on a sustainable basis has the effect of encouraging what Daily and Ehrlich (1992) refer to as the "Netherlands fallacy": the idea that all regions could simultaneously sustain populations that sum to more than the global carrying capacity.

In order to relate carrying capacity more closely to human populations, Rees and Wackernagel, among others (Cohen 1995; Daily & Ehrlich 1992; Ehrlich 1994; Geerling & de Bie 1986), have chosen to redefine the concept. Rather than defining carrying capacity as the maximum population that can be safely imposed on the environment, they have chosen to define it as the maximum load that can safely be imposed on the environment, where human load is a function of both population and per capita consumption. The resulting human carrying capacity is defined as the maximum rate of resource harvesting and waste generation that can be sustained indefinitely without impairing the productivity and functional integrity of relevant ecosystems, wherever these ecosystems may be located. Thus, the corresponding population size depends on both technology and mean per capita material standards (Rees 1996; Wackernagel & Rees 1996).

Whether the traditional definition of carrying capacity is used or the more refined definition of human carrying capacity, quantifying the carrying capacity of a region is extremely difficult. The reasons for this are manifold, but are primarily due to the dynamics of complex systems. Theories, including systems theory, catastrophe theory and chaos theory all point to the complex, dynamic and highly unpredictable nature of ecosystems. Ecosystems are prone to dramatic, sudden changes which are impossible to predict and that result from the accumulation of slow processes (Holling *et al.* 1997; Kay and Schnieder, 1994). These processes erode the resilience or capacity of the ecosystem to absorb disturbances, moving it closer to thresholds and threatening to flip it from one equilibrium state to another. When a system will reach this threshold is usually impossible to predict as are the types of changes which will occur once this threshold has been surpassed (Arrow *et al.* 1995; Holling *et al.* 1997). The situation is further complicated for human systems because of the substantial individual differences in the types and quantities of the resources consumed and the rapid cultural (including technological) evolution in the types and quantities of the resources that supply each unit of consumption (Daily & Ehrlich 1992). These factors make it impossible to accurately predict the carrying capacity of any given region and suggest that all estimates of carrying capacity contain a substantial element of the arbitrary (Hardin 1986).

The problems associated with estimating carrying capacity do not mean that the discussion surrounding it is irrelevant. Carrying capacity is essential to the long-term sustainability of man-kind and our planet. Not only does nature provide the raw materials on which our entire economy is based, but it provides waste assimilation and essential life support services, such as protection from ultraviolet radiation, for which there exists little potential for man-made substitution. Human life is so tightly interwoven with nature that maintaining the balance with nature's productive, absorptive and regenerating capacity is critical (Wackernagel *et al.* 1993). The consequences of exceeding carrying capacity can be calamitous and, more often than not, irreversible even when the territory is freed of exploitation. As Hardin (1986) points out, the Tigris-Euphrates valley which was ruined by mismanagement two thousand years ago is still ruined today.

Considering that our current population is being maintained by the exhaustion and dispersion of natural capital, decreasing carrying capacity may become one of the most important issues facing humanity (Rees 1996). The rapid depletion of world resources, coupled with a worldwide degradation of land and atmospheric quality suggests that we have already exceeded the current human carrying capacity and are now reducing future carrying capacity by depleting essential resource stocks (Daily & Ehrlich 1992). According to one study, the fraction of terrestrial net primary productivity (the basic source of food energy of all terrestrial animals) directly consumed, co-opted or eliminated by human activity is approximately forty per cent (Vitousek *et al.*, 1986). Not only does this threaten long-term ecological sustainability, but it threatens social sustainability by violating the principle of intergenerational equity and economic sustainability by eliminating the raw materials on which our economy is based (Rees 1996; Wackernagel *et al.* 1993).

EF Analysis is unique because it manages to measure sustainability in terms related to carrying capacity, while at the same time circumventing many of its associated problems. This is done by inverting the quintessential carrying capacity question. Rather than asking, 'What population can the land and resources available support indefinitely?', EF analysis asks 'How large an area of productive land is needed to sustain a population indefinitely at current levels of technology and consumption, wherever that land may be located?' (Rees 1996).

Acknowledging that the location of the land may be different from the location of the supported population is an important insight. As a result of technology and trade, the ecological locations of human settlements no longer necessarily coincide with their geographic locations. In other words, it is a recognition that human populations have the ability to appropriate carrying capacity from around the globe (Rees 1993; Wackernagel *et al.* 1993).

Essentially, EF analysis is based on three modifications of the conventional definition of carrying capacity. Firstly, it estimates the impact of the aggregate consumption of the population rather than just counting people (Wackernagel *et al.* 1993). In this way, the analysis produces a single measure of ecological demand which, unlike traditional carrying capacity, accounts for net trade and reflects both current income and prevailing technology (Wackernagel & Rees 1996). Daily and Ehrlich have substantiated the importance of this modification by suggesting that demographic statistics give a misleading impression of population problems because of the vast regional differences in environmental impact. They argue that the impact (I) of any population can be expressed as a product of three characteristics: the population's size (P), its affluence or per capita consumption (A), and the environmental damage (T) inflicted by technologies used to supply each unit of consumption. In mathematical terms:

$$I = P \times A \times T$$

(Daily & Ehrlich 1992; Ehrlich 1994).

This being the case, high per capita rates of consumption and the large-scale use of environmentally damaging technologies greatly magnify the impact of industrialized countries as compared to developing nations. This is so despite the fact that the latter contain almost four-fifths of the world population and are growing rapidly. In fact, estimates suggest that each inhabitant of the Industrialized world does roughly 7.5 times more damage to Earth's life-support systems than does an inhabitant of the developing world. At the extremes, the impact of a typical person in a desperately poor country is roughly one thirtieth that of the average citizen of the United States (Daily & Ehrlich 1992).

The second modification made by EF analysis is that, unlike carrying capacity, it is based on the current consumption of a given resource stock, rather than the maximum yield of that resource stock (Wackernagel *et al.* 1993). This too is significant. By looking at the current consumption of a resource rather than trying to determine its maximum yield, EF analysis avoids the problems of trying to estimate maximum yield. Not only are many resource systems inherently unpredictable, but information about resources can rarely be perfectly measured nor can the effect of changing technologies (Folke *et al.* 1997; Hilborn & Walters 1992; Kay & Schneider 1994). This makes determining the maximum yields of a resource, with any reliability, extremely difficult. The basic problem is that finding the maximum yield of a resource stock cannot be done without going past it, and, often, quite a bit past it. Attempts to determine the maximum yield from a resource stock may actually be dangerous because, once it has been found, the use of the resource must be reduced to this optimum to be sustainable. Reducing resource use after a population has become dependent on a given level of harvesting is very difficult (Hilborn & Walters 1992).

Finally, EF analysis quantifies the land and resources required by a population wherever the land is located. This is different than the traditional carrying capacity approach which assesses the population that may be supported in a region by the available land (Wackernagel *et al.* 1993). As mentioned previously, this is important because it avoids the problems associated with calculating the carrying capacity of a land base, it accounts for varying levels of consumption and technology and recognizes that populations may import carrying capacity from all over the globe (Rees 1996; Wackernagel *et al.* 1993; Wackernagel & Rees 1996).

### *2.6.2 Ecological Footprint Analysis and Sustainability*

EF analysis can be used as a tool for measuring sustainability - ecologically, as well as socially and economically. The fundamental question for the sustainability of any region is whether resource flows will be adequate to sustain anticipated future demand. EF analysis attempts to answer this question and, in the process, illustrates the state of sustainability at many levels. In terms of ecological sustainability, EF analysis allows us to identify gaps between the EF of a region and its current productivity. In other words, it allows us to estimate the 'ecological deficit' of any specified region or country, ecological deficit being a measure of the amount by which a region exceeds its local carrying capacity. This serves to reveal the extent to which the region is dependent on external productive capacity through trade or appropriated resource flows. Those regions that are running high ecological deficits, i.e. are appropriating large amounts of carrying capacity, are not sustainable (Folke *et al.* 1997; Wackernagel & Rees 1996). EF analysis also allows for a comparison of the ecological impacts of separate human activities. This helps to determine the ecological constraints within which our society operates and can be used to establish criteria for sustainability. Sustainability policies can then be targeted at those activities which are placing the highest demands on ecological space (Wackernagel *et al.* 1993; Wackernagel & Rees 1996).

In terms of social sustainability, EF analysis can be used to study inter- and intra-generational equity issues. Sustainability requires that each generation inherit an adequate stock of essential resources. EF analysis helps to identify whether the current consumption of resources is so great that stocks are being depleted faster than they can be replenished, thus threatening long-term social sustainability. EF analysis also allows for the identification of areas where carrying capacity is being unfairly appropriated. Per capita EFs can be compared on an international level to determine disparities between countries or on a national or regional level to determine disparities between groups of individuals within a society (Rees & Wackernagel 1994). This serves to raise consciousness and forces over-consumers to face the otherwise implicit trade-off made between their own consumption levels and the poverty and human suffering that results "elsewhere". As well, by showing that not everyone can become as materially wealthy as the average North American or European without undermining global life support systems, EF analysis strengthens the case for a more equitable distribution of earth's natural resources (Wackernagel *et al.* 1993).

EF analysis can also be used to measure economic sustainability. For example, the EF of trade can be calculated to determine how much carrying capacity is embodied in a region's imports and how much capacity it gives up to produce the exports required to pay for the imports (Wackernagel & Ress 1996). This is important for long-term sustainability because an economy which does not rely heavily on outside resources is cushioned from disruptions to the supply of those resources caused by such things as conflict or lack of availability (Wackernagel *et al* 1993). Conversely, those economies which depend heavily on the exportation of their carrying capacity are subject to losses caused by changes in consumption patterns and the need of others for their ecological goods and services. If the carrying capacity exported by these regions exceeds its natural surplus then, once lost to the export market, the carrying capacity of these economies may never be recovered and the region may have no choice but to become net importers of carrying capacity (Rees & Wackernagel 1994).

### 2.6.3 The Benefits of Ecological Footprint Analysis

There are three main benefits to EF analysis. The first of these is its modification of the traditional carrying capacity definition to make it more relevant to human populations and their associated levels of resource consumption, technology and waste production. This benefit has already been discussed (see section 2.6A).

The second major benefit of EF analysis is that it circumvents some of the sustainability problems posed by conventional economic analysis and manages to link environmental impacts with economic activity (Hart 1998; Maclaren 1996b). Conventional economic models are blind to ecological function, viewing the economic system in isolation from the biosphere. They have been focused principally on the maximization of profits and the growth of national economies by exploiting resources, with only slight emphasis on the environmental consequences or sustainability of this exploitation. Environmental functions have been viewed as externalities and have not been accounted for by resource decision makers (Berkes 1993; Field & Olewiler 1995; Holden 1990). Some of these decision makers do not consider the exploitation of resources to be a problem, suggesting that higher prices for scarce resources automatically lead to conservation and the search for substitutability (Rees & Wackernagel 1994). Those who have tried to account for environmental functions have generally done so by trying to quantify the costs of environmental problems, such as landscape degradation, so that these costs can be included in decision making processes (Barbier 1993; Holden 1990). Unfortunately, it is extremely difficult to place quantifiable dollar values on many environmental resources, for example, scenic beauty and protection from ultraviolet radiation by the ozone layer (Holden 1990). Another problem with conventional economics is that it has traditionally sought to realize short term economic goals from resources which were considered to be free. It has been considered economically 'optimal' to draw down natural capital, which is free, in order to finance economic development by reinvesting the proceeds in other assets that are expected to yield a higher economic return (Barbier 1993). The problem with this is that it assumes that man-made capital is a perfect substitute for natural capital, when the two are actually compliments (Daly 1994). Conventional economics is also not able to provide for such things as intergenerational equity because of its focus on short term economic gains. Resources are thought of in terms of their present value and any decision to stall their development means foregoing the chance to invest in alternative income-yielding assets. This means that the value of a resource is generally considered to be greater if it is exploited today than at any time in the future (Barbier 1993). EF analysis offers a solution to these problems by deriving estimates of the actual physical stocks of natural capital necessary to sustain a given population and then comparing this to the carrying capacity of the home territory. By relating sustainability to land use it moves the study of sustainability away from the problems inherent in purely economic valuations and points to the amount of strain a community's economy is putting on its environment (Hart 1998).

The third advantage of EF Analysis is that it is conceptually easy to understand because the impacts of consumption patterns are brought down to a single common measure - land area (Hardi & Barg 1997; Levett 1998b). According to Wackernagel and Yount (1998), this makes the results more accessible because everyone has experienced space, while many other quantities (like embodied energy or erosion rates) may require technical skills to interpret and appreciate. Reducing impacts to a single 'currency' also allows for comparisons between the human "demand" for ecological space and earth's finite supply of space (Wackernagel & Yount 1998). In addition, comparisons can be made between different types of environmental damage and the effect that differing income levels and technology have on ecological impact . One can also assess the extent to which local carrying capacity has been exceeded and the population has become dependent on trade (Hardi & Barg 1997; Simmons 1998). Monitoring the EF of a region over time could also reveal progress towards sustainability and indicate to what extent economic and demographic change have expanded or contracted a region's footprint (Wackernagel & Yount 1998).

### *2.6.4 The Limitations of Ecological Footprint Analysis*

Despite the advantages of EF analysis, there are also numerous limitations and many criticisms of the technique. The greatest limitation is the copious quantities of data and research that are required, particularly if the analysis is to be applied to a specific community. Since it is impossible to collect data on every item consumed by a society, the analysis is not only missing data, but is usually based on a large number of assumptions about data applicability and environment-economy relationships (Maclaren 1996b; Levett 1998b). This has the effect of leading to large error bars. According to Levett (1998a), the heavy reliance on national data to calculate local footprints serves to suppress what might in fact be special, distinctive or significant about the local study area in terms of sustainability. He argues, however, that this problem could be corrected with a "sufficiently large helping of old-fashioned statistical elbow-grease", preferably paid for by government (Levett 1998b).

Although the creators of EF analysis focus on its ability to measure all aspects of sustainability, Simmons (1998) argues that the analysis only addresses environmental issues. According to Simmons (1998) it is perfectly easy for a community to have a good footprint score, but be unsustainable in other ways, such as health, noise, culture or social cohesion. Levett (1998a) makes a similar argument, criticizing EF analysis for failing to reflect any aesthetic, cultural, recreational or other qualitative aspects of land or the environmental impacts of land uses on human health or welfare. For this reason, it is recommended that EF analysis be used as one of several indicators/methods when assessing sustainability. For example, other data, such as that from local interviews or surveys, could be combined with the footprint results to generate an overview of sustainability in the region.

EF analysis has also been criticized for its calculation of energy impacts.

Maclaren (1996b) has suggested that one of the more serious weaknesses of the analysis is its failure to include alternate forms of renewable energy. EF analysis only includes energy production by fossil fuels, nuclear energy and hydro-power and she argues that attempts need to be made to include other forms of renewable energy resources, such as solar, geothermal, or wind energy in the calculations of the land area required for energy production (Maclaren 1996b). Simmons (1998) has also argued that EF analysis fails to account for risk and, as a result, there is considerable disagreement on how to handle low risk/high damage energy alternatives, such as nuclear power.

In a scathing review of EF analysis, van den Begh and Verbruggen (1999) also point to the lack of sustainable energy use scenarios in the analysis. Their biggest concern is with the use of forest area needed to assimilate the carbon dioxide emissions from burning fossil fuels as a measurement of the land area appropriated by fossil fuels. They argue that carbon dioxide assimilation by forests is one of many options to compensate for carbon dioxide emissions and a very land-intensive option at that. In addition, they suggest that EF analysis calls for such large reductions in carbon dioxide emissions that 'carbon sink land' would not be the cheapest sustainable option in the long run. Rather, they argue that it is likely that other sustainable solutions, which are less land intensive and thus less sensitive to increasing land prices, will become attractive, such as shifts to other fuels, less fuel use, or increasing energy efficiency of processes (van den Bergh & Vergruggen 1999).

In terms of land use, Hardi and Barg (1997) have argued that EF analysis is flawed because it excludes several important issues related to sustainable land uses, such as areas lost to biological productivity because of contamination, erosion and urban "hardening" and possible ranges of consumption goods and waste flows. They also criticize the analysis for only considering the economic decisions with regard to resource use on the environment (1997).

Van den Bergh and Verbruggen (1999) also take issue with how land use is accounted for in EF analysis. They argue that although the results denote hypothetical land area, there is a serious danger that it will be interpreted as actual or realistic land use, not only by the general public and politicians, but also by environmentalists and academic researchers. They are also concerned that the EF of a region does not distinguish sustainable and unsustainable land uses and argue that as an indicator, EF analysis fails to reflect both the quality and the quantity of renewable resource use. For example, different types of agriculture and forestry practices can impact land differently, yet the footprint considers all land use practices to be the same (Holmberg *et al.*, 1999). Van den Bergh and Verbruggen (1999) also argue that the calculation procedure implies that land is only used for a single function. In many cases, however, a certain piece of land provides multiple services or functions and may be subject to multiple use regimes. By failing to account for this, the EF may be biased upwards (van den Bergh & Vergruggen 1999). In addition, they emphasize that the analysis does not indicate where in the world the impacts of appropriating land use are found. Borgstrom and Wackernagel (1999), however, suggest that this latter point is inconsequential because the increased appropriation of space logically involves increasing pressure on the remaining productive space and diminishing the productive areas available for economically weaker groups and other species.

Currently, EF analysis also fails to account for the ecologically productive area appropriated for human freshwater use and only partially includes the ecological impacts of water contamination and waste streams (Wackernagel & Yount 1998). The inclusion of freshwater use, however, is beginning to be studied (Holmberg *et al.* 1999). In addition, attempts have recently been made to account for the EF of nutrient assimilation by water resources. Unfortunately, the analysis thus far is limited to the excretory release by humans of phosphorous in sewage sludge and the nitrogen in processed water from sewage treatment plants. Other sources of nutrients, such as food processing, household waste, and car emissions have not yet been included (Jansson *et al.* 1999). The inclusion of pollutants, wastes and the impacts of these on water and land are also not included in EF accounting at this time. The inclusion of pollutants is extremely difficult because of the non-linear effects of many pollutants, as well as local variations in the response to the impact of pollutants (Levett 1998a). The inclusion of wastes is also extremely difficult if not impossible at this time because the assimilation rates of wastes are only known for a few naturally occurring substances (Holmberg *et al.* 1999).

Some have argued that EF analysis also suffers from an anti-trade bias. Implicit in the comparison of EF with the available productive land in a region is the assumption that some form of self-sufficiency is the most desirable situation. Although there are cases where this may be true, van den Bergh and Verbruggen (1999) argue that this interpretation neglects the comparative advantages that countries or regions may have in terms of resource endowments, space or population density and point to the example of the Netherlands versus Canada. According to van den Bergh and Verbruggen (1999), the distribution of human settlements and the immobility of natural resources means that a spatial matching of consumption, production and resources use is only feasible on the basis of trade in commodities and resources. In order for this trade to be sustainable, however, correct national and international incentives and regulation need to be implemented.

Finally, Hanley *et al.* (1999) suggest that EF analysis fails as a predictive measure because it is impossible to tell whether next year's footprint will be greater or lower than the value for the current year. This, however, can be somewhat countered by using trend indicators of future population levels, consumption patterns and energy use to predict future EFs. Hanley *et al.* (1999), as well as van den Bergh and Verbruggen (1999) also criticize EF analysis for failing to provide directions for detailed policy advice.

## 2.7 Chapter Summary

This chapter discussed the concepts of sustainable development, urban sustainability, mountain sustainability, and EF analysis as a sustainability indicator. All of these issues are intertwined and all of them are fraught with debate over the relative importance and utility of different contributing factors. Attempts have been made to include both sides of the debate surrounding each concept in order to elicit a fuller understanding of the issues at hand. In particular, a great amount of information has been provided on the debate surrounding EF analysis. While there are distinct advantages to using EF analysis, it is also important to have a complete understanding of the criticisms and shortcomings of the technique. In so doing, a better assessment can be made of the results of the EF calculations undertaken in this study.

# Section II -

# Methods

## 3.0 Calculating Manali's Ecological Footprint

The Ecological Footprint (EF) of Manali was calculated for the years 1971 and 1995. The year 1971 was chosen because data for this period were readily available and because it represents the situation in Manali prior to large scale tourism development (Singh 1989). The year 1995 was chosen to represent the situation in Manali following the development of large-scale tourism and is the most recent year for which a full data set is available. The methods used to calculate the EFs of Manali, as well as the assumptions associated with this method, are discussed below.

### 3.1 Assumptions of Ecological Footprint Analysis

In order to fully appreciate the derived EFs of Manali, it is important to understand the general assumptions that are made when using this analysis. In theory, the EF of a population is estimated by calculating how much land and water area is required on a continuous basis to produce all the goods consumed and to assimilate all of the wastes produced by that population. In practice, however, it is virtually impossible to accurately account for all of the different consumption items, waste types and ecosystem functions (Wackernagel & Rees 1996). For this reason, simplifications are made to the theoretical EF concept. The first of these simplifications is the inclusion of only biologically productive land (pastures, arable land, forests and sea) in the calculation. According to Rees and Wackernagel, this restriction was chosen because: a) this land alone produces the renewable resource flows to the human economy; b) fossil fuel is only a temporary and not a sustainable energy source and; c) it represents the finite character of Earth, as its productive areas have remained fairly constant. This biologically productive land area is classified using a simple taxonomy of ecological productivity representing five land (ecosystem) categories - fossil energy land, built-up area, arable land, pasture, and sea (Wackernagel 1998; Wackernagel & Rees 1996; Wackernagel *et al.* 1993).

A similar type of taxonomy is used for consumption items. These are restricted to major categories containing the most important individual items. This is done because it is simply not feasible, nor is the data available, to determine the land requirements for the provision, maintenance and disposal of each of tens of thousands of consumer goods (Wackernagel & Rees 1996).

Another major assumption of EF analysis is that current industrial harvest practices, such as those used for agriculture and forestry, are sustainable - which they often are not. As well, only the basic services of nature are included in the calculation. Among these are the appropriation of nature's services through the harvest of renewable resources, the extraction of non-renewable resources and paving over. There are various ecological aspects which are still excluded from current assessments, such as soil contamination and other forms of pollution like ozone depletion (Wackernagel & Rees 1996; Wackernagel 1998).

The net effect of these assumptions is that all 'derived' EFs are smaller than the 'actual' footprint of the region. Thus, they represent an extremely conservative view of humanity's demands on nature.

## 3.2 General Calculations for the Basic Ecological Footprint

Estimating the EF of a population is a multi-stage process. The first step in calculating the EF of a region is estimating its per capita EF. This begins with an estimate of the average person's annual consumption ['c', in kg/capita] of particular items. For Manali, this was done by calculating the per capita consumption of an average Indian citizen. The items included in the analysis reflected those used in readily available international data, primarily compiled by organizations of the United Nations, such as the Food and Agricultural Organization (FAO), the United Nations Conference on Trade and Development (UNCTAD), and the Department of Economic and Social Affairs Statistical Office (see Table 3.1). In all of the categories where trade data were available, trade- corrected consumption was assessed by subtracting exports from the sum of production and imports (Wackernagel & Rees 1996).

Once the average annual consumption per Indian had been estimated, the next step was to estimate the land area appropriated per capita (aa) for the production of each major consumption item ('i'). This was done by dividing average annual consumption of a particular item, as calculated above, by its average annual productivity or yield ['p', in kg/ha]. Thus, the following equation was used:

$$aa_i = c_i / p_i$$ (Wackernagel & Rees 1996).

The total consumption footprint for the average Indian ('cf') was then calculated by summing all of the ecosystem areas appropriated ($aa_i$) by all purchased consumption goods and services (n) on an annual basis. This per capita Indian consumption footprint was found using the following equation:

$$cf = \sum_{i=1 \text{ to } n} aa_i$$ (Wackernagel & Rees 1996).

The total consumption footprint ($CF_p$) of Manali was then calculated by multiplying the average per capita Indian EF by the total population of Manali (N) as follows:

$$CF_p = N(cf)$$ (Wackernagel & Rees 1996).

## Table 3.1: References for the data used to calculate Manali's basic Ecological Footprint

| ***Data Required*** | ***Reference*** |
|---|---|
| *Population:* | |
| - India | FAOSTAT Agriculture Database on the Internet at http:\\apps.fao.org |
| - Himachal Pradesh | Central Statistical Organization Department of Statistics, Ministry of Planning and Programme Implementation, 1997. Statistical Abstract of India 1997. Government of India, New Delhi. |
| - Kullu District | The Directorate of Economics and Statistics, 1971 & 1997. Statistical Abstract of Kullu District 1973-74; Statistical Abstract of Kullu District 1997. Govt. of H.P., Shimla. |
| - Manali Town | Director of Census Operations, Himachal Pradesh, 1991 & 1971. Kullu District Census Handbook 1971; Kullu District Census Handbook 1991.<br>Thakur, D. (Junior Engineer Nagar Panchayat Manali), 1997. Integrated Solid Waste Management and Environment Project of Manali Town. |
| *Land Use:* | FAOSTAT Agriculture & Forestry Databases at http:\\apps.fao.org |
| - built-up area | Central Statistical Organization Department of Statistics, Ministry of Planning and Programme Implementation, 1997. Statistical Abstract of India 1997. Government of India, New Delhi. |
| - forests | Central Statistical Organization Department of Statistics, Ministry of Planning and Programme Implementation, 1997. Statistical Abstract of India 1997. Government of India, New Delhi.<br>World Resources Institute, 1999. World Resources 1998-99. WRI, New York. |
| - sea area | Roy, R., 1999. *Maritime Surveillance of the Indian EEZ.* Institute for Defence Studies and Analysis, New Delhi. On the Internet at: http://www.idsa-india.org/an-apr8-4.html |
| *Foods:* | FAOSTAT Agriculture Database. On the Internet at http:\\apps.fao.org |
| *Other Crops:* | FAOSTAT Agriculture Database. On the Internet at http:\\apps.fao.org |
| - rubber consumption | United Nations Conference on Trade and Development, 1995. UNCTAD Commodity Yearbook 1995. United Nations, New York. |
| - wool productivity | Wackernagel, M. with J. McIntosh, W. Rees & R. Wollard. How Book is Our Ecological Footprint? A Handbook for Estimating A Community's Appropriated Carrying Capacity. School of Regional and Community Planning, UBC, Vancouver. |
| - cotton productivity | Wackernagel, M, 1998. The Ecological Footprint of Santiago de Chile. Local Environment. 3(1): 7-25 |
| *Timber* | FAOSTAT Forestry Database. On the Internet at http:\\apps.fao.org |
| *Energy Consumption* | United Nations, 1976. World Energy Supplies 1950-1974. United Nations, New York.<br>United Nations, 1997. 1995 Energy Statistics Yearbook. United Nations, New York.<br>World Resources Institute, 1999. World Resources 1998-99. WRI, New York |
| *Commodity Trade* | United Nations, 1974 & 1997. Yearbook of International Trade Statistics 1972-73; Yearbook of International Trade Statistics 1995. United Nations, New York. |

## 3.3 Calculating the Ecological Footprint of an Average Indian - 1971 & 1995

The calculations of Indian EF per capita in 1971 and 1995 were originally completed using an Excel spreadsheet model developed by Mathis Wackernagel (1998) for the city of Santiago, Chile. Following the development of this spreadsheet, Wackernagel, Lillemor Lewan and Carina Borgström Hansson created a newer version of this spreadsheet for Sweden which contains better energy and trade accounting and which, according to Wackernagel (personal communication 1999), is the best footprint calculated to date. Using the Swedish model and the most up-to-date embodied energy statistics[4] , the calculations were then redone. There was, however, only a slight difference in the outcome of this model when compared to the Santiago model.

### *3.3.1 The Spreadsheet*

For the purposes of this report, the spreadsheet results using the Swedish model will be discussed and it is probably easiest to refer to the spreadsheets in Appendices 1A and 1B throughout the following discussion of the methods employed.

The rows of the spreadsheet represent resource types while the columns contain the productivity, energy intensity, production, import, export, apparent consumption of raw materials, net import of manufactured goods, footprint per capita, and the energy embodied in imports of these resources. Two final columns serve to highlight the footprint in imports and exports so that India's trade balance could be analyzed.

The first two columns, average world productivity and Indian productivity, refer to the yield, usually in kilograms per hectare (kg/ha) of the resource item in question. The next column is the energy intensity column which indicates the amount of embodied production energy in the particular product. This is equal to the amount of energy invested to produce the raw or manufactured product in question. The units for energy intensity are gigajoules per tonne and it is assumed that all of the energy comes from liquid fossil fuels. The associated embodied energy values come from a variety of studies[5] that were compiled and provided by Dianna Deumling, a researcher at Resources for the Future, a non-profit organization based in Seattle, Washington. For the purposes of this study, it was also assumed that the amount of embodied energy per product was the same in 1971 as it was in 1995. There are three main reasons for making this assumption. Firstly, although

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[4] Provided by Diana Deumling at Resources for the Future (e-mail communication).

[5] References used to compile the embodied energy statistics include the following:

Brown, H.L., B. B. Hamel and B. A. Hedman. 1985. *Energy Analysis of 108 Industrial Processes*. Philadelphia: Fairmont Press. [TJ163.2 B78 1985].

Cole, R.J. and D. Rousseau. 1992. Environmental Auditing for Building Construction. *Building and Environment*. Vol. 27 No.1. p. 23-30

Das, S., T. R. Curlee, C. G. Rizy and S. M. Schexnayder. 1995. Automobile Recycling in the United States: Energy Impacts and Waste Generation. *Resources, Conservation and Recycling* 14 (1995), 165-284.

Freeman, S.L., M.J. Niefer and J.M. Roop. 1996. *Measuring Industrial Energy Efficiency: Physical Volume Versus Economic Value*. Pacific Northwest National Laboratory.

Fritsche, U., L. Rausch and K.-H. Simon. 1989. *Umweltwirkungsanalyse von Energiesystemen: Gesamt-Emissions-Modell Integrierter Systeme (GEMIS)*. (Analyzing Ecological Impacts of Energy: Total Emissions Model for Integrated Systems (TEMIS). Oko Institut

Hofstetter, Patrick. 1992. *Personliche Energie und CO2 Bilanz*. (Personal Energy and CO2 Balance) Second draft. Buro fur Analyse und Okologie, Zurich.

IVEM (Interfacultaire Vakgroep Energie en Milieukunde, Center for Energy and Environmental Studies), Groningen, Netherlands. 1999. (estimates obtained through Harry Wilting, IVEM)

OECD. 1991. *Energy Efficiency and the Environment*. International Energy Agency, France.(SEF), Humm, Othmar, ed. 1991. Schweizerisches Energiefachbuch.

Kuntzler-Bachmann, St. Gallen, Switzerland.Tuinen, S.T. van. 1992. Metalen in het milieu: een nadere analyse van toepassingen van metalen in desamenleving. IVEM, Groningen University.

Worrell, E, R., J.J. van Heuningen, J.F.M. de Castro, J.H.O. Hazewinkel, J.G. de Beer, A.P.C. Faaij, and K. Vringer. 1994. New Gross Energy-Requirement Figures for Materials Production. *Energy* Vol. 19, No. 6, p. 627-640.

the machines in operation in India in 1971 were likely more energy intensive than those used in 1995, it is extremely difficult to develop a "technology factor" to account for these differences. Secondly, although the machines may have been more energy intensive, the production of manufactured goods in India relies more heavily on manual labour than automation. This means that for each product produced in India more people and fewer machines are employed, thus decreasing the amount of fossil fuel energy consumed in the process. Finally, the use of modern statistics (those for production in the nineties) is seen to represent a highly conservative view of the actual energy consumed in manufacturing processes. Even though many of the machines in Indian manufacturing plants did not exist 25 years ago, many of these machines are still old. There has been widespread complaint throughout India that large multi-national corporations bring in outdated technology and their investments are limited to second-hand machinery (Sen, Sarkar & Vaidya 1997).

The next column in the spreadsheet, Biological Production, refers to the amount of the particular item in metric tonnes that has been produced in India over a one-year period. If no number is listed for this column, then the resource being assessed is a manufactured, rather than a raw, product. The import and export columns indicate the amount of raw materials and manufactured goods that have been traded over the one year period. Imports and exports are listed in both their weight in metric tonnes and their value in United States dollars.

The apparent consumption of raw materials refers to the consumption of those products which are consumed by Indians in their natural state, i.e. not manufactured. In most cases, this consumption is calculated by subtracting total exports of a raw product from the sum of its production and imports. The consumption of manufactured goods is calculated in the following column by considering only imports and exports of the good in question. Thus, the net import of manufactured goods is calculated by subtracting the imports of the product in question from India's exports of this product. The Indian production of a manufactured good is not included because the raw materials needed to make this good have already been accounted for. Including the Indian production of a product would lead to double counting of the resource in question. For example, in order to produce cheese, a manufactured product, milk, a raw product, must be used. Since the total production of milk has already been accounted for in the milk row, including cheese production in the cheese row would imply that additional milk was made available for its manufacture. As this is not the case, only the import and export of cheese are included to indicate changes in the stock, as well as the energy needed to produce the cheese from milk.

The next two columns represent the EF per capita and the energy embodied in imports. The EF per capita is the footprint component of the resource type in question and it is calculated in hectares per capita. The energy embodied in imports is calculated by multiplying the net imports (imports minus exports) by the embodied energy value and then dividing by one million to translate the value into petajoules. Since India both imports and exports goods, it is consuming as well as exporting energy that is embodied in consumption goods and this column accounts for the impact of global trade on the energy balance of India.

The final two columns are an accounting of the import and export footprints of India. These columns identify the amount of biologically productive land that India is importing and how much land they are exporting. The data can be used to analyze whether India's trade balance is sustainable. If India is importing far more than is produced locally then they are relying heavily on external ecosystems for their continued existence.

The spreadsheet itself is divided into ten main areas based primarily on resource types. The upper part of the spreadsheet is used to calculate India's consumption of and energy embodied in categories associated with agriculture, namely - animal based food, animal-based non-food products, plant-based food, non-timber plant fibres, and non-fibre, non-food plant products. The next few categories consider manufactured chemicals and non-metallic and metallic products. This is followed by an account of the consumption and energy used for timber resources and products. The last accounting section deals with India's energy balance. The final section of spreadsheet summarizes the EF of the average Indian citizen and the ecological capacity of India. Each of these sections and their associated assumptions, calculations and data sources will be discussed in turn.

#### 3.3.1.1 Animal-Based Products - Food & Non-Food

The upper part of the spreadsheet is used to calculate India's consumption of animal products, both food and non-food. These products can be divided into those that are pasture raised and those that are raised on cereals grown on arable land. In the case of pasture-raised products (beef, goat, sheep and buffalo products) the per capita EF for each product was found by dividing the consumption per capita of a product by the product's associated productivity. For example, in the case of goat meat, the EF per capita would be:

$$\frac{(\text{Production}_{goat} + \text{Imports}_{goat} - \text{Exports}_{goat})/\text{Population of India}}{\text{Yield}_{goat}} = \text{EF per capita}$$

The numerator represents the consumption per capita of goat meat, while the denominator represents the average global yield of goat meat (Wackernagel 1998).

In the case of pork, chicken, eggs and manufactured meat products, those raised on cereals from arable land, the EF per capita is calculated by subtracting imports from exports to find consumption per capita and then dividing by the population of India, followed by the productivity of the product. For example, in the case of pork meat, the equation is as follows:

$$\frac{(\text{Imports}_{pork} - \text{Exports}_{pork})/\text{Population of India}}{\text{Yield}_{pork}} = \text{EF per capita}$$

The production of pork, chicken, eggs and manufactured meat products are not included because the raw materials for this product are already accounted for in the cereals section of the spreadsheet.

### 3.3.1.2 Productivity Values

In all cases, the productivity value used for animal based products was the average world yield of the item in question. Average world yield was chosen, rather than average Indian yield, because trade facilitates the consumption of items from all over the globe. The data for world yield of each animal product were calculated using data from FAO's statistical database and the 1997 Statistical Abstract of India.

#### *3.3.1.2.1 Productivity of Animal Products from Pasture*

The productivity of animal products from pasture (bovine, goat, mutton and buffalo meat, dairy products, and hides and skins), was calculated by dividing the weight of all animal products, in kilograms, grown on pastures by the total pasture area, in hectares, of the world. In order to do this, the various animal products were weighed according to their conversion efficiencies - that is, the ratio of the total kilojoules of input to the total kilojoules of output for each product. These conversion efficiencies are 16 for beef, goat, sheep and buffalo and 5 for milk, with an average conversion efficiency estimated to be about 7.1. (Pork, chicken and eggs have a conversion efficiency of between 5 and 6, but are not included in this calculation because they grow on cereals from arable land rather than being pasture raised.) To calculate the average productivity, the weight of all beef, goat, sheep and buffalo products (including hides and three times the wool, as its conversion efficiency is three times lower than beef) was multiplied by 16/7.1 to convert it into average animal product. The amount of milk was multiplied by 5/7.1 and then divided by 4.78 since one kilojoule of milk is 4.78 times heavier than one meat kilojoule. The sum of these products was then divided by the total pasture area of the world to get the final productivity value (Wackernagel 1998). The general equation for this calculation is:

$$\frac{[(\text{beef, goat, sheep and buffalo meat (kg)} + \text{hides(kg)} + 3*\text{wool(kg)}]*16/7.1 + \text{milk(kg)}*5/7.1/4.78}{\text{pasture area of the world (ha)}}$$

In the case of 1971, this productivity was 61 kilograms per hectare and in 1995 it was 82 kilograms per hectare.

The productivity of beef, goat, sheep and buffalo meat from pasture was calculated by dividing the world average productivity of animal products from pasture by 16 (the average conversion efficiency for these meats) and multiplying by 7.1 (the average world productivity for animal products from pasture). Similarly, the average productivity of milk was calculated by dividing the average world productivity of animal products from pasture by 5 (the average conversion efficiency of milk) and multiplying by 4.78 (since one kilojoule of milk is 4.78 times heavier than one meat kilojoule) and then by 7.1 (the average world productivity for animal products from pasture). The average productivity of cheese and butter was found by dividing the productivity of milk by 10 since it takes approximately 10 kilograms of milk to produce 1 kilogram of butter or cheese (Wackernagel 1998; Wackernagel *et al.* 1993).

The productivity of wool was calculated in 1993 by Wackernagel *et al.* to be 15 kilograms per hectare. The productivity of hides and skins is assumed to be same as that for beef, goat, sheep and buffalo meat, while the productivity of animal based fats and oils and other materials are assumed to be the same as average animal productivity from pasture - 61 and 82 kilograms per hectare in 1971 and 1995, respectively.

#### *3.3.1.2.2 Productivity of Animal Products from Arable Land*

As mentioned previously, pork, chicken and eggs are considered to be produced on feed from arable land, rather than being pasture raised. As a result, the productivity of these animal products are calculated differently. The productivity values of these products are calculated by dividing the average world yield of fodder cereals (in this case barley) by the conversion efficiencies of pork, chicken and eggs. Since the conversion efficiencies lie between 5 and 6, an average value of 5.5 was used.

In the case of miscellaneous and manufactured meats, such as tinned meats, salted meats, dried meats, meat extracts, and meat meal, it was assumed that the meat in question was raised on grains from arable land. As such, the productivity values were found by dividing the average world yield of barley by the average conversion efficiency value of 7.1.

### *3.3.2 Plant-Based Products - Food, Non-Timber Fibres, Non-Fibre & Non-Food*

The EF per capita of plant-based products is calculated in much the same way as for animal-based products. In the case of raw materials, the per capita EF for each product was found by dividing the consumption per capita of a product by the product's associated productivity. For example, in the case of wheat, the EF per capita would be:

$$\frac{(\text{Production}_{wheat} + \text{Imports}_{wheat} - \text{Exports}_{wheat})/\text{Population of India}}{\text{Yield}_{wheat}} = \text{EF per capita}$$

The numerator representing the consumption per capita of wheat and the denominator representing the average global yield of wheat (Wackernagel 1998).

For those products which are manufactured, such as finished cereal products, the production of the product is not included in the footprint calculation, only the import and export amounts.

#### 3.3.2.1 Productivity Values

The bulk of the productivity values for plant-based products came directly from yield data provided in the FAO Statistical Database. Again, average world yield values were chosen, rather than average Indian yields, because of the impact of trade. There were, however, a few exceptions as some of the productivity values were obtained from other sources or derived from the average world yields. These exceptions are discussed below.

##### *3.3.2.1.1 Productivity of Sugar*

As sugar cane is the primary sugar crop in India, it was assumed that all of the sugar in India was produced using sugar cane. Since it takes approximately 13 kilograms of sugar cane to produce 1 kg of sugar, the average yield of sugar cane was divided by 13 to obtain the productivity value for sugar (Wackernagel *et al.* 1993).

##### *3.3.2.1.2 Productivity of Cotton*

The productivity of cotton came from the International Institute of Economic Development and is estimated to be 1000 kilograms per hectare (Wackernagel 1998).

*3.3.2.1.3 Productivity of Margarine and Other Oils and Fats*

The productivity of margarine and other oils and fats was calculated by multiplying the average world yield of oilseeds by 0.45. This is because the oil content of oil seeds is approximately 45 per cent (Wackernagel, Lewan & Borgström Hansson 1999).

### 3.3.3 Manufactured Chemicals, Non-Metallic & Metallic Products

The next three sections of the spreadsheet deal with manufactured products. Only the imports and exports of these items are considered because they are produced from raw materials that are accounted for elsewhere. The reason these products are included is to determine their embodied energy so that this may be included in the energy accounting portion of the spreadsheet. The values for imports and exports of these products were obtained from the United Nations Yearbook of International Trade Statistics for 1972-73 and 1995. In cases where only a dollar value was available for Indian imports or exports, the average tonnes per dollar were calculated using subcategories with available weight and dollar values. Once the average tonnes per dollar were known this ratio was multiplied by the value of the import or export product in question to determine the approximate weight in tonnes of the particular item. This is needed because the embodied energy is calculated based on weight. For example, in the case of road vehicles and other transportation equipment in 1971, only the dollar value of imports was available. For the subcategory of railway locomotive and car parts, however, both the dollar value and the weight of imports was available. In order to estimate the total weight of road vehicles and other transportation equipment, the ratio of weight to dollar value for this subcategory was determined and it was assumed that this ratio was the same for the entire category. Thus, the weight of road vehicles and other transportation equipment were estimated as:

$$weight_{\text{road vehicles \& other trans. equip.}} = value_{\text{road vehicles \& other trans. equip.}} \times \frac{weight_{\text{railway locomotive \& car parts}}}{value_{\text{railway locomotive \& car parts}}}$$

In cases where no subcategories existed the average tonnes per dollar worldwide for the item was calculated and this value was then used.

### *3.3.4 Timber Products*

The world average productivity of timber is estimated to be approximately 1.99 cubic metres per hectare per year. This is an estimate calculated by Mathis Wackernagel based on statistics from a number of FAO reports[6].

For each of the timber categories there is an associated waste factor which indicates how much round wood is needed per unit of manufactured product. Again, these waste factors have been previously estimated by Wackernagel based on forest statistics. These waste factors are used to determine the total consumption of roundwood. Production, imports and exports of each product are multiplied by their waste factor and then summed together to determine the total roundwood equivalent for each category. Exports are then subtracted from production and imports to determine the total consumption of roundwood. This value is then divided by the productivity (1.99 $m^3$/ha/yr) and the population of India to determine the footprint per capita. The energy embodied in each timber category is calculated separately.

[6] Wackernagel (1998) indicates that the following FAO reports were used to calculate this average world productivity value:
FAO, 1995. State of the World's Forests.
FAO, 1981. Tropical Forest Assessment Project. (one each for Asia, Africa and the Americas).

### *3.3.5 Energy Balance of India*

The next part of the spreadsheet analyzes the energy requirements of India. The energy types included in this analysis were coal, liquid fossil fuels, gaseous fossil fuels, nuclear power, hydroelectricity, biomass and the energy embodied in net imported goods. As previously mentioned, the energy embodied in net imported goods is used to account for trade in the calculation of per capita energy consumption. Per capita energy consumption needs to be corrected for trade because India consumes energy to produce export goods, but also imports goods whose production energy has been invested elsewhere.

#### 3.3.5.1 Energy Consumption Per Capita

The total Indian consumption of each energy type was obtained from statistics compiled by the United Nations and World Resources Institute, with the exception of energy embodied in net imported goods (see Section 3.3.1). All of these values were converted from their respective units into total gigajoules. The consumption per capita was then calculated by dividing the total consumption of each energy type by the population of India. In order to determine the per capita EF for each energy source, the consumption per capita was divided by the conversion factor of the energy type in question. These conversion factors are discussed below.

#### 3.3.5.2 Conversion Factors

##### *3.3.5.2.1 Conversion Factors for Fossil Energy*

For fossil fuel energy sources - coal, liquid fossil fuels and gaseous fossil fuels - the conversion factors are estimates of the land area needed today to absorb the excessive carbon dioxide ($CO_2$) released by fossil energy burning. Forest ecosystems and peat bogs are among those systems that can be significant natural assimilators of $CO_2$. Young to middle-aged forests, however, accumulate $CO_2$ at the fastest rate over a 50 to 80 year time span. Data on typical forest productivities of temperate, boreal and tropical forests show that an average forest can accumulate approximately 1.05 tonnes of carbon per hectare per year. This means that one hectare of average forest can annually absorb the $CO_2$ emissions generated by the consumption of 60 gigajoules of biomass fuel (Wackernagel 1998; Wackernagel & Rees 1996). The conversion factor for each fossil energy type is approximated by adjusting this absorption value according to the specific carbon intensity of the energy type. For example, the conversion factor for coal is 55 gigajoules per hectare per year, compared to values of 71 and 93 for liquid and gaseous fossil fuels, respectively (Wackernagel 1998). This is because coal combustion releases a greater amount of carbon dioxide than the combustion of fossil liquids or gases. As a result, it takes a greater amount of land to absorb the carbon dioxide released per gigajoule of coal consumed.

##### *3.3.5.2.2 The Conversion Factor for Nuclear Energy*

For nuclear energy, the same footprint per energy unit as that for liquid fossil fuel is used. There are two reasons why this assumption has been made. Firstly, rough calculations suggest that the lost bioproductivity caused by accidents, primarily the Chernobyl accident, compared with the total nuclear power produced since the 1970's leads to a nuclear footprint similar to that for liquid fossil fuels. Secondly, non-subsidized nuclear energy is not economically competitive with fossil fuel and, as a result, will likely be replaced in the short run with fossil energy (Wackernagel 1998; Wackernagel & Rees 1996).

#### *3.3.5.2.3 The Conversion Factor for Hydro-Electric Energy*

In the case of hydro-electric energy, the conversion factor is estimated by dividing the flooded land behind dams, plus the land occupied by high voltage power line corridors, by the annual production of electricity. No data of this sort were available for the state of Himachal Pradesh or India as a whole. Based on a variety of studies, however, an average land-for-energy ratio of one hectare for each 1,000 gigajoules of continuous generating capacity is considered reasonable for general EF calculations. It is important to remember that this is a very general estimate and more specific calculations require regionally collected data (Wackernagel *et al.* 1993; Wackernagel 1998; Wackernagel & Rees 1996).

#### *3.3.5.2.4 The Conversion Factor for Wood-Based Energy*

The conversion factor for wood-energy is based on the assumption that the density of wood is 600 kilograms per cubic metre and that forests used for fuel can produce double the biomass per unit of time because they are left in a highly productive, immature state. On average, each hectare of forest can produce 1.99 cubic metres of roundwood with a waste factor for firewood equal to 0.53 (because its productivity is considered to be twice that of roundwood). This means that the average hectare of forest can produce approximately 3.8 cubic metres of firewood, or 2,253 kilograms. With an energy content of wood of 20 megajoules per kilogram this equates to a footprint of approximately 90 gigajoules per hectare. The EF of wood energy is not included in this section, however, because it has already been included in the section dealing with the use of timber products (Wackernagel 1998).

#### *3.3.5.2.5 The Conversion Factor for Energy Embodied in Net Imported Goods*

The conversion factor for the energy embodied in net imported goods is considered to be the same as that for liquid fossil fuels - 71 gigajoules per hectare per year. This is based on the assumption that liquid fossil fuels are the primary energy source used to produce these goods (Wackernagel 1998).

### *3.3.6 Summaries*

The final section of the Excel spreadsheet summarizes the EF of the average Indian citizen and the ecological capacity of India.

#### 3.3.6.1 Summary of the Ecological Footprint Per Capita

The left section of the summary itemizes the footprint components according to six ecological categories of - fossil energy land, built-up area, arable land, pasture, and forest - and gives total values for each of these components. In order to facilitate comparisons between each of these land areas, the total area for each ecological component has been multiplied by an equivalency factor. This was done because the productive capacity of each land type is substantially different. For example, arable land has a much higher potential for biological production than land only suitable for pasture. The equivalency factors scale the land categories proportional to their productivities. Each equivalency factor provides information about the land category's relative productivity as compared with world average land, which has a factor of 1. For example, the arable land factor of 3.2 indicates that arable land can produce 3.2 times more biomass than world average land (Wackernagel 1998).

### 3.3.6.2 Summary of the Biologically Productive Capacity Within India

Having accounted for the per capita EF, the right section quantifies the biologically productive capacity within India and, for comparison, in the world. To do this, the physical land area per capita was multiplied by the equivalency factor and the 'yield factor' associated with each land type (Wackernagel 1998). In general, the bio-capacities are overestimates, since they build on the assumption that industrial yields are sustainable (Borgström Hansson & Wackernagel 1999).

The physical land per capita for India was estimated using national land use statistics (Wackernagel 1998). Most of these came from FAO and the World Resources Institute. The area of built-up land was estimated at 50 per cent of the land use category 'land unavailable for cultivation' in the Statistical Abstract of India - a classification which includes water bodies, railways, deserts, high mountain areas, roads and buildings (1997). The sea area per capita was calculated by dividing the total area of India's Exclusive Economic Zone, 202 million hectares, by the population of India (Roy 1999).

The 'yield factor' is the relative productivity of each land type in India compared to the average world productivity for these lands. For example, a yield factor of 1.5 indicates that the local productivity of this ecosystem category is fifty per cent higher than world average. The yield factors for each ecosystem category are calculated differently. For arable land, the yield factor is found dividing the per hectare yield of cereals in India by the global per hectare cereals yield. The yield factor for built-up land is considered to be the same as that for arable land since most settlements are thought to be placed on land with prime agricultural potential. It is important to note, however, that there are differences of opinion over the choice of this yield factor[7]. For the purposes of this study, built-up land is considered to have the same yield factor as arable land so that the results are consistent and comparable to footprints calculated for other regions. The yield factor for pasture is calculated by summing up the total Indian animal production on pastures (converted into "average animal products"), dividing by the pasture area of India (to obtain the productivity for animal products produced from pasture) and then dividing by the average world productivity for animal products produced from pasture. The yield factor for forests is estimated from FAO and International Panel for Climate Change (IPCC) statistics[8]. In the case of Himachal Pradesh, the productivity of forests was considered to be 3.00 cubic metres per hectare per year. The yield factor for the sea is based on the assumption that all sea space in the Economic Exclusive Zones is equally productive and, therefore, it is 1.

In the case of 1971, the summary charts were calculated for India and the Kullu District. The results achieved for the Kullu District in this year are rather large and should be regarded with caution. The large number has resulted from the rather high area of forested land reported for the Kullu District (2.57 hectares per capita, as opposed to 0.1 hectares per capita in the rest of India) and the resulting high yield factor for forest (2.1 as opposed to 0.8 in the rest of India). As well, the

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[7] Built-up land could have a yield factor of 1, since the productivity of concrete is the same worldwide. In cases where the yield factor of arable land is low (i.e., substantially less than 1), it may be more beneficial to develop built-up areas which produce specialized/manufactured goods and services. There is also evidence that urban agriculture is often higher yielding than that of arable lands. Wackernagel (personal communication) has argued that the yield factor for built-up land should be zero to indicate the lost productivity it represents.

[8] According to IPCC statistics, the following forest productivity values apply to Continental Asia:

Montane Dry - 1.25 $m^3$/ha/yr;
Montane Moist - 3.00 $m^3$/ha/yr;
Tropical Dry - 3.15 $m^3$/ha/yr;
Tropical Moist with long dry season - 3.75 $m^3$/ha/yr;
Tropical Moist with short dry season - 5.50 $m^3$/ha/yr;
Tropical wet forest - 7.00 $m^3$/ha/yr.

Assuming that all of these forest types are found in India in equal proportions, the average productivity of Indian forests is 3.94 $m^3$/ha/yr.

In the case of Himachal Pradesh, the Kullu District and Manali, the forests are Montaine Moist with a productivity of 3.00$m^3$/ha/yr yield factor for pasture also appears to be disproportionately high. This is likely a result of the calculation used to obtain the yield factor. This equation assumes that all of the animal products from pasture were actually produced in reported pasture areas. In the Kullu Valley, however, many pasture animals are raised in forested areas and on areas not classified as pasture in official reporting statistics. As a result, it appears that a small amount of pasture land is producing a large amount of pasture products and is substantially more productive than pasture areas in other parts of the world.

In 1995, the summary charts were calculated for India, Himachal Pradesh and the Kullu District. Summary charts for Himachal Pradesh were not calculated in 1971 because no land use data were available.

### 3.4 Calculating the Ecological Footprint of Manali Residents - 1971 & 1995

The estimate of the national EF per capita was the starting point for assessing the EF of Manali. In order to calculate Manali's EF, the population of Manali was multiplied by the national per capita EF. Unfortunately, data were not available to make the footprint specific to the Manali.

The population figure used for Manali for 1971 was 1,800 persons. This value came from the Kullu District Census Handbook for 1971. There was, however, great variability in the population data for Manali in 1995. The 1991 Census of India indicates that the population of Manali is 2,433 persons. These numbers have been criticized by local individuals who complain that the Census is done in January and February when many Manali residents have gone to Southern India for the winter months. A more recent study on waste disposal done by the town of

Manali puts the town's population at 2,609 persons (1997(?[9])). Other researchers working in Manali have suggested that the population is between 4,000 and 5,000 individuals (Berkes *et al.* 1998; Gardner 1995; Pandey, Singh & Singh 1998, among others). An August 8, 1998 article in *The Tribune*, a local newspaper, states that the population of Manali is 2,850 and that there are approximately 5,000 Tibetan refugees living in the town and an additional 4,000 individuals which come to the town each day to work (Lohumi 1998b). Singh (1989), on the other hand, estimates that during the tourist season there are 10,000 additional workers in Manali town.

For the purposes of this study, the population figure generated by the Town of Manali (1997 (?)) of 2,609 has been chosen. This number is conservative, at approximately half of the estimated 5,000 people quoted in other studies, and was apparently calculated in 1995, the year this study is examining. Tibetan refugees are not included in the calculations because there were no official government accounts available of their actual numbers in Manali. The floating population generated by Singh (1989) of 10,000 individuals during the tourist season was used to calculate the tourist footprint. Singh's (1989) value was chosen because his was the only in-depth study available that explicitly considered the impact of the tourism industry on Manali's population. The use of a conservative resident population value and the exclusion of Tibetan refugees means that the calculated EF of Manali is likely an underestimate of the town's true footprint.

### 3.4.1 Determining Ecological Footprint Distribution of Manali Residents

The distribution of the EF among Manali residents is based on income distribution statistics for Himachal Pradesh. For the purposes of this study it was assumed that income distribution is directly proportional to the footprint. There are,

[9] No date was available for the year this report was produced, but individuals working for the

however, some problems with this assumption. Differences in monetary wealth are only coarse estimations of the varying standards of living within India, but they are the only statistics which are readily available for this type of analysis. Wackernagel (1998), who undertook a similar calculation for Santiago, Chile, points out that although money flows are not correlated to quality of life[10], they are closely linked to resource flows[11]. In addition, he points out that income distribution may fail to fully emphasize the gap between rich and poor because the rich are subject to many hidden income benefits, such as capital gains and savings abroad, which escape statistical measurement. This effect, however, may be cancelled out by the fact that as income increases, individuals tend to shift their purchases from tangible items to more labour-intensive goods and services (Wackernagel 1998).

The distribution analysis for Manali could only be completed for 1995, as similar statistics for 1971 were not available. As well, it had to be assumed that the income distribution for Himachal Pradesh was the same as that for the Manali area. Income distribution data for the state of Himachal Pradesh came from the 1996 book, <u>Indian Market Demographics: The Consumer Classes</u>, by Rao and Natarajan. Based on this study, the income distribution in Himachal Pradesh in 1994/95 breaks down as follows:

| Annual Income | Percentage of Population |
|---|---|
| less than 20,000 Rupees[12]: | 57.05% |
| 20,001 to 40,000 Rupees: | 26.69% |
| greater than 40,000 Rupees: | 16.26% |

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Nagar Panchayat in Manali indicated that it was completed in 1997 (personal communication)

[10] See Herman Daly and John Cobb's 1989 criticism of Gross National Product - <u>For the Common Good</u>, Beacon Press, Boston.

[11] Wackernagel refers to:

1. Hall, C., C. Cleveland & R. Kaufman, 1986. <u>Energy and Resource Quality</u>. Wiley Publishers, New York.
2. Kaufman, R., 1992. A biophysical analysis of the energy/real GDP ratio: implications for substition and technical change. <u>Ecological Economics</u>. 6(1): 35-56.

[12] One Canadian dollar is equal to approximately 25 Rupees

This compares to an average annual salary in Himachal Pradesh in 1995 of 8,759 rupees per person, according to the 1998 Himachal Pradesh Economic Review. In order to determine the size of the footprint of each income class, the ratio of each income class to the average income was estimated. This value was then multiplied by the EF per capita of the average Indian. For example, for the middle income class, the annual income ranges from 3.0 to 6.0 times greater than the average income in Himachal. Thus, the footprint for these individuals is three to six times greater than that for the average Himachali.

## 3.5 Calculating the Ecological Footprint of Manali Tourists - 1971 & 1995

Considering Manali's role as a "hot" tourist destination, it was important to include the consumption of tourists to the EF of the town. On average, tourists stay in Manali for three days. Thus, the average per capita EF of a tourist to Manali was calculated by multiplying the ratio of the number of days of the year a tourist spends in Manali (3 days/365 days) by the EF of the average Indian per year. This per capita tourist footprint was then multiplied by the total number of tourists to Manali to get the total footprint of tourists for 1971 and 1995. In 1971, the total number of tourists to Manali was 18,500 (Singh 1989). Based on informal interviews in Manali, as well as comparisons with tourism statistics for the years 1987 to 1995 from the Himachal Pradesh Tourism Development Corporation (HPTDC) (1998?), it was estimated that three per cent of these visitors were foreigners.

Precise data for the number of visitors to Manali in 1995 were unavailable. The number of tourists to the Kullu Valley, however, was available from the HPTDC. Based on comparisons with data provided by Singh (1989) for tourist arrivals to Manali in the 1980's and data for the same time period from the HPTDC, it was estimated that approximately 87 per cent of the visitors to the Kullu Valley went to Manali[13]. It is assumed that this ratio is the same for 1995. Thus, in 1995, 425,878 Indian tourists and 13,856 foreign tourists visited the Kullu Valley for a total visitor count of 438,734 people (Himachal Pradesh Tourism Department 1998(?)). Assuming that 87 per cent of these individuals visited Manali, there were 370,514 Indian tourists and 12,055 foreign tourists for a total of 382,569 tourists to Manali in 1995.

It was assumed that all of the visitors in 1971 and 1995 stayed in Manali for the average period of three days. It was also assumed that during these three days tourists exhibited the same consumption patterns as Manali residents. This latter assumption errs strongly on the side of caution. It is likely that tourist consumption is actually much greater than local consumption since individuals on a vacation tend to dine frequently in restaurants, purchase souvenirs and take day trips to other locations. All of these activities are usually not part of every day life and, as a result, would serve to increase the average consumption of tourists to Manali. This, in turn, would increase the total cumulative effect that tourists are having on Manali's EF.

### *3.5.1 Footprint Distribution of Manali Tourists - 1995*

For 1995, data on the income distribution of Manali's tourists were extrapolated from Singh's 1987 study, Impact of Tourism in Mountain Areas. This study, published in 1989, found that the income distribution of tourists to Manali was as follows:

[13] According to Singh (1989), there were 184,500 tourist arrivals in Manali in 1987. According to the HPTDC there were a total of 212,991 tourist arrivals to the Kullu Valley as a whole. Thus, the percentage of tourists to the Kullu Valley who visited Manali was:
(184500 / 212991)*100% = 87%.

| Annual Income | Percentage of Indian Tourists | Percentage of Foreign Tourists |
|---|---|---|
| less than 12,000 Rupees[14]: | 10.47% | 4.76% |
| 12,001 to 36,000 Rupees: | 36.05% | 19.04% |
| 36,001 to 60,000 Rupees: | 44.19% | 19.04% |
| 60,001 to 96,000 Rupees: | 6.98% | 14.29% |
| greater than 96,000 Rupees: | 2.33% | 42.86% |

Singh's (1989) results were based on interviews conducted with 86 Indian and 21 foreign tourists, of the over 200,000 tourists that visited Manali in 1987. Despite the inadequacies of the study, it provides the only data available on tourist income distribution for Manali. Thus, for the purposes of this study, Singh's (1989) findings were used and it was assumed that the income distribution of Manali tourists in 1995 was similar to that in 1987.

The footprints of each income group were estimated in the same manner as those for the resident population. The income of tourists was compared to the average income of Indians and this was then used to estimate differences in the EF of each tourist income group. For 1995, the average income of Indians was approximately 9,100 rupees (Prakash 1997).

### 3.6 Calculating the Ecological Footprint of Manali's Floating Population

Tourism in Manali also attracts a substantial number of seasonal workers. It has been estimated that the floating population of Manali for 1995 (i.e. seasonal workers) was approximately 10,000 people (Singh 1989; Town of Manali 1997(?)). Since the main tourist season in Manali occurs during the months of May and June it was assumed that on average each seasonal worker remains in Manali for approximately two months or 61 days. Naturally, there are some that

[14] One Canadian dollar is equal to approximately 25 Rupees

stay for longer periods of time, while others remain for shorter periods of time, but this is considered to be a conservative estimate. Having said this, the EF per capita of the seasonal workers is 61 days/365 days multiplied by the EF of the average Indian. No data of this sort were available for 1971. It can be assumed, however, that since the number of tourists and hotels at this time was so low there was likely no appreciable floating population.

## 3.7 Estimating Monthly Variations in Manali's Ecological Footprint - 1971 & 1995

Due to the large fluctuations in the tourist population throughout the year, monthly estimates of Manali's EF were also calculated to assess annual changes in the footprint (see Tables 3.2 and 3.3).

In order to determine the monthly EF of Manali's permanent residents, the total EF for these individuals was divided by 12. It was assumed that the consumption patterns of each individual remained approximately the same throughout the year. This is probably not the case since Manali is quite cold in the winter and energy consumption likely increases during this time.

The monthly EF of tourists was estimated using 1995 data compiled by the Himachal Pradesh Tourism Department on the number of visitors each month to the Kullu Valley. Again, it was assumed that 87 per cent of these individuals visited Manali. For 1971, no monthly data on tourist arrivals were available so monthly fluctuations in tourist flow were estimated using the 1995 data. The percentage of total annual tourists to Manali in each month was calculated for 1995. These values were then used to determine the number of tourists in each month of 1971, of the total 18,500 for the year.

For example, in 1995, 23.02 per cent of the tourists who visited Manali came in the month of May. Thus, for 1971 it was assumed that 23.02 per cent of the 18,500

**Table 3.2: The monthly Ecological Footprint of Manali - 1971**

| MONTH | Number of Indian Tourists | Number of Foreign Tourists | % of Yearly Total | Indian Tourist Footprint | Foreign Tourist Footprint | Local Footprint (pop = 1,800) | Total Tourist Footprint | Total Footprint |
|---|---|---|---|---|---|---|---|---|
| January | 452 | 4 | 0.02 | 0.04 | 0.00 | 1.62 | 0.04 | 1.66 |
| February | 523 | 5 | 0.03 | 0.05 | 0.00 | 1.62 | 0.05 | 1.66 |
| March | 1159 | 10 | 0.06 | 0.10 | 0.00 | 1.62 | 0.10 | 1.72 |
| April | 1886 | 30 | 0.10 | 0.17 | 0.00 | 1.62 | 0.17 | 1.78 |
| May | 4236 | 28 | 0.23 | 0.37 | 0.00 | 1.62 | 0.38 | 1.99 |
| June | 5183 | 26 | 0.28 | 0.46 | 0.00 | 1.62 | 0.46 | 2.08 |
| July | 1347 | 96 | 0.08 | 0.12 | 0.01 | 1.62 | 0.13 | 1.74 |
| August | 364 | 131 | 0.03 | 0.03 | 0.01 | 1.62 | 0.04 | 1.66 |
| September | 243 | 97 | 0.02 | 0.02 | 0.01 | 1.62 | 0.03 | 1.65 |
| October | 1085 | 94 | 0.06 | 0.10 | 0.01 | 1.62 | 0.10 | 1.72 |
| November | 637 | 11 | 0.04 | 0.06 | 0.00 | 1.62 | 0.06 | 1.67 |
| December | 828 | 24 | 0.05 | 0.07 | 0.00 | 1.62 | 0.08 | 1.69 |

**Table 3.3: The monthly Ecological Footprint of Manali - 1995**

| MONTH | Number of Indian Tourists | Number of Foreign Tourists | % of Yearly Total | Increased Resident Population | Indian Tourist Footprint | Foreign Tourist Footprint | Increased Resident Footprint | Local Footprint (pop = 2,609) | Total Tourist Footprint | Total Footprint |
|---|---|---|---|---|---|---|---|---|---|---|
| January | 9139 | 297 | 2.47 | 247 | 0.98 | 0.03 | 0.54 | 2.83 | 1.01 | 4.37 |
| February | 10561 | 344 | 2.85 | 285 | 1.13 | 0.04 | 0.62 | 2.83 | 1.17 | 4.61 |
| March | 23379 | 761 | 6.31 | 631 | 2.50 | 0.08 | 1.37 | 2.83 | 2.58 | 6.78 |
| April | 38343 | 1247 | 10.35 | 1035 | 4.10 | 0.13 | 2.25 | 2.83 | 4.23 | 9.30 |
| May | 85286 | 2775 | 23.02 | 2302 | 9.11 | 0.30 | 5.00 | 2.83 | 9.41 | 17.24 |
| June | 104200 | 3390 | 28.12 | 2812 | 11.13 | 0.36 | 6.11 | 2.83 | 11.50 | 20.43 |
| July | 28945 | 942 | 7.81 | 781 | 3.09 | 0.10 | 1.70 | 2.83 | 3.19 | 7.72 |
| August | 10028 | 326 | 2.71 | 271 | 1.07 | 0.03 | 0.59 | 2.83 | 1.11 | 4.52 |
| September | 6911 | 225 | 1.87 | 187 | 0.74 | 0.02 | 0.41 | 2.83 | 0.76 | 3.99 |
| October | 23684 | 771 | 6.39 | 639 | 2.53 | 0.08 | 1.39 | 2.83 | 2.61 | 6.83 |
| November | 12975 | 422 | 3.50 | 350 | 1.39 | 0.05 | 0.76 | 2.83 | 1.43 | 5.02 |
| December | 17062 | 555 | 4.61 | 461 | 1.82 | 0.06 | 1.00 | 2.83 | 1.88 | 5.71 |

tourists which visited Manali, or 422 people, came in the month of May. Having determined the number of tourists to Manali in each month, the total tourist footprint per month was calculated by multiplying the number of tourists by 3 days/365 days and then multiplying this value by the EF per capita of the average Indian.

For 1995, the monthly EF of the floating population was also estimated using the 1995 tourist statistics. It was assumed that the floating population mirrored the number of tourists per month in Manali. As such, the total EF of the resident population for the year was multiplied by the percentage of total tourists visiting Manali in each month. For example, in the month of May, 23.02 per cent of the total yearly tourists visited Manali. Thus, the footprint component for May for the floating population was 0.2302 multiplied by the total yearly footprint of 2134 hectares for the floating population.

## 4.0 Interviews with Manali Hotel & Restaurant Operators, Shopkeepers, and Residents

As a result of the criticisms presented in the literature, a series of interviews were conducted with Manali residents, hotel and restaurant operators and shopkeepers to validate and enhance the findings of the EF calculations. These interviews were also used to unearth the problems that Manali residents felt existed in their community and to discover what solutions they thought would be most applicable. In total, 81 individuals were interviewed, of which 44 were hoteliers, 22 were restaurateurs, 7 were shopkeepers, 3 were the owners or employees of local scrap shops, and 5 were individuals who live and work in Manali. Others were interviewed in Shimla, Kullu and Manali regarding the situation in Manali, however these interviews were highly informal and are mentioned in this document only when a relevant fact was provided by one of these individuals.

### 4.1 Interviews with Hotel Operators

Manali hotel operators were interviewed because of the importance and prevalence of tourism to Manali's economy and the exceedingly large number of hotels in the region. Throughout the study, care was taken to balance the number of hoteliers in each of three categories of hotel - large (20 rooms or more), medium (10 to 19 rooms) and small (less than 10 rooms). These categories were chosen arbitrarily based on a review of the size of hotels in Manali. Of the 44 hotels chosen for interview, 10 (24%) were large hotels, 20 (48%) were medium hotels and 12 (29%) were small hotels. This is considered to be a fair representation of the approximately 220 hotels in Manali, of which 16 per cent were large, 40 per cent were medium-sized and 43 per cent were small (Hotels and Rest Houses in Himachal Pradesh 1998). Two individuals were also interviewed who operate cottages and apartments for tourists that have full kitchens, living rooms and several bedrooms.

The hotel operators interviewed were both owners and employees. The persons interviewed were told that their anonymity would be maintained. All of them were asked the following set of questions:

1. Do you stay open year-round?
   If no, what months are you closed?
   If yes, how is the hotel heated?
   - Are there fireplaces? If yes, how much wood is used per season?

2. Does your hotel have a restaurant &/or room service?
   Is this open/available in the off-season?

3. Are the products used in the hotel/restaurant purchased locally?
   What products do you bring from outside the Kullu Valley?

4. Are your clients primarily Indian or foreigners?

5. Do you plan any changes/improvements for the hotel in the immediate future?

6. What things could/should be done locally to improve your business?

7. What local problems face the new Nagar Panchayat and how should they deal with these problems?

(Hotel operators were also asked about garbage generation, collection and recycling, and these are elaborated on in Chapter 5, Attempting to Estimate Manali's Waste Footprint.)

The questions above were thought to emphasize the main sustainability issues being addressed by the rest of the study and, it was thought that the answers could be used to verify information that was collected through other means. Questions 1 through 5 were considered to be basic questions about hotel operations. Questions 1 and 2 were asked to get an idea about how many hotels were open during the winter months, whether their kitchens were operating and to get a sense of the types of energy demands they had as a result. This issue has important implications for the size of Manali's EF because greater energy consumption equates to a larger footprint. These questions also provided information about tourist flow in Manali during the winter months, a potentially important economic sustainability issue. Question 4 was asked to get a sense of the type of tourist coming to Manali, while Question 5 was asked to determine if the hotels were planning large expansions or renovations within the next year to attract more tourists.

Questions 6 and 7 were asked to determine what hoteliers think are problems in Manali, as well as what they believe would be good solutions to these problems. This is important, particularly for the recommendations section of this report, because it helps to identify what issues are important to Manali residents, as well as what types of solutions they are most likely to support.

## 4.2 Interviews with Restaurant Operators

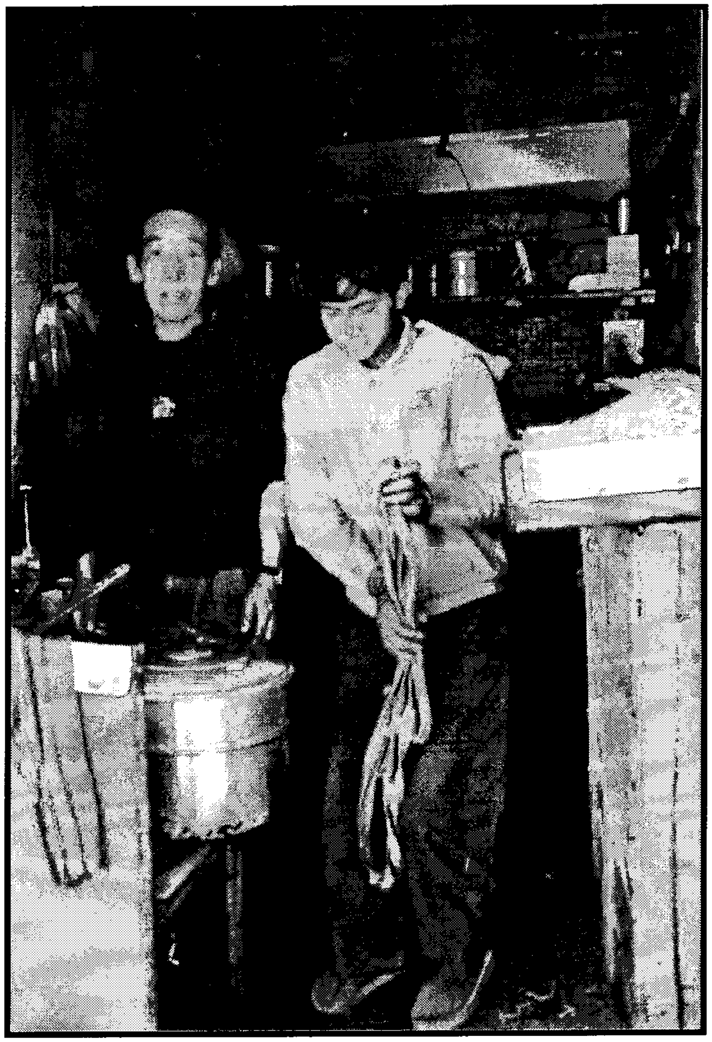
In addition to hotel operators, a number of Manali's restaurant operators were also interviewed to verify the results of the EF calculations and to identify important sustainability issues in the region. Those interviewed included the owners and/or employees of both formal sit-down restaurants and informal dhabas[15] (see Figure 4.1). Of the 21 persons interviewed, 14 owned or were employed in regular sit-down restaurants and 7 owned dhabas.

The restaurant operators interviewed were both owners and employees. Again the persons interviewed were told that their anonymity would be maintained. All of them were asked the following set of questions:

1. How many people does your restaurant seat?
2. Do you stay open year-round?
   If no, what months are you closed?
   How many customers per day do you have in the high season? Low season?
3. Are the products used in the restaurant purchased locally?
   What products do you bring from outside the Kullu Valley?

[15] Smaller street vending operations which may seat about 10 people

**Figure 4.1 Tibetan dhaba in Manali**



4. Are your clients primarily Indian or foreigners?
5. Do you plan any changes/improvements for the hotel in the immediate future?
6. What things could/should be done locally to improve your business?
7. What local problems face the new Nagar Panchayat and how should they deal with these problems?

(As with the hotel operators, restaurant operators were asked about garbage production, collection, and recycling at their establishments, and this is outlined in Chapter 5, Attempting to Estimate Manali's Waste Footprint)

Like the hotel surveys, the questions above emphasized the main sustainability issues being addressed by the rest of the study and the answers could be used to verify information that was collected through other means. The first set of questions, 1 through 5, were basic inquiries about restaurant operations. Question 1 was asked to get a sense of the size of the restaurant. Question 2 was asked to determine whether the restaurant operated all year and how many customers it was serving on a daily basis. Both of these questions are important to the footprint because they indicate the number of individuals eating at restaurants, which is generally more wasteful than eating at home. As well, it addresses the economic sustainability issues associated with seasonal tourism and seasonal income. Question 3 was asked to determine if local products are being purchased by Manali's restaurants or if this economic flow is leaving Manali - a large factor associated with long-term economic sustainability. Question 4 was asked to get a sense of the type of customers frequenting Manali's restaurants. Question 5 was asked to determine if the restaurants were planning large expansions or renovations within the next year.

Questions 6 and 7 are identical to those the hotel operators were asked. These questions were asked to determine what local restaurant operators perceive to be problems in Manali and what they think are potential solutions to these problems.

### 4.3 Interviews with Shop Owners

In order to determine whether the goods being sold in Manali were from the Kullu Valley or elsewhere, interviews where held with the owners of food vendors in Manali, in particular, vendors selling bulk fruits, vegetables and grains. The particular emphasis on bulk raw foodstuffs is because there are no manufacturing plants in the Kullu Valley, so it is unlikely that manufactured goods, such as shoes, come from within the Kullu Valley. Also, since the Kullu Valley has a large agricultural industry, it is interesting to see whether the products being produced in this area are being consumed locally or exported elsewhere.

In total, three bulk foods vendors and four fruit and vegetable vendors were questioned. All were asked the following questions:

1. Do you stay open all year?
   If no, what months are you closed?
2. What products do you buy locally for your shop/stall? What proportion of what you sell is local?
3. Are these bought directly from the producer?
4. Which products are from outside the Kullu Valley?
5. Where do these products come from?
6. How are the products purchased for your shop/stall?
7. Do any of your products come from outside of India?

Shop keepers, like hotel and restaurant operators, were asked if they remained open all year to determine whether their businesses are seasonal in nature. The remaining questions were meant to determine where the products being sold in their shops originated. This is important to the EF of Manali because it indicates whether they are relying on ecosystems outside of the region for support. A heavy reliance on imports could mean the local populace has little control over the flow of these goods and could potentially lose access to them.

## 4.4 Interviews with Others in Manali

Five other individuals who live and work in Manali were interviewed to determine their perspectives on some of the "hot" issues in Manali. These individuals included a local hotel manager, a member of the Nagar Panchayat and local hotel owner, the Director of the Mountaineering Institute, a civil servant with the Himachal Tourism Development Corporation, and a local environmental activist/travel agent/orchard owner. The interviews with these individuals, while formal, were unstructured in terms of questions. All of the individuals were asked about environmental, tourism and social issues in Manali and were free to comment in any manner they saw fit. Each of the interviews had their own flow and all of them were flexible in the sense that those interviewed could discuss any topic they felt relevant to the research.

## 5.0 Attempting to Estimate Manali's Waste Footprint

In addition to calculating the basic EF of Manali, attempts were also made to account for the waste absorption requirements of Manali's population and its tourists. As mentioned previously, the waste footprint of a population is an aspect of EF analysis which has not yet been fully developed.

In order to calculate the waste footprint of a region, the following steps need to be taken. First, the amount, type and volume of waste produced, as well as the amount of waste that gets recycled needs to be determined. Recycled products are deducted from the overall waste footprint because they have essentially been removed from the waste stream. Once the above information is known, the waste footprint is calculated as the amount of land area needed to dispose of the waste items and the length of time for which this land is needed. In other words, how much space (in land area) does the waste consume and how long does it take for this waste to decompose. Materials which decompose quickly have a smaller EF than those which decompose slowly because they are consuming the land area for a shorter period of time. Thus, in order for the waste footprint to be calculated, the decomposition rates of each waste item also needs to be known. This can be very problematic as it is extremely difficult to obtain data on the decomposition rates of the myriad of waste items produced.

For Manali, many failed attempts were made to obtain data on waste absorption rates. These included an extensive literature review and Internet search, as well as interviews with several individuals in the waste field, including individuals at the Canadian Composting Council, BFI Waste Management, Wardrop Engineering - Environmental Division, the Winnipeg Health Sciences Centre - Hazardous Waste Disposal Unit, former students at the Natural Resources Institute and Resource Conservation Manitoba Inc. None of these sources were able to provide data on waste decomposition rates, or information on where such data could be obtained. As a result, the waste footprint of Manali could not be calculated.

Despite this inability to effectively calculate the waste footprint of Manali, the data collected on waste generation and recycling in the town do contribute to the evaluation of overall sustainability in Manali. The steps taken to gather the data included interviews with the three local scrap dealers in Manali, hotel and restaurant operators in Manali and local individuals, as well as an extensive review of waste studies completed in the area. These methods are outlined in the sections below.

## 5.1 Interviews with Scrap Dealers

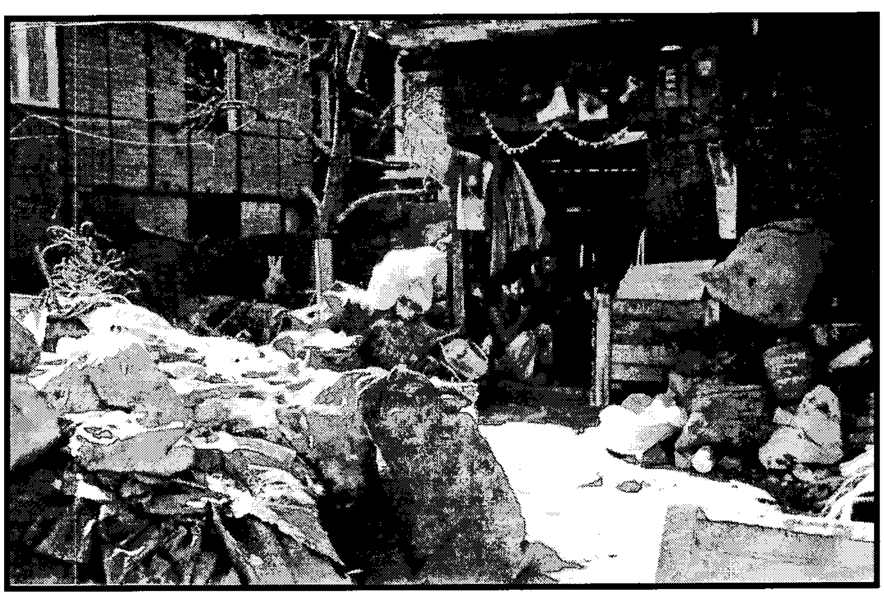
The removal of recyclable items from Manali's waste stream reduces the waste footprint of Manali town by eliminating the need to dispose of these wastes. It also reduces the overall footprint of Manali because fewer new materials need to be extracted from the earth and because the recycling of these items consumes substantially less energy than virgin extraction (Vincent & Fick 1999).

In Manali, there is a large element of informal recycling[16] involving the collection of "junk" - bottles, cans, old cutlery, plastics - by a poorer segment of Manali's population. In addition to collecting these items from hotels and restaurants, several individuals, typically entire families, are licensed to live at the garbage dump and sort through the garbage which is dumped there (Figure 5.1). These individuals then sell the collected recyclables to scrap dealers in Manali (Figure 5.2). In order to determine the impact these collectors and scrap dealers are having on Manali's waste stream, interviews were held with the workers and owners of the three local scrap shops.

[16] The term informal recycling has been used because other, wealthier individuals in Manali do not consider this practice to be a form of recycling. To them, recycling involves the development of an actual factory which physically breaks down these items and turns them into new items.

Figure 5.1 Garbage collectors in Manali carrying bags of recyclables

Figure 5.2 One of Manali's three local scrap dealing operations



All of the scrap dealers interviewed in Manali were asked the following set of questions:

1. What types of material are you collecting?
2. Where does it come from? Who collects it?
3. How much do you pay per pound or kilogram for the different materials?
4. How much material do you collect on a daily/monthly/annual basis?
5. What are some of the problems you face with your business?

By ascertaining how much material is collected and where it is collected, the amount of recyclables exiting the waste stream on an annual basis can be estimated. How much is paid for the items indicates the economic sustainability of the operation and the livelihoods of those who collect the wastes, as well as the value of the items themselves.

## 5.2 Interviews with Hotel and Restaurant Operators

As mentioned in the previous chapter, interviews were also held with hotel and restaurant operators. In total, 44 hotel operators and 22 restaurant operators were asked about their garbage production, collection, and recycling.

In terms of waste, all of the hotel and restaurant operators were asked the following set of questions:

1. Approximately how much garbage does your establishment generate daily?
   High season (May/June)?
   Other?
2. Who picks up the garbage?
   How often?
3. What sorts of waste does your establishment generate?
   Which types the most?
4. Do any scrap dealers collect items from the hotel?

If yes, what types of items do they collect?
How often do they collect the items?

These questions were asked to generate information about the type and quantity of waste being generated by hotels and restaurants and to determine whether any of this waste is being recycled through scrap dealers. These questions also helped to identify how Manali residents deal with waste - information that is useful for generating recommendations on how to decrease Manali's footprint. Naturally, the more wastes that are being composted and recycled, the smaller the EF of Manali.

## 5.3 Review of Waste Studies

Another means for collecting data on waste production and disposal in Manali was a review of waste studies undertaken in Manali by different individuals and organizations. The reports examined for this research included the following: an Urban Local Bodies report on solid waste management in Manali, an as yet unpublished report by the G.B. Pant Institute, and the Engineering Handbook for the Manali area. In addition to these studies, complimentary interviews were carried out with Manali's junior engineer and Manali's garbage collection crew. The data collected through these sources were then amalgamated to create a clearer picture of total waste production by type and by season in Manali. The results of this review are outlined in Chapter 8 of the Results Section.

# Section III -

## Results

# 6.0 Manali's Growing Ecological Footprint

The first set of results reflect the changes which have occurred in the per capita Indian EF and the amount of land available per capita in the World, India and the Manali area. In addition, the import, export and production footprints for 1971 and 1995 are also detailed, as well as the changes in the EF of Manali between 1971 and 1995. The results are given in point form, as well as expressed graphically. The actual spreadsheets for the 1971 and 1995 EF calculations can be seen in Appendices 1A and 1B, respectively.

## 6.1 Results for 1971

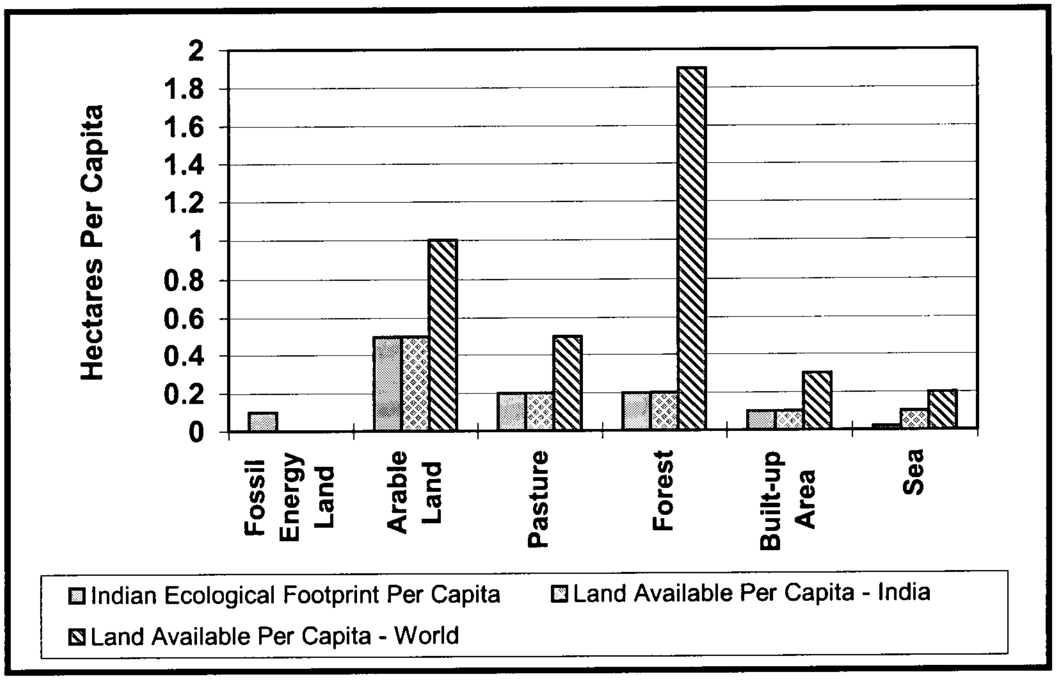
### *6.1.1 The 1971 Per Capita Ecological Footprint & Per Capita Land Available*

The 1971 per capita EF reflects the amount of land in hectares being used by the average person in India to maintain consumption levels. For 1971, the EF per capita for the average Indian resident is calculated to have been 1.1 hectares (ha/cap). As displayed in Figure 6.1, the composition of this footprint breaks down as follows:

- 0.1 ha/cap fossil energy land;
- 0.5 ha/cap arable land;
- 0.2 ha/cap pasture;
- 0.2 ha/cap forest;
- 0.1 ha/cap built-up area and;
- 0.02 ha/cap sea area.

Once the amount of land required by the average Indian was determined, it was also important to determine the amount of land available per capita for the sake of

**Figure 6.1 1971 Per Capita Ecological Footprint of the Average Indian and the Per Capita Land Available in India and Worldwide**




comparison. In 1971, the 1.1 hectares per capita of land consumed by the average Indian compared to a land availability in India of 0.8 hectares per capita, the composition of which broke down as follows:

- 0.5 ha/cap arable land;
- 0.2 ha/cap pasture;
- 0.2 ha/cap forest;
- 0.1 ha/cap built-up area and;
- 0.1 ha/cap sea area.

In Kullu District, specifically, the land available per capita was 9.4 hectares[17]. The

[17] As mentioned in section 3.3F ii), this estimate seems rather large and appears to have resulted from rather large reported forest areas, as well as large calculated yield factors for forest and pasture areas. As a result, it has not been included in Figure 3.4 and it should be noted with caution.

composition of this is as follows:

- 0.3 ha/cap arable land;
- 1.2 ha/cap pasture;
- 9.1 ha/cap forest;
- 0.04 ha/cap built-up area and;
- no sea area.

Worldwide, in 1971, 3.4 hectares per capita were available and this land broke down as follows:

- 1.0 ha/cap arable land;
- 0.5 ha/cap pasture;
- 1.9 ha/cap forest;
- 0.3 ha/cap built-up area and;
- 0.2 ha/cap sea area.

### *6.1.2 The Import, Export and Production Footprints - 1971*

The import, export and production footprints were calculated to determine how much Manali residents were relying on outside resources to meet their footprint demands; how much of the land in the Kullu Valley was being exported to support populations in other parts of the world; and how much locally produced goods were being consumed in the area.

The footprint for imports in 1971, including fossil and nuclear energy, was 0.2 hectares per capita, while the footprint in exports was the same at 0.2 hectares per capita. Thus, the footprint for production in India in 1971 was the same as the per capita EF at 1.1 hectares per capita. It is important to note that the import and export of energy is not considered in this calculation, with the exception of energy embodied in net imported goods, because no reliable statistics for the import and export of energy from India were available. It is known, however, that the energy sector accounts for the biggest single item in Indian imports (Parikh *et al.* 1997). Thus, it is likely that in reality India's import footprint is actually much larger than its export footprint. In terms of land area, the import and export footprints broke down as follows:

| Land Type | Import Footprint | Export Footprint |
|---|---|---|
| arable land | 0.01 ha/capita | 0.01 ha/cap |
| pasture | 0.005 ha/capita | 0.003 ha/cap |
| forests | 0.0003 ha/cap | 0.0001 ha/cap |
| sea space | 0.000004 ha/cap | 0.0001 ha/cap |

Thus, in 1971, India exported more sea space than it imported and imported more forest and pasture land than it exported.

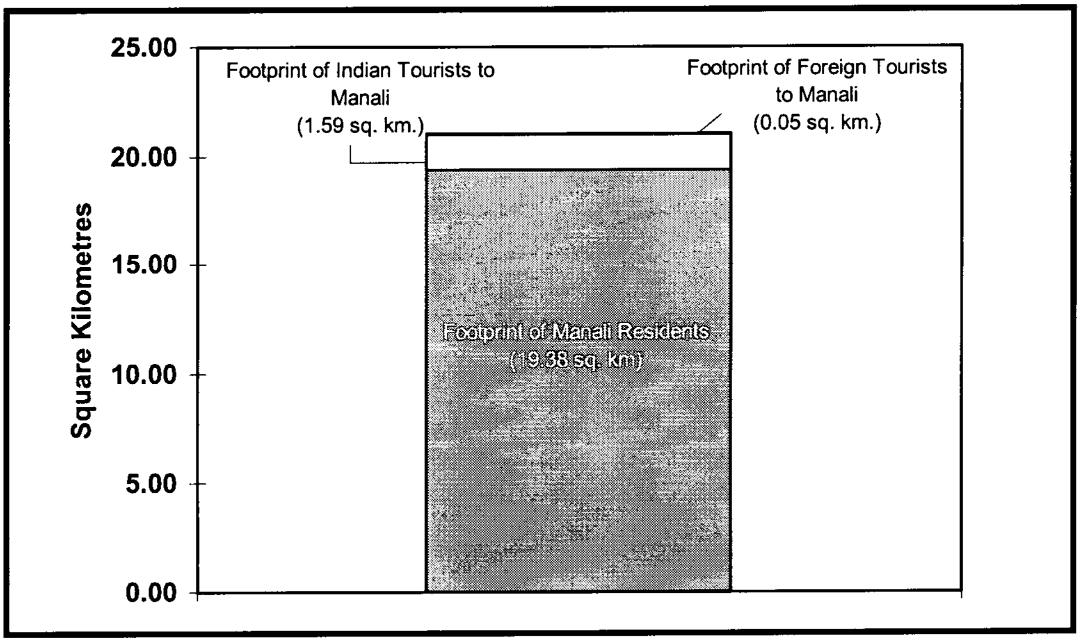
### *6.1.3 The 1971 Ecological Footprint of Manali Town*

The EF of Manali town reflects the total land area required to support Manali residents and its tourists. Overall, the EF of Manali residents in 1971 was 1,938 hectares or 19.38 square kilometres. The EF of the tourists to Manali in 1971 was 164 hectares (1.64 square kilometres) - 159 hectares from domestic tourists and 5 hectares from foreign tourists. As can be seen in Figure 6.2, with the inclusion of the tourist footprint, the total EF of Manali in 1971 was to 2,102 hectares or 21.02 square kilometres. This equates to an area that is 11.7 times greater than Manali's 1971 town area of 1.8 square kilometres.

The total EF of Manali town is composed of the following:

- 46.7 per cent (980 hectares) arable land;
- 16.8 per cent (350 hectares) pasture;
- 14.5 per cent (310 hectares) forests;
- 13.8 per cent (290 hectares) fossil energy land;
- 6.4 per cent (130 hectares) built-up land and;
- 1.7 per cent (40 hectares) sea area.

**Figure 6.2 Total Ecological Footprint of Manali Town - 1971**



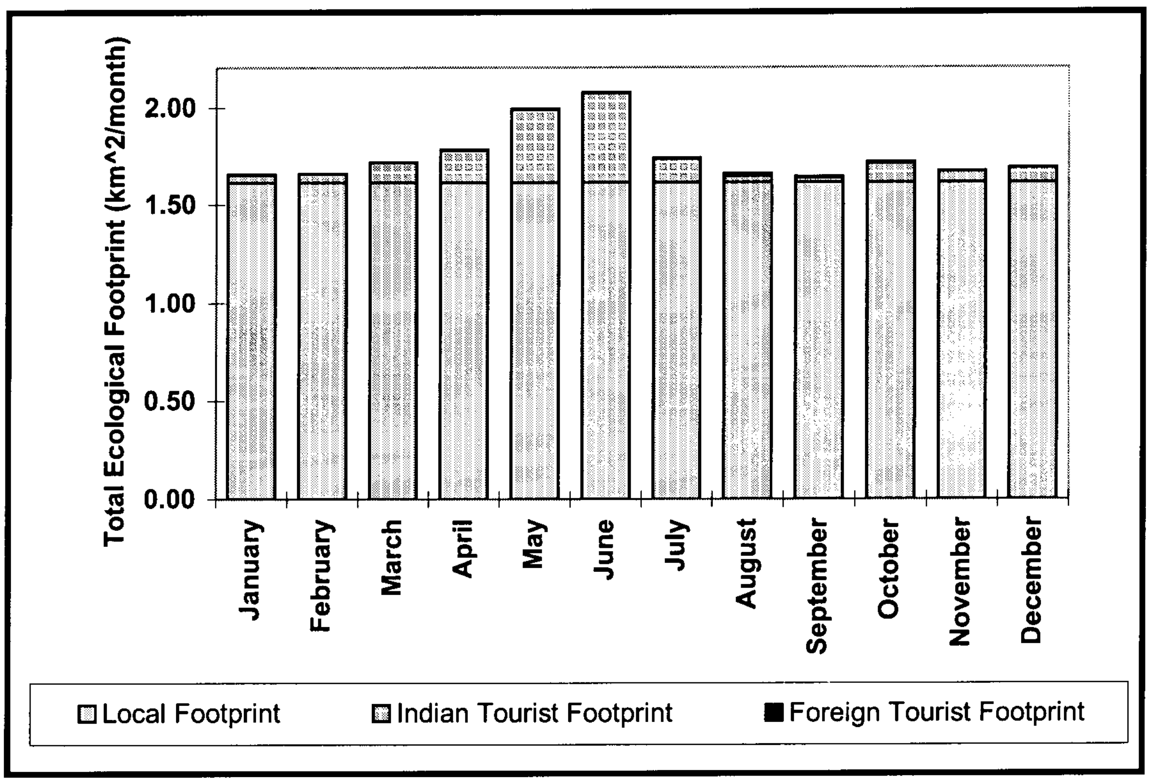

### *6.1.4 The Monthly Ecological Footprint of Manali Town - 1971*

The monthly EF of Manali is a good indication of the stress placed on Manali's resources at different times throughout the year. Results for the monthly EFs of Manali can be seen in Table 6.1 and graphically in Figure 6.3. The results indicate that the largest EFs occur in the months of May and June - those months when tourist arrivals are at their highest. It is interesting to note that the Indian tourist footprint peaks in these months, while the foreign tourist footprint peaks in the months when the Indian tourist footprint appears to be at a minimum - August, September and, to some extent, October. This occurs because, in general, Indian tourists come to Manali in May and June so they can see snow at the Rohtang Pass. These are the best months for snow viewing because the Pass is open, but the snow has not yet melted. Foreign tourists, on the other hand, generally come to Manali for trekking. The best months for this activity are August, September

**Table 6.1: The Monthly Ecological Footprint of Manali - 1971**

| MONTH | Number of Indian Tourists | Number of Foreign Tourists | Percentage of Yearly Total | Indian Tourist Footprint | Foreign Tourist Footprint | Local Footprint (pop = 1,800) | Total Tourist Footprint | Total Footprint |
|---|---|---|---|---|---|---|---|---|
| January | 452.46 | 4.33 | 2.47% | 0.04 | 0.00 | 1.62 | 0.04 | 1.66 |
| February | 523.08 | 4.81 | 2.85% | 0.05 | 0.00 | 1.62 | 0.05 | 1.66 |
| March | 1159.13 | 9.53 | 6.32% | 0.10 | 0.00 | 1.62 | 0.10 | 1.72 |
| April | 1886.16 | 29.76 | 10.36% | 0.17 | 0.00 | 1.62 | 0.17 | 1.78 |
| May | 4235.52 | 28.04 | 23.05% | 0.37 | 0.00 | 1.62 | 0.38 | 1.99 |
| June | 5183.42 | 26.12 | 28.16% | 0.46 | 0.00 | 1.62 | 0.46 | 2.08 |
| July | 1346.93 | 95.61 | 7.80% | 0.12 | 0.01 | 1.62 | 0.13 | 1.74 |
| August | 363.93 | 130.78 | 2.67% | 0.03 | 0.01 | 1.62 | 0.04 | 1.66 |
| September | 243.30 | 97.25 | 1.84% | 0.02 | 0.01 | 1.62 | 0.03 | 1.65 |
| October | 1085.48 | 94.05 | 6.38% | 0.10 | 0.01 | 1.62 | 0.10 | 1.72 |
| November | 637.31 | 10.98 | 3.50% | 0.06 | 0.00 | 1.62 | 0.06 | 1.67 |
| December | 828.28 | 23.75 | 4.61% | 0.07 | 0.00 | 1.62 | 0.08 | 1.69 |
| TOTAL | 17945 | 555 | | 1.59 | 0.05 | 19.38 | 1.64 | 21.02 |

**Figure 6.3 The Monthly Ecological Footprint of Manali - 1971**



and October, when the weather is warm and the monsoon has passed (Kumar 1996; Singh 1989). Variations in energy use throughout the year have not been included in this calculation. It is likely that the winter months, in particular, have higher monthly footprints than specified because of increased energy use for heating.

## 6.2 Results for 1995

The same categories of results were calculated for 1995 as 1971. The one exception is that in 1995 enough data were available to calculate the EF per income class and determine what impact each income group in Manali was having on the total EF of Manali town.

### *6.2.1 The 1995 Per Capita Ecological Footprint & Per Capita Land Available*

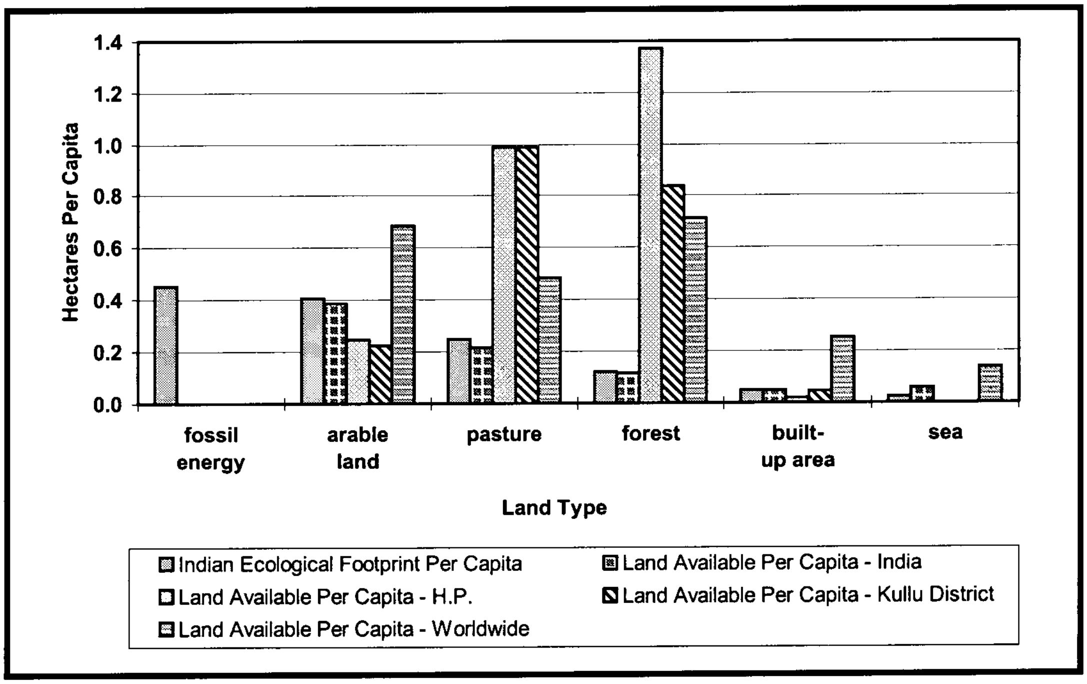
In 1995, the EF per capita for the average Indian resident is estimated to have been 1.3 hectares per capita (ha/cap). As can be seen, in Figure 6.4, the composition of this footprint breaks down as follows:

- 0.5 ha/cap fossil energy;
- 0.4 ha/cap arable land;
- 0.2 ha/cap pasture;
- 0.1 ha/cap forest;
- 0.05 ha/cap built-up area and;
- 0.03 ha/cap sea area.

This EF compares to a land availability in India of only 0.7 hectares per capita, a drop of 0.1 hectares per capita since 1971. The composition of this land breaks down as follows:

- 0.4 ha/cap arable land;
- 0.2 ha/cap pasture;
- 0.1 ha/cap forest;

**Figure 6.4: 1995 Per Capita Ecological Footprint of the Average Indian and Land Available in India, Himachal Pradesh, Kullu District, and Worldwide**




- 0.05 ha/cap built-up area and;
- 0.1 ha/cap sea area.

The land available per capita in Himachal Pradesh was approximately 2.3 hectares per capita, which broke down as follows:

- 0.3 ha/cap arable land;
- 1.0 ha/cap pasture;
- 1.4 ha/cap forest;
- 0.02 ha/cap built-up area and;
- no sea area.

In Kullu District, specifically, the land available per capita was calculated to be about 1.8 hectares per capita. This breaks down as follows:

- 0.2 ha/cap arable land;
- 1.0 ha/cap pasture;
- 0.8 ha/cap forest;
- 0.05 ha/cap built-up area and;
- no sea area.

If tourists are included in this estimate, the land available per capita in Kullu District decreases to 1.82 hectares per capita, a drop of 0.02 hectares per capita.

Worldwide, in 1995, 3.4 hectares per capita were available and this land broke down as follows:

- 0.7 ha/cap arable land;
- 0.5 ha/cap pasture;
- 0.7 ha/cap forest;
- 0.3 ha/cap built-up area and;
- 0.1 ha/cap sea area.

### *6.2.2 The Import, Export and Production Footprints - 1995*

The footprint in imports for 1995, including fossil and nuclear energy, was 0.2 hectares per capita, while the footprint in exports was the same at 0.2 hectares per capita. Although these values are the same as those calculated for 1971, they differ in their composition. The footprint for production in India in 1995 was the same as the per capita EF at 1.3 hectares per capita. The import and export footprints cancel each other out. As in 1971, the import and export of energy is not considered in this calculation, with the exception of energy embodied in net imported goods. This is because no reliable statistics for the import and export of energy from India were available. As stated previously, however, India imports almost all of its liquid fossil fuels, with oil accounting for 27% of India's total imports in 1995 (Parikh *et al.* 1997).

In terms of land area, the import and export footprints broke down as follows:

| Land Type | Import Footprint | Export Footprint |
|---|---|---|
| arable land | 0.01 ha/capita | 0.02 ha/cap |
| pasture | 0.004 ha/capita | 0.008 ha/cap |
| forests | 0.001 ha/cap | 0.0002 ha/cap |
| sea space | 0.000003 ha/cap | 0.00007 ha/cap |

Thus, in 1995 India exported more arable land and pasture than it imported and imported more forest and sea space than it exported.

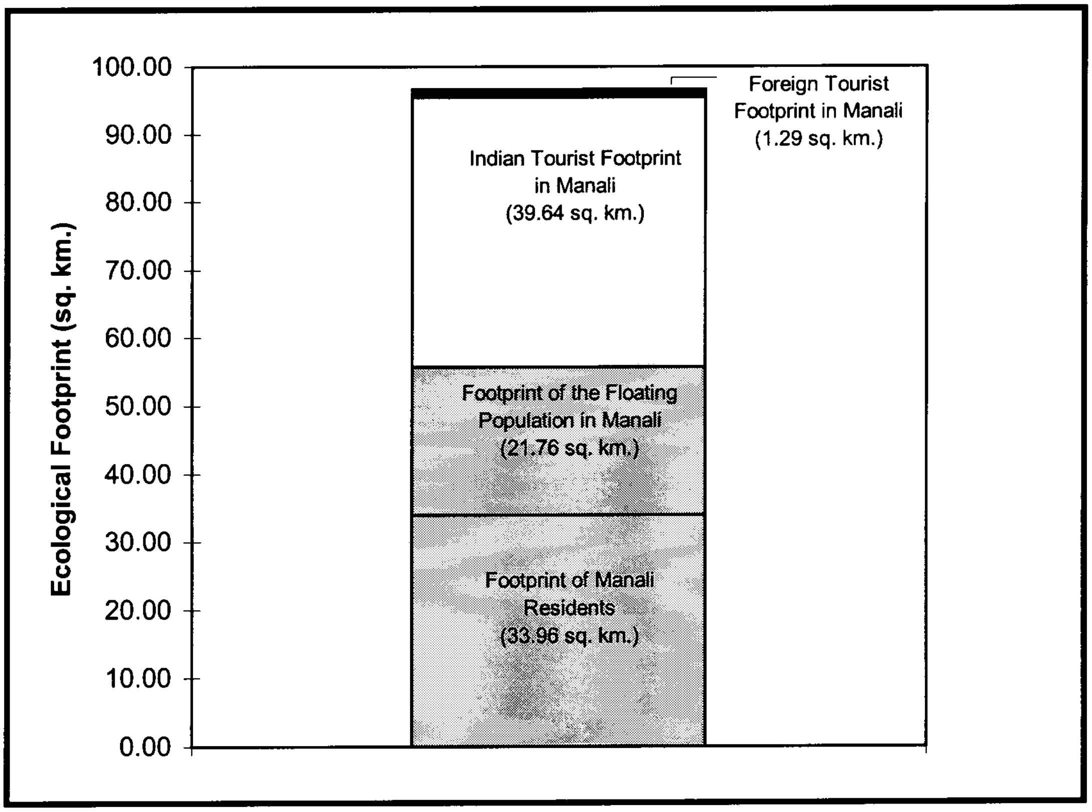
### *6.2.3 The 1995 Ecological Footprint of Manali Town*

The total EF of Manali residents in 1995 was 3,396 hectares or 33.96 square kilometres. This is an 80 per cent increase in the size of Manali's EF since 1971, even though Manali's resident population only rose by 40 per cent over the 24 years from 1,800 to 2,609 residents. Manali's tourist resort status has also meant that a lot of seasonal workers come to Manali for tourism-related industries or, in some cases, to work as farm/orchard labourers. (Employment as labourers is available because some members of local families have opted for more lucrative jobs in the tourism industry.) The EF of the estimated 10,000 seasonal workers that make up Manali's floating population is 2,176 hectares or 21.76 square kilometres. Finally, the EF of the tourists to Manali in 1995 was 4,093 hectares (40.93 square kilometres) - 3,964 hectares from domestic tourists and 129 hectares from foreign tourists. As can be seen in Figure 6.5, when the footprints of the resident population, the floating population and the tourists to Manali were combined, the total 1995 EF of Manali in 1995 was 9,665 hectares or 96.65 square kilometres. This equates to an area that is over 338 times greater than Manali's 1995 town area of 3.5 square kilometres. As well, it represents an almost five-fold increase in the town's total EF since 1971.

The total EF of Manali town is composed of the following:

- 40.8 per cent (3943 hectares) fossil energy land;
- 23.3 per cent (2252 hectares) arable land;
- 17.2 per cent (1662 hectares) pasture;
- 8.4 per cent (812 hectares) forests;
- 3.4 per cent (329 hectares) built-up land and;
- 1.8 per cent (174 hectares) sea area.

**Figure 6.5: Total Ecological Footprint of Manali Town in 1995 in square kilometres**




The composition of Manali's total EF in 1995 is substantially different than in 1971, particularly in terms of fossil energy land. The fossil energy footprint of Manali has gone from 13.8 per cent of the total footprint in 1971 to 40.8 per cent of the total footprint in 1995. This equates to a rise from 290 hectares to 3,943 hectares over the 25 year period. Due to the large rise in the fossil energy footprint, the arable land footprint of Manali town fell from 46.7 per cent of the total footprint in 1971 to 23.3 per cent of the total footprint in 1995. These results indicate a large increase in the use of fossil fuels for energy consumption in India.

### *6.2.4 Distribution of the Ecological Footprint of Manali Residents and Tourists - 1995*

Based on the income distribution of Himachal Pradesh residents and an average income of 8,759 Rupees in 1995 (Himachal Pradesh Economic Review 1998), the following results were tabulated:

**Table 6.2 Ecological Footprint Distribution of Manali Residents - 1995**

| | Annual Income (Rs/Year) | Percentage of the Population | Magnitude Greater than Average H.P. Income | Ecological Footprint Per Capita (ha/cap) | Contribution to Manali's Total Ecological Footprint (ha) |
|---|---|---|---|---|---|
| **Lower** | less than 20,000 | 57.05 | 0x - 2.3x | 0 - 2.97 | 0 - 5747 |
| **Middle** | 20,000 - 40,000 | 26.69 | 2.3x - 4.6x | 2.97 - 5.94 | 2,068 - 4,136 |
| **Upper** | greater than 40,000 | 16.26 | + 4.6x | 5.94 - +12.76 | +4,136 |

In terms of the tourists to Manali, the following results were tabulated for Indian tourists using the income distribution of Singh (1989) and an average annual salary of 9,100 rupees for Indian residents (Rao & Natarajan 1996):

**Table 6.3 Ecological Footprint Distribution of Indian Tourists to Manali - 1995**

| Annual Income (Rs/Year) | Percentage of Indian Tourists | Magnitude Greater than Average Indian Income | Ecological Footprint Per Capita (ha/cap) | Contribution to Manali's Total Ecological Footprint (ha) |
|---|---|---|---|---|
| less than 12,000 | 10.47 | 0x - 1.3x | 0 - 1.69 | 0 - 539 |
| 12,001 - 36,000 | 36.05 | 1.3x - 4.0x | 1.69 - 5.20 | 1,855 - 5,709 |
| 36,001 - 60,000 | 44.19 | 4.0x - 6.6x | 5.20 - 8.58 | 6,998 - 11,546 |
| 60,001 - 96,000 | 6.98 | 6.6x - 10.5x | 8.58 - 13.65 | 1,824 - 2,901 |
| greater than 96,000 | 2.33 | + 10.5x | +13.65 | + 969 |

The same calculations were done for foreign tourists and the results are as follows:

**Table 6.4 Ecological Footprint Distribution of Foreign Tourists to Manali - 1995**

| Annual Income (Rs/Year) | Percentage of Foreign Tourists | Magnitude Greater than Average Indian Income | Ecological Footprint Per Capita (ha/cap) | Contribution to Manali's Total Ecological Footprint (ha) |
|---|---|---|---|---|
| less than 12,000 | 4.76 | 0x - 1.3x | 0 - 1.69 | 0 - 7.8 |
| 12,001 - 36,000 | 19.05 | 1.3x - 4.0x | 1.69 - 5.20 | 25 - 98 |
| 36,001 - 60,000 | 19.05 | 4.0x - 6.6x | 5.20 - 8.58 | 98 - 162 |
| 60,001 - 96,000 | 14.29 | 6.6x - 10.5x | 8.58 - 13.65 | 121 - 193 |
| greater than 96,000 | 42.86 | + 10.5x | +13.65 | + 560 |

The tables above indicate that on a per capita basis, foreign tourists have a greater impact on Manali's EF than Manali residents or Indian tourists. The bulk of Manali residents (about 84 per cent) have a per capita EF that is less than 5.94 hectares. Most Indian tourists (80 per cent) have a per capita EF of between 1.69 and 8.58 hectares, while most foreign tourists (71 per cent) have per capita footprints of between 1.69 and +13.65 hectares, with 76.2 per cent of these individuals having footprints between 5.20 and +13.65 hectares per capita. It is important to note that these results should be viewed with caution because of the prevailing assumption that greater income is directly proportional to greater consumption. Based on observations in Manali, however, the finding that foreigners consume more than local residents or Indian tourists is likely accurate.

### *6.2.5 The Monthly Ecological Footprint of Manali Town - 1995*

Results for the monthly EFs of Manali can be seen in Table 6.5 and graphically in Figure 6.6. As in 1971, the largest monthly footprints occur in May and June when tourist arrivals are at their highest. Again, it is important to note that variations in energy use throughout the year have not been included in this calculation and it is likely that the winter months have higher monthly footprints than specified.

**Figure 6.6: The Monthly Ecological Footprint of Manali 1995**

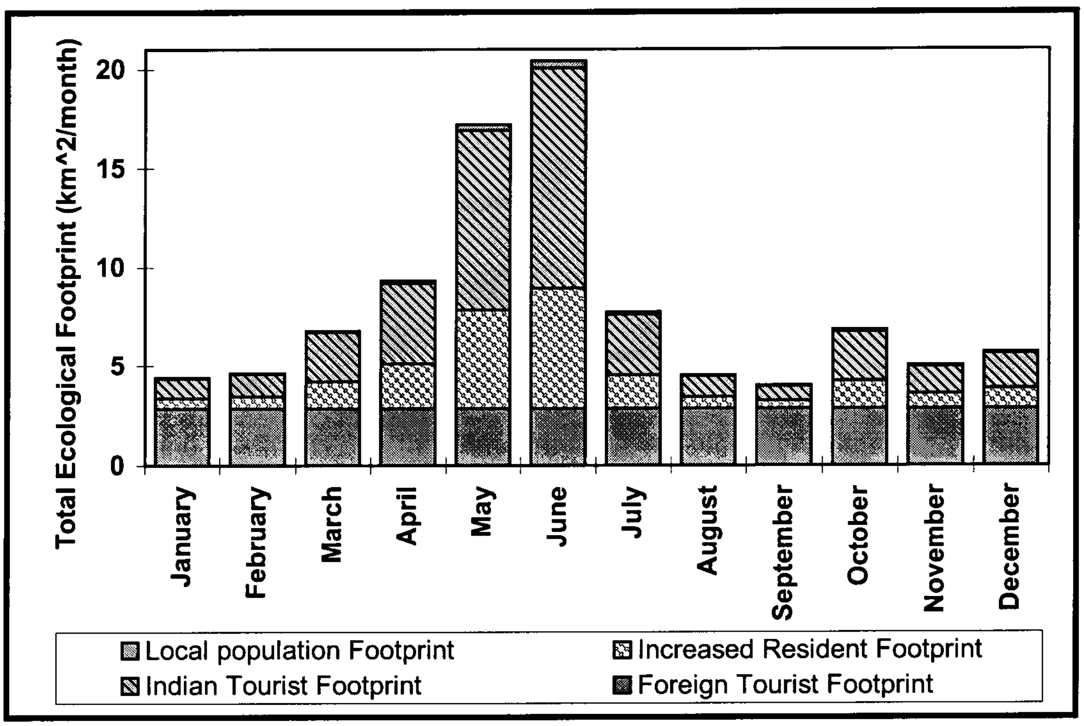


**Table 6.5: The Monthly Ecological Footprint of Manali - 1995**

| MONTH | Number of Indian Tourists | Number of Foreign Tourists | Percentage of Yearly Total | Increased Resident Population | Indian Tourist Footprint | Foreign Tourist Footprint | Increased Resident Footprint | Local Footprint (pop = 2,609) | Total Footprint |
|---|---|---|---|---|---|---|---|---|---|
| **January** | 9139 | 297 | 2.47% | 246.65 | 0.98 | 0.03 | 0.54 | 2.83 | 4.37 |
| **February** | 10561 | 344 | 2.85% | 285.04 | 1.13 | 0.04 | 0.62 | 2.83 | 4.61 |
| **March** | 23379 | 761 | 6.31% | 631.00 | 2.50 | 0.08 | 1.37 | 2.83 | 6.78 |
| **April** | 38343 | 1247 | 10.35% | 1034.85 | 4.10 | 0.13 | 2.25 | 2.83 | 9.30 |
| **May** | 85286 | 2775 | 23.02% | 2301.82 | 9.11 | 0.30 | 5.00 | 2.83 | 17.24 |
| **June** | 104200 | 3390 | 28.12% | 2812.31 | 11.13 | 0.36 | 6.11 | 2.83 | 20.43 |
| **July** | 28945 | 942 | 7.81% | 781.22 | 3.09 | 0.10 | 1.70 | 2.83 | 7.72 |
| **August** | 10028 | 326 | 2.71% | 270.66 | 1.07 | 0.03 | 0.59 | 2.83 | 4.52 |
| **September** | 6911 | 225 | 1.87% | 186.52 | 0.74 | 0.02 | 0.41 | 2.83 | 3.99 |
| **October** | 23684 | 771 | 6.39% | 639.23 | 2.53 | 0.08 | 1.39 | 2.83 | 6.83 |
| **November** | 12975 | 422 | 3.50% | 350.19 | 1.39 | 0.05 | 0.76 | 2.83 | 5.02 |
| **December** | 17062 | 555 | 4.61% | 460.51 | 1.82 | 0.06 | 1.00 | 2.83 | 5.71 |
| TOTAL | 370514 | 12055 | | 10000 | 39.59 | 1.29 | 21.73 | 33.92 | 96.52 |

# 7.0 What the People Had to Say!

In addition to calculating the EF of Manali, interviews were carried out with Manali residents to verify the results obtained through the EF Analysis and to generate a better understanding of the prevailing sustainability issues in Manali. Most of the data used for the EF were taken from national statistics for India, so the interviews helped to determine if the same trends were apparent in Manali. The interviews also helped to establish the impact that tourism is having on the Manali area and to determine the problems that Manali residents feel are present in the area. In addition, the interviews helped identify possible solutions to many of the issues and problems identified for the Manali area.

The results of the interviews carried out can be seen in the remaining sections of this chapter. They are divided into sections based on the type of business in question - hotel, restaurant or shop. In total, 44 hotel operators, 21 restaurant operators, 7 shop owners, and 5 local residents were interviewed.

## 7.1 Interviews with Hotel Operators

The first set of questions posed to the hotel operators, questions 1 through 5, were basic questions about the operation of their hotels. They included such things as the length of time they are open each year; how the hotel is heated; restaurant and room service operations; the purchasing of hotel items; and any plans for future renovations at the hotel. The answers to these questions are summarized in Appendix 2 and discussed in section 7.1.1 below. These questions were asked to verify the impact that tourism is having on hotel operations in Manali, the extent of tourism in Manali, and the consumption patterns of tourists/hotel operations in the Manali area. The latter is particularly important to the EF because the entire footprint calculations are based on consumption data for India. Determining whether these patterns hold true at a local level helps to verify that the results obtained are in fact realistic for the Manali area.

The next set of questions, questions 6 and 7, have been separated from the first set of questions because they deal primarily with issues and concerns that hotel operators feel exist in Manali and the surrounding area. Specifically, hotel operators were asked what could be done locally to improve their business and what problems the new Nagar Panchayat faced and how these problems should be addressed. These two questions helped to identify problems that existed in the Manali area, as well as solutions that are feasible and acceptable to Manali residents. The results of these two questions are summarized in Figure 7.1 and discussed in detail in Section 7.1.2 below.

### *7.1.1 Hotel Operations*

Winter Operations

The first question posed to hotel operators was whether their hotels are open during the winter months and, if so, how they are heated. Of the hotel operators interviewed in Manali, those operating the ten largest hotels said they are open year-round, with about a 20 per cent occupancy rate throughout the winter. Of these hotels, three have central heating and all of them provide their guests with small electric room heaters during the winter months.

Among the medium-sized hotels, 16 of the 20 are open all year. Of these, 14 provide their guests with small electric room heaters, one hotel provides its guests with wood for metal tandoors (wood stoves) in the rooms, one provides guests with small, portable coal fireplaces and one provides no heat at all except for a large fireplace in the lobby where guests can "warm up". Of these hotels, the average number of rooms occupied during the winter months is between 1 and 2 at any given time and some hotels apparently remain empty for weeks without any guests at all. Of the medium-sized hotels that close during the winter months, two close from November until the beginning of March, one closes from December to the end of January, and one closes from December to the beginning of April.

Only three of the twelve small hotels are open all winter. Those that are open provide room heaters for their guests, of which there are generally 1 or 2 at a time throughout the winter months. Of the small hotels that are closed, one closes for the months of February and March, 6 close from the end of November to the beginning of March, and two close for the months of January and February.

These results indicate that hotel operators who keep their establishments open throughout the winter are likely taking a financial loss by operating with so few guests. This is a strong indication of the economic sustainability of tourism in Manali and the impact that its seasonal nature is having in this area. It also suggests that small operators cannot afford to take the same winter losses as those that are suffered by larger hotel operators.

Keeping rooms open and the use of additional energy for heating throughout the winter months would also have the effect of slightly increasing the energy footprint of Manali during the winter months. The use of room heaters and wood tandoors, however, is likely more energy efficient than the central heating found in larger hotels because the additional energy is only being consumed when guests are staying in these rooms.

### Type of Guests

Hotels were next asked whether their guests were foreigners or Indian to determine the composition of the tourist population. Seven of the ten large hotels indicated that the majority (greater than 70 per cent) of their guests are Indian. One of the hotels cited a closer split of 60 per cent Indians and 40 per cent foreigners and two of the large hotels indicated that it is mainly foreigners from July to September and mainly Indians during the rest of the year.

Of the medium hotels, all but four indicated that the majority of their guests (70 per cent) are Indian. Of these, one advised that all of its guests are Indians in order to avoid the bother of having its employees fill out the forms needed for foreign tourists to stay in the hotel. Another of the medium-sized hotels indicated that foreigners constituted about 40 to 50 per cent of the guests during the months of July to September and two others indicated that foreigners stay in the hotel in the low season (July to September) and Indians stay there in the high season (May, June and October). Only one of the medium-sized hotels cited a majority of foreign guests (90 per cent) year-round.

All of the small hoteliers said that the majority of their guests are Indian. Of these, one indicated that in July and August there are about 20 per cent foreigners and another stated that, with the exception of May and June, the split between foreign and Indian guests is about 50/50.

Of the two individuals who operated the cottage and apartment accommodations, the cottage operator said that 90 per cent of the guests are Indian and the individual operating the apartments stated that the guests are all Indian in the high season and all foreigners in the low season.

These results parallel those found by other studies which indicate that the bulk of tourists to Manali are Indians who vacation during the months of May and June. This finding is important because all of the consumption values used to calculate Manali's EF are based on Indian national statistics. The predominance of Indian tourists in Manali suggests that the use of these national statistics is valid. That Indians represent the majority of tourists to Manali also verifies the studies, particularly those by Singh (1989), that were used to calculate the monthly, tourist and income distribution footprints of Manali.

It is also interesting to see that foreign tourists to Manali tend to stay in larger, more expensive hotels. This could be indicative of the amount of money they are able to spend in Manali and, by comparison, the higher consumption levels they may have than Indian tourists. Although these differences have not been included in the footprint calculations, they may actually serve to increase the overall footprint of foreign tourists to Manali.

Restaurants & Room Service

Hotel operators were asked whether they had restaurants or room service in operation all of the year to determine if these operations are also affected by the seasonal nature of Manali's tourism. The results indicate that the larger hotels, for the most part, have much better restaurant and room service options than the smaller hotels. Of the ten large hotels interviewed, six have restaurants that are open all year. The remaining four have full menu room service. Of these, one does not have a kitchen of its own, but gets the food from a local restaurant and another has a restaurant under construction.

Of the medium-sized hotels, only five have restaurants and five do not have either a restaurant or room service. The remaining ten have some form of room service but the menu varies: three have a full-menu; two have an "order in advance" menu; two have a full menu, but get the food from a local restaurant; three serve only breakfast and snacks and; one serves only coffee and tea.

Of the small hotels, two have restaurants, two have neither restaurant nor room service and the remaining eight have varying types of room service - one has full-menu room service; one has a full menu but gets the food from across the street; four serve only breakfast and tea and coffee; and two serve only tea and coffee.

The cottage operator did not have room service or a restaurant, while the tourist apartment complex had both.

Purchases for the Hotel

Hotel operators were asked if the items used in their hotels were purchased locally to determine if income generated at these businesses is being spent in Manali, i.e. are there economic spin-offs from these hotel operations, beyond those of tourists buying souvenirs. This question was also asked to help identify what portion of the products being used in Manali are being imported from a distance. This is important to the footprint because for every mile an imported good must travel, the energy invested for its eventual consumption increases.

In terms of responses, very few of the large hotels in Manali buy their goods locally, i.e. within the Kullu Valley. Of the nine[18] large hotels asked about purchases, seven indicated that everything but fresh food, such as vegetables and fruit, comes from either Delhi or Chandigarh, and one indicated that everything comes from Delhi. Only one of the large hotels buys everything locally. Of the twenty medium-sized hotels, five of the operators interviewed did not know where goods for the hotel are purchased; five buy everything locally; one buys hotel items, such as bed linens, televisions, etc., from Kullu and food from Manali; and nine buy only food locally. Seven of the twelve small hoteliers interviewed purchase everything for their hotels locally, with one indicating that some products are purchased from a traveling salesman. Three buy their food locally and of these, two buy other hotel items in Delhi. Two of the hotel operators interviewed did not know where any of the hotel's products are purchased.

Larger hotels appear to spend the greatest amount of money outside of Manali. This is unfortunate because they purchase a large amount of goods, particularly

[18] One of the ten large hotels did not answer this question.

food, to keep their hotels operating and almost all of this money is leaving Manali. The distribution in ownership may have something to do with this. The larger hotels are generally owned and operated by individuals from outside of the Manali area. The smaller hotels are generally owned by local individuals. The smaller hotel operators likely do not have the time or capital to travel to other locations to purchase items for their hotels. As well, due to the smaller nature of their operations, they probably are not buying in large enough quantities to reap the economic benefits of buying in volume from outside the Kullu Valley.

Scheduled Improvements

Finally, hotel operators were asked if they were scheduling any improvements or renovations for their hotels in the next year. This was asked in an effort to determine if the hotels were getting larger and what types of consumption could be expected in terms of construction during the next year. Of the large hotel operators interviewed, half of them were not undertaking any type of renovations or changes. Four of the hotels were doing general maintenance work, such as painting, replacing carpets, etc., and one was undergoing a major expansion with the addition of an indoor gym, a conference hall, a restaurant and about 50 rooms.

Of the medium hotels, nine of the twenty were not planning any changes, with one individual claiming that there was no point improving his hotel because there were too many hotels in Manali and improvements would not increase his occupancy enough to pay for the renovations. Five of the hotels were undertaking general maintenance, one was adding wood panelling to the rooms, one was adding four rooms to the hotel and two were adding entire stories, with one gaining 12 rooms and the other 5 rooms. Two individuals at medium-sized hotels were unsure about whether the owner would make changes.

Among the small hotels, four were not making any changes and four were undertaking general maintenance work. One of the small hotels was adding 6 new rooms and the owner of another was contemplating adding wood paneling within the next few years. Two of the small hotel operators were not sure if changes were going to occur, indicating that such decisions would have to be made by the owner.

### *7.1.2 Thoughts About Manali - Hotel Operators*

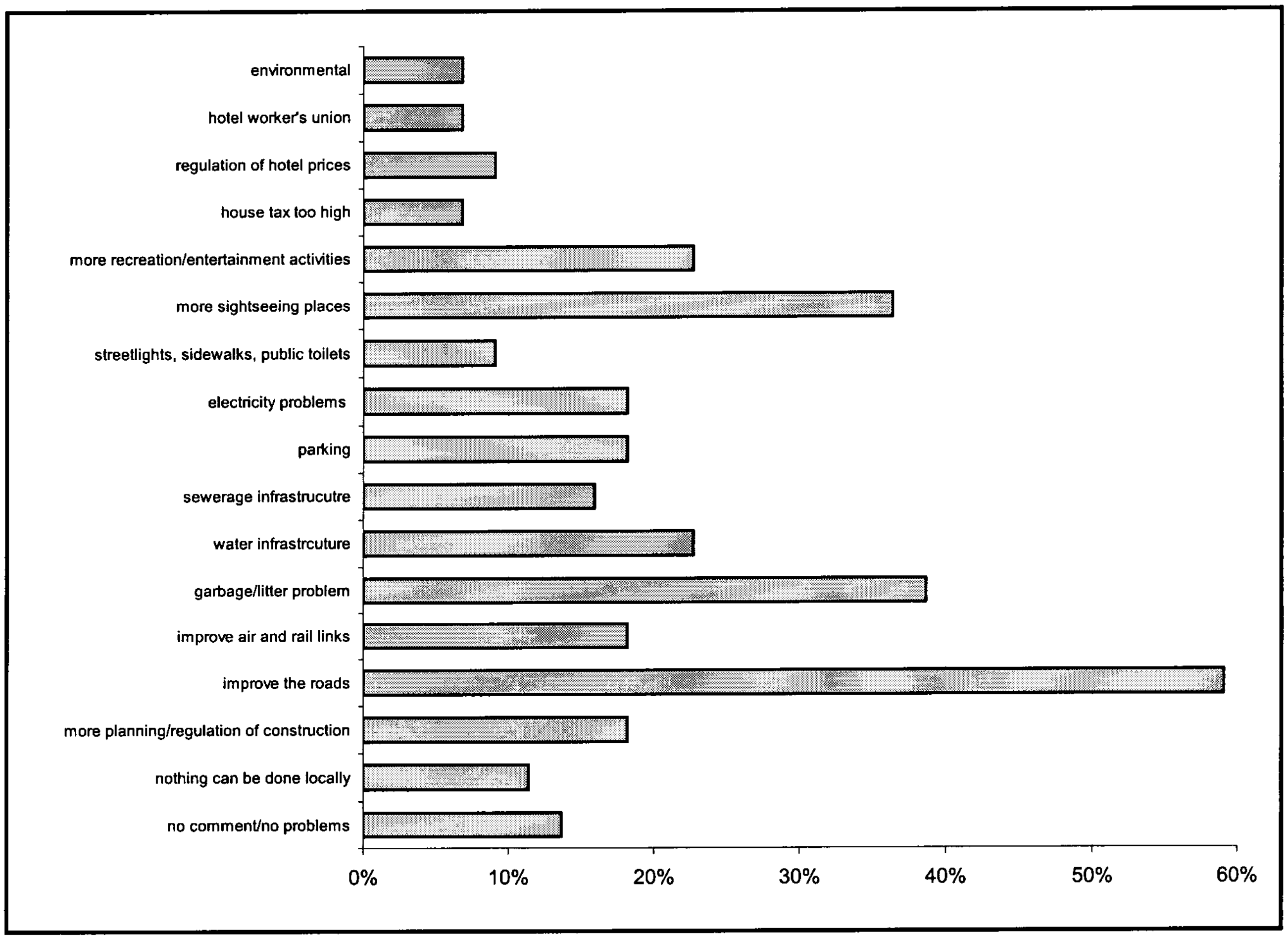
Questions 6 and 7, "What things could be done locally to improve your business?" and "What local problems face the new Nagar Panchayat and how should they deal with these problems?", have been combined for the purposes of reporting the results. In most cases, the individuals interviewed either answered these questions in the same manner or the questions simply ended up being combined. In a few cases, individuals answered these two questions differently, primarily by shifting their focus from problems requiring state or central assistance to those which could be solved locally. This difference, however, was negligible and for the most part those interviewed answered both questions similarly.

The bulk of the responses centred around transportation, town infrastructure and services, planning, tourism and hotel specific complaints (see Figure 7.1). Some respondents felt that nothing could be done locally and there were also a few comments made about environmental issues. Two of those interviewed had no comment, while four felt that there were no problems in Manali.

<u>Transportation</u>

Transportation was the number one issue on the minds of Manali hotel operators. In particular, over half of the respondents (26 of 44) felt that there was a need to improve road conditions, both inside and outside of Manali town. Many felt that their business depended almost solely on road conditions and that tourists were not coming to Manali because the roads through the mountains were so bad. One individual thought that more bridges should be built over the Beas so that if the road on one side of the Beas was impassable, tourists could easily pass over the river to the road on the other bank. Another individual felt that in addition to improving the roads, the government should also advertise the fact that there are roads to Manali on both banks of the Beas. This way tourists would know that if one of the roads was washed out or impassable, that there was another option. Others expressed a concern about the roads inside Manali town, particularly the

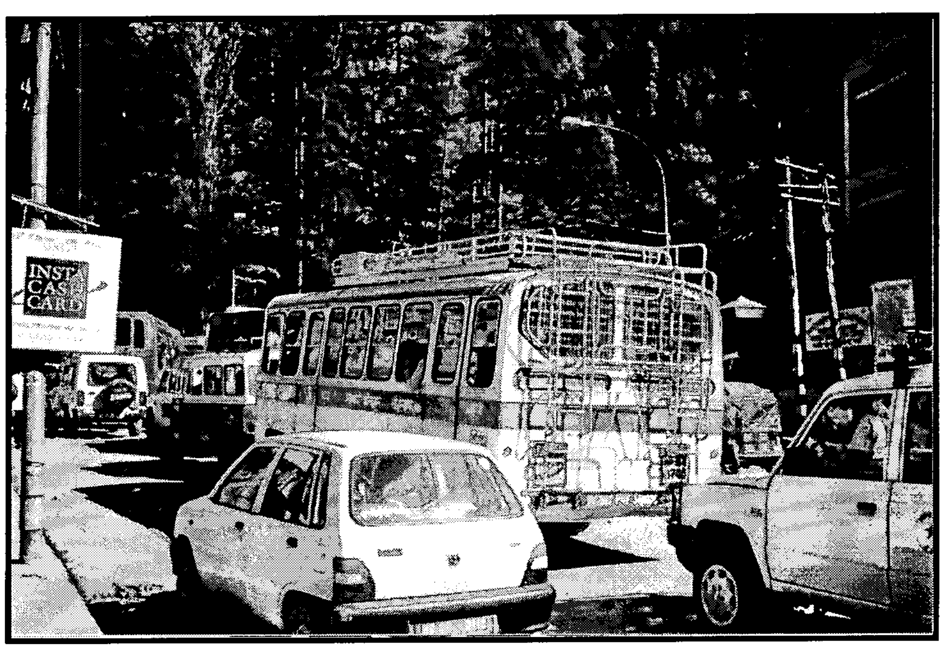
**Figure 7.1: Problems/needs hotel operators identified for Manali & Surrounding Area**
Number of Respondents: 44



number of traffic jams that occur during the peak season (Figure 7.2) Some felt that this could be solved by building a by-pass around the main market so that buses and transport trucks did not all have to enter the main Mall area. Two of those interviewed wanted the Nagar Panchayat to built a road to their hotel so that it was easier for tourists to get to them. This complaint is based on the fact that many of the hotels that are not in the main market area are only accessible by a footpath. In addition to improving road conditions, at least five people mentioned that other transportation options should be available to tourists. Four individuals felt that there should be a rail link to Manali, or at least to Bilaspur, while two felt that Manali should have an airport.

Hotel operators also felt that the Nagar Panchayat should build better parking facilities. They wanted parking facilities for both their hotel, as well as the market place. Many were concerned about vehicles along the Mall, which are parked "here, there and everywhere."

**Figure 7.2 Traffic jam on the main Mall in Manali.**



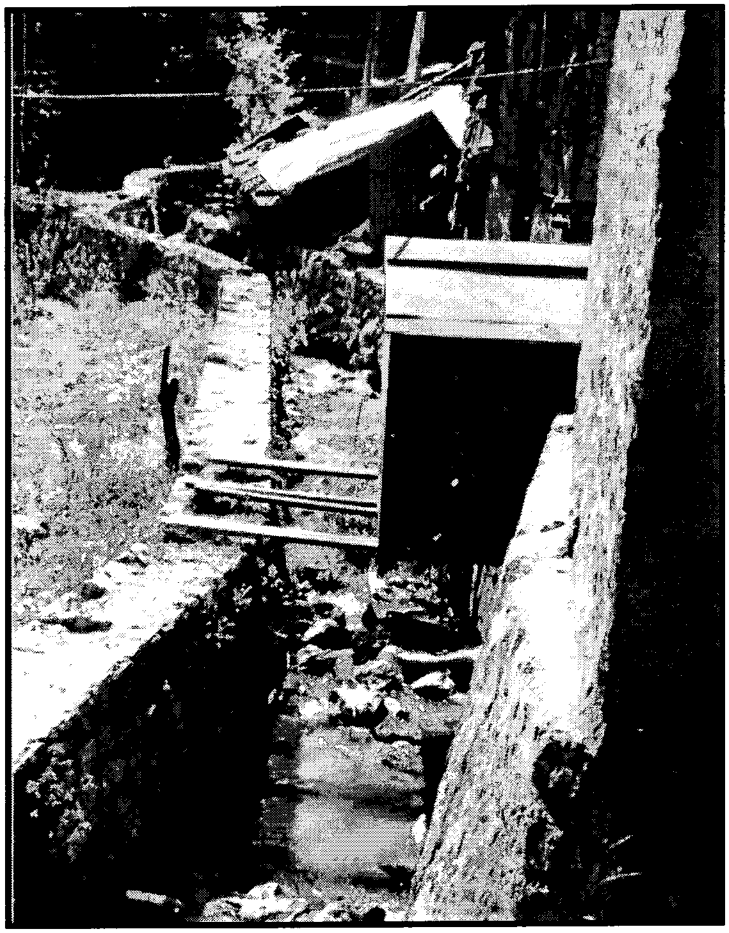
Infrastructure and Local Services

The second major set of complaints revolved around town infrastructure and local services. Seventeen of the hotel operators interviewed felt that cleanliness was a huge problem in Manali and that litter and garbage was destroying the beauty of the area. Most of these felt that the Nagar Panchayat should do a better job cleaning the streets and some indicated that particular attention should be paid to cleaning up the areas around municipal dustbins. Two of the respondents believed that an education campaign was necessary to make tourists and town residents more aware of the litter problem.

Water and sewerage infrastructure was also a high priority for hotel operators. Ten of those interviewed felt that water infrastructure in Manali needed to be improved. These individuals expressed concerns about the quality and quantity of water available in their hotels. In terms of quality, several mentioned that the water is often muddy in the peak season and that the quality is so bad that "even Indians get sick drinking it". One hotel operator suggested that the latter was particularly troublesome because Indian tourists, unlike foreigners, cannot afford bottled mineral water. In terms of quantity, some hotel operators mentioned that there were often acute shortages of water in the peak season, as well as early in the morning. Eight of the ten hotel operators who mentioned water as an issue suggested that the Nagar Panchayat should build a water treatment plant for drinking water. Of these, three mentioned that the Nagar Panchayat should also take a long-term approach when developing any water supply facilities, planning on a time-scale much greater than the two to three years currently considered.

The state of Manali's sewerage system was also brought under fire, with seven of the hotel operators interviewed suggesting that it needed drastic improvements. Much of the town's sewerage system consists of an open, brick-lined creek that runs through Manali and empties into the Beas (see Figure 7.3). Many felt that the openness of the system was quite dangerous and one individual complained that

**Figure 7.3 Sewage creek running through Manali to the Beas River**



the creek smells, especially in the summer, because people empty their safety tanks (septic tanks) into it.

Hotel operators also complained about the availability of electricity. Eight of those interviewed mentioned that the supply of electricity is highly erratic and can go out for days to weeks at a time in the winter and during the rainy season.

Other facilities and services which the hotel operators felt should be improved or provided in Manali were snow removal, streetlights, sidewalks, an eye hospital, and public toilets. The latter was expressed as a concern by two hotel operators near the main Mall, as well as the head of the Nagar Panchayat. Those who mentioned it were either annoyed that tourists are constantly asking to use the washroom facilities in their hotel and/or upset that many tourists and residents simply relieve themselves in the street.

Tourism-Related

Several of the concerns expressed by hotel operators related specifically to tourism in the area. Many were concerned that tourists only stay in Manali for two to three days and felt that this was due to a distinct lack of tourist activities in the area. Fifteen of those interviewed felt that more sightseeing places should be developed, including one-day tourist trips, picnic spots, gardens, parks and even a zoo. One individual even complained that everything is natural in Manali and there is nothing "artificial" or "built", like rose and rock gardens, to "give tourists something to do." Others (10 hotel operators) mentioned that more entertainment and recreation activities needed to be developed around Manali. These individuals felt that better sports facilities should be developed locally and that winter tourism, in particular, should be heavily promoted. One individual thought that there should be more opportunities for adventure sports, like paragliding, but was concerned that tourists would not partake in these activities because life insurance for doing so was not available in Manali. Four individuals thought that lakes should be developed in the Manali area with houseboats like those in Kashmir.

Some hotel operators also made mention of cultural and social problems stemming from tourism. Four of those interviewed felt that Manali residents needed to be more polite to tourists so that they would want to return to Manali. Another two mentioned that there is a lot of cheating of tourists in the local shops and that many shop owners charge tourists double what they charge local people.

These individuals felt that fixed prices were needed for most goods, particularly Kullu caps and shawls.

Local Planning

The state of local planning was mentioned by eight of those interviewed. Six hotel operators felt that construction was out of control in Manali and that unauthorized construction needed to be stopped. Many were concerned, however, that the Nagar Panchayat could not control construction outside of the town limits and that the areas surrounding Manali were turning into unplanned "slums". Some felt that more regulations were needed to govern hotel construction or that construction should be stopped entirely until more tourist attractions are developed.

Hotel-Specific

Many of the hotel operators also touched on issues that are specific to the hotel industry in Manali. Of these, the primary concern was that there needed to be greater regulation of hotel prices. Six of those interviewed were frustrated that many hotel operators in Manali bargained with customers, bringing their prices so low that, to compete, many hotel operators were losing money. Some suggested that the hotel operators should get together and create a code of conduct and a new pricing structure so that no one bargains. They thought this could be regulated by the hotel union or the Himachal Pradesh Tourism Development Corporation (HPTDC). The latter is an interesting suggestion since the HPDTC has already been charged with this responsibility under the HPTDC Act, which regulates hotel rates and calls for random inspections by an HPTDC inspector. According to this act, the penalty for charging more or less than the posted rate is 6 months imprisonment or a fine of 10,000 rupees (HPTDC worker, personal interview, October 21, 1998).

Three of those interviewed felt that the taxes charged to hotels were too high. The "house tax" in Manali is based on the number of rooms in the hotel and the amount that is supposed to be charged per room, based on the fixed rates developed under the HPTDC Act. This amount of tax is to be paid regardless of whether the hotel operators make any money or have to reduce prices to compete with other hotels. One individual felt that the solution was to charge taxes based on the value of the property and not the cost of the rooms. Another complained about the ten per cent luxury tax charged to tourists if a hotel room costs greater than 300 Rupees per night. This individual claimed that customers did not want to pay the tax since most 300 Rupee per night hotels are *not* luxury hotels.

Three of those interviewed thought that there should be a hotel worker's union. These individuals were all hotel workers. They were concerned that if they quit their jobs or were fired or laid off they would not get good recommendations from their employers to obtain work at other hotels. They felt that a hotel workers union could provide them with good recommendations to other employers. Others felt that a union was necessary because they were being worked too hard and were not getting adequate holiday time.

No Local Solutions

Five of those interviewed felt that there was nothing that could be done locally to improve their business or solve local problems. One of these felt that solutions could only be provided at the state government level and that the state was not interested in helping them. Another felt that hotel business depended on advertising outside of Manali and that there were no local ways to improve business. The remaining three felt that there were just too many hotels in Manali and not enough business for everyone. Unless the number of tourists increased, or hotels shut down, there was no hope of improving their business.

Environmental Issues

There was very little mention made of environmental issues in Manali by hotel operators. Two people mentioned that air pollution from vehicles was a problem in the market place/Mall; one mentioned that there was too much traffic, and one mentioned that flooding was a problem. Another individuals was concerned that there was not enough government control over the cutting of trees and that all of the trees would be gone within the next 25 years.

## 7.2 Interviews with Restaurant Operators

The restaurateurs interviewed ranged from the operators of canteens and dhabas to more formal sit-down restaurants. The more formal sit-down restaurants could seat anywhere from 36 to 100 people, with the average size being approximately 60 seats. The more informal dhabas ranged in size from a street canteen with no seating to those which could seat 20 people, with the average dhaba seating about 12 people.

Much like the hotel operators, restaurant operators were first asked a set of questions (questions 1 through 5) about the operation of their restaurants. The questions included such things as how many people the restaurant seats, whether the restaurant is open in the winter months, the number and type of customers at different times throughout the year, where restaurant items are purchased, and plans for future renovations. These questions were asked to determine the impact that tourism is having on restaurant operations in Manali and the consumption patterns of tourists and residents in the Manali area. The answers provided by restaurant operators are summarized in Appendix 3 and discussed in section 7.2.1 below.

Questions 6 and 7 are separated from the first set of questions because they deal primarily with issues and concerns that restaurant operators think exist in Manali and the surrounding area. As with hotel operators, restaurant operators were asked what could be done locally to improve their businesses and what problems the new Nagar Panchayat faces and how these problems should be addressed. These two questions helped to identify problems that exist in the Manali area, as well as their potential solutions. The results of these two questions are summarized in Figure 7.4 and discussed in detail in Section 7.2.2 below.

### *7.2.1 Restaurant Operations*

Year-round Operations

Of the larger, more formal restaurants, 9 of the 14 are open during the winter months while one stayed open during its first year of operations and would try to do the same in the 1999-2000 winter. Among those that close in the winter, two close during January and February, one closes in January, and another closes in February and March. The number of customers these restaurants serve in the off-season and winter months ranges from 30 people to 300 people per day. In terms of the number of people per seat[19], this equates to about 0.4 to 6 people per available restaurant seat. This compares to a high season where these same restaurants are serving, on average, between 100 and 500-600 people per day, or 3 to 10 people per seat per day. There were even three restaurant operators who claimed that during the high season they serve over a thousand people per day - citing between 2,000-3,000, 3,000-4,000 and 5,000-8,000 people per day. If the claims are true then these restaurants have an average number of people per seat in the high season of 38-58, 63-83, and 50-80, respectively. These values seem exaggerated given that the restaurants in question seat 52, 48 and 100 people, respectively. If accurate, however, the business of these three restaurants is over 13 times lower in the winter months than in the summer months. At the other restaurants, the drop in business generally appears to be less significant, although

[19] The number of people per seat has been used because it removes the factor of restaurant size from the number of customers. By dividing the number of customers per restaurant by the number of people the restaurant can seat a more accurate representation of the number of people dining out is presented.

some reported their winter business to be 15 times lower than during the summer months. This is a definite indication that tourists are consuming mass quantities of restaurant food when they are in Manali - a fact directly related to consumption and the EF of this mountain town. The more that individuals eat in restaurants, the greater the amount of energy consumed and food wasted in the process. Such seasonal fluctuations also relate to economic sustainability and the impact that reduced tourism has on restaurant operators in the winter. If only 10 of 14 formal restaurants can afford to stay open, what are the other operators doing to earn an income during the winter months? In addition, those that remain open have so few customers that they may not be earning enough money to cover their costs during these months. These restaurant operators must depend heavily on a good tourist season to tide them over the slow months.

Of the dhaba operators interviewed, 5 of the 7 are open all year, one closes from December to March and another closes from January to July. Despite their small size, these restaurants are serving a large number of customers. Throughout the high season, the number of customers cited ranged from 70 per day for a canteen with no seats, 100 people per day for a dhaba with 16 seats and up to 3000 people per day for a dhaba with only 3 benches. Since most of these restaurants seat the same number of people (with the exception of the canteen) there is little change when size of the restaurant is taken into account. These dhabas do not experience the kind of decrease in customers during the off-season that their more formal competitors have to face, with the exception of the operator claiming 3,000 customers per day in the high season. While this restaurant experiences a drop from 3,000 to about 250 customers per day, the others have about a 50 per cent decrease in their business. While this is still a significant drop, a drop of 2 times is much less substantial than the drop of 15 times seen in larger restaurants. This is likely due to differences in the types of customers served. While the larger restaurants tend to service tourists, the smaller dhabas are frequented by locals, particularly school children. The dhaba serving 3,000 people per day likely experiences such a significant decrease in customers because it is situated on the main Mall and caters to Southern Indian tastes. This is also the same restaurant that closes from January to July, another sign that it caters primarily to the tourist population of Manali and not the local population.

Type of Guests

As alluded to in the previous section, the larger sit-down restaurants tend to cater more to the tourist population. Seven of the 14 restaurateurs interviewed stated that the majority of their customers (over 70%) are Indians; three claimed that from July to September the majority of customers are foreigners with Indians as the majority the rest of the year; two claimed that in May and June the customers are mostly Indians but the rest of the year they are primarily foreigners; and two claimed that over 90 per cent of their business is from foreigners. Considering that foreigners make up less than three per cent of Manali's tourist population, they appear to be eating in restaurants at a much higher rate than Indian tourists. This suggests that foreign tourists may have a larger per capita EF, particularly in terms of food and energy, than their Indian counterparts. It also re-emphasizes the fact that the EF calculated for Manali is likely an underestimate of the true EF of Manali town and its tourists.

At all of the dhabas, the majority of customers are Indians. Three of the seven dhabas interviewed also stated that the customers are primarily locals and mostly school children. This makes them slightly more sustainable economically, because they do not undergo the large seasonal shifts in business to which the bigger restaurants are prone.

Purchases for the Restaurant

Restaurant operators were asked if the food and other items being used in their restaurants is purchased locally to determine if products were being imported over long distances (a sign of extra consumption in energy to transport the items) and if the money being generated at these restaurants was being spent in Manali (a sign of economic spin-offs from restaurant/tourism operations).

At the larger restaurants, almost all of the food, especially fresh food, is purchased locally, but most of the restaurant products - napkins, tablecloths, cutlery, etc. - are bought in Chandigarh or Delhi. Two of the restaurants indicated that they buy their cheese from Delhi, one buys rice and grains from the grain market in Chandigarh, two buy their spices in Chandigarh and another buys ice cream cones and tinned food stuffs in Chandigarh. All of the dhabas purchase everything locally, with the exception of one operator who buys biscuits and sweets in Kullu during the high season. The prevalence of imported goods at the larger sit-down restaurants is another indication of the greater consumptive patterns of wealthier tourists, as compared to local Manali residents.

Scheduled Improvements

Restaurant operators were asked if they were scheduling any improvements or renovations to their premises in the next year. At the larger sit-down restaurants, three of the restaurants planned on making no changes, five were going to undertake general maintenance work like painting, changing the carpets, adding new seat covers, etc. One wanted to add a new facade to the restaurant and another wanted to add a bathroom for customers. Two of the restaurants were planning to close in March of 2000 because there simply were not enough customers to pay the high rental costs at the restaurant location - a good sign of too many restaurants in Manali. In addition, the government was proposing to turn a Himachal Pradesh Tourism Corporation restaurant into a bowling alley - a change that would increase the recreational activities available to tourists. None of the dhabas were planning to make any changes, with the exception of the canteen owner who was hoping to build a permanent stall so he would not have to bring his moveable stall back and forth every day.

### *7.2.2 Thoughts About Manali - Restaurant Operators*

As with the hotel interviews, Questions 6 and 7, "What things could be done locally to improve your business?" and "What local problems face the new Nagar Panchayat and how should they deal with these problems?", have been combined for the purposes of reporting the results. Again this is because in all of the interviews these questions were either answered in the same way or ended up being combined.

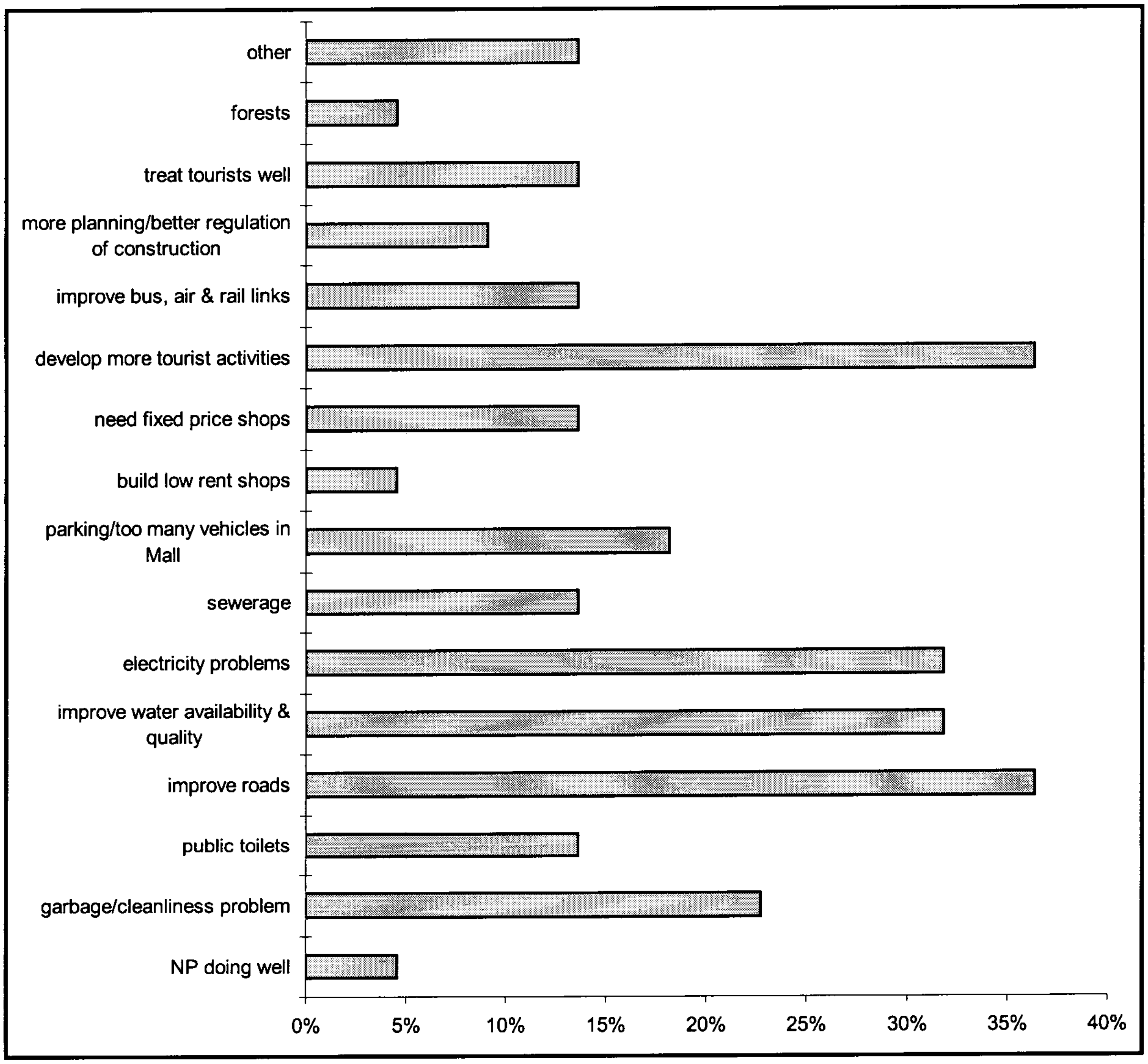
The responses that restaurant operators gave to these questions touched on many of the same issues as those of the hotel operators. Most dealt with transportation, town infrastructure and services, tourism, and local planning and development (see Figure 7.4). Three of the restaurant operators said they did not know of any problems or solutions in Manali, either because they had not thought about the issue or were not from Manali and did not feel comfortable answering. Only one of the respondents felt that the local Nagar Panchayat was doing a good job and did not need to fix any problems.

<u>Transportation</u>

In terms of transportation, 8 of the 22 restaurant operators (36%) felt that the roads to Manali were in terrible shape and were negatively affecting their business. Although fewer restaurant operators than hotel operators cited roads as a problem, all of those who did believed that poor road conditions were stopping tourists from coming to Manali and, as a result, affecting their business. One of those interviewed was particularly concerned about the state of the road from Kullu to Manali. He emphasized that many tourists pay a lot of money to fly to Kullu and then have to spend two or more hours driving from Kullu - a distance which should take about 40 minutes. This is frustrating for tourists and deters them from coming to Manali again in the future. Two of those interviewed thought that roads should also be built into the interior of the Kullu Valley to remote villages and

**Figure 7.4: Problems/needs restaurant operators identified for Manali & Surrounding Area**

Number of Respondents: 22



areas which have not yet been exposed to tourism. They felt this would help these areas benefit from tourist rupees and that Manali hotel and restaurant operators would see an increase in their business since tourists would want to stay in the Valley for more than 3 or 4 days.

Two of the restaurant operators thought that the air and rail inks to Manali should be improved and another felt that bus operations should be better coordinated. The two demanding better air and rail links were of the opinion that flights to Kullu were too expensive and there was not enough competition to bring these prices down. They also wanted a rail link to at least Bilaspur, with one calling for computerized ticketing for this rail line. The individual concerned about Manali's bus operations made an extremely valid point. All of the buses to and from Manali arrive and depart at either nine in the morning or eight at night. As a result, there are often huge traffic jams at these times to get over the bridge at the Beas or to simply get out of the Mall, where the bus stand is located. Rather than relocate the bus stand, which is what many hotel operators think is necessary, this individual proposed rescheduling the buses so that they come and go throughout the day, rather than all at once. This is a good solution and would remove some of the pressure for a by-pass around Manali or a new bus stand in the town.

Four of the restaurant operators felt that better parking facilities needed to be built in Manali. One of these thought that a new taxi stand should be built adjacent to the Mall within walking distance for tourists. This would decrease the number of haphazardly parked vehicles throughout the Mall. Another individual opined that vehicles should be banned altogether from the Mall area, as in Shimla, so that it is easier for pedestrians to walk around and to shop.

Town Infrastructure and Services

Seven of the restaurant operators (32%) felt that the availability and quality of water in the town of Manali needed to be improved. This is another of the issues which ranked high among both hotel and restaurant operators. Restaurant operators complained that during the rainy season the water is often muddy and that during the high season it is often difficult to get water at certain peak hours of the day. One of the restaurant operators complained that the local water makes the tourists, even Indian tourists, sick - a complaint that was also expressed by some hotel operators. In addition, three of the restaurant operators (14%) complained that sewerage facilities need to be built in Manali. One of these individuals was adamant that this must be done as soon as possible because current sewage disposal methods pose a serious health concern.

Thirty-two per cent of restaurant operators were also concerned about the power supply in Manali. They complained that the electric supply was unreliable and that during the winter months many of them had to use kerosene lanterns in their homes.

As with the hotel operators, many of Manali's restaurant operators were concerned about cleanliness in Manali. Eight of those interviewed (36%) felt that the Nagar Panchayat should be doing a better job to keep the town clean. Two individuals felt that part of the problem would be solved if the town installed more municipal dustbins. This way people would not have to walk so far to put their garbage into the dustbin and would be more likely to dispose of the garbage properly. Two others felt that Manali should construct better garbage disposal facilities, including an incinerator. One of the restaurant operators felt that the public also needed to be informed about the problems of littering and improper garbage disposal. According to this individual, the problem of garbage in Manali is caused by both the Nagar Panchayat and public attitudes and both should be addressed if a solution is to be found.

Public toilets were also an issue among restaurant operators, particularly dhaba owners. Three of the restaurant operators, two of whom were dhaba owners, felt that the town should build more public toilet facilities. All agreed that these should be placed throughout Manali, especially in the downtown area. A similar complaint was expressed by hotel operators who were upset that customers were using their toilets. In the case of the dhaba owners, it may be that they would like toilet facilities nearby for their personal use, as much as that of their customers.

Two of the restaurant operators thought that rent was too high in Manali and one of them suggested that the Nagar Panchayat should build shops which could then be rented at a lower rate than those available privately.

Tourism

Eight of the restaurant operators (36%) thought that more tourist spots and recreational activities needed to be developed. Although this is similar to the responses from the hotel operators, it is interesting to note that only one of the dhaba operators mentioned the need to develop more tourist activities. The types of things which restaurant operators thought should be developed for tourists included lakes, parks, a beer bar, skating and other winter activities, a local hall, and a cable car up one of the mountains. All of those who mentioned the development of more tourist spots and activities thought that these types of developments would encourage tourists to spend more time in the Manali area, would promote greater winter tourism, and, as a result, would boost their business year-round.

Three restaurant operators mentioned that local people need to treat tourists better. One of these complained that too many business agents harass tourists in the street and nag them to buy items and trips. Similarly, three other restaurant operators thought that there should be more fixed price shops in Manali and shop owners should have to post their prices. These individuals thought that tourists were being exploited by shop keepers who inflated their prices for non-locals. Two of these restaurant operators also complained that vegetable shop owners do not post their prices and the prices are inflated.

## Local Planning and Development

While local planning and development was a "hotter" item with hotel operators, two of the restaurant operators mentioned that there needed to be better planning throughout the Kullu Valley. These same individuals were of the opinion that there are already too many hotels in Manali and construction of hotels should be stopped. One of them mentioned that there are too many restaurants, as well, and that it is difficult to break even throughout the year, with the exception of May and June.

## Environmental and Other Issues

As with the hotel operators, restaurant operators made almost no mention of environmental problems in the Manali area. Only one restaurant operator mentioned an environmental issue and this was that "the forests are disappearing too fast".

Two other interesting points were mentioned by restaurant operators. Two thought that there needed to be better policing and enforcement of laws in the Manali area. One of these individuals said that tourists often fight in the streets and the police do nothing about it, while the other was frustrated that the police do not enforce fixed price laws in shops which state they have fixed prices. Another individual was concerned that in the evenings people place illegal stalls along the sidewalks. He thought this should be stopped because it was difficult for tourists and others to walk along the street.

## 7.3 Interviews with Shop Owners

The interviews with shop owners focused on those who sell either bulk foods, such as grains, and those who sell fruits and vegetables. In total, three bulk foods dealers and four fruit and vegetable vendors were interviewed. The results are outlined below.

Bulk Foods Dealers

The results of the interviews with bulk food dealers are summarized in Table 7.1. It is apparent from these interviews that very little of the stock sold by bulk foods vendors in Manali actually originates in the Kullu Valley. On the positive side, those local products that are purchased are bought directly from the farmers with no middle men. This means that local farmers are likely paid a higher price for their goods than they may have been otherwise. Most of the imported products are brought from agents in Chandigarh or Delhi. As a result, Manali's EF is likely higher than it could be because of the extra energy expended to import these goods. By relying more heavily on outside ecosystems for its consumption goods - Manali is also risking the supply of such goods being impeded or even cut off. Fortunately, all of the imported products are coming from within India so it is unlikely that such shortages, if any, would occur for long periods of time.

It is a positive sign, economically, that shop keepers are able to keep their stores open all year. This indicates that they are less affected by tourism than other industries, such as restaurants and hotels. One must assume, however, that business decreases in the winter since restaurants and hotels are buying less food because they are feeding fewer people.

Fresh Fruit and Vegetable Vendors

The results of the interviews with the fresh fruit and vegetable vendors is summarized in Table 7.2. The fruit and vegetable vendors appear to be using more

**Table 7.1 Summary of Interviews with Bulk Foods Vendors**

| | Months Open | Local Products | Products from Outside the Kullu Valley | Products From Outside of India |
|---|---|---|---|---|
| **Bulk Foods Vendor 1** | open all year | • nothing<br>• flour is from Kullu because there is a mill there | • all the rest<br>• come from Delhi and Chandigarh, rice is from Amritsar<br>• bought mostly from the company<br>• some bought from agents (rice, pulses) | nothing |
| **Bulk Foods Vendor 2** | open all year | • about 20% local<br>• kidney beans, potatoes, local rices, chilies<br>• bought directly from farmers | • all the rest - about 80%<br>• come from Delhi and Chandigarh<br>• 50% bought from agents (lentils, rices, spices)<br>• 50% bought from manufacturers (all tea, oils, soaps) | nothing |
| **Bulk Foods Vendor 3** | open all year | • chilies, beans, cardamom, turmeric, dry apples<br>• bought directly from farmers | • all the rest - about 99%<br>• come from Punjab and Chandigarh<br>• bought from agents | nothing |

**Table 7.2 Summary of Interviews with Fruit and Vegetable Vendors**

| | Months Open | Local Products | Products from Outside the Kullu Valley | Products From Outside of India |
|---|---|---|---|---|
| **Fruit & Vegetable Vendor 1** | open all year | • apples, japani<br>• bought from commission agents | • all the rest<br>• come from Delhi and Punjab<br>• bought from commission agents | nothing |
| **Fruit & Vegetable Vendor 2** | open all year | • apples<br>• local vegetables from May to October - potatoes and cauliflower<br>• bought from a commission agent<br>• he is also a commission agent who buys directly from farmers and sells to other shopkeepers | • all the rest<br>• onion, garlic, ginger, mango, pineapple, grapes, dates, guava<br>• after November, all vegetables are imported | nothing |
| **Fruit & Vegetable Vendor 3** | open all year | • 70% local<br>• apples, japani, lemon<br>• local vegetables - cabbage, cauliflower, green beans, radish, spinach tomatoe<br>• bought from commission agents | • 30% - all the rest<br>• come from Delhi and Punjab<br>• bought from commission agents | nothing |
| **Fruit & Vegetable Vendor 4** | open all year | • about 60% local<br>• all the vegetables, except onions<br>• apples<br>• bought from commission agents | • about 40%<br>• onions, oranges, coconuts, potatoes<br>• come from Delhi and Punjab | nothing |

| | | | | |
|---|---|---|---|---|
| | | | • bought from commission agents | |

local products than the bulk foods dealers. All four are purchasing local fruits and vegetables when they are in season and appear to be selling mostly locally produced items, although none of the produce is bought directly from the farmers. In all cases the produce is purchased through a commission agent or middle man. While this creates more opportunities for employment, it means that the farmers may get paid less for their goods than if they had them sold directly to the merchants. As with the bulk foods dealers, all of the imported products are coming from Chandigarh and Delhi. Again, it is fortunate for Manali residents that these items are coming from within India where the supply is less likely to be disrupted.

The vegetable and fruit dealers are also able to stay open for the whole year, a good sign of economic sustainability. As with the bulk foods dealers, however, they likely experience a decline in sales during the winter months.

### 7.4 Interviews with Others in Manali

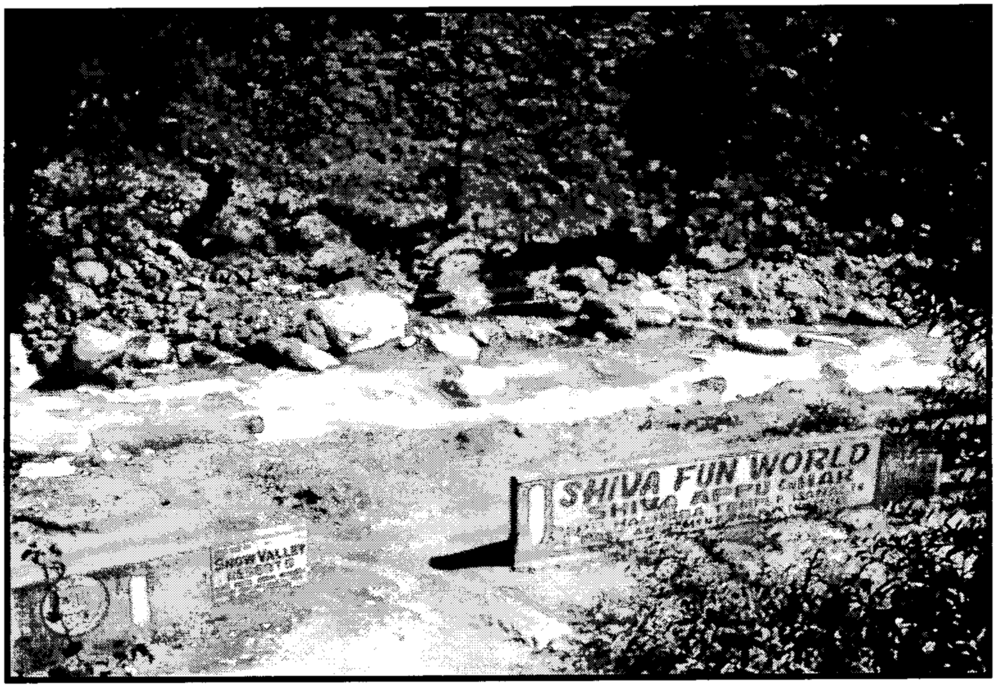
Five additional interviews were carried out with people who live and work in Manali. Of these, one was a hotel manager, one was a member of the local Nagar Panchayat and a hotel owner, one was the Director of the Mountaineering Institute, one was a civil servant with the Himachal Pradesh Tourism Development Corporation and one was a local activist/travel agent/orchard owner. The discussion below outlines the more relevant and dominant themes brought up in the course of these interviews.

Although many of the comments made by these five individuals build upon those made by others interviewed in this study, a much greater emphasis was placed on environmental issues in and around Manali. Waste was a big issue among all five interviewees. All mentioned that the recent ban on polythene bags in Manali is beneficial. One of these individuals was positive that this ban, unlike past attempts, would work because the Nagar Panchayat took the time to consult with local groups, like the Shopkeeper's Union, and made sure that they were involved in the development and implementation of the ban. The problem of poly bags was linked to tourism by all of these individuals and two of them mentioned that the ban must include an education campaign for tourists to the area if it is to be totally effective. These individuals also believed that the bags should be banned in the villages around Manali so that the problem can be addressed in the area surrounding Manali all the way to the Rohtang Pass.

In addition to the ban on polythene bags, three of the five mentioned that Manali needed a better waste management system, including a sewerage treatment facility and a more aptly located garbage dump, i.e. one which is not situated on the bank of the Beas River (see Figure 7.5). One of the individuals stated that the main issues facing the new Nagar Panchayat were waste and sewage management, but that the Nagar Panchayat thinks the main issue is parking. True to prediction, the Nagar Panchayat member interviewed stressed the importance of parking for private and public vehicles throughout Manali. Other issues expressed for the town of Manali by these individuals included the need to build local toilets, the removal of the bus stand to outside of Manali, problems with electricity in the winter months, and air pollution.

The two other major environmental issues mentioned were deforestation and flooding. Deforestation and the illegal felling of trees was a concern mentioned by all but one of these 5 individuals. One of the individuals stated that when he was a child, Kosh trees extended all the way to the Beas River and that now it is difficult to even find a Kosh tree in the Manali area. Three others mentioned that there is an urgent need for forest officials to work closely with local people to develop an awareness and concern for the state of the forests in the Manali area. There is also a belief among local people that deforestation is the cause of flooding along the

**Figure 7.5 Manali's garbage disposal site on the banks of the Beas River**




Beas and throughout the Kullu Valley and two of those interviewed thought that reforesting the river banks should be a top priority of the forest department. Another cause given for the flooding, which according to many has become much more frequent, is the mining of gravel and large boulders from the Beas River bed for road construction. Although this practice was banned after the 1995 flooding in the area, the ban has since been lifted and mining of the river bed has recommenced. Four of the five interviewed thought that this practice should be completely banned and that it is among the primary causes of flooding and river bank erosion in the area.

With respect to tourism, two individuals mentioned that the roads to Manali were in need of serious improvement. This is a theme that has occurred throughout all of the interview sets. One of those interviewed also thought that snow clearance throughout the Kullu Valley, particularly from Manali to the Rohtang Pass should be improved, especially if tourists are to be attracted during the winter months. House taxes charged to hotels were also mentioned, but for two conflicting reasons. One individual thought that the house taxes were far too high and that large hotels, in particular, were paying too much for the services they received from the Nagar Panchayat. This is similar to the concerns expressed by the hotel operators interviewed in Manali. Another, however, was of the opinion that the house taxes should remain the same or even be increased to pay for the building of a sewage treatment plant and proper waste disposal facilities in Manali. This individual thought that tourists were the main cause of Manali's waste problems and that local officials should be using hotel taxes to fund the solution to these problems.

Finally, in terms of planning and construction in the Manali area, two distinct issues arose during these interviews. The first was the need for better planning in the Manali area. All five of those interviewed complained that there is no effective planning mechanism for the Manali area. Although plans are made, they are drafted by someone in Kullu and the implementation is usually non-existent. This, however, may change with the new Nagar Panchayat because it will be responsible for approving and implementing the town plans developed by the planner in Kullu. In addition to planning, these individuals also mentioned that there are too many hotels in Manali and that most of them are only full in the busy season. Three suggested that new hotel construction should be banned altogether in the Manali area. The development of other areas, however, was mentioned by these same individuals as something that should be done. They suggested that tourism development in the Kullu Valley has focused too heavily on the Manali area and should be extended to other, more remote, less exploited areas. This, it was thought, would spread the economic benefits of tourism to other parts of the Kullu Valley and would alleviate some of the environmental pressures in Manali. (It may also create more widespread and damaging problems than already exist!)

# 8.0 Waste Generation, Collection and Recycling in Manali

As mentioned previously, initial research plans were to develop a waste footprint for Manali town and its tourists. Unfortunately, this was not possible because of a lack of information about decomposition rates of the various waste items. Data on waste generation, disposal and recycling were still collected, however, and are reported here because they provide a good indication of the potential magnitude of Manali's waste footprint and the types of items being consumed by Manali residents and tourists.

In order to determine the amount of waste being produced in Manali, as well as its disposal and recycling, interviews were held with the three local scrap dealers and hotel and restaurant operators. These interviews are summarized in sections 8.1 and 8.2 below. Studies on waste production were also reviewed and the summation of these studies is outlined in Section 8.3 below.

## 8.1 Interviews with Scrap Dealers

Interviews were conducted with owners and workers at the three local scrap dealers in Manali. These individuals were asked about the types, amount and value of the recyclables they collect, as well as how these items are collected and sold. Table 8.1 outlines the responses which were given to the main questions asked about their operations.

Based on these responses, it appears that all of the scrap dealers collect the same basic items. Surprisingly, one of the items which the dealers do not collect is cardboard. This was evident on a trip to Manali's garbage dump which had quite a large amount of cardboard present. Another item which these dealers do not collect is polythene bags - an item that is present at the garbage dump and littered

**Table: 8.1 Summary of Items Collected and Sold by Scrap Dealers and their Values**

| | items collected | amount dealer pays for items | amount collected per day | where the items are sold | amount dealer gets paid for items |
|---|---|---|---|---|---|
| **Scrap Dealer 1** | • bottles<br>• plastics<br>• iron<br>• other metals - aluminum, brass, etc.<br>• paper - newspapers, books, copies | • iron = 5Rs/kg<br>• plastics = 8Rs/kg<br>• brass, aluminum & other metals = 40Rs/kg<br>• paper = 4Rs/kg<br>• bottles:<br>beer = 1.55Rs<br>other = 1Rs/kg | • 1000-1500 Rs/day on average<br>• 400-500 Rs goes to iron<br>• 400-500 Rs to bottles<br>• 10-20 Kg of paper/day | Chandigarh<br>• beer bottles returned to the company<br>• juice bottles go to juice company in Kullu | • iron = 7Rs/kg<br>• paper = 5.5Rs/kg<br>• bottles:<br>72 beer bottles/set = 120Rs<br>120 small liquor bottles/set = 80Rs<br>180 juice bottles/set = 100Rs. |
| **Scrap Dealer 2** | • bottles<br>• plastics<br>• iron<br>• other metals - aluminum, tin, etc.<br>• paper | • iron = 5Rs/kg<br>• plastic = 6Rs/kg<br>• paper = 4Rs/kg<br>• bottles<br>small = 25Ps<br>beer = 1.55Rs<br>other = 50Ps | • 1500-1600 Rs/day on average<br>• from May to August 3000-4000 Rs/day<br>• about 2 times more bottles than everything else | Chandigrah and Delhi | • double what they pay for bottles<br>• plastics = 8-9Rs/kg<br>• iron = 6.5Rs/kg |
| **Scrap Dealer 3** | • bottles<br>• scrap metal, tin<br>• plastic boots<br>• plastic sacks, like grain sacks<br>• paper | • tin = 2Rs/kg<br>• plastic = 4Rs/kg<br>• paper = 2-2.5Rs/kg<br>• bottles:<br>beer = 1.5 Rs<br>small = 20 Ps | • 300-400 Rs/day<br>• majority is tin (30-40 kg)<br>• plastics - 2-10 kg | Chandigarh | • depends on market<br>• 3 to 3.5 Rs/kg, but can be higher |

| | | | | | |
|---|---|---|---|---|---|
| | | others = 40 Ps | | | |

throughout the Manali area. Unfortunately, there is nowhere in Himachal where polythene can be recycled. It is, however, being used in a village near Shimla to make woven rugs (Employee, Himachal Pradesh State Council for Science and Technology, Shimla, personal interview, November 17, 1999).

All of the dealers hire people to collect the recyclables. These collectors make about 1,500 rupees per month, or 18,000 rupees per year - an amount that is almost double the average yearly salary of 9,100 rupees in Himachal Pradesh. Despite this, the workers interviewed complained that their salaries are too low and said that they hope their children are able to secure better jobs than them. One of the dealers has collectors who bring items from Lahaul and Spiti to be sold in Chandigarh. This same dealer also goes to local villages where he exchanges items of value, like pots and cutlery, for villagers' recyclable items. This is an excellent program and encourages both reusing and recycling - two components essential to the process of improving a waste footprint.

The amount that two dealers pay for scrap is fairly similar; the third scrap dealer pays less than the other two. This individual is aware that he pays less and says that the other dealers get more items because they pay more. This is especially evident from the amount each dealer collects per day. The first two scrap dealers collect about the same amount, while the third dealers collects about eight per cent less per day. It is interesting that scrap dealer 2 noted a difference in the amount of items being collected per day in the high season. This is an indication of the higher consumption that occurs in Manali during the tourist season. It is likely that if these recyclables are increased during the tourist season, so too do non-recyclables like cardboard and polythene bags.

All of the scrap dealers sell the items they collect in a market in Chandigarh, and one sells some of his items in Delhi. The dealers make their biggest profit from bottles, for which they get about double what they pay. The rest of the items sell for about twenty per cent more than what the dealers pay. Dealers, however, must pay for a truck to take the items to the scrap market, which, according to the first scrap dealer, costs about 9,000 Rupees for a trip to Chandigarh. One of the scrap dealers complained that the cost of shipping the materials is so high because the truck drivers in Himachal Pradesh are unionized. Since the dealers are shipping the items out of Himachal Pradesh, they must also pay a Himachal State Tax of thirty per cent of the value of the material. The amount of tax actually paid, however, is said to be extremely inconsistent, with the government constantly changing the levy. Problems also arise because government officials do not know the real value of the goods so they end up, according to the scrap dealers, charging too much, although the ignorance of government workers must also on occasion work to the dealer's benefit. Regardless, the interviews indicate that the actual profits made by these scrap dealers are not as high as they may appear at first glance. It must also be said that the dealers are providing a valuable service to the people of Manali, even though theirs is a money-making operation, and even though the residents may be unaware of the benefits.

## 8.2 Interviews with Hotel and Restaurant Operators

Interviews were also held with hotel and restaurant operators to determine the quantity and types of waste generated in these establishments, as well as disposal methods and recycling. The results of these interviews are summarized in sections 8.2.1 and 8.2.2 below.

In all cases, respondents were asked to estimate waste generation to the best of their knowledge. Respondents were also free to answer using the measurement they felt most comfortable reporting - for example litres, kilograms or room dustbins. It is recognized that this approach could not elicit precise answers about garbage generation at these establishments. It did, however, serve to highlight differences in waste generation among the different types of hotels and restaurants.

### *8.2.1 Interviews with Hotel Operators*

Hotels operators were asked about their garbage generation and collection because it is a good indication of what types of items are being consumed by tourists in the hotels, whether recycling is occurring, and how the hotels are disposing of waste. Ultimately, the more garbage that is recycled or composted, the smaller the waste footprint for Manali.

Those interviewed at the large hotels gave estimates of garbage generation from 1 to 50 kilograms per day in the high season and 500 grams to 15 kilograms per day in the low season. This equates to a generation per room of between 50 grams and 2.4 kilograms per day in the high season and between 1 gram to 1.2 kilograms per day in the low season[20]. One of the operators indicated that the hotel generates approximately 216 cubic feet of garbage per day (one 6 by 6 foot dustbin) in the high season and the same amount every 3 to 4 days in the low season. As there is no way to quantify this in terms of weight it has not been included in the average values. Of the garbage produced, seven of the ten large hotels indicated that the majority (greater than 70%) of the waste is food waste such as vegetable peels. The other 3 hotels indicated that paper and packaging/food wrappers constituted the bulk of their garbage.

In terms of disposal, four of the ten large hotels get their garbage picked up directly by the Nagar Panchayat, while the remaining six have personal sweepers who bring their garbage to municipal dustbins (see Figure 8.1), usually once or twice daily. Four of the large hotels keep their recyclables, i.e. glass bottles, scrap

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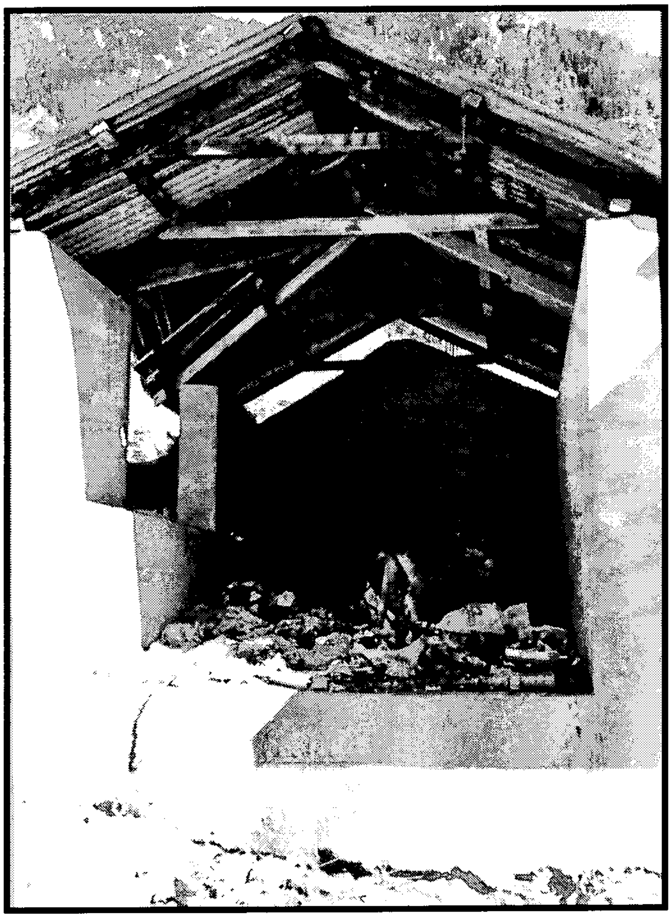
[20] Please recall that during the low season only 20 per cent of the rooms are occupied. This has not been accounted for in this calculation.

metal, newspapers, magazines and hard plastics, for scrap dealers which come to the hotel on a regular basis. Six of the large hotels do not have or do not allow

**Figure 8.1 Municipal dustbin in Manali**



scrap dealers to come to their premises. Some operators were quite indignant at the mere suggestion that scrap dealers frequent their establishments.

At the medium sized hotels, ten of the twenty hotels provided garbage data in terms of litres produced per day. Of these ten hotels, the amount of garbage produced ranged from 10 to 40 litres per day in the high season and 1 to 20 litres per day in the low season. This equates to about 0.5 to 4 litres per room per day in the high season and 0.2 to 1 litres per room per day in the low season. Five of the medium hotels responded in terms of kilograms. Of these, garbage generation ranged from 2 to 75 kilograms per day in the high season and 10 grams to 30 kilograms per day in the low season. This equates to a garbage generation per room of between 13 grams and 8 kilograms per day in the high season and between 0.7 grams and 2.7 kilograms per day in the low season. Two of the medium sized hotels indicated that garbage generation is 1 to 2 room-sized garbage cans per day in the high season and about 1 room-sized garbage can every two days in the low season. Three of the hotels did not indicate how much garbage they produce.

As for the type of garbage, only one of the medium-sized hotels indicated that the bulk of its garbage is food waste. This is probably because these hotels are less likely than the large hotels to have restaurants or room service. Eight of the hotels cited paper, packaging and polythene bags as constituting the bulk of the garbage produced, with two indicating that polythene bags constitute greater than 50 per cent of their garbage. Four of the hotels indicated a 50/50 split between food waste and papers, packaging and polythene bags; two indicated a 50/50 split between papers, packaging and polythene bags and dust; and three indicated a 50/50 split between papers, packaging and polythene bags and plastic water bottles. Interestingly, the one medium-sized hotel whose customers are primarily foreigners, indicated that the majority (over 90 per cent) of its garbage is plastic water bottles.

With the exception of one, all of the medium sized hotels have their own sweepers who bring the garbage to a municipal dustbin at least once daily. The remaining hotel burns its garbage at night. All but five of the medium-sized hotels have scrap dealers which come to the hotel regularly to collect recyclables. According to interview responses, the majority of these recyclables are beer and whiskey bottles. Three of the hotels which do not have visits from scrap dealers claim it is because they do not allow liquor in their hotels.

The 12 small hotels also indicated garbage generation in a variety of ways. Five of the thirteen hotels responded by giving a number of full room-sized garbage cans per day. The range in answers was between 2 to 8 in the high season and 1 to 5 in the low season. This is about 0.67 to 3 small garbage cans per room per day in the high season and between 0.1 and 0.6 small garbage cans per room per day in the low season. Four of the hotels answered in terms of litres per day. In the high season, the values ranged from 10 to 30 litres per day and in the low season they ranged from 10 to 20 litres per day. In terms of garbage per room per day, this equates to about 1.1 to 3.8 litres per day in the high season and 1.3 and 2.5 litres per day in the low season. Four of the hotels answered in terms of kilograms per day. Of these, the values for garbage generation ranged from 1 to 10 kilograms per day in the high season and 2-3 water bottles per day to 5 kilograms per day in the low season. Per room, this equates to between 100 grams and 2 kilograms per day in the high season and about 10 grams to 600 grams in the low season.

The type of garbage found in the smaller hotels was predominantly papers, packaging and polythene bags, likely because of the low rates of room service and restaurant facilities in these hotels. Three of the hotels indicated that papers, packaging and polythene bags formed the bulk of their garbage (greater than 70 per cent), while three indicated a 50/50 split between papers, packaging and polythene bags and plastic bottles. Three more indicated a 50/50 split between food waste and papers, packaging and polythene bags, one indicated an even split between food waste, papers, packaging and polythene bags and plastic bottles, and one indicated a split between papers, packaging and polythene bags, plastic bottles and food waste, with food waste constituting about 50 per cent of the garbage. In addition, two of the hotels indicated that prior to the recent poly bag ban in Manali the bulk of their garbage had been polythene bags.

All of the small hotels indicated that they hired sweepers who took their garbage to a municipal dustbin at least once a day. One of the hotels reported that its paper wastes were all burned and another said that about two times a week its sweeper burns the garbage in the municipal dustbin. Seven of the 12 small hotels do not have scrap dealers collecting recyclables. Of these, two indicated that it was because they have nothing to give them since they do not serve beer and one indicated that their sweeper takes the recyclables directly to the scrap dealers.

With respect to the cottage operations, the amount of garbage generated was between 6 and 7 kilograms per day in the high season and about 3 kilograms per day in the low season. The garbage is primarily (80%) kitchen waste, with papers making up the remainder. The garbage is taken to the municipal dustbin twice daily and no collectors/scrap dealers come directly to the cottages. The apartment complex generated between 4 to 5 small dustbins of garbage per day in the high season and less than 1 small dustbin per day in the low season. The garbage is composed of 50 per cent paper, 20 per cent plastic and 15 per cent each of food and food packaging. The garbage at the apartment complex is taken three times daily to a municipal dustbin and no scrap dealers come to this complex.

The high per centage of food waste in both large hotels and cottage operations and a small number of medium-sized hotels is interesting. As stated, one reason for this difference may be because the small- and medium-sized hotels are less likely to have restaurant facilities or room service. Other reasons may be that the tourists staying in large hotels can afford to buy expensively priced hotel meals or are more wasteful than those in less expensive hotels. Regardless, the high per centage of food waste could provide an excellent opportunity for composting operations in the Manali area. Currently, all of this waste is going to the municipal garbage site and, based on site visits in Manali, is not being composted. It is encouraging to see that a lot of the recyclables being generated in Manali are being passed on to the scrap dealers for recycling. The reluctance of large hotels to give their recyclables directly to scrap dealers is unfortunate. It would be more efficient, in terms of time and energy, if hotel operators handed the recyclables over directly to scrap dealers, rather than forcing scrap dealers to pick through the garbage dump and/or municipal dustbins to find these items.

### *8.2.2 Interviews with Restaurant Operators*

Like hotel operators, restaurant operators were asked about their garbage generation and collection to determine the types of items, other than food, being consumed by their customers and to find out where this garbage is going when it leaves the restaurant premises.

At the larger sit-down restaurants, 10 of those interviewed provided estimates of garbage generation in kilograms per day, while the remaining 4 provided estimates in terms of litres per day. The estimates in kilograms ranged from 5 to 40 kilograms per day in the high season and 2 to 15 kilograms per day in the low season. In order to provide an estimate of garbage generation per customer, this amount was divided by the number of customers per day quoted by each restaurant. Thus the garbage generation in these restaurants ranges from 9 to 240 grams per person in the high season and from 12 to 600 grams per person in the low season. The average overall is about 99 grams per restaurant customer. In those restaurants which reported their garbage in terms of litres, the generation per day ranged from 20 to 90 litres in the high season and from 5 to 15 litres in the low season. This equates to a generation per customer of about 0.01 to 0.2 litres in the high season and 0.05 to 0.1 litres in the low season. The average was about 0.08 litres per customer. Of the garbage produced, 12 of the 14 restaurants indicated that the majority (greater than 70%) of the waste is food waste, such as vegetable peels. The rest of the garbage at these restaurants consisted of papers, primarily serviettes, food packaging and plastic water bottles. One of the restaurants estimated that only 60 per cent of the garbage was food waste, with napkins, papers and bottles (10%) and ash from coal burning (30%) making up the remaining 40 per cent. As well, another restaurant indicated that only 20 per cent of its waste is food, while 60 per cent is plastic water bottles.

Nine of the 14 sit-down restaurants have personal sweepers who take their garbage to a municipal dustbin at least once daily. One of the restaurants has their kitchen cleaners take the garbage to the municipal dustbin, and another has no sweeper, but takes the garbage personally to the municipal dustbin. One of the restaurant owners gives all of the food waste (which constitutes the majority of the garbage) to his cows. The remaining restaurant, ironically a Himachal Pradesh Tourism Corporation restaurant, burns everything that can be burned, behind the restaurant, including polythene plastics and papers. The non-combustible material is dumped in a local ditch behind the hotel once a day.

Eight of the sit-down restaurants keep their recyclables, primarily glass beer bottles and scrap metal (oil tins) for scrap dealers which come to the restaurant on a regular basis. The remaining six restaurants do not have or do not allow scrap dealers to come and collect recyclables. This includes the Himachal Pradesh Tourism Corporation restaurant which insisted that if collectors want their recyclables they will have to go look for them in the ditch behind the restaurant where they throw their garbage.

The garbage situation at the dhabas is quite different from that at the sit-down restaurants, a strong indication of the difference in the types of customers they attract. Four of the dhabas said that all of their waste was vegetables and noodles, one had 90 per cent waste food and 10 per cent waste paper plates, and the two others reported that the majority was waste tea, vegetables and egg shells with about 20 per cent papers and candy wrappers. The latter two dhabas are near the school and the majority of their customers are school children, which explains the high percentage of candy wrappers. It is interesting to note that none of the dhabas had waste water bottles, an indication that foreigners and wealthier tourists are not eating at these restaurants. In terms of quantity of garbage, the amounts range from about 0.5 to 11 kilograms per day and 5 to 45 litres per day in the high season and 0.5 to 4 kilograms per day and 2 to 15 litres per day in the low season. This equates to about 10 grams per customer, or 0.12 litres per customer on average throughout the year. In terms of grams per customer, this is substantially less than for customers in the larger sit-down restaurants which have average garbage generation of 99 grams each. In terms of litres, however, the garbage generation in both of these restaurants appears to be similar at about or 0.1 litres per customer. Regardless, there is definitely less waste generated in the smaller dhabas and this is a sign of over-consumption be wealthier tourists in Manali. Only one of the dhabas has collectors which come to the restaurant regularly to collect soya sauce and vinegar bottles. This may be because the smaller dhabas simply do not generate enough recyclables for the collectors to bother coming or because dhaba operators take the items themselves to the scrap dealer to collect the money.

### 8.3 Compilation of Reviewed the Waste Studies

As mentioned previously, the reports on waste in Manali reviewed for this study included the following: an Urban Local Bodies report on solid waste management in Manali; an as of yet unpublished report by the G. B. Pant Institute, and; the Engineering Handbook for the Manali area.

The Urban Local Bodies report (prepared by Gupta and Kaushesh and submitted by the Town of Manali 1997) entitled, Integrated Solid Waste Management and Environmental Project of Manali Town, was prepared as a proposal to the Government of Himachal Pradesh to obtain funding for new waste management facilities in Manali. According to this report, 60 per cent of the garbage produced in Manali is readily biodegradable waste (RBW), 15 per cent is biodegradable waste (BW), and 20 per cent is non-biodegradable waste (NBW). Where RBW is food waste, BW includes paper and textiles (cloth), and NBW includes glass, metals, and plastic (including plastic bags). This same report produced the seasonal waste production chart seen below as Table 8.2.

**Table 8.2 Seasonal Waste Production in Manali**
*(Source: Urban Local Bodies 1997)*

| TYPE | QUANTITY (ton/day) | | | |
|---|---|---|---|---|
| | **Summer** | **Monsoon** | **Winter** | **% of Total** |
| **Kitchen Waste** | 9.84 | 4.48 | 3.36 | 32 |
| **Paper** | 2.45 | 1.40 | 1.05 | 10 |
| **Glass** | 0.98 | 0.56 | 0.42 | 4 |
| **Textile** | 1.225 | 0.70 | 0.525 | 5 |
| **Plastic/Polythene bags** | 1.96 | 1.12 | 0.84 | 8 |
| **Other Material, such as sand & ashes, etc.** | 8.045 | 5.75 | 4.305 | 41 |
| **Total:** | 24.50 | 14.00 | 10.5 | 100 |

Based on Table 8.2, it would appear that Manali town produces up to 24.5 tons of garbage per day and never less than 10.5 tons per day. These, however, are extremely large values and inconsistent with the information provided during interviews with Manali's Junior Engineer and the town's garbage collection crew. Both of these sources indicated that the amount of garbage collected per day in Manali ranges from 3 tons in the off-season to 7 tons in the tourist season (May/June and September/October).

It was, however, assumed that the proportion of waste collected per day in each season compared to the amount of waste produced over the entire year, is accurately portrayed in Table 8.2. Thus, it was estimated that during the summer season (May/June) 1.75 times more waste is produced per day than in the monsoon season (July/August/September) and 2.33 times more waste is produced per day than in the winter (October to the end of April).

Since the 1999 study done by the G. B. Pant Institute has not yet been published, very little of the data in this report were made available. The information which was available suggests that 54.8 per cent of the waste produced in Manali is RBW, 17.2 per cent is BW, and 28 per cent is NBW. These values are very close to those cited in the Urban Local Bodies report, which were 60, 15 and 20 per cent, respectively. For the purposes of this study, the breakdown produced by the G. B. Pant Institute was thought to be the most reliable and is, therefore, the one used.

The final written source of information in which data were available was the Engineering Handbook for Kullu District. This handbook has a breakdown of waste by type, as well as by producer. These data are portrayed below in Table 8.3.

**Table 8.3 Estimates of waste production and sources of waste in Manali**
*(Source: Engineering Handbook, Kullu District)*

| | Hotel Beds | Solid waste Kg/day | bio-degradable kg/day | non-bio-degradable kg/day |
|---|---|---|---|---|
| **behind tourist bungalows and Hotel Beas** | 724 | 289 | 275 | 14 |
| **Manali Town** | 2283 | 913 | 867 | 46 |
| **near Jagatsukh** | 461 | 184 | 175 | 9 |
| **Old Manali** | 344 | 139 | 132 | 7 |
| **Mission School Road** | 341 | 136 | 129 | 7 |
| **Circuit House Road** | 393 | 157 | 1479 | 8 |
| **Hadimba Road** | 711 | 284 | 269 | 15 |
| **Rangri Road** | 981 | 392 | 372 | 20 |
| **Left Bank Manali** | 2283 | 913 | 867 | 46 |
| **TOTAL** | 8693 | 3474 | 3199 | 175 |
| **residential persons** | 4671 | 1868 | 1775 | 93 |
| **office** | 211 | 42 | 40 | 2 |

| | | | | |
|---|---|---|---|---|
| **student** | 1000 | 200 | 190 | 10 |
| **hospital** | 55 | 27 | 27 | - |
| **TOTAL** | | 5611 | 5331 | 280 |

Since the data covers a wider range than just Manali, values for 'Left Bank Manali', "Rangri Road', 'Old Manali', and 'near Jagatsukh' were excluded. As well, the data for residential persons were adjusted using the chosen population value for this study of 2,609 persons[21]. The table was also changed to incorporate the waste breakdown values provided by the G. B. Pant Institute. This meant that the solid waste category was broken down to 54.8 per cent RBW, 17.2 per cent BW, and 28 per cent NBW. Although this changed the values slightly for biodegradable and non-biodegradable wastes, it was thought to be more accurate. The BW and NBW categories were further broken down using data from the Urban Local Bodies Report. BW was broken down to two-thirds (66.7%) paper and one-third textiles (33.3%)[22]. As well, NBW was broken down into the categories of glass, plastic/polythene, and metal/other. Glass and plastic/polythene were estimated to be 4 and 8 per cent of the garbage stream, respectively. It was assumed that all of the remaining NBW was metal and other unspecified non-biodegradable material.

Based on these results, a final table of waste production in Manali, Table 8.4, was compiled. Using the seasonal values from the Urban Local Bodies report and the average daily value of 3,091 kilograms, it was estimated that 5,593 kilograms of waste are produced per day in the summer season; 2,319 kilograms per day are produced in the winter months and 3,074 kilograms per day are produced during

[21] The data was adjusted by dividing each waste value by 4671 persons to determine the amount per capita and then multiplying this value by the 2609.
[22] This calculation was based the claim in the Urban Local Bodies report that 10 per cent of the total waste was paper and 5 per cent was textile. Thus, of the total BW (15 per cent), 66.7 per cent was paper and 33.3 per cent was textiles.

the monsoon season in Manali[23]. These values are consistent with those indicated in interviews with Manali's garbage collection crew. They stated that they collect

[23] This was calculated using the relationship: waste/day in the summer = 1.75 waste/day in the monsoon = 2.33 waste/day in the winter. Thus,

$$3091 \text{ kg/day} = \frac{61 \text{ days(kg/day summer)} + 92 \text{ days}(0.57\text{kg/day monsoon}) + 212 \text{ days } (0.43\text{kg/day winter})}{365 \text{ days/year}}.$$

## Table 8.4 Waste production in Manali

| | | | bio-degradable kg/day | | | non-bio-degradable kg/day | | |
|---|---|---|---|---|---|---|---|---|
| | | | RBW | BW | | | | |
| | Hotel Beds | Solid waste Kg/day | food waste = 54.8% | paper = 11.5% | textiles = 5.7% | plastic/polythene = 8% | glass = 4% | metal/other = 16% |
| **behind tourist bungalows and Hotel Beas** | 724 | 289 | 158 | 33 | 17 | 6 | 3 | 71 |
| **Manali Town** | 2283 | 913 | 500 | 105 | 52 | 20 | 10 | 225 |
| **Mission School Road** | 341 | 136 | 75 | 15 | 8 | 3 | 2 | 34 |
| **Circuit House Road** | 393 | 157 | 86 | 18 | 9 | 4 | 2 | 39 |
| **Hadimba Road** | 711 | 284 | 156 | 33 | 16 | 6 | 3 | 70 |
| TOTAL | 4452 | 1779 | 975 | 204 | 102 | 40 | 20 | 438 |
| **Residential persons** | 2609 | 1043 | 572 | 119 | 60 | 4 | 2 | 46 |
| **Office** | 211 | 42 | 23 | 5 | 2 | 0 | 0 | 2 |
| **student** | 1000 | 200 | 110 | 23 | 11 | 1 | 0 | 9 |
| **hospital** | 55 | 27 | 15 | 3 | 2 | | | |
| TOTAL | | 3091 | 1694 | 354 | 177 | 45 | 22 | 495 |

7 tons per day in the high season (summer); 3 to 7 tons per day from July to October; and about 3 tons per day in the winter months. This equates to a Manali resident population of approximately 2,609, a floating population during the tourist season of about 10,000 and a tourist population that reaches a maximum of 107,590 in June and decrease to less than 10,000 in January. Since these tourists only stay for about 3 days, the maximum number in June per day is about 11,000[24].

[24] This value was determined by assuming that tourists visiting Manali are evenly spread out throughout the month. The total number of tourists for June, 107,590, was divided by the 30 days in the month and then multiplied by 3 days visiting time.

# Section IV -
# Discussion

# 9.0 Manali's Burgeoning Footprint

As is evident from the results of the Ecological Footprint (EF) analysis, Manali's footprint increased dramatically from 1971 to 1995. With this increase, the town has also started to have a much greater impact on its surrounding environment. The following sections discuss the changes that have occurred in Manali's EF at both the individual and regional level, and the implications of these changes for the long-term sustainability of this Himalayan town.

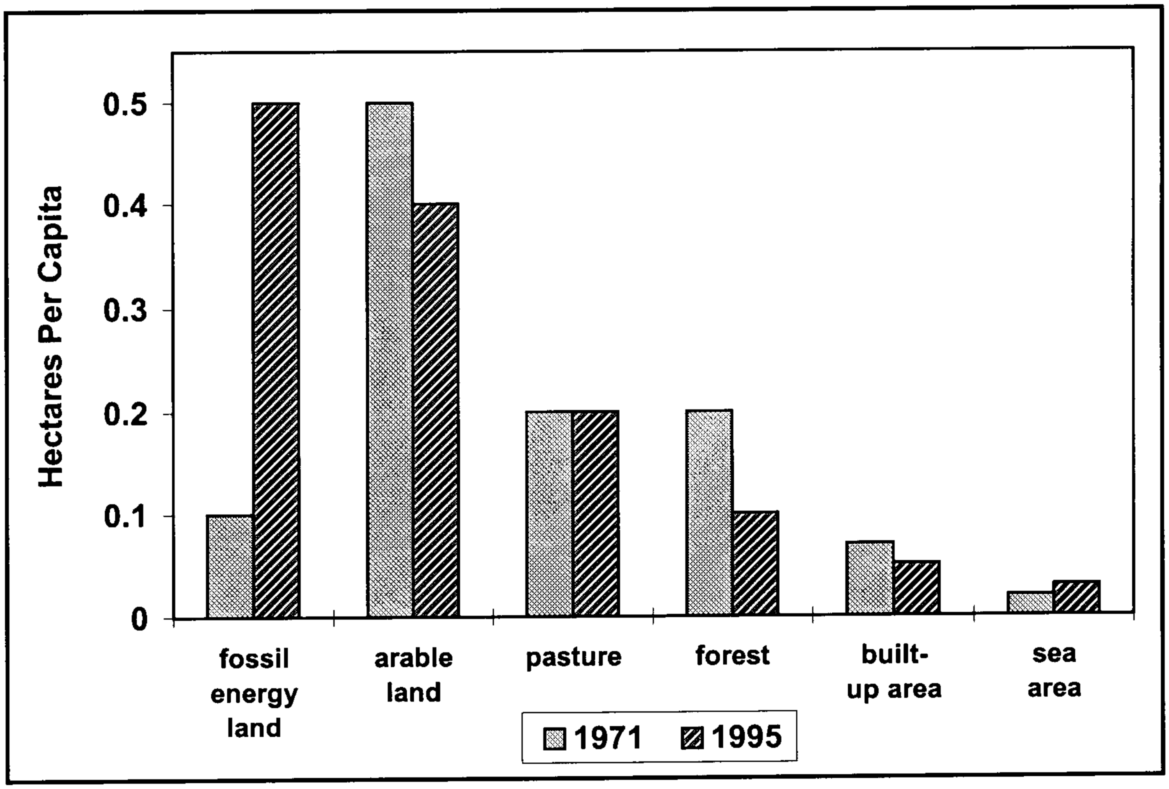
## 9.1 Manali's Per Capita Footprint and the Per Capita Land Available

### *9.1.1 Changes in the Ecological Footprint of Manali Residents*

It is important firstly to consider changes in the per capita EF of Manali residents since this is the basis for the overall EF of Manali town. Because of the scarcity of reliable regional data, the per capita EF of Manali residents was calculated using national statistics. It was assumed, therefore, that the consumption patterns of Manali residents were the same as the average for the rest of India. Given the wide disparities in climate, resources, and culture, among other things, throughout India, this assumption is likely inaccurate. As well, because Manali residents were assumed to act like average Indians, many of the unique conditions found in the Kullu Valley are not reflected in the results of the footprint calculations. The numerous interviews held in the Manali area, however, have been used to partially compensate for these discrepancies.

Per capita, the Indian EF grew from 1.1 hectares in 1971 to 1.3 hectares in 1995. While this equates to only a 19 per cent increase, the bulk of the increase was due to the growing consumption of fossil fuels (see Figure 9.1). The per capita footprint for fossil fuel energy for the average Indian rose from 0.1 hectares per capita in 1971 to 0.5 hectares per capita in 1995 - an increase of 500 per cent.

**Figure 9.1 Changes in the Per Capita Ecological Footprint of the Average Indian between 1971 and 1995**




This heavy reliance on fossil energy is a burgeoning problem for India. Not only are the bulk of India's fossil fuels imported from other parts of the world but, in 1995, oil accounted for 27 per cent of India's total imports (Parikh *et al.* 1997). Importing oil means that India is relying on the availability of outside supplies for this energy source, supplies which are threatened by shortages or disruptions in other parts of the world. India also has no control over the price of oil and is therefore extremely vulnerable to price fluctuations, particularly if the comparative value of the Rupee falls in world markets. The cost of importing oil in the midst of an internal economic crisis or external supply crisis, such as the 1970 OPEC oil embargo, could bankrupt India. Increased prices can also create an environmental burden. For example, the high cost of kerosene oil for cooking purposes has been blamed for deforestation in the countryside surrounding Delhi (Brown & Jackson 1987).

Of equal interest are the consumption changes within the fossil energy footprint. In 1971, the bulk of the per capita fossil energy footprint could be attributed to coal, with the average Indian consuming 3.42 gigajoules (Gj) per year, for a coal consumption footprint of 0.06 hectares per capita. By 1995, the per capita consumption of coal had increased to 7.48 Gj per year, for a per capita coal consumption footprint of 0.2 hectares - a rise of over 218 per cent. Equally dramatic were the per capita increases in liquid and gaseous fossil fuel consumption. Between 1971 and 1995, per capita liquid fossil fuels consumption rose from 1.3 Gj to 2.7 Gj per year and per capita gaseous fossil fuel consumption rose from 0.21 Gj to 0.77 Gj per year. This equates to increases of 208 and 367 per cent, respectively. Perhaps the most astonishing change is that for energy embodied in net imported goods. This value rose from an annual consumption of 0.4 Gj per capita to 14.61 Gj per capita - a rise of 3,653 per cent.

This last change in particular is a sign of India's increasing economic dependence on the outside world. It also signals a major increase in the consumption of durable goods by Indian consumers. As hypocritical as it may sound for a Westerner to make this observation, the spread of our profligate consumerism to the developing world can only make the quest for global sustainability that much more difficult. The number of consumers in India represents about one-fifth of the world's population and the country holds one of the largest and fastest growing economies in the developing world. Even if half of the population began to emulate the consumption patterns exhibited by individuals in the Western world, patterns which are extremely gluttonous and highly unsustainable, the world could suffer serious environmental and social problems.

Some may argue that the fossil energy footprint of Manali residents may actually be lower than for individuals from other parts of India because all of the state energy production and consumption in Himachal Pradesh in 1995 came from hydroelectric sources. Certainly hydroelectric power has the potential to be a less polluting, more renewable energy source than fossil fuel powered electrical generation and this may reduce Manali's energy footprint. Manali, however, is constantly being struck by power outages and during these periods local residents use fossil-fuel powered generators as their primary source of electricity. These generators are usually diesel and, in many cases, are old and inefficient. As well, during the winter months, some Manali residents heat their households with kerosene lamps and coal stoves. Both of these factors would tend to offset the reduction in fossil energy footprint gained from the use of hydroelectric power.

There is other evidence to suggest that in Manali the same patterns of fossil energy consumption are occurring as elsewhere in the subcontinent. For example, the number of vehicles registered in Kullu District increased by 481 per cent between 1971 and 1997, rising from 128 vehicles in 1971 to 616 vehicles in 1997 (Directorate of Economics and Statistics, Himachal Pradesh 1976; Directorate of Economics and Statistics, Himachal Pradesh 1997). This does not include buses operated by the Himachal Pradesh government, of which there were 91 in the district in 1997, or tour buses and transport trucks from other parts of the state which operate in the Kullu Valley (Directorate of Economics and Statistics, Himachal Pradesh 1997). Another likely indication of increased fossil fuel consumption in the Manali area is the rise in the number of vehicles passing through Manali - from 82 in 1969 to 205,185 in 1994 (Pandey, Singh & Singh 1998). Such a huge increase must presumably have added to the fossil energy footprint.

Interviews held with business owners in Manali indicate that most of the goods being consumed in the Kullu Valley are being imported and this would also require extra fuel for transportation. The heavy dependence of Manali residents on imported goods would also serve to increase their footprint for the energy embodied in such goods. This, however, is not necessarily deleterious to sustainability in the Kullu Valley itself and serves to highlight one of the inadequacies of EF analysis. Little attention is paid in EF analysis to the fact that some regions of the world are better suited to certain activities than others. Residents in the Kullu Valley may have a larger energy footprint than those in Delhi because they have to import the goods they use rather than produce them locally. In terms of sustainability, however, this strategy may be more advantageous for Kullu residents because their local environment is not naturally equipped with the resilience needed to absorb the by-products of many manufacturing processes. This does not negate the fact that residents of the Kullu Valley are consuming imported goods that require significant energy inputs. Rather, it is meant to emphasize the fact that the EF of a region does not tell the whole story of its sustainability.

For example, consider the impacts of increased fossil energy consumption that are not currently included in EF calculations. The conversion of fossil fuel consumption to a land area is based on the amount of forest land needed to absorb the carbon dioxide released from burning a particular fossil fuel. No account is made, however, of other pollution caused by burning fossil fuels (for example, Indian gasoline is still leaded and 90 per cent of airborne lead is caused by vehicle emissions (Laxmi, Parikh & Parikh 1997), the associated health and social impacts, and environmental damage caused by mining and refining fossil fuels. These are all impacts which are difficult to include in the footprint calculations, yet can have a significant impact on the sustainability of a region. In Manali, the unaccounted for impacts of increased fossil fuel dependence include air pollution in the form of vehicular and generator exhaust fumes, water pollution from the release of fuel[25] into waterways, soil pollution[26], and the actual and potential health implications of this pollution.

While the changes in the per capita energy footprint of Manali residents are relatively obvious, those in the other land categories are not as straight-forward. At first glance, it appears that from 1971 to 1995 there were no significant changes in the amounts of arable and pasture land required by Manali residents. As with the fossil energy footprint, however, the per capita footprint presents an incomplete picture. Agricultural practices have changed substantially over the 24 year period considered in this study and, in particular, the use of fertilizers, pesticides and herbicides has significantly increased the productive potential of the world's agricultural regions. Since the per capita EFs of arable and pasture land areas are based on the world productivity or yield of a particular crop or animal product, the higher the productivity of the item the lower the per capita footprint. Between 1971 and 1995, the annual productivity of world average animal product increased from 61 to 82 kilograms per hectare, a rise of 134 per cent, and the world average annual productivity of cereals increased an average of 152 per cent. Similar changes also occurred in the productivity of Indian crop and animal products (see Appendices 1A and 1B). Had the productivities of agricultural products remained the same throughout this time period, the Indian per capita EF for arable land and pasture would have been much higher.

While higher yields tend to decrease total per capita EF by allowing more of an agricultural product to be produced in the same land area, it would be naïve to assume that gains in productivity have been won without significant environmental costs. In many cases, the high yields of modern farming are won by increased chemical use and extensive irrigation. The chemicals sprayed on

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[25] Transport truck drivers and bus operators were seen dumping oil from oil changes directly into the Beas River.

[26] In the Manali area, oil drums are left "stored" in many open locations where residual oil can seep into the soil and children or others can directly play with them.

agricultural fields, however, are destroying the very properties which hold soil together, thus decreasing productivity in the long run. They are also causing water, air and atmospheric pollution and generating a myriad of unpleasant health effects. For example, the runoff of chemicals from farm lands is causing algal bloom and eutrophication in many lakes and studies have linked the prevalence of non-Hodgkin's lymphoma in farming regions to the use of the herbicide 2,4-D. Nitrogen fertilizer may be contributing to both global warming and ozone depletion and nitrates in groundwater have been linked to blue baby syndrome and cancer (Eisenberg 1998). The heavy use of such chemicals, though often associated with the large-scale, monoculture farming of the North American Plains, is becoming increasingly common in other parts of the world, including India. In Kullu District alone, the consumption of fertilizers has increased from 611.6 tonnes in 1971-72 to 1,822.74 tonnes in 1994-95 (Directorate of Statistics and Economics, Himachal Pradesh 1971 & 1997). As farmers in the Kullu District adopt the practices of chemical farming, it can only be assumed that this region will experience similarly negative impacts.

Modern farming also consumes an enormous amount of water, another factor not included in the EF of food production. It is estimated that it takes about 1,000 tons of water to produce one ton of grain. To meet agricultural demands, many regions are already consuming more water for agriculture than can be sustained (Lazaroff 2000; Postel 1999). Worldwide, more irrigated farmland is lost to salt, groundwater depletion and other causes than is won by new waterworks and some are predicting that water scarcity will lead to rising grain prices in the coming decades (Eisenberg 1998; Lazaroff 2000). In India, water demand is now almost double the sustainable yield of the country's aquifers. As India's wells run dry and irrigation is becoming increasingly difficult, some have argued that the corresponding decrease in grain production could lead to widespread starvation and death for millions (Lazaroff 2000; Postel 1999). Fortunately for Kullu residents, the amount of irrigated land in the District has actually decreased from

2,482 hectares in 1971 to 2,232 hectares in 1995. Unfortunately for Kullu residents and the visiting tourists, much of the food consumed in the region comes from other parts of India where this is not the case.

Finally, the agricultural industry tends towards monocultures and this has served to simplify the landscapes of many of the world's regions. Forests, grasslands and wetlands have all been replaced by less diverse agricultural ecosystems (Eisenberg 1998). In the Manali region, individuals interviewed commented on the loss of forests for cropland and orchards. This has reduced available habitat for endemic wildlife and is contributing to the loss of thoroughfares used by wildlife populations. As well, some individuals commented on the decrease in the varieties of apples grown in the region, with only a few orchards still growing the original apples of the Kullu Valley. This decreased diversity could pose economic problems should a common variety of apple be subject to disease or fail to produce well in a given year. It is this inability of EF analysis to account for ancillary environmental impacts and differing production techniques that has generated the most severe criticism (Holmberg *et al.*, 1999; Levett 1998a).

With respect to forest land, the amount of land required per capita in India has actually decreased by 50 per cent over the 24 year period, from 0.2 to 0.1 hectares per capita. This does not mean that Indians are consuming fewer forest products today than they were 24 years ago. In fact, consumption per capita over the 24 year period has actually increased from 0.18 tonnes per year to 0.21 tonnes per year. The reason for the decrease in per capita footprint has more to do with a decrease in the equivalency factor for forest land than any significant changes in consumption. The changes in equivalency factor, however, cannot be commented on adequately because the productivity of forests was assumed to be the same in both 1971 and 1995. Regardless, it is still worth noting that Indians are consuming more wood products now than in 1971. This trend may also hold true for Manali, despite the fact that efforts have been made to halt deforestation.

One of the more common environmental complaints of those interviewed in Manali was that residents of both Manali and the surrounding villages were illegally felling trees and selling them on the black market. All of the hotels in the area use wood for their construction and rumour has it that much of this wood is purchased illegally from individuals who "steal" wood from the forests. The need for wood for the purposes of hotel construction did not exist in the area 25 years ago and the increased demand for this commodity would definitely increase Manali's footprint for forest products. In addition to wood for construction, many residents and some of the hotels heat their water with wood-fired boilers and their rooms with metal tandoors or wood burning stoves. While this practice has been common for many years, the additional heating requirements of a tourist population increase the amount of wood needed for this purpose. Manali is also an apple producing region and the apples are boxed in wooden crates before they are shipped to market. Although the government has special eucalyptus plantations to grow wood for these boxes and farmers are apparently not cutting local forests for this wood, it is still a consumption item that must be taken into account.

The final two land categories, built-up area and sea space, show a small decrease and a small increase in per capita footprint, respectively, over the 24 year period. The small decrease in built-up area is likely due to the poor accounting of built-up area in EF analysis. The only category under which built-up land is considered is the area of flooded land created following the development of a hydroelectric dam. No account is made of the fact that Manali town itself has grown from 1.8 to 3 kilometres square or the fact that the region surrounding Manali has also experienced significant growth. Additionally, no data were available for the area of land flooded behind hydroelectric dams in India so the global estimate of 1,000 hectares per gigajoule of energy produced had to be used. Based on interviews with Manali residents, as well as individuals who have visited the area at different time periods throughout the last ten years, it is reasonable to assume that the built-up area of Manali has actually increased and that the footprint calculations are wrong. The small increase in the sea space required per capita for Indian residents is largely due to an increase in consumption per capita. This footprint component is likely to be smaller for Manali residents because they are so far away from the sea that the consumption of marine fish is not common. Manali residents do, however, consume freshwater fish, most notably trout, from the Beas River and its tributaries, as well as from fish farms. This has not been accounted for in the footprint calculations.

The purpose of the preceding paragraphs is to illustrate the differences in per capita footprint between 1971 and 1995 for Manali residents, and to highlight some of the inadequacies of this analysis to account for changes that have occurred. Despite all of the potential accounting errors and oversights the per capita footprint of Manali residents still increased over this 24 year period. This is a strong indication that on an individual basis the choices people are making and the consumption habits they are developing are moving towards the unsustainable consumption patterns of the Western world. At this time, however, the per capita footprint of Manali residents is still well below the 4 to 10 hectares per capita of the average Westerner (Wackernagel *et al.* 1999).

### *9.1.2 Manali's Shrinking Land Base*

Although the per capita EF of Manali residents is still well within the 3.4 hectares per capita available worldwide, the amount of land available per capita in India and Himachal Pradesh has actually decreased. In 1971, the land available per capita was 0.8 hectares, as compared to an EF per capita of 1.1 hectares. By 1995, the land available per capita in India had shrunk to 0.7 hectares, while the EF per capita had grown to 1.3 hectares. Such changes indicate greater competition for land and resources among India's residents. Fortunately, Himachal Pradesh with its lower population density still provides enough land per capita for its residents. In 1995, the per capita land available was 2.3 hectares. The composition of this land, however, is slightly different than that of the per capita EF. While Himachal Pradesh provides its residents with ample forest resources, the arable land and pasture land per capita are each 0.1 hectares lower than the per capita EFs of these land types.

Although there were no data available to adequately estimate the land available per capita in Manali, literature and interviews with local residents indicate that it has decreased substantially over the last 24 years. Most notable is the loss of arable land and pasture land to the concrete, biologically unproductive landscape of hotels, restaurants and roads. Areas that were once orchards have been converted to large hotel developments and those which remain as orchards sit as isolated, fenced in areas. Adjacent to Manali, hotel developments through Aleo, Prini and other local villages have also claimed once productive land areas.

## 9.2 Tourists versus Local Footprint

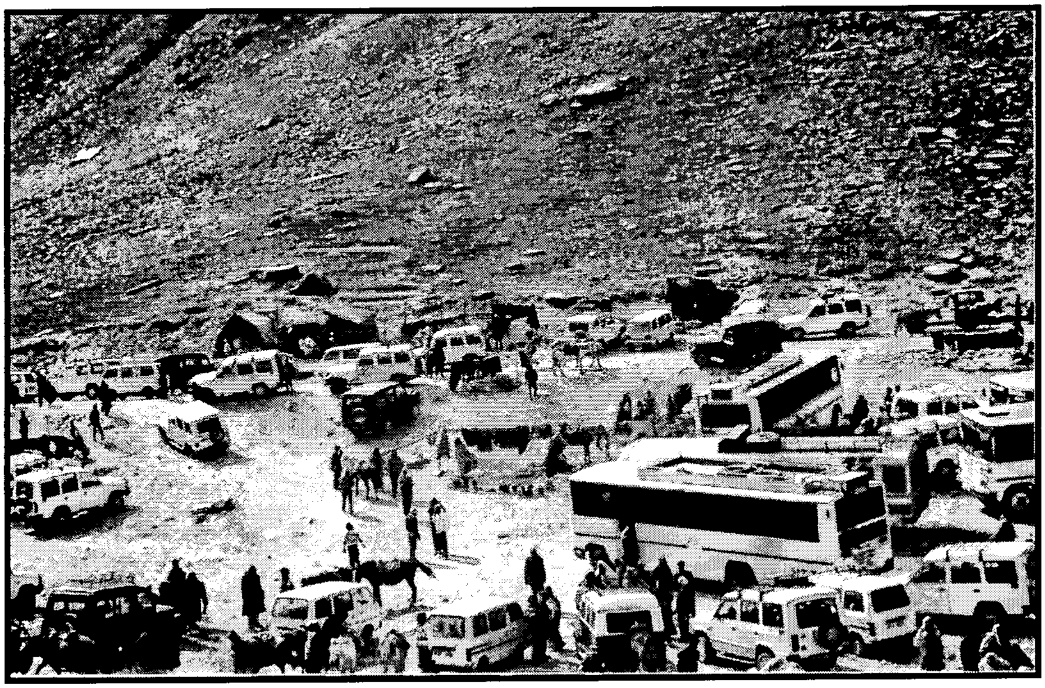
For both 1971 and 1995, the per capita footprint of foreign and Indian tourists was assumed to be the same as that for the average Indian. Although this assumption is more realistic for Indian tourists than it is for foreign tourists, there is a lot of evidence to suggest that the per capita footprint of all tourists is actually much higher. When tourists come to Manali, all of them stay in hotels and most of them eat in restaurants. Providing these amenities requires, among other things, the mining of stone, the cutting of trees and the consumption of available land in the Kullu Valley. Many of the products used in these facilities, from food to sheets, come from outside the Kullu Valley, increasing the influence of imports in the real footprint of the average tourist. Based on interviews in Manali, foreign tourists may actually have a larger per capita footprint than Indian tourists because they are more likely to stay in Manali's larger hotels and eat in its more expensive restaurants than their Indian counterparts.

Tourists to the area have also catalyzed an explosion in the number of taxis, auto-rickshaws and buses. There are currently over 90 buses, 550 taxis and 250 auto-rickshaws operating in the Manali area. These vehicles are consuming fossil fuels, releasing noxious fumes into the atmosphere, and creating noise pollution throughout Manali town. All of the buses and many of the taxis have diesel engines which are less efficient than gasoline engines and, as a result, release greater carbon emissions into the atmosphere. The auto-rickshaws, in addition to being loud, are also heavy polluters because they have two-stroke engines which burn a mixture of oil and gas.

Many of the activities engaged in by tourists while in Manali also deplete natural resources in the surrounding area. Most Indian tourists come to Manali because of the beauty of the Kullu Valley and its proximity to snow, while foreign tourists come to the mountains for trekking. Although different, both activities can have a significant impact on Manali's surrounding environment and on the footprint of its tourists. During the high season, between five and six thousand tourists a day visit the Rohtang Pass. These trips require buses and private vehicles which consume fossil fuels and release harmful fumes into the environment. The large number of people who visit Rohtang has led to the development of tea stalls and other food shops along the route and at the pass, all of which rely on kerosene and wood fuel for their operations. As well, most of the food sold at these establishments is served in disposable packaging. Since there are few garbage bins in the area, almost all of this waste ends up as litter strewn throughout the pass (see Figure 9.2). Trekking, although a low emission activity, also has its share of environmental impacts. The depletion of fuel wood along popular trekking routes is common, as is the presence of copious quantities of litter, including tetrapaks, plastic bags, and tin cans (Himachal Helicopter Skiing 1998;

Rao 1998; Sharma 1995; Sharma 1998b; Singh 1989; Tiwari 1990). Erosion is common along trekking routes and so is the destruction of local flora and fauna and the disruption

**Figure 9.2 Tourists at Rhotang Pass have lead to the development of tea stalls and, in the process, the generation of litter throughout the area.**



of animal habitats (Qasim 1996; Sharma 1995; Sharma 1998b; Singh 1989; Tiwari 1990). It is interesting to note that despite these impacts, Manali residents indicated in interviews that they would like to see more tourist areas developed, have tourists remain in Manali for a longer period of time and expand the tourist season. While the economic basis for such thinking is understandable, any further expansion of tourism can only magnify the negative impacts it is already having in the region.

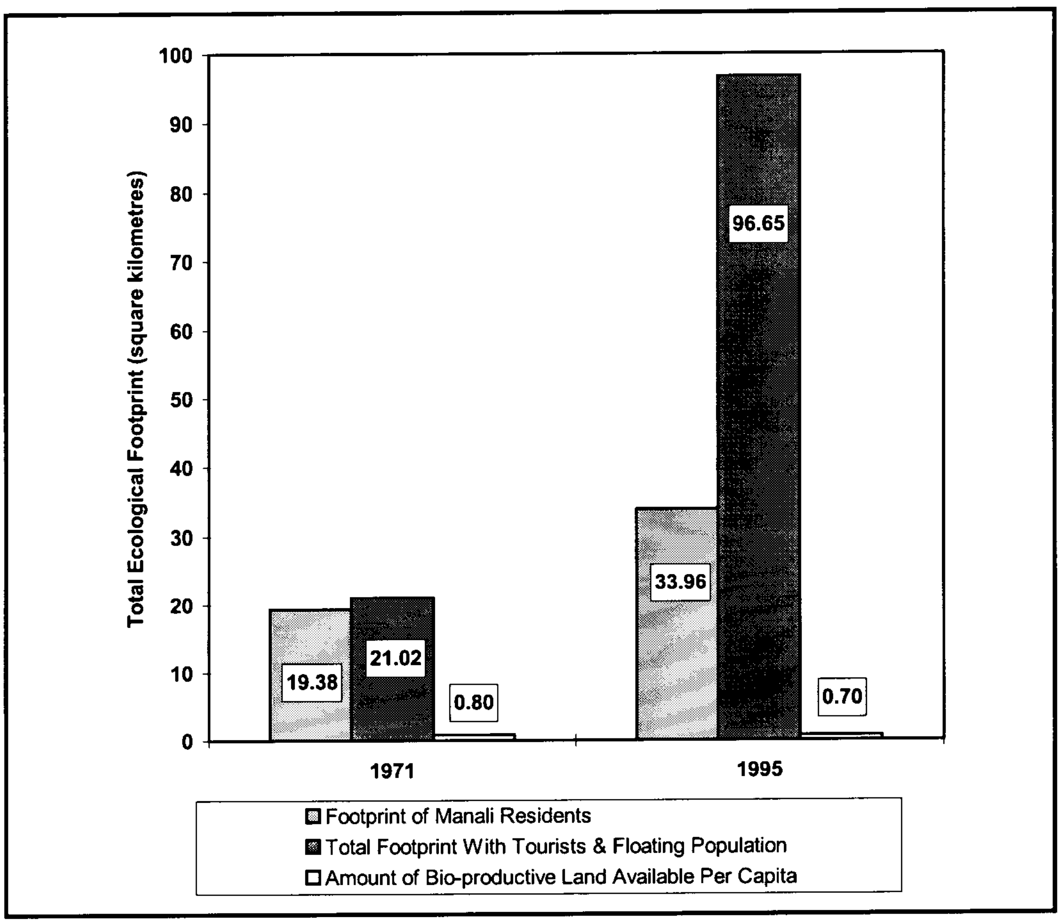
Assuming that annual income is a direct indication of consumption habits, the calculation of the distribution of EFs supports the notion that there are great differences between the footprints of Manali residents and those of its tourists. Based on this analysis, the average Indian tourist has an EF that is 5.2 to 8.6 times larger than that of an average Himachali. The difference for foreigners is even more pronounced, at about 10.5 times greater than that for the average Himachali. This would suggest that although there are fewer foreign tourists, their impact on Manali's true EF is significantly greater than that of the individual Indian tourist. The economic distribution of per capita EF also supports the notion that it is the wealthier, middle class Indians with more disposable income available for travel who have an EF not only greater that that of the average Manali resident, but also greater than that of the average Indian. Although there are some problems with the use of income as a measure of consumption (see Section 3.4 A), there is evidence that this is a good assumption for tourists to the Manali area. While tourists are in Manali, they purchase consumer items and souvenirs like Kullu shawls and caps, woolen socks and mittens, and other trinkets which the average Indian would not have the income to afford. For example, in 1988, the average tourist spent approximately 2,034 Rupees per four-day stay in Manali, of which 420 Rupees (21 per cent) was spent on souvenirs and gifts (Singh 1989). Considering that the average Himachali has an annual income of 8,759 Rupees, or 730 Rupees per month, it would seem that tourists are spending a substantial amount of money in a four-day period on what are essentially frivolous items. As for winter tourism, a recent study done by Himachal Helicopter Skiing estimated that a single couple staying at the Holiday Inn in Manali for a week spends over three thousand US dollars in purchases and extras over and above the fee they pay to Himachal Heli-Skiing (1998). This equates to approximately 120,000 Rupees, or 14 times the average annual income of a Manali resident.

## 9.4 Manali's Enhanced Footprint

The increase in per capita footprint of Manali residents and its tourists, as well as the sheer number of tourists now visiting Manali each year has served to significantly increase the footprint of Manali town. Between 1971 and 1995, the total EF of Manali town increased from 2,102 hectares (21.02 square kilometres) to 9,665 hectares (96.65 square kilometres) (see Figure 9.3). Had the footprint of

Tibetan refugees living in Manali been included in the calculations, the local resident footprint would have tripled and the total 1995 EF would have increased to 16,165 hectares. Even excluding the Tibetans, the calculations still indicate a five-fold increase in the total EF of Manali town, of which 80 per cent can be attributed to tourism. While the total EF of Manali residents increased by 1,393 hectares (13.93 square kilometres), that of tourists and seasonal workers rose by 7,563 hectares (75.63 square kilometres) over the 24 year period.

**Figure 9.3 Changes in Manali's Ecological Footprint 1971 & 1995 -**



To put these values into perspective it is important to remember that the size of Manali was approximately 1.8 square kilometers (180 hectares) in 1971 and 3 square kilometres in 1995 (300 hectares). This means that in 1971 the footprint with tourists was about 10 times greater than the size of Manali. By 1995, even with the growth in area of the town, this footprint had expanded to be almost 25 times greater than the area of Manali. Such a substantial increase is a sign that Manali is moving away from, rather than towards, urban sustainability. It also highlights the magnitude of the impact of tourism in the Manali area, despite what is in all likelihood a gross underestimation of that impact in the calculated values.

Not only is the EF of individual tourists to Manali likely greater than the value used for this study, the cumulative impact of these tourists is bound to exceed the sum of their per capita EFs (Sharma 1995). Even if the individual footprints of all tourists are equal, it only makes sense that the impact of 300,000 tourists in an area would be much, much greater than the impact of only 30 tourists. There is no adjustment factor, however, in EF analysis to account for this difference. The analysis also fails to account for the impact the large numbers of hotels and restaurants are having on the region, and the atmospheric and noise pollution created by auto-rickshaws, taxis and buses. These impacts can be quite significant. A recent study by the G. B. Pant Institute found that during the peak tourist season there is a sharp increase in suspended particulate matter in Manali, to levels that are up to 18 parts per million greater than the prescribed level of 100 parts per million (Lohumi 1998).

Economically, the increased tourist footprint indicates a growing reliance on tourist Rupees in the Manali area. Tourists are much like an imported resource - their supply could be cut off at any time. Relying so heavily on this single industry threatens the long-term sustainability of Manali because disruptions in the flow of tourists could completely devastate the local economy. The fear that tourism will disappear looms large in the minds of Manali's hotel and restaurant operators. Already many of them are having trouble breaking even during the year and the prospect of even fewer tourists would likely drive them out of business. Many of those interviewed mentioned their concerns about what will happen if Kashmir ever reopens for tourism. The fear of losing tourist dollars is undoubtedly a key factor fueling the desire to have more tourist attractions developed in the Manali area. It also underlies the common concern about the state of the local highways. Landslides and road closures equate to fewer tourists and bolster the opinions of many Plains dwellers that Manali is difficult to access and a risky holiday choice. Although a collapse of Manali's tourism industry would be devastating, the impact on local people might be less than first thought. Many of the hotels and restaurants are owned by individuals who reside outside of the Kullu Valley. The outsider presence in Manali is so great that the local government has seen fit to ban the sale of land in the area to non-Himachalis. As with many such legislative enactments, however, enterprising individuals can always find a way to circumvent the law and do. Manali's hotels, in particular, have an especially large ownership from outside the area because many local owners have sold their establishments to large hotel-operating conglomerates from the Plains. While this is presently a problem because fewer of the economic benefits of these businesses are accruing to local individuals, in the long run it might be a blessing in disguise.

The overall increase in Manali's EF also signifies the town's increasing dependency on outside sources for food, energy, housing materials and other goods - a finding corroborated in interviews with hotel and restaurant operators, and produce and bulk foods vendors in Manali. As Manali's residents turn more and more to outside resources they are beginning to acquire unaccounted for 'ecological deficits'. This threatens both the ecological and economic sustainability of the town and means that Manali is less able to cushion itself from possible economic disruptions and discontinuities in resource availability (Wackernagel *et al.* 1993; Wackernagel & Rees 1996). Although most of

Manali's imported goods come from within India, the region is still vulnerable to supply disruptions because of the unreliability of the transportation system. Road access to and from Manali, particularly during the monsoon season, is under constant threat from erosion, debris torrents, landslides, rockfalls and snow avalanches. Flooding has posed a particular problem in recent history, with the main Kullu to Manali road having to be closed for several months following a major flooding of the Beas in July, 1993 (Gardner 1995).

Manali's total EF may also be much larger in reality because personal water consumption and waste production are not included in the analysis. The consumption of water for agricultural purposes has already been discussed, but personal water consumption must also be on the rise in Manali as the number of tourists multiplies. Many of those interviewed complained that throughout the tourist season there is a shortage of water during certain peak hours, a condition that was extremely rare prior to the development of tourism in the area. Individuals also mentioned that the quality of water has degraded to the point where even "Indian tourists get sick drinking it". In fact, the Himachal Pradesh State Pollution Control Board has determined that the quality of water passing through Manali degenerates from pristine quality to 'B' and 'C' classes; the result of an increase in biological oxygen demand from 0.1 to 0.3 parts per million, a decrease in dissolved oxygen from 9.5 to 8 parts per million, and a rise in coliform count from 2 to 7 parts per million (Lohumi 1998). Tourism and urban development, it would seem, have also created water pollution - an additional component not included in the EF.

The failure to adequately account for wastes in Manali's EF is another major omission in the application of footprint analysis. Over the last 25 years, waste has increased substantially in the Manali area and in all of the Kullu Valley. In the early 1970's wastes consisted primarily of food and it is likely that most of the vegetable wastes were fed to cows and other domestic animals. By 1998, the year of this study, the situation in Manali had changed dramatically. There is now enough recyclable garbage in the town to support three scrap dealing operations. Interviews with local hotel operators indicate that the bulk of the garbage at most of these hotels constitutes wastes that are not readily biodegradable, primarily packaging and food wrappers, paper, plastic water bottles and plastic bags. While restaurant operators indicate that the bulk of their garbage is food, many of them cited plastic water bottles and papers as the remaining constituents of their garbage. Glass and metals are also produced, but many of the hotel and restaurants save these for scrap collectors. Overall, the data indicate that approximately 3,000 kilograms per day of solid waste are produced in Manali. Of this, about 55 per cent is food waste, 12 per cent is paper, 6 per cent is textiles, 8 per cent is plastic/polythene, 4 per cent is glass and 16 per cent is metal and other wastes. The bulk of these wastes are produced in Manali town where most of the hotels and restaurants are concentrated.

Disposing of Manali's garbage requires both space for storage and time for decomposition - factors which contribute significantly to the actual size of Manali's EF. Informal recycling in the region through scrap dealers is a positive factor in reducing this waste footprint and should be more widely recognized as such. The garbage which is disposed of at Manali's garbage dump, including medical wastes, may or may not actually decompose at this site. Currently, Manali's official garbage dump is located 3 kilometres outside of Manali on the banks of the Beas River. Much of the garbage dumped here is washed away by the river, adding significantly to water pollution and creating a serious health concern since medical waste is also being carried downstream. Garbage which does not make it to the "official" dump often gets left in heaps at the side of the road or at other locations along the river bank. Much of the garbage is burned, both at Manali's dump and at other locations, releasing noxious fumes into the atmosphere. These can include sulfur dioxide, volatile organic compounds, nitrogen dioxide, carbon monoxide and suspended particulate matter, all of which give cause for a further health and environmental concern (Laxmi, Parikh & Parikh 1997).

The poor garbage disposal facilities in Manali were mentioned by residents as a serious issue that needs to be addressed by the town's Nagar Panchayat. Residents also expressed concerns about the fate of sewage waste which is piped directly into the river. Such waste diminishes the natural ability of the Beas to absorb pollutants and threatens to create more serious environmental and health crises in the region.

Garbage and the manner of its disposal not only has environmental impacts. It may also have negative social impacts. Many Manali residents were concerned and embarrassed about the amount of litter and the overall lack of cleanliness in their town. Litter in the form of plastic bags has been a particular nuisance in recent years. (This is interesting because in 1971 it is unlikely that plastics even existed in the region and today they constitute eight per cent of all the garbage produced in Manali.) These bags are non-biodegradable and most of them are not recycled. Their presence is reducing the aesthetic value of the region - a potential factor in deterring tourists - and is also being blamed for clogging turbines and decreasing production at hydroelectric stations on the Beas. Plastic bags can also cause intestinal damage and, in some cases, death to grazing livestock that accidentally eat the bags.

To address the issue, the local Nagar Panchayat decided to ban the use of polythene bags in Manali town in 1998. This is the second time such a ban has been imposed and there are mixed reactions about whether it will solve the problem. Some believe the ban will be successful because of the strong efforts of the Manali Nagar Panchayat to include local unions in the development and implementation of the ban. Others are not so sure about the impact the ban will have because it is only effective within Manali town limits and not the entire

Kullu Valley. These individuals are also skeptical about the town's ability to enforce the ban, given its poor track record on other issues such as bans on river mining and the construction of buildings greater than two and a half stories.

The above discussion has highlighted what is missing from the EF analysis of Manali in order to emphasize that the calculations represent an underestimate of Manali's true EF. Nevertheless, despite the deficiencies and the problems of calculation, there is little doubt that there has been a significant rise in Manali's overall footprint, a sure indication that the town is moving away from sustainability. Tourism in Manali is the leading source of most of the region's footprint growth and, based on interviews with local residents, most of its environmental and social problems. Tourism may also be threatening economic sustainability because of the town's increasing reliance on this single industry - a source of money which could vanish if, for example, Kashmir should reopen to tourists.

## 9.5 The Ebb and Flow of Manali's Annual Ecological Footprint

Manali's EF waxes and wanes with the flow of tourists to the area. In May and June the footprint is at its greatest, it decreases in July and August, rises again in September and November and then falls to its lowest point during the winter months. Assuming that tourism is inevitable, this seasonal flow of tourists to the region may actually be quite beneficial. The impact of 300,000 tourists traveling through Manali places substantial stress on Manali's local environment. The decreased tourism during the monsoon season and winter months provides an opportunity for Manali's local environment to regenerate and repair some of the damage done during the tourist season.

As for economic sustainability, the seasonal nature of tourism in Manali has both drawbacks and benefits. The main disadvantage is that Manali hotel and restaurant operators, as well as others in the tourism industry, must have an extremely busy and profitable spring season or they may make no money at all in that particular year. This is the reason that the bulk of the hotel and restaurant operators interviewed in Manali thought that local officials should be developing more tourist activities, particularly during the winter months. Many of the owners of these establishments are already having trouble making money and they would like to see tourism increased and extended throughout the year. Increasing tourism, however, may not actually bring much in the way of economic gain to these individuals. The reason they are not making money has more to do with market saturation than a declining number of tourists. There are simply too many hotels and restaurants in the Manali area. Were tourism to increase and/or extend into the winter months the saturation could actually get worse, with yet more players lured into entering the Manali market, increasing competition and reducing individual profits.

The principal economic benefit of tourism in the Manali area is greater employment opportunities for local residents, and the principal benefit of seasonal as opposed to year-round tourism, is that it forces a diversity of income sources. Since local residents can only live off the tourists for part of the year, they must resume their traditional way of life for the rest of the year or find other sources of income. Such income diversity provides a cushion of sorts if tourism, like the monsoon, should ever fail. If tourism in Manali were to extend into the winter months, many local residents would likely succumb to the lure of this lucrative and relatively easy income source. In the process, they could loss the income diversity necessary to provide a fallback should the local tourism industry ever collapse. The traditional, and far more sustainable, way of life is already under attack not only through the attrition of those who actually still live it but through the attrition of the natural resources that made it possible. By maintaining a diversified income, Manali residents are in effect inoculating themselves from a potential future disaster.

## 9.6 Summary of Ecological Footprint Findings

Changes in the EF of Manali town from 1971 to 1995 provide a strong indication that Manali is becoming less sustainable, particularly in an environmental sense. The reason the town's footprint has experienced such substantial growth is primarily due to the remarkable increase in tourism the region has experienced over the last 24 years. While this tourism has brought many economic benefits and increased Manali's national and international profile, it has contributed to environmental and social degradation in the region. The time has come for officials in Manali, the Kullu Valley and Himachal Pradesh to develop, implement and enforce local zoning and construction plans and regulations so that tourism does not completely destroy the natural beauty and tranquillity of the region - the very factors that attracted tourists in the first place.

# 10.0 The Challenge of Using Ecological Footprint Analysis in India

The difficulty of using EF analysis at a local level in a developing country like India deserves some attention. In short, employing this analysis at the local level in Manali was extremely difficult but for the most part not for reasons unique to Manali itself or its location. The problems encountered would have to be faced in the study of many other localities worldwide. The reasons for this are varied and are outlined below.

Firstly, calculating the EF of any region requires copious quantities of data. Production, imports, exports and embodied energy values are needed for all of the consumption items. Many countries do not collect these types of data at the national level. In India, as is probably the case in many other developing nations, the data which were available were often quite unreliable. Regional or town data were even rarer than national data and, again, unreliable. For example, statistics reported in the Statistical Abstract for Kullu District 1997 indicate a greater amount of forested land in the district than can possibly exist naturally! To actually collect the necessary data on one's own, however, would be extremely time-consuming and costly and next to impossible in the time frames and budgets allocated to most projects. As a result, statistics calculated by the Food and Agricultural Organization of the United Nations were the main source of data for Manali's EF. While these data can be considered reliable, they were calculated for the nation as a whole. Thus, it was difficult to distinguish unique footprint features in the Manali area. Instead, these characteristics had to be extrapolated from interviews with local individuals and literature about the Kullu Valley.

Even if the data required for footprint calculations were collected on a regular basis in the Manali area, actually obtaining these statistics would still be difficult. The data used in this report that were collected by the local government were difficult and frustrating to acquire. Government workers are hesitant to give out any information about the country, especially to foreigners, for fear of losing their jobs. Obtaining a government job in India is highly desirable and doling out government information, even that meant to be public, is considered a high risk to job security. These fears are heightened in Manali because of its proximity to Kashmir and the presence of an army base nearby in the village of Palchan. Not even the Kullu town planner has access to a reliable map of the Kullu District for "security reasons."

Data not collected by government, but produced by private institutes and organizations in India can also be difficult to acquire because they are often very costly. For example, a soft cover book on the consumption habits of Indian consumers sells for over one hundred Canadian dollars.

Finally, assuming that one could get reliable, local statistics for some of the items included in the EF calculations, there are few means available within the analysis itself to incorporate these data. Essentially, it is all or nothing. As a result, without comprehensive statistics for a given area, it may be futile to try and calculate locally specific EFs. If EFs are calculated for a local area using national data, they must be accompanied by additional information, such as from interview data and a literature review, so that potential differences between local and national per capita footprints can be identified.

# Section V -

# Conclusion & Recommendations

## 11.0 Conclusion

The ecological footprints (EF) calculated for Manali, in addition to the interview data and literature review, indicate that the town is moving away from sustainability - environmentally, socially and economically - and into a situation where it is relying increasingly on outside ecosystems. While Manali residents are certainly consuming more now than they did 25 years ago, the bulk of Manali's footprint growth has occurred as a result of tourism. The phenomenal rise in the number of tourists going to Manali, particularly in the last ten years, is definitely placing an increasing strain on the resources of this mountainous region. It is likely, however, that both the town's residents and its tourists are having a far greater impact than indicated by the results obtained in this study.

Despite the notable increase in the town's EF, the calculations are very conservative estimates of the 'true' EF of Manali. They use a very conservative estimate of the resident population and do not include the local Tibetan population because no reliable data on this population were available. In addition, the EF does not include waste and fails to account for the environmental damage caused by current industrial and agricultural practices. Locally, these impacts are quite noticeable. The region has suffered forest loss, air, noise and water pollution, increased incidences of flooding, losses of local wildlife and a general deterioration in the surrounding environment. As well, both garbage production and littering have increased dramatically.

Some may argue that the EF of Manali may actually be smaller than reported, since EF analysis fails to account for the efficiencies of denser urban living, particularly in terms of energy consumption. Certainly this is a recognized limitation of the analysis, but the efficiencies gained through Manali's urbanization are not likely to put a large dent in the dramatic increases in the town's EF. Much of this increase is due to increases in tourism, rather than an increased urban size. In addition, the greatest portion of the Indian per capita EF has been created by an increased consumption of consumer goods not produced in Manali.

Regardless of the EF results, urbanization and tourism will both characterize Manali and its surrounding environment for many years to come. For this reason, Manali residents must start to proactively address the negative consequences of these processes.

In terms of environmental resources, Manali residents need to asses whether additional tourist income is substantial enough to warrant the environmental costs being incurred as a result of this industry. They must also decide whether they are willing to allow tourists, particularly wealthy Indian outsiders and foreign tourists, to continue consuming the lion's share of the resources in the Manali area. Spending by a tourist couple of up to double the average salary of a local resident is not uncommon in a four-day trip to the Manali area. Considering the limited availability of resources in and around Manali, tourist consumption which exceeds the per capita availability of resources actually limits or excludes the use of those resources by other people, most notably local Manali residents (Wackernagel *et al.* 1993).

As well, it is likely that the most disadvantaged individuals in Manali are those who are suffering the most from the environmental impacts inflicted by those who are over-consuming. Informal talks with local individuals indicates that this has caused problems with the area's younger generation because they are eager to adopt the lifestyles of tourists but do not have the resources to do so. Watching tourists "waste" their money must also anger and frustrate the older residents, many of whom have worked demanding subsistence lifestyles in the mountains with few financial rewards. This may be what has led to comments like those made by hotel and restaurants operators, that local residents are rude to tourists and do not treat them with respect.

Certainly tourism has brought some additional sources of income to local residents, but most of the money generated by this industry is actually flowing to outside hotel owners and tourism operators. The money that does stay in Manali is highly seasonal in nature and has the long-range benefit of forcing local residents to diversify their incomes. Manali residents and tourists have also become increasingly dependent on outside sources for food and other consumption items. In particular, the region's dependency on outside sources of fossil fuels, arable land and pasture land have increased dramatically. Such dependence places the people of Manali in a precarious position because they are relying on resource flows over which they have little control. The supply could be cut off at any time and Manali residents would be forced to find alternative sources or fend for themselves. Although it might be argued that the situation is not overly critical because the products being imported come from within India, it is important to remember that Manali is at the mercy of an unreliable road system subject to frequent closures.

One of the more beneficial aspects of EF calculations is the ability to isolate those consumption items and waste types that are having the greatest impact on the footprint and, hence, the sustainability of the area under study. This is important for several reasons. Firstly, in an area where demands on scarce resources are escalating, the analysis identifies the primary resource needs of the local economy. In so doing, it provides an opportunity to compare those resource needs to the productivity of the resource stocks available and to determine whether the stocks will be able to meet the area's needs in the future - a factor certainly important for the long-term sustainability of Manali (Wackernagel *et al.* 1993). As well, identification of an area's main consumption and waste products offers insight into the policies and programs that would be most effective in increasing the sustainability and ecological efficiency of the area. The latter point is particularly important for developing long-term sustainability in the Manali region.

Based on the results of the EF calculations, local interviews and the literature reviews, officials in Manali, the Kullu Valley and Himachal Pradesh should be focusing on waste management, decreasing fossil fuel dependency in the area, developing eco-friendly tourism, and increasing the environmental awareness of tourists and residents. It could be argued that limiting tourism, not encouraging it, is the most critical need in the area. It is unlikely, however, that any steps taken to curb tourism in the region would be greeted with much enthusiasm. Rather, Manali residents and others throughout the Kullu Valley should accept tourism as inevitable and work with the tourists to create sustainable solutions that everyone can accept.

## 12.0 Recommendations

Based on the conclusions of this study, the following recommendations address the issues of waste management, fossil fuel dependency, eco-friendly tourism and raising environmental awareness. Addressing these four major issues with a series of workable policies and programs would go a long way towards ensuring a sustainable future for the people of Manali.

It is important to note that the policy recommendations being made are intentionally conservative and focus primarily on smaller, community level projects. The interviews in Manali suggested that residents and policy-makers tend to think grandly, rather than practicably in terms of environmental management. Enforcement of regulations, regional land-use planning and better waste and sewage disposal facilities are all extremely important and necessary measures, but in reality the resources do not exist for their effective implementation. The hope is that these policy suggestions will highlight the beneficial impacts of smaller, well-thought out programs. The success of these types of programs will help to lay the foundation and provide the community support necessary for moving to broader-based environmental management regimes in the future.

### Waste Management

Waste management is a serious issue in the Manali region. The lack of proper waste management affects not only the environmental, health and social well being of the residents, but it can sour Manali's reputation as a preferred tourist destination. It would be easy to recommend that Manali construct a better situated, modern landfill or incinerating facility. The fact is, however, that the local government is well aware of the need for better waste disposal facilities and has made several proposals to the state and federal governments to receive funding for this type of project. To date, nothing has come of their efforts.

This lack of response, however, does not mean that the town cannot do things for itself to reduce or at least better control the amount of garbage ending up in the landfill. The density of urban areas like Manali can create greater opportunities for recycling, waste collection and community composting programs (Sattherwaite 1996). In addition, municipalities that recycle wastes can simultaneously save money, land and fresh water for other uses (Brown & Jackson 1987). Manali residents should work with this potential and create a sophisticated program of composting and recycling. Wastes could be separated according to type and returned to the natural environment or re-used. Municipal dustbins could be set-up with three separate sections - biodegradable (food wastes), recyclable (paper, metals, glass and hard plastics), and non-recyclables (soft plastics, cardboard and textiles). Simply providing more municipal dustbins would be a big help since residents are already complaining that they have too far to walk to get to the existing dustbins. As a result some people take the easier option of simply throwing their garbage on the street and in the ditches. Bins for recycling could be created by cleaning and painting the old oil drums that currently lie rusting in piles throughout the area (see Figure 11.1). This should not be too costly a venture and could be done as a community service/volunteer activity by local residents or by involving local high school children.

Once separated, the garbage can be disposed of in an environmentally appropriate manner. The non-recyclable items could be collected by the local garbage collection crew and deposited at the current landfill site. While this site is not ideal because of its location, it is all that is available at the moment. The reduced stream of garbage should at least minimize the pressure on the site.

For the compostable garbage, the town Nagar Panchayat could designate a composting site. The compostable garbage could be collected by the town garbage collection crew and deposited at this site for composting. The garbage

**Figure 11.1 Empty oil barrels left to rust at the side of the Kullu-Manali road**

collection crew would also be responsible for maintaining the site. Once composted the mulch could be sold to local farmers and gardeners as fertilizer at a reduced rate. This would have the additional benefits of encouraging local farmers to use natural, rather than chemical fertilizers. The money recovered from selling the mulch could be applied towards the costs of maintaining the site.

Finally, the collecting of recyclable items should be the responsibility of the local scrap dealers and their networks of collectors. Those people and businesses who do not want collectors at their premises can simply deposit their recyclables in the correct container at the site of a municipal dustbin. If considered necessary the collector system could be formalized through a town licensing system for legitimate collectors/scrap dealers. The Nagar Panchayat could also offer collectors gloves and boots at subsidized rates to adequately protect them from health hazards. These initiatives would serve to recognize the importance of the service being provided by the scrap dealers and collectors to the people of Manali, and lend a semblance of dignity to a profession that has been otherwise marginalized as socially inferior.

Any strategy, such as that suggested above, needs to be accompanied by consultation with local households and businesses. Ownership of a program by those being served can go a long way towards ensuring its success. For example, the current polythene bag ban in Manali is expected to be a success because the Nagar Panchayat consulted with local unions in the development of the ban. Thus, the Nagar Panchayat should allow residents and business owners a means to express their concerns and to influence the development of a waste management strategy. Once the plan is operational, educating the public as to its purpose and benefits will be crucial to its ongoing success. A thorough advertising and awareness building campaign could be undertaken to emphasize the benefits of recycling and composting, starting with the local schools. The young people of Manali are the ones who will bear the consequences of improper environmental management. Their understanding and involvement could be a significant influence on their elders. As elsewhere in the world, including our own back yard, people have to be sold on the idea that the extra effort involved today in such simple tasks as separating their garbage is much less of a nuisance than in the future coping with what may be life-threatening environmental problems.

The success of such a program in Manali could be used as a model throughout the Kullu Valley to create similar programs in other towns and villages. In this regard, the Nagar Panchayat should actively promote their program because the cleaner the entire Kullu Valley, the greater its overall attraction to tourists. There may also be opportunities to create joint waste management programs with nearby villages. For example, villages without garbage collection services could contract the Manali Nagar Panchayat to collect their garbage, as well as encourage Manali collectors to come and gather their recyclables.

Fossil Fuel Use

The largest component of Manali's footprint is attributed to fossil fuel use. Fossil fuels are imported from outside of the Kullu Valley and, in most cases, come from outside of India. This heavy dependence on a scarce imported resource is dangerous economically and the burning of fossil fuels can have dire environmental consequences. Steps should be taken at both the local and state level to try and reduce this heavy dependence on imported fossil energy.

Locally, Manali town officials could develop a strategy to limit the number of taxis and auto-rickshaws in the area, as well as the unnecessary use of these vehicles for short trips within Manali. For example, a stringent licensing system could be implemented to limit the number of taxis and auto-rickshaws available in the Manali area. This, however, requires enforcement to ensure that people abide by the regulations, and enforcement in turn requires money. It may be necessary, therefore, to create a district-wide initiative with proper funding from the state government. The cost of the licenses could be used to offset some but certainly not all of the monitoring expenses.

There is also a need to reduce the unnecessary use of these vehicles in Manali town. Rickshaws and taxis are loud, spew unhealthy emissions and can cause hazardous conditions for those people trying to walk on the main Mall or up to the Hadimba Temple. They are also part of the reason traffic jams are so common in the area. The HPTDC and town of Manali could jointly develop initiatives to promote more environmentally friendly means of transportation. For example, it would be beneficial if the HPTDC could rent bicycles to people at a reasonable cost for journeys around the Manali area. This would be non-polluting and would create an alternative tourist activity.

The town could also build better walking paths and sidewalks to local attractions like the Hadimba Temple and the Forest Education Centre. Tourists would have more ready access to these sites by foot and, at the same time, would be encouraged in general to walk more throughout the Manali area. This might have the indirect effect of reducing the need for more rickshaws and taxis although the effect would definitely be subject to the tourists' willingness to expend some personal energy. Whether tourists would walk or not is questionable, although there are examples of cases where tourists have been willing and pleased to walk provided they are not threatened by an onslaught of vehicles. A good example is Shimla hill station which has banned vehicles on its Mall. It remains an extremely popular resort despite the fact that its tourists must walk to all of the local tourist attractions.

Another suggestion is to close the Mall to vehicle traffic during certain busy hours of the day. This would require bus schedules to be changed to accommodate this ban. Closing the Mall during certain peak hours would create an environment that is more relaxing for tourists and residents and easier to negotiate on foot.

At the state level, government officials should be promoting the use of alternative energy sources, like solar-power. For example, hotel operators and household owners could receive tax incentives for installing solar panels. Although expensive today the cost is coming down. These type of systems could be backed up with hydro-electric power supplied by mini-hydel projects. Excess hydro-electric power could be sold out of the state to help cover the costs of subsidizing alternative energy sources. The reliability of hydro-electric power and its transmission also needs to be improved so that individuals are not relying on diesel generators during low energy periods.

Eco-Friendly Tourism

Developing more activities for tourists to Manali was one of the hottest topics on the minds of local people. They have grand ideas of man-made lakes and cable cars running up the sides of nearby mountains. While these would no doubt attract tourists, they would also carry significant economic and environmental costs. If local developers rush into building these types of projects it is likely that the development will occur in the unplanned, mish-mash manner that is already destroying the aesthetic value of the Kullu Valley. Rather than trying to manipulate the local environment through large-scale tourist developments such as the popular "lakes of Kashmir" notion, the developers would be better off promoting smaller, more manageable and more eco-friendly activities. For example, the Himachal Pradesh Tourism Development Corporation and others could rent bicycles for personal use or locally guided trips. Developers could play on the desire of tourists to experience something different by renting tandem bicycles or mountain bicycles.

Another activity which could be promoted is organized walking tours through the forest at the Forest Education Centre. This is one of the most underutilized tourist attractions in Manali. Tours through the forest could include a lunch and an educational exploration of the different plants and animals. Environmental issues in the forest should be high on the agenda for discussion. These are just two of the many ideas that could be successful in the Manali area and there is evidence that Indian tourists do appreciate some of these more environmentally friendly activities. For example, Matheron hill station near Mumbai in Maharashtra, is a popular tourist destination that has completely banned motorized vehicles. Tourists go on small hikes through the local forest and are willing to take the two-hour toy-train journey or walk to reach the location. The town is overrun with tourists during the summer months, an indication of the desire of tourists to escape the noise, pollution and heat of large Indian cities (Menon 1998).

Hotel operators in Manali complain profusely about the cost of their house taxes. Rather than decreasing these taxes, the Nagar Panchayat should be using house taxes as a means of recouping some of the environmental costs of tourism. For example, the taxes collected could be used to develop better waste disposal and sewage treatment facilities or to improve Manali's drinking water supply. House taxes could also be used to encourage eco-friendly development. For example, rebates could be given to hotel operators who maintain large areas of green space around their properties, rather than selling or developing this land further. Similarly, rebates could be offered for hotels that invest in solar-powered energy or better waste disposal systems.

Finally, the Himachal Pradesh Tourist Development Corporation (HPTDC) should increase its monitoring of hotel prices. HPTDC regulates hotel room rates and house taxes are based on these rates. In the off-season, however, hotel operators reduce their room rates well below the regulated price. This has forced fierce competition among the hotel operators and because of the heavily reduced prices, it is very difficult for anyone to make any money, let alone pay the house taxes. This creates a system that is economically and socially unsustainable. HPTDC should implement better enforcement and fine hotel operators who are undercutting their rates. While this will be difficult, it should stabilize hotel prices in Manali so that operators, particularly local operators, are able to make a living during the off-season.

### Raising Environmental Awareness

For any of the above programs to be effective, the town of Manali, in association with other villages in the Kullu Valley, needs to develop an environmental awareness campaign targeted at both residents and tourists that will be comprehensive enough to have the desired impact. This program should include initiatives undertaken by local governments, the district schools and the Himachal Pradesh Development Corporation (HPTDC).

Local governments, working with the HPTDC should develop an anti-litter campaign targeted at tourists and residents. Signs could be erected at certain points along the highway to Rohtang, as well as at the pass, which emphasize the problems of litter and encourage individuals to put their garbage back in dustbins in Manali - even if it means bringing it back down from Rohtang with them. HPTDC could encourage this behavior by placing large garbage cans in their buses for tourists and bringing waste back to Manali on behalf of tourists. HPTDC could further support such a program by placing anti-litter notices in their brochures for the region.

Tourists should also be made aware of the poly bag ban in Manali and encouraged to use their own jute bags or other reusable carrying cases. The town could actually sell jute bags to tourists as a souvenir item of the region. If the slogan "I ♥ New York" could overcome the mean image of that megalopolis, then why not "I chose to protect the beauty of Manali". The point is to have each visitor take some personal pride in keeping the beauty of this Himalayan resort as pristine as possible for his or her own enjoyment and for the continuing enjoyment of those who call it home.

Finally, local governments should press the district's school boards to develop environmental awareness curriculum. The funding for such a program should come from the state government.

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# Appendix 1A

# Swedish model spreadsheet for the Ecological Footprint of Manali - 1971

# Appendix 1B

# Swedish model spreadsheet for the Ecological Footprint of Manali - 1995

# Appendix 2

# Summary of the interviews with hotel operators

## Large Hotels

| Number of Rooms | Months Open | Type of Tourists | Restaurant & Room Service | Garbage Generated per day | Type of Garbage | Garbage Collection | Scrap Dealers | Hotel Products | Hotel Improvements |
|---|---|---|---|---|---|---|---|---|---|
| 50 rooms | open all year - central heating and room heaters | Indians: 60% Foreigners: 40% | Restaurant | High Season: 20-25 kg/day Low Season: 5-10 kg/day | primarily food and kitchen waste | municipal corporation collects it daily | no scrap dealers | only vegetables bought locally, the rest is brought from Delhi | general maintenance work - painting, new furniture |
| 32 rooms | open all year - central heat and heaters for cottages | high season: mainly Indians low season: a lot of foreigners from July to September | Restaurant/Bar | High Season: 20 kg/day Low Season: 5 kg/day | mainly vegetable wastes | municipal corporation collects daily | collectors come about once a week for metal and beer bottles | everything purchased locally | none planned |
| 31 rooms | open all year - central heating | Indians: 90% Foreigners: 10% | Restaurant | High Season: 1 dustbin (6x6 feet)/day Low Season: 1 dustbin every 3-4 days | 80% kitchen waste and 20% room cleaning waste (primarily papers) | municipal corporation collects daily | collectors come once a month for bottles and iron things | most products from Delhi or Chandigarh. Food is purchased locally | no changes planned |
| 24 rooms | open all year - room heaters. Maximum of 8-9 rooms occupied in the winter | high season: 80% Indians low season: 80% foreigners | Restaurant | High Season: 10-15 kg/day Low Season: 500-600 g/day | primarily food and kitchen waste | municipal corporation collects daily | no scrap dealers | Fresh foods purchased locally. Other items and grains, rice, wheat, etc. from Chandigarh | none planned |
| 28 rooms | open all year - electric room heaters | Indian: 80% Foreigners: 20% | Restaurant | High Season: 30-40 kg/day Low Season: depends on occupancy | about 70% food and kitchen waste | sweeper takes to municipal dustbin 2 times daily | no scrap dealers | most products from Delhi | yes - preparing for the cold winter |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 23 rooms & 4 cottages | open all year - electric room heaters | Indian: 70% Foreigners: 30% | Room Service | | | taken to municipal dustbin | keep items for collectors who come every 2-3 months | owner from Delhi and bring products from Delhi with him | none planned |
| 21 rooms | open all year - electric room heaters. About 50% occupancy in winter | Indians: 85% Foreigners: 15% | Restaurant | High Season: ½ quintal/day Low Season: ¼ quintal/day | 75% vegetable peels and remainder are papers and packaging | take to municipal dustbin 2 times daily | collectors come 1-2 times per moth for newspaper, magazines, bottles, tin | most items for rooms bought in Chandigarh. Food is bought locally | general maintenance |
| 38 rooms | open all year - electric room heaters | Indians: 99% Foreigners: 1% | Room Service (restaurant under construction) | High Season: 2-3 buckets (15 kg)/day Low Season: 1 bucket/day | 50% papers and 50% food wrappers | have 2 sweepers that take garbage to municipal dustbin once daily | no collectors - throw everything in dustbin | buy raw materials locally and purchase furniture, carpets, etc. from Delhi | finishing the hotel - restaurant, gym, conference hall, indoor sports centre and 50-60 rooms |
| 20 rooms | open all year - provide blowers and heaters. Winter occupancy about 20% | Indians: 96% Foreigners: 4% | Room Service | High Season: 1 kg/day Low Season: ½ kg/day | 75% paper and 25% dust | hotel sweeper takes to municipal dustbin 2 times daily | no collectors | food is bought locally and hotel items are from Delhi | general maintenance |
| 20 rooms | open all year - electric room heaters | Indians: 95% Foreigners: 5% | Room Service - use restaurant across the street | High Season: 5-6 kg/day Low Season: 2-3 kg/day | food and papers | bring to municipal dustbin two times a day | no scrap dealers | | no - was renovated last year |

## Medium Hotels

| Number | Months | Type of | Restaurant | Garbage | Type of | Garbage | Scrap | Hotel | Hotel |
|---|---|---|---|---|---|---|---|---|---|

| of Rooms | Open | Tourists | & Room Service | Generated per day | Garbage | Collection | Dealers | Products | Improvements |
|---|---|---|---|---|---|---|---|---|---|
| 12 rooms | closed December and January - provide electric heaters if asked - 2-3 rooms in low season | Indians and Foreigners | neither | doesn't know | doesn't know | sweeper brings it to municipal dustbin 1-2 times a day | collectors come for beer bottles and newspaper | | none planned |
| 12 rooms | closed December until April - no heat, use boilers for hot water | Indians: 10% Foreigners: 90% | small kitchen with special order room service | High Season: 1 10 litre bucket/day Low Season: 1 10 litre bucket/day | 70% plastic water bottles | sweeper brings it to the municipal dustbin once daily | collectors come 2 times a year for water bottles, beer bottles, hard plastics and utensils | buy things from local markets | none planned - too many hotels in Manali and little business, therefore, little need to improve |
| 10 rooms | closed November until March - no heating | Indians: 95% Foreigners: 5% | Room Service, but food from a canteen across the street | High Season: 3-4 10 litre buckets/day Low Season: 1 10 litre bucket/ | 50% paper and 50% dust | take to the municipal dustbin | collectors come once a month for beer bottles | bedsheets, etc. from Delhi and the rest is purchased locally | no changes planned |
| 10 rooms | closed middle of October until April - no heating | 100% Indians because they do not want to fill out all the forms for foreigners | neither | 2 10 litre buckets/day | mixed garbage - before lots of polythene, but now papers, etc. | sweeper brings it to municipal corporation 2 times a day in the high season | no scrap dealers because don't allow liquor in the hotel | everything purchased locally | none planned |

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| 12 rooms | open all year<br>- electric room heaters<br>- about 50% occupancy in low season | Indian: 75%<br>Foreigners: 25% | full menu Room Service | High Season: 2-3 small dustbins/day<br>Low Season: 2-3 small dustbins/day | used to lots of plastic, now about 100% papers | sweeper takes to municipal dustbin 2 times daily | collectors come once a week for beer bottles and glass | hotel items are bought in Chandigarh, Mandi and sometimes Kullu and food is from local markets | adding another floor which is an additional 12 rooms |
| 10 rooms | closes in winter if weather is bad<br>- provides electric room heaters | Indian: 70%<br>Foreigners: 30% | Room Service for breakfast and snacks | High Season: 2-3 10 litre buckets/day<br>Low Season: 1 10 liter bucket/day | 50-60% biscuit wrappers, papers, and packaging | sweeper takes to municipal dustbin 3 times daily | collectors come for beer bottles 1-2 times a month | hotel items from Kullu and kitchen items from the local market | want to build a 3rd storey, adding about 5 rooms |
| 12 rooms | open all year<br>- electric room heaters<br>- often fully booked in winter | Indians: 95%<br>Foreigners: 5% | Room Service for tea, coffee and breakfast | High Season: 3-4 10 litre buckets/day<br>Low Season: 1 10 litre bucket/day | food, peels, papers | sweepers take to municipal dustbin 1-2 times daily | collectors come 1-2 times per moth for plastic and beer bottles | buy things from local markets | general maintenance |
| 10 rooms | open all year<br>- electric room heaters<br>- occupancy is 20-30% in the winter | Indians: 99%<br>Foreigners: 1% | neither | High Season: 5-6 kg/day<br>Low Season: 3-4 kg/day | 90% apers, packagin, polybags and 10% dust | sweeper takes to municipal dustbin 2 times daily | no collectors - | doesn't know | none planned |
| 11 rooms | open all year<br>- provide blowers and heaters<br>- January about 2-3 rooms/day<br>- February about 7-8 rooms/day | 40-50% Foreigners from July to September and primarily Indians the rest of the year | Room Service for snacks and breakfast | High Season: 1 small dustbin/day<br>Low Season: 1 small dustbin every 2 days | about 15-20 polythene bags a day before banning. Tourists bring bags so still common | hotel sweeper takes to municipal dustbin 1 time daily | collectors come every 3-4 months for beer bottles | buy hotel items like sheets, towels, etc. from Chandigarh and Delhi. All food bought locally | changing carpets in rooms |
| 15 rooms | open all year | Indians: 80% | Restaurant | High Season: | 60% paper | sweeper | collectors | almost all from | none planned |

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|---|---|---|---|---|---|---|---|---|---|
| | - electric room heaters and blankets | Foreigners: 20% | | 4 10 litre buckets/day<br>Low Season: 2 10 litre buckets/day | and biscuit wrappers. Rest is cigarettes and dust | brings to municipal dustbin three times a day | come once a week for beer bottles | Manali. Televisions, carpets, sheets, mattresses, etc. are from Chandigarh | |
| 18 rooms | open all year<br>- provide electric heaters if asked<br>- January: 3-6 rooms per month | Indians: 90%<br>Foreigners: 10% | Restaurant | High Season: 2 small dustbins/day<br>Low Season: 1 small dustbin/day | 90% food waste, 10% paper and plastic bags | sweeper burns everything at night | collectors come 2 times a week for bottles | buy food in the local market and hotel items in Merit, Uttar Pradesh | putting wooden panelling in the rooms |
| 10 rooms | open all year<br>- electric room heaters | Indians: 99.9% | Room Service for tea and coffee | High Season: 20 litres/day<br>Low Season: 2-3 litres/day | 50% paper and polythene bags | sweeper bring to the municipal dustbin 3 times daily in high season and in low season depend on clients | collectors come for beer bottles | buy everything locally | adding 4 rooms |
| 12 rooms | open all year<br>- electric heaters provided | majority are Indian | Room Service, but must order dinner in advance | High Season: 5-6 kg/day<br>Low Season: 1 kg/day | bottles, food wrappers, food waste | sweeper brings to municipal dustbin 2 times a day | collectors come 1-2 times a week for beer bottles | buy very little from the local market | none planned |
| 15 rooms | open all year<br>- provide electric room heaters if asked<br>- January to March about | Indians | Room Service | High Season: 2-3 kg/day<br>Low Season: 100-200 g/day | mostly paper | sweeper comes once every 5 days in low season and 2 times daily in the high | no collectors, sweeper takes everything away | food is purchased locally | renovate every 3 years - new carpets, etc. |

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|---|---|---|---|---|---|---|---|---|---|
| | 1 room occupied | | | | | season | | | |
| 11 rooms | open all year - provide electric heaters if asked - often completely empty from December to March | Indians | Room Service from nearby restaurant | High Season: 2-3 10 litre buckets/day | mostly papers and tourist garbage | sweeper brings to municipal dustbin 3 times daily | no collectors, sweeper takes everything away | | none planned |
| 17 rooms | open all year - provide electric room heaters | Indians: 95% Foreigners: 5% | Room Service - full menu | High Season: 1 20 litre bucket/day Low Season: 1 small dustbin/day | 50% vegetable matter from kitchen and 50% room waste. Room waste is 50% packaging and papers and 50% dust | take to municipal dustbin 3 times daily | collectors come every 3-4 months for beer and whiskey bottles | food is purchased locally | depends on owner |
| 10 rooms | open all year - electric room heaters | Indian: 70% Foreigners: 30% | Restaurant | High Season: 70-80 kg/day Low Season: 20-25 kg/day | 50% paper and plastic. Packaging and kitchen waste | Nagar Panchayat collects it | collectors come 2 times a week in the high season and every 2 weeks in the low season | local products mostly. Larger hotel items from Delhi and Chandigarh | bathroom renovations, new carpets and lights |
| 11 rooms | open all year - provide metal tandoors | High Season: 100% Indians Low Season: 100% foreigners | Restaurant | High Season: 75 kg/day Low Season: 20-30 kg/day | 15-20 kg/day are plastic bags, mineral | municipal corporation collects every 1 to 2 | collectors come 4 times/day in the high | purchase goods locally | put phones in rooms, installed a generator and put in a road for small |

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|---|---|---|---|---|---|---|---|---|---|
| | - use about 50-60 quintals of wood for season | | | | water bottles. Hotel maintenance generates most garbage | days<br>- burn plastic to light fires if no collectors come | season and 1-2 times/day in the low season for glass and plastic bottles | | vehicles, but no parking |
| 10 rooms | open all year<br>- small coal fireplaces<br>- 60 kg coals last 2-3 months | most are Indian | neither | no idea | no idea | bring to municipal dustbin 1 time a day | no scrap dealers | | none planned |
| 13 rooms | open all year<br>- no heaters<br>- guests can sit in reception to warm up at a heater | mostly Indian | neither | only room garbage. Not very much | plastic bottles and biscuit wrappers | bring to municipal dustbin once daily | collectors come every 2-3 months for bottles | | depends on owners |

**Small Hotels**

| Number of Rooms | Months Open | Type of Tourists | Restaurant & Room Service | Garbage Generated per day | Type of Garbage | Garbage Collection | Scrap Dealers | Hotel Products | Hotel Improvements |
|---|---|---|---|---|---|---|---|---|---|
| 6 rooms | closed December until March - provide electric room heaters if asked | Indians: 90% Foreigners: 10% | Room Service - breakfast, tea and coffee only | High Season: 6-7 small dustbins/day Low Season: 1-2 small dustbins/day | mostly paper and water bottles. 60-70% plastics, cottons, food | sweeper takes to municipal dustbin and lights it on fire 2 times a week | collectors come in the high season for bottles, iron, tin, and plastics | bring products like sheets from Delhi. Food is purchased locally | redecorating rooms - new blankets, seats, room pictures |
| 8 rooms | open all year - provide electric room heaters | mainly Indians. About 20% foreigners in July | | High Season: 8 small dustbins /day Low Season: 4-5 small dustbins/day | papers, little waste food, more packing and water bottles | sweeper takes to municipal dustbin once daily | no scrap dealers | | none planned |
| 5 rooms | open all year - room heaters provided | Indians: 95% Foreigners: 5% | Room Service, but food from neighbouring restaurant | High Season: 10 kg/day Low Season: ½ kg/day | Majority = paper, water bottles, polythene, napkins | sweeper takes to municipal dustbin once daily | collectors come every 2-3 weeks for beer bottles | everything is purchased locally | no changes planned |
| 8 rooms | open all year - electric room heaters. Maximum of 1-2 rooms/day occupied in the winter | Indians: 75% Foreigners: 25% | Room Service - breakfast only | High Season: 2 kg/day Low Season: about 2-3 water bottles/day | almost all plastic bottles in the off season. Used to be polythene. They burn papers | sweepers take to municipal dustbin two times daily | no scrap dealers collect, but sweeper takes items to the dealers | bring most hotel items from Delhi, but kitchen items are bought locally. | In 1-2 years want to put wood panelling in the rooms |
| 8 rooms | closes | Indian: 99% | none | High Season: | 60% paper | sweeper | no scrap | unsure | depends on owner |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | February to March<br>- electric room heaters | Foreigners: 1% | | 1 10 litre bucket/day<br>Low Season:<br>1 10 litre bucket/day | | takes to municipal dustbin 2 times daily | dealers, sweeper takes bottle to the dustbin | | |
| 6 rooms | closed November to March<br>- electric room heaters | Indian: 95%<br>Foreigners: 5% | Room Service-only tea and coffee | High Season:<br>2 small dustbins /day<br>Low Season:<br>1 small dustbin/day | primarily papers (60%) - biscuit wrappers, food wrappers, paper bags. Remainder is food | sweeper takes to municipal dustbin 3 times daily | collectors come every day. Primarily give beer bottles | everything purchased locally | general maintenance in March |
| 9 rooms | close 2nd week of November until March<br>- provide electric heaters if asked | Indians: 95%<br>Foreigners: 5% | Room Service for tea and coffee only | High Season:<br>1 10 litre bucket/day<br>Low Season:<br>nothing - only 1 room occupied | 50% water bottles, 50% beer bottles and paper | sweeper take to municipal dustbin once daily | no scrap dealer, sweeper takes everything away | buy things from local markets | general maintenance |
| 7 rooms | closed December to March<br>- electric heaters if asked | majority are Bengalis | Restaurant | High Season:<br>5-6 small dustbins /day<br>Low Season:<br>1-2 small dustbin/day | before lots of polythene, now about 20% papers and food packaging and 50% food waste | take to municipal dustbin | collectors come about every 2 weeks for heating oil tins | all food from Manali town | going to make another 6 rooms and changing furniture and carpets |
| 8 rooms | closed December to the end of March<br>- electric | Indians: 98%<br>Foreigners: 1-2 rooms in July and August | Room Service for tea, coffee and breakfast | High Season:<br>3 10 litre buckets/day<br>Low Season:<br>1-2 10 litre | about 70% paper and the rest is dust and food | hotel sweeper takes to municipal dustbin 3 | collect about 15 bottles/season and call dealer to | buy things from local markets, although some things are bought from traveling | None planned |

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| | room heater provided if asked | | | buckets/day | | times daily | come and get them | salesmen. | |
| 8 rooms | closed December to March | primarily Indians | Restaurant | High Season: 8-10 kg/day Low Season: 4-5 kg/day | kitchen waste and usually high tourist waste like bottle and papers | sweeper brings to municipal dustbin two times a day | no scrap dealers because nothing to give them since they don't serve beer | most things are from the market and most of the vegetables are from the local area | improvement of services, staff and facilities |
| 8 rooms | close January until March - no heating | Indians: 95% Foreigners: 5% | Room Service for tea and coffee and breakfast | High Season: 2 10 litre buckets/day Low Season: next to none | 80% is paper | sweeper brings to municipal dustbin three times a day | collectors come about 10 times a month for beer bottles | everything bought locally | none planned |
| 9 rooms | close January and February - provide electric heaters if asked | Indians: May/June Foreigners: rest of year.<br><br>About 50/50 | have a kitchen | High Season: 1 kg/day Low Season: 1 kg/day | 95% papers and dust from rooms. But, in total, 50% room waste and 50% kitchen waste | sweepers bring to the municipal dustbin 3 times a day | no scrap dealers | kitchen items are from the market. Towels, etc., not sure. | none planned |

## Cottages/Apartments

| Number of Rooms | Months Open | Type of Tourists | Restaurant & Room Service | Garbage Generated per day | Type of Garbage | Garbage Collection | Scrap Dealers | Hotel Products | Hotel Improvements |
|---|---|---|---|---|---|---|---|---|---|
| 5 huts - 2 and 3 bedroom with kitchen, sitting room, gas stove, fridge | closed January and February, will open if there is a demand<br>- room heaters and fireplaces in the huts<br>- 5-6 quintals of wood per season | Indians: 90%<br>Foreigners: 10% | neither | High Season: 6-7 kg/day<br>Low Season: 3 kg/day | 80% kitchen waste and 20% papers | sweeper picks up two times daily | no scrap dealers - collectors get it from garbage site | room products like sheets, furniture, towels, etc. are from Delhi or Chandigarh | none planned |
| 7 apartments | open all year<br>- provide electric room heaters | high season: 100% Indians<br>low season: 100% Foreigners | Restaurant | High Season: 4-5 small dustbins /day<br>Low Season: 1 small dustbins/day | 15% food, 20% plastic, 50% paper, 15% food packaging | sweeper takes to municipal dustbin three times daily | no scrap dealers | everything from Delhi and Chandigarh | none planned |

# Appendix 3

# Summary of the interviews with restaurant operators

## Larger, Sit-Down Restaurants

| Number of People Restaurant Seats | Months Open | Customers Per Day | Type of Customers | Garbage Generated per day | Type of Garbage | Garbage Collection | Scrap Dealers | Restaurant Products | Restaurant Improvements |
|---|---|---|---|---|---|---|---|---|---|
| 48 people | open all year - finish contract in March 1999 and then closing down the restaurant | High Season: 3000-4000 people/day<br>Low Season: 300 people/day | Indians: 75%<br>Foreigners: 25% | High Season: 30 kg/day<br>Low Season: 4-5 kg/day | 80% food<br>20% napkins and water bottles (no water bottles in the off-season | 3 times daily personal sweeper takes to municipal dustbin | no scrap dealers | everything is purchased locally | no because closing in March |
| 48 seats | closes January and February | High Season: 500 people/day<br>Low Season: 200-250 people/day | Indians: 97-98%<br>Foreigners: 2-3% | High Season: 15 kg/day<br>Low Season: 5-7 kg/day | only food waste (about 1% potato peels) | once daily personal sweeper takes to municipal dustbin | collectors come about once a week for empty oil cans | everything purchased locally. Sweet boxes from Hamirpur | want to close the shop because there is not much profit in it. |
| 60 seats | open all year | High Season: 500-600 people/day<br>Low Season: 100-150 people/day | Indians: 80%<br>Foreigners: 20% | High Season: 20 kg/day<br>Low Season: 1-2 kg/day | 90% kitchen waste and 10% paper | twice daily personal sweeper takes to municipal dustbin | collectors come every day for bottles, but sometimes don't have any | cheese corn come from Delhi and the rest is purchased locally | no changes planned |
| 100 people (200 with buffet service) | open all year | High Season: 100-200 people/day<br>Low Season: 50 people/day<br>Also cater a hotel: about 30 | Indians: 99%<br>Foreigners: 1% | High Season: 30 kg/day<br>Low Season: 15 kg/day | 10% bottles; 2-3 kg/day of paper. Rest is food waste | whatever can be burned is burned behind the restaurant (polythene, paper, etc.). | no - scrap dealers go to the ditch and go through the garbage to collect | napkins, cutlery, etc. come from the head office in Shimla. Food is purchased locally | government is proposing to turn the restaurant into a bowling alley |

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| | | rooms/day in the high season and about 50 people/day in the low season | | | | Rest is thrown once daily in a local ditch | items | | |
| 80 seats | closed January and February | High Season: 400-500 people/day<br>Low Season: 30 people/day | July-September: 70% foreigners<br>Rest of the year: 70% Indians | High Season: 30-40 kg/day<br>Low Season: 2-3 kg/day | mainly food and kitchen waste. 15% napkins and bottles | sweeper takes to municipal dustbin 2 times daily | no scrap dealers - all put into garbage | most locally purchased | general maintenance like painting |
| 60 seats | open all year | High Season: 200-300 people/day<br>Low Season: 50 people/day | May/June: 100% Indians<br>Rest of the year: 100% foreigners, majority of which are Israelis. In the winter it is mostly locals | High Season: 5 kg/day<br>Low Season: 2 kg/day | 60% water bottles<br>20% food waste | once daily sweeper takes to municipal | come to get bottles (water, beer & sauce) 2 times a week in high season and 2 times a month in low season | most locally purchased. Buy cheese from a dealer in Delhi, some tea from Dharamsala, soya sauce from Calcutta | yes, maybe a bathroom in the back |
| 50 people | sometimes close December to February, but last year kept open. | High Season: 250-300 people/day<br>Low Season: 50-60 people/day | Indians: 90%<br>Foreigners: 10% | High Season: 20-30 kg/day<br>Low Season: 10 kg/day | 2 drums - 1 for food he gives to cows in his orchard;<br>1 for rest - 10-15% of total waste (almost all papers) | sweeper takes 2nd drum to municipal dustbin once daily | no scrap dealers | rice, grains from grain market in Chandigarh, napkins from Chandigarh. Cheese, butter, meat, vegetables from local market | yes, wants to change facade because getting old |
| 72 seats | open all year | High Season: 500 people/day | Foreigners - 75% in August- | High Season: 20-30 kg/day | 90% food 10% | sweeper takes to | collect tin, glass | ice cream cones, tin food | general maintenance like |

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| | | Low Season: 150-200 people/day | September Indians - 75% rest of the year | Low Season: 10-15 kg/day | napkins, water bottles, etc. | municipal dustbin 3 times daily in the high season and 2 times in the low season | bottles, plastic materials are 2 times a week | stuffs, spices are bought in Chandigarh. Pulses, sugar and other foods are bought locally | painting |
| 44 seats | first year. Will try to stay open all year | | mostly foreigners | High Season: 5-6 kg/day Low Season: 2 kg/day | food, plastic, dust, paper | take ourselves (no sweeper) to the municipal dustbin at night | collect beer bottles (1 Rs.) and juice bottles (30,25 Ps.) every week or 10-15 days | all food purchased locally | no |
| 50 seats | closed in January | | June and July there is a good mix. August-September mostly foreigners. Rest of the year majority are foreigners | 5 garbage cans, 2 from the kitchen. Get full daily. About 25 litres each | chicken bones, leftovers, plastics, paper from wrapping when food is bought | kitchen cleaners take to municipal dustbin once daily | collect beer bottles 2 times a month in the high season and once a month in low season | all purchased locally | new cushions on seats, carpets, tablecloths, chair covers changed annually |
| 24-36 seats | open all year | about 100 people per day | May & June and September to November - Indians. July to September - Foreigners | High Season: 2 10L dustbins in the kitchen and 1 5L dustbin out front. All are full | mostly kitchen waste. Some water bottles and serviettes | sweeper takes to municipal dustbin 2 times daily | beer bottles sold every 7-15 days. Cans are reused for takeout | all purchased locally now. In 1970's bought cutlery, etc. in Chandigarh, but now all local | paint every spring. Wood stove in the winter |
| 100 people | open all year | High Season: 5000-8000 people/day Low Season: | Indians: 100% | High Season: 5-6 15L dustbins/day | majority is food and 10-12% napkins, | 2 times daily take to municipal dustbin | no | most from Manali. Coal, napkins and some spices | no |

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| | | 200-300 people/day | | | papers, etc. | | | from Chandigarh | |
| 52 people | closed February to March | High Season: 2000-3000 people/day Low Season: 100-120 people/day | Indians: 95% Foreigners: 5% | High Season: 3-4 15L dustbins/day Low Season: 1 15L dustbin/day | 60% food; 10% napkins, papers, bottles; 30% ash from coal | once daily take to municipal dustbin (2 times daily in the high season) | no | all purchased locally | no |
| 52 seats | open all year | always lots of customers. In December to January about 75 customers a day | mostly foreigners. Previously greater than 90% foreigners, but now many restaurants for foreigners opened so there are fewer customers | 5-10 kg/day | mostly vegetables. Don't use plastics (but bought bottled water there) - some paper for takeout | give all the vegetables to the cows. | Collect beer bottles every 5-6 months | all food purchased locally. Tablecloths, etc. are from Delhi | every year we change a little bit |

## Dhabas

| Number of People Restaurant Seats | Months Open | Customers Per Day | Type of Customers | Garbage Generated per day | Type of Garbage | Garbage Collection | Scrap Dealers | Restaurant Products | Restaurant Improvements |
|---|---|---|---|---|---|---|---|---|---|
| 16 people | open all year | High Season: 300 people/day Low Season: 80-100 people/day, but not a lot on Sunday because a lot of business is from local school | in season time, some foreigners (3-6 per day). Otherwise all Indians | High Season: 3 15L tins/day Low Season: 1 15L tin/day | all vegetables and noodles | take to municipal dustbin once daily | no scrap dealers | everything purchased locally | depends on the owner |
| 16 people | closed December to march. Reopen in April | High Season: 100 people/day Low Season: 35-50 people/day | all local school students | High Season: 1 15L tin/day Low Season: ½ 15L tin/day | all vegetables and noodles | take to municipal dustbin once daily | no scrap dealers | everything purchased locally | depends on the owner |
| 20 people | open all year | High Season: 1000 people/day Low Season: 800 people/day | Indians: 75% Foreigners: 25% | High Season: 2 kg/day Low Season: 1.5 kg/day | all vegetables | take to municipal dustbin once daily | no scrap dealers | everything purchased locally | no |
| 4 benches | open all year | High Season: 100 people/day Low Season: 40-50 people/day | Indians: 80% Foreigners: 20% | High Season: 1 5L bucket/day Low Season: 1 5L bucket every 3-4 days | vegetables and tea | take to municipal dustbin once daily or dump into sweeper trolley | no scrap dealers | most purchased locally. Buys biscuits, chocolates, etc. in Kullu during the season time | no |

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|---|---|---|---|---|---|---|---|---|---|
| 4 benches | open all year | High Season: 300-400 people/day Low Season: 150-200 people/day | Indians: 100% | High Season: 6 kg/day Low Season: 3-4 kg/day | 50-60% vegetables; 10% tea. Rest is paper, newspaper, egg crates, etc. | takes to municipal dustbin 2 times daily | collect soya sauce and vinegar bottles once a month | everything purchased locally | no |
| canteen - no seats | open all year | serves about 50 people/day, primarily from the school and the hospital. In the high season there are about 20 more people | Indians: 99% Foreigners: 1% | ½ kg/day | 80% waste tea and eggshells; 20% papers (candy wrappers) | 2-3 times a day he empties into 10kg bucket and in evening takes to municipal dustbin | no scrap dealers | everything purchased locally | wants to build a proper stand because every day he has to pick it up and take it away |
| 3 benches | closed January to July | High Season: 2000-3000 people/day Low Season: 200-250 people/day | Indians: 97% Foreigners: 3% | High Season: 10-12 kg/day Low Season: 4 kg/day | 90% food waste - about 4-5 kg of potato skins - 10% paper plates | personal sweeper takes to municipal dustbin 4-5 times a day | no scrap dealers | everything purchased locally | no |