Chapter – 1
INTRODUCTION

Many environmental movements and debates have emerged in various parts of the world during the recent decades. These reflect that the concern about ecological degradation is growing at global as well as local scales. Inspite of the fact that most of these originated in the developed countries and some in the underdeveloped, many scholars are treating all the movements to be similar in nature. They are projecting these in terms of conflict between environmental conservation on the one hand and the processes of modern development on the other. However, issues in the developed countries are different from those emanating in the developing ones.

There is no doubt that the theme of ecological preservation is common to the movements emerging in both type of countries but the aims and objectives are very different. Issues in the developed countries are related largely to the rejuvenation of surroundings in order to improve the quality of living-environment which has deteriorated in the process of attaining high living standards and modernized life style. Contrary to this, the conflicts in developing countries are concerned primarily with the protection of natural resources as these form the basis of the survival needs of the people. Historically, the natural resources have been exploited recklessly mainly to fulfill the demands of the developed regions.

Many contradictory views have been highlighted through a large number of studies conducted after World War-II. These have tried to re-interpret the processes of environment-development interface in various parts of the world. Equity in economic development at international and intra-national levels remained the central idea upto 1960s. Concern about the various types of environmental degradation at local, regional and global scales got major impetus in the 1970s onwards. The debates pertaining to such issues brought about many changes in the meaning of development from that of mere economic growth to socio-economic development and finally to the satisfaction of basic needs. Also the choice of indicators for measuring the levels of development shifted from Gross National Product or Per Capita Income to aggregation of social, economic, demographic and
infrastructural parameters and lastly to the availability of bare essential needs of
day-to-day life. However, the relevance of each type of indicators is largely
determined by the scale and nature of study on the one hand and by the region and
society under question on the other.

Apart from these, some scholars reviewed the role of development models
as well as technologies. They are of the view that increasing socio-economic
disparities and environmental degradation are caused by the adoption of same
developmental models and similar modern technology irrespective of the variations
in many other determining factors. They suggest for 'alternative' developmental
strategies and the use of 'intermediate' and 'appropriate' technologies taking into
consideration the problems and potentials of various regions.

An overview of these and of many previous studies raises the question that
how to ensure survival and improve the quality of life which has remained the
prime motive of human beings through the ages. Man has been trying his best to
achieve this by adopting various means from time to time. The type of
environment he lived in largely influenced the level of his success and the nature
of technology he employed in order to meet his purpose. Man's increasing
technological capability reduced his environmental subservience and enabled him
to play a dominant role in the process of man-nature interaction. The increasing
dominance turned his quest for healthier living into lust for luxurious lifestyle.
Consequently, he started over-exploiting of natural resources not only in the
adjacent environments but also in the far off areas. However, there have been
spatial and temporal variations in these processes.

The phase of rapid industrial and technological progress brought about
unprecedented socio-economic as well as environmental changes. This process
helped many people largely those living in the developed countries to attain a
highly modern and comfortable lifestyle but at major environmental costs.
Deterioration of environment is today getting reflected through fast depletion of
natural resources, human exposure to harmful chemicals, air and water pollution,
atmospheric and climatic changes, disappearance of many forms of life etc. Many
of these are found to be having further intricate ecological linkages. Consequently,
man-nature relationship in many parts of the world has reached a stage where the
very survival of mankind itself is getting jeopardised. The socio-economic benefits of modern development are largely confined to only a few areas and some sections of the society while its environmental implications are distributed over much wider area. The ill effects are borne more by the underdeveloped countries that have lost a lot of their share of resources for the sake of affluent countries and the sections of the society. No doubt, expansion of some advanced facilities especially in health care saved the life of many people from epidemics in the underdeveloped parts. However, these could not provide them many sources of livelihood so that they could also improve the quality of their life. Increasing population in many of such parts, mainly due to declining mortality, started exerting more pressure on the available resources.

As stated above, there has been a definite change in the models of development. This is what came to be known as paradigm shift. Half a century has already elapsed after the phase of paradigm shifts began in the history of development and the impasse is persisting. The optimism that relatively underdeveloped societies may experience the similar processes of development through which some other have passed is prevailing. The concern is because socio-economic disparities are widespread. It is true that efforts have been made to reduce the developmental inequalities at various territorial and societal levels but the results have not been very successful. Some attempts have been made to transform the traditional subsistent communities into modern commercial economies. However, the processes have failed to replicate themselves in most of the cases. This happened mainly because similar developmental models and technological aids have been applied in various regions / countries. But the specificity in terms of diversities in natural environment, resource endowments, socio-cultural set-up, historical and economic processes have been overlooked. Similarly, the level and nature of necessary infrastructure prevalent in various parts have also not been taken into account. The rapidly growing population in the underdeveloped countries continues to depend largely on the exploitation of depleting natural resources in order to ensure their survival.
Figure - 1.1 (a)

Figure - 1.1 (b)
The physical environment of the earth is not homogeneous and the capability of various regions to tolerate the intensity of human activity also varies. Some environments are more fragile and are sensitive even to a marginal overuse of their resources. These have remained largely neglected from the point of human inhabitation as well as for the purposes of development. Even the similar type of natural regions of the world has experienced different processes of development mainly because of variations in the historical and politico-economic processes. The socio-economic change in the areas having relatively fragile environment in many cases has been quite different from that which took place in the other areas. This shows that many regions with fragile environment are not responsive to the application of similar technological aids, which have brought about development in other regions.

Mountainous regions generally have fragile environment wherein various elements of nature are delicately balanced. Modifying these for intensive economic purposes is difficult due to prevailing physiographic and climatic conditions. Exploitation of natural resources beyond a limit may cause serious adverse effects in these ecosystems. Environmental degradation in the mountains expands rapidly due to their fragile nature. Many a times these may cause serious immediate as well as long-term socio-economic problems not only for the local communities but also for the people living in adjacent lowlands. Thus, protection of mountain ecosystem is important for the wellbeing of local people as well as for those living in adjacent plains. However, the processes of development in the mountains of developed and developing countries are not similar. The mountainous regions of the developing countries have remained largely underdeveloped and the society here depends mainly on the exploitation of natural resources.

Most of the population is concentrated in the lower parts of these mountains, which coincide with valleys. Here, the life is mostly based on subsistence farming combined with livestock rearing (Fig-1.1a). It has been observed in many parts that growing population results in the expansion of cultivated land. The land for growing more food is carved out of the relatively steeper slopes which otherwise are the sources of fodder for the animals (Fig-1.1b). The reclamation of agricultural land from the grass-growing lands generally causes
a decline in the availability of fodder. Other sources of fodder are limited in such mountain areas. Therefore, people have to reduce the number of their domestic animals. A decline in the livestock population reduces the supply of animal products as well as manure for the agricultural fields. The declining availability of manure effects the fertility of land and causes a reduction in the crop-yields, thus, effects the supply of food. The declining availability of food from animal products as well as from agricultural fields creates a demand for more land for cultivation which is further reclaimed from the already shrinking pasture lands. The process gets repeated and creates a vicious circle of expanding cultivated land on steeper slopes and; reducing supply of food and fodder (Fig-1.1c).

At times, new land for crop-cultivation is obtained by clearing forest. Generally, Forest is the only local source of fuelwood in the underdeveloped mountain regions. Thus, decrease in forest cover reduces the availability of energy needed for cooking and heating. The need is met by using animal-dung as fuel. This further reduces the supply of manure for agricultural-fields. The reduced application of manure affects the fertility of land causing a decline in the crop-yields. This also leads to the reduced availability of food, which results in further clearing of more forest for growing food. The repetition of the process causes reduction in the supply of food and fuel. The increasing population continues to create more demand of food. This exerts more pressure on cultivated-land. Subsequently, hazard-prone areas are also brought under plough which ultimately get damaged. This causes degradation in the fragile environment (Fig-1.1c). Damage of cultivated land also creates demand for more land for this purpose. The Himalayas are typical mountains in the developing countries where above mentioned features can be seen. The Himalayas have rugged terrain and inclement climate. The society living therein is at the early stages of development and has largely adapted to the requirements of the nature. The economy is mainly associated with subsistence farming and livestock rearing and some pastoral nomadic grazing. The carrying capacity of land is low. However, population is increasing at a fast rate. New economic opportunities are limited and most of the people are not skilled or qualified for these new jobs. The dependence on subsistence farming is continuing. As stated earlier, the environment is fragile and
resources are limited. The increasing requirements of growing population are exerting more pressure on scarce resources which is causing some environmental degradation. It suggests that the processes reflect in terms of the following sequence: -

- rapidly increasing population,
- reducing availability of food,
- expansion of cultivated-land on the fodder-supplying / fuel-providing areas,
- decreasing livestock population,
- declining availability of animal products,
- reducing supply of manure,
- depleting forest cover,
- changing fuels,
- damaging agricultural land.

The stages are quite clear but these suggest an undisturbed process of man-nature interaction whereby the role of external influences is absent or bear a limited impact. This means such processes will be more discernible in the regions, which have remained relatively isolated for long on the one hand and have experienced rapid increase of population on the other. The increasing population may not be having many new economic opportunities. Thus, the people have to depend largely on local resources for the satisfaction of their 'basic needs' of food, fodder and fuel.

Pangi valley of Chamba district in Himachal Pradesh is one of the regions which has remained quite isolated until a few years ago. It has also experienced a quite high increase in population during the recent decades. The population has doubled between 1951 and 1991. It may be mentioned that the state of Himachal Pradesh has been included in the backward hill areas of India. A report of the Working Group on Hill Area Development mentions that "the high growth rate of population in hill areas has been exerting pressure on the finite quantum of resources decreasing in availability on account of over-use, with the result that the hill populations are under severe constraints of food, fodder, fuel and water".

Some developmental activities had started penetrating the valley since the beginning of Planned Development in India. However, the level of development in
LOCATION OF PANGI VALLEY

LOCATION OF WESTERN HIMALAYAS IN INDIA

PANGI VALLEY

Jammu & Kashmir

0 200 400 KILOMETRES

Figure - 1.2
Pangi valley can be well assessed from the fact that a survey conducted by the Department of Rural Development HP in 1984-85 concluded that 65 percent of the total households in Pangi live below poverty line\textsuperscript{12}. Thus, the meaning of development for them has not risen above the level of satisfying their basic needs of food, fodder and fuel as identified by the Planning Commission of India.

**STUDY AREA**

Pangi valley situated between the Pir Panjal Range and the Great Himalayan Range, forms a part of the Chandra-Bhaga basin (Figure-1.2). It occupies grid location between $76^\circ 14'$ east to $76^\circ 47'$ east longitudes and $32^\circ 48'$ north to $33^\circ 13'$ north latitudes. It is one of the nine Sub-Divisions of Chamba district and one of the five Scheduled Tribal Areas of Himachal Pradesh. It may be mentioned that neither the non-natives can own any kind of landed-property in scheduled tribal areas of India nor they have direct access to the various resources in such areas. Pangi, Pangi valley and Pangi tehsil are the names of same area and these have been used interchangeably. The boundaries of Pangi valley coincide with the crests of the spurs of Great Himalayan Range in the east and the Pir Panjal Range in the west. It means, the western slopes of the former and eastern slopes of the latter fall within Pangi valley. It is surrounded by the parts of Jammu & Kashmir situated to its north, Churah tehsil of Chamba district to west and southwest; and Lahaul-Spiti district to south and east. The altitude of Pangi valley varies between 2150 meters and nearly 6400 meters. Average annual rainfall and snowfall (1951-1962) are 54 centimeters and 650 centimeters respectively.

It covers an area of 1254 square kilometers and has 106 villages. Only 60 villages were inhabited by a total number of 14960 persons in 1991. The population was 7449 persons in 1951 which has doubled during last four decades. Settlements are mostly confined to the lower slopes of the sub-valleys lying in the Great Himalayan Range. There are very few settlements on the slopes the Pir Panjal Range. The net sown area amounts to 2105 hectares which accounts for 1.68 percent of the total geographical area of Pangi tehsil.

High altitude, rugged terrain and physiographic configuration make the valley highly inaccessible. Communication with the outside regions, until recently,
was possible only through high snow-bound passes situated above 4400 meters above the mean sea level. The area was connected to adjacent Lahaul-Spiti district by a *kutchha* road in the summer of 1995. Travelling by mini-bus is possible upto the southern half of the valley which is accessible through Rohtang Pass (4300 mts) for four to five months in a year during summers. However, the old bridle path through Sach Pass (4413 mts) links Pangi with rest of the Chamba district. It continues to be the main communication route but remains closed from mid-October till mid-June.

The region remains snow-covered during winters and the movement of people comes to standstill even within the valley. Winter is severely cold and nearly no outdoor activity is possible for four to five months of this season. People live in small *kutchha* houses build of stone, mud and wood. Human beings and domestic-animals live in the same cooking-cum-sleeping room during winter months. The livestock are grazed on natural pastures in summers but they have to be stall-fed during winters. The food, fodder and fuel for use in winters has to be procured during summers only.

**LITERATURE REVIEW**

The above discussion shows that Pangi is a remote region. Its relative isolation, cold climate and rugged terrain have led to the emergence of distinctive culture. Some of the changes taking place in the region may have far reaching impact on the society and the environment. Therefore, it is important to review the literature written on other mountain areas in order to understand the processes operating therein.

It has been mentioned that socio-economic conditions and processes of change in the mountainous regions of developed and underdeveloped countries are different. Keeping this in mind, it becomes essential to have a look at the studies related to these processes operating in the mountains of developed and developing countries. Equally important is to see the studies conducted on Pangi valley and the adjacent areas. It is in this light that the literature has been grouped into the following two categories :-
STUDIES RELATED TO THE MOUNTAINS

Subsistence agriculture and transhumance have been predominant economic activities in most of the mountain regions of the developing world. Some higher parts are not suitable for agricultural activities. The smaller communities living in such areas have been rearing animals and are engaged in the trade of some animal products.

Unfortunately, studies discussing the socio-economic changes in the mountains of developed countries in the pre-industrial period were not available to the author. Similar was the problem of obtaining studies on the mountains, except the Himalayas, of underdeveloped countries.

The information collected from limited number of available studies related to the mountains of Europe and North America is useful in order to understand the processes of socio-economic change in the mountains of the developed countries since last century. Similarly, some consulted works pertain to the mountains of the Central and the South America; Africa and Asia. These contain relevant discussions on the prevailing socio-economic activities in the mountains of developing countries.

Due to fewer available studies on the mountains, except the Himalayas, the material has been clubbed into two main sections and one sub-section.

- Processes of Change in the Mountains of Developed Countries.
- Processes of Change in the Mountains of Developing Countries.
- Issues of Environment-Development Interface in the Himalayas.

Processes of Change in the Mountains of Developed Countries

Allan\textsuperscript{13} has attempted to analyse the utility of accessibility and altitudinal models in the context of socio-economic changes in the mountains. He writes that tiered-belt subsistence cultivation and transhumant activities started declining in many parts of the European Alps in the early 19\textsuperscript{th} century. It happened mainly due to increasing highland-lowland interactive system. Construction of Trans-Alpine railway line and many other roads provided easy travelling facilities. The people of
lowlands started coming for recreational purposes and promoted tourism industry in the Alps. Highlanders were earning cash income from the tourists and bringing the required items from adjacent lowlands. Because, frequent travelling was no more a problem due to expanding rail and road communication networks. Outmigration from the higher Alps began largely during and after the World War-II. It was because there were plenty of opportunities to earn good wages, to enjoy modern living facilities and to avail annual holidays. The processes of depopulation created shortage of labour in the highlands. As a result of this, about 90 percent of the transhumance disappeared within 20 years after the war. He states that mechanization of agricultural activities also started in the later years due to reduced availability of labour. Potato became the principal cash crop and cultivation of grains was negligible. However, Austria, France, Germany and Switzerland declared the Alpine areas as 'national asset' in late 1960s. These areas, along with the inhabitants, have been preserved and are taken care by the governments of respective countries. Income generated through tourists and some dairy farming added more to the prosperity of these 'national assets'.

Kariel refers that economic activities in the mountains of Canada were based mainly on the trade of natural resources. The vast stretches of forest sheltered many wild animals and export of Fur was major activity for a long time. The increasing demand of raw materials for the growing industries led to the promotion of mining and forestry activities. The process of industrialization also created demand for energy and the mountains had enough potential for the development of pollution-free hydroelectric power generation. Kariel states that tourism started as early as 1862 but major change came after the completion of Trans-continental Canadian Pacific Railway in 1885. It was constructed by a private company in order to expand its business. Along with other activities, it also started promoting tourism industry in the Rocky and Columbia mountains. It developed many contacts with various clubs in Europe and hired guides for boosting tourism which is major economic activity for about last 100 years.

Rinschede writes that transhumance has been largely lost to the development of tourism industry and environmental protection in the Rocky mountains of United States of America. However, the remaining form is more of
seasonal livestock migration than traditional transhumance. Development of communication networks has facilitated transportation of livestock between lowlands and highlands with the help of rail and road vehicles since 1930s. Overground hoof-migration has disappeared due to these factors.

Above discussion suggests that traditional economic activities in most of the mountain regions of developed countries started disappearing in the last century itself. Various developments in the lowlands and increasing accessibility in the highlands of these countries have played most important role in economic transformations. These shifted the pressure from physical exploitation of natural resources in fragile environments to their improvement for recreational purpose. However, developed form of traditional activities still exists in some mountains. Many measures have been taken to check the environmental effects generally caused by such activities in the traditional form.

Processes of Change in the Mountains of Developing Countries

Traditional economic systems of subsistence cropping of various foodgrains mixed with livestock rearing, transhumance and shifting cultivation are widely prevalent in the mountains of underdeveloped countries.

Brush\textsuperscript{16} has found in his field-study that the size of landholdings in many parts of the Andes in Central and South America is one-fourth of an acre. In some areas, it is as large as eight acres but its production does not fulfil more than half of the food requirements of dependent families. The landholdings are fragmented into many small fields located away from each other in most of the cases. Size of landholdings is decreasing and incidence of fragmentation is increasing due to its sub-division among the increasing number of shareholders. Communal labour system is used to overcome the difficulties in agricultural activities. New fields are carved out of relatively steeper slopes due to increasing population pressure on land. Overgrazing by domestic animals is causing degradation in many parts.

Parish\textsuperscript{17} observed that combined cultivation of foodgrains and fodder on the terraced valley-sides and livestock rearing has been the traditional economic activities in the high-Atlas mountains of Africa (Morocco). Cultivation is still restricted to the lower parts and higher slopes are used for summer pastoral grazing. Fields are irrigated by constructing contour-channels on the mountain
slopes. The economy of drier anti-Atlas mountains was based on cultivation of barley and goat rearing. Barley was used for food as well as fodder in the higher parts but leaves of Argan tree constituted larger part of the fodder in the valley-floors. The author states that Atlas mountains have experienced many changes during the second half of 20th century. The State has made many efforts to integrate these mountains with national and international economy. As a result, a lot of outmigration has occurred. The growth rate of population has declined to less than 1 percent per annum whereas it is more than 2 percent for the nation as a whole. However, the benefits of subsidies through modern agricultural inputs are confined to irrigated-farming on larger landholdings situated on the valley-floors. Parish says that Small farmers in the rain-fed conditions of higher slopes are facing many problems because they need to depend on the purchase of both food and fodder. These factors increase the pressure on higher slopes. Crop-cultivation system in the drier anti-Atlas mountains has almost collapsed due to introduction of intensive irrigation requiring crops and agricultural inputs like HYV and chemical fertilizer. This has forced the people to opt for off-farm labour activities and a lot of population is outmigrating.

Whiteman\textsuperscript{18} writes that Simen mountains of Africa in Ethiopia have been attracting many agriculturists due to its tropical environment. Agricultural activities were carried out on the lower and gentler slopes for centuries. A very high rate of population growth of 2 to 3 percent per annum in 1970s led to the expansion of cultivation on steeper slopes. The higher parts contain steppe-grasslands which are used for cattle grazing. Extensive stretches of forest on the middle slopes have been replaced by the fields of under barley cultivation to feed the increasing population. Lowest montane belt has remained under cultivation of foodgrains and pulses since the early times but the cropping-intensity has increased very fast. All the sloping portions under cultivation are suffering from massive soil erosion whereas forests have been almost cleared. Food needs of the growing population have led to a lot of environmental damage.

Allan\textsuperscript{19} found that apart from the usual cultivated and livestock products in the mountains, the people of Hindukush mountains in Afghanistan and Pakistan added a lot of walnut, almond and mulberry to their food. Causes of change in the
traditional economic system within and around the Hindukush mountains are quite different. Political, military and police administration has penetrated in most of the valleys during last 50 years due to some international and intra-national problems. The people coming from other areas were not adapted to the eating of coarse foodgrains traditionally cultivated in these areas. Local farmers started shifting to the production of fine foodgrains, vegetables, potatoes, apples and grapes. Demand for some other products like nuts, meat and opium has led to commercialization of these traditionally self-subsistent activities. All these factors combined with the growing local population have led to intensive use of land and its expansion on hazard prone areas. The demand of marketable animal products caused an increase in livestock population. Overgrazing of pastures became unavoidable. Rising need of timber and fuelwood increased pressure on forest resources.

Another study by Allan shows that economic activities in the mountains of northern Pakistan have been characterized by the subsistence cultivation of coarse foodgrains and transhumance. Millet, buckwheat, amaranth, barley, maize and wheat were grown for domestic consumption because the land holdings were very small. Gujars carried out transhumance of sheep, goats and buffaloes. Seasonal migration of the Gujars between plains and mountains kept them aware of the developments occurring in the plains. They used to bring potatoes for their own consumption during summers while staying in pastures. Over the time, they started growing some potatoes on small patches in the pastures and carried these on horses after summer pasturage. But they could not become the source of change in mountain economy. It was only in the mid 1960s that vehicles started reaching in Swat town. Increased transportation facilities brought about shift from subsistence mixed foodgrain cultivation to commercial potato growing. This led to the expansion of agricultural land by local people near the villages who cleared some patches of forest. A lot of new land was reclaimed along the streams because potato cultivation required intensive irrigation. The sedentarising Gujars had no option but to bring some parts of the pastures, which were outside the claims of local people, under potato growing. The commercial cropping caused the replacement of natural manure and bullocks with chemical fertilizers and tractors. The intensive use of higher slopes is resulting to soil-erosion and damage to land.
Above discussion suggests that economic activities like cultivation of land and livestock-grazing in the mountains of developing countries are largely based on the physical exploitation of natural resources. Overground seasonal migration of livestock is quite frequent. Landholdings are small and fragmented. Size of landholdings varies significantly but it does not bear much importance because agriculture is largely at subsistence level based on traditional methods of cultivation, thus, productivity is very low. In many cases, the dependent families are not able to produce even to fulfil their food requirement. Major benefits of some special developmental programmes introduced by the government are confined to the large-farmers and small-farmers have rather suffered some adverse socio-economic problems. Not many cases of development in road and even one in railway communication are mentioned. However, various discussions in these studies suggest that most of the areas have low level of interaction with the lowlands.

The rising political significance of some parts led to the construction of some roads during the recent decades. This made travelling easier and many farmers have shifted to the cultivation of cash-crop based on modern agricultural inputs. Also, a lot of inmigration of government officials in some parts created demand for agricultural, livestock and horticultural products. The needs of increasing local population as well as of the immigrants led to the intensified use of natural resources. In many cases, agricultural land is carved out in pastures and by felling trees. The shortage of fodder and fuelwood is also visible. Such processes are creating direct or indirect damage to the environment of these mountains. However, they have no other option but to depend on the local resources for their sustenance.

The people living in various parts of the Himalayas face similar problems. Due to this, literature pertaining to the basic needs of food, fodder and fuel or resources like cultivated land, pastures and forests has been discussed in the context of the Himalayas.

**Issues of Environment-Development Interface in the Himalayas**

It is well known that Himalayas are youngest folded mountains of the world, which extend in southeast - northwest directions over a length of about
2500 Kilometers. Due to its huge east-west stretch, the Himalayas have different ecological setup in its different parts. Literature is also related to the different areas, which has been grouped into three parts i.e. eastern, central and western parts of the Himalayas.

Some research material is available for all these sections but there is rarely a publication, which covers all the aspects of the same area. Since, the present study focuses on the issues of environment and development; thus, the information contained in the available material has been discussed in terms of population, economy, resources and effects of resource-scarcity etc.

Jamakrishnan discusses about the four types of land-use practices in the northeastern hill areas of India out of which shifting agriculture or Jhumming is predominant. The four types are low-elevation Jhum, high-elevation Jhum, valley-agroecosystem and terrace-agroecosystem. He mentions that the agricultural fields are obtained by clearing the trees in the former two types. The average size of plot varies between 1 to 2.5 hectares and 5 to 6 persons depend on the plot. Earlier, the cycle of Jhumming used to be 20 to 30 years but in many cases it has reduced to 4 or 5 years due to the increasing population pressure. The output/input ratios in the high-elevation Jhum cycle of 15 years are highest (6.01 percent) of all the systems.

Karan observed that Bhutan is not overpopulated unlike some other parts of the Himalayas. It has an average population density of 25 persons km$^2$ with annual population growth rate of about 2 percent. The cultivated area constitutes 5 percent of the total area of the country and per capita availability of this is about 1.04 hectares. On the other hand, population density in the adjacent Sikkim is 44 persons km$^2$ and annual population growth rate is 5 percent. Cultivated area in Sikkim amounts to 11 percent of its total area. The population pressure influences the land-use here as per capita availability of cultivated land is 0.25 hectares only. As a result, cultivation on the steeper slopes is unavoidable which is leading to rapid soil erosion and permanent loss of land.

Mitra states that cultivation of crops, works related to tea-plantations, forestry and livestock raising are the main rural occupations in the Darjeeling district. Tea garden workers have far better remunerations, therefore, the crop cultivation is less preferred in the areas where these opportunities are available.
This thana level study reveals that only 1 to 3 percent of the workers is engaged in secondary activities. Thanas having towns show 12 to 16 percent workers engaged in the tertiary sector of economy because towns have many offices but most of the officials come from other parts of the state.

Maikhuri and Gangwar\textsuperscript{24} conducted a study in Lailad (Meghalaya) which is inhabited by four communities namely Garos, Khasis, Mikirs and Nepalese. The first three communities practice slash and burn agriculture. Along with this, wet cultivation of rice is carried out in the valleys but Khasis do not practice it. The authors concentrated on the fuelwood consumption of the four communities and found that Garos has the highest average consumption of 4.7 kgs per capita per day and Nepalese have least of 2.1 kgs per capita per day. As forest is the major source of fuelwood and its depletion is obvious. They found an inverse relationship between the amount of fuelwood consumption and the distance of the place of its collection. It means Garos travel shortest distance of 0.75 kms and Nepalese bring fuelwood from 4 kms distance.

Above discussion suggests that primary economic activities are predominant in the eastern parts of the Himalayas. The agricultural fields are obtained largely by tree cutting. The population pressure on land as well as population-growth is relatively high. The terraces for crop-cultivation are carved on the steeper slopes, which increase soil-erosion and causes loss of land which reduce the crop-production. Most of the rural communities depend on the adjacent forest for their fuelwood needs. Forest is depleting and effecting the availability of fuelwood.

Central part of the Himalayas has been attracting worldwide attention towards the problems of its environment and development. One of the factors is Nepal's utterly underdeveloped conditions and; the other 'Chipko' movement which emerged in the Uttar Pradesh Himalayas of India. Moreover, there is no restriction on the movement of western scholars in Nepal.

Shrestha\textsuperscript{25} states that Nepal's population is more than 16 million and has an annual growth rate of 2.6 percent. 94 percent of the total population lives in the rural areas and depends mainly on the cultivation of land. The land resources are
becoming scarce and per capita availability of land is only 0.16 hectares. Crop-yields are very low whereas the incidence of landlessness is increasing.

Thapa and Weber\textsuperscript{26} found that cultivated land in upper Pokhara valley (Nepal) is obtained by clearing the forest cover in stages beginning from tree-felling to scrub-removing and using the land for crop-cultivation. The prevailing physiographic and climatic conditions have accelerated the soil erosion. The highest loss of soil found in the scrub and grazing lands which was about 15 and 35 metric tons per hectare annually. It was estimated to be 8 and 10 metric tons of soil from forest and terraced land respectively.

Schreier et al\textsuperscript{27} conducted a GIS resource-evaluation of all the 75 districts of Nepal. They projected the situation for the year 2000 by making two main assumptions. First, the levels of resource-use remain the same as in 1981 and; second, human and livestock populations change at the current rates. They found that Nepal will be facing 27 percent food deficit and 54 percent feed shortage in the year 2000 AD whereas there will be a surplus of 6 percent fuelwood. They have also suggested some measures to improve this situation.

Bohle and Adhikari\textsuperscript{28} observed that incidence of poverty is increasing in Nepal. Sixty percent of the population spends more than 66 percent of their household budgets on the purchase of food alone. Their field study of Nawalparsi district shows that the people in some villages are able to procure only 21 percent of their food requirements from agricultural fields. Next fifty percent they buy from market, thus, consume only 71 percent of their total food requirements. In another village the overall availability of food was equivalent to 61 percent of the requirements. People have to sell forest and livestock products or locally brewed alcohol as well as to work as casual labourers and porters to earn money, which enables them to buy some quantity of food.

Hall\textsuperscript{29} analysed the implications of resource scarcity and found that a significant proportion of population outmigrates from Nepal to various parts of India and some other countries of Asia. This process is steadily increasing as the number of long-term outmigrants were 200,000 in 1950s and 400,000 in 1981. Most of them go to work as casual labourers and maidservants but quit a number of young girls become prostitutes. An estimate shows that there are about 200,000
Nepalese prostitutes in India. Every year, 5 to 7 thousand new girls join this work to make a living and remit some money back to their homes.

Above discussion suggests that the population of Nepal has exceeded the current carrying capacity of the available resources. A very large proportion of the population is not able to meet its minimum food requirements. As a result, clearing of forest for crop cultivation is quite frequent. The other way to escape this problem is sought through outmigration in search of any type of work. Many of the girls do not find anything else but work in brothels to feed their family members left at home. Thus, the scarcity of food has environmental as well as social effects.

Singh and Singh\(^{30}\) mention that the population of U.P.Himalayas is growing at 2.8 percent annual rate. Nearly 90 percent population lives in rural areas and depends primarily on agriculture. The resources are not sufficient and outmigration is quite high. About 30 to 40 percent of the total population between 15 and 35 years age has outmigrated. Around 90 percent of the total geographical area show varying levels of degradation. Almost equal proportion of healthy forest and pastures cover the remaining area. The authors have analysed the energy-flows in agro-ecosystem and farm-forestry system. They found that farm-forestry system is beneficial in terms of economic gains and also has environmental value.

Saxena et al\(^{31}\) conducted a study in three villages of Pauri Garhwal district in Uttar Pradesh Himalayas. They found that none of the females has a government job or other such permanent employment. But 38 percent of the males work at lower level posts in various offices situated far away from the villages. Those who commute everyday spend 8-9 hours in travelling. Women spend 10-12 hours per day in the household activities and 4 to 6 hours in the collection of fuelwood / fodder. Animal grazing and on-farm activities are mainly the responsibility of males. The authors observed that the time spent in fuelwood / fodder collection in these villages is more than the same reported from many other parts of the Himalayas. They attribute this to the depleting resource areas i.e. pastures and forest.

Pandey and Singh\(^{32}\) also analysed the relationships among crop-cultivation, pastures and forest in three villages situated in the U.P Himalayas. They observed that each unit output of agronomic energy (including milk) takes 2.04 to 12.45
units of input energy from the surrounding forest / pastures. The ratio of human energy expended in agricultural activities, fodder and fuelwood collection is 1:2.5. This ratio is increasing every year because the distances to fodder / fuelwood collection areas are increasing and total agricultural output is declining. They conclude that the prevailing agricultural system can not sustain for long as its pressure on forest / pastures are very high which are degrading very fast.

Negi33 analysed the factors controlling the change in the agricultural system in the catchment of river Gaula in the Kumaun Himalayas. He found that traditional system of cultivation is predominant. The use of HYV and chemical fertilizers is limited due to small size of landholdings and non-availability of irrigation on the one hand and the preference for the local crop-varieties on the other. People grow low grain yielding local varieties because these give more crop-residue, which is needed for fodder. They feel that import of foodgrains is better than that of fodder. Moreover, people find HYVs non-resistant to the prevailing environmental conditions.

Above discussion highlights that a very large proportion of population in central parts of the Himalayas to be dependent on the local natural resources. Growing population is exerting more pressure and the production is declining. As a result, younger generation is outmigrating continuously. Those who are involved in traditional economic activities need to put more efforts and get very low returns. Consequently, agricultural land, forest and pastures are undergoing the processes of depletion and degradation.

Two Indian states of Himachal Pradesh and Jammu & Kashmir are the main parts of Western Himalayas. Rani et al34 observed that population of Himachal Pradesh was 50.26 lakhs in 1991. The decadal growth rate during 1961-71 was 23.04 percent, which decreased to 19 percent during 1981-91. According to 1991 census, 91.3 percent population lives in rural areas. 71 percent of the workforce was engaged in agriculture which is largely dependent on timely rainfall and other weather conditions. They state that per capita income of Rs.3614 during 1988-89 in Himachal Pradesh was less than that of Rs.3835 at the national level. The economy of Himachal Pradesh is largely based on the primary activities the output of which is low.
Sarkar\textsuperscript{35} has looked at Bharmour area of Chamba district from the perspective of sustainability. She found that about 80 percent of the area is not usable as it is barren, rocky and under perpetual snow. Agriculture mixed with livestock rearing is the prime economic activity in the region, which is constrained by the natural environment. The size of landholdings varies between 0.8 and 1 hectare and the fields are dispersed. People cope with these constraints by using crop rotation, multi-layer cropping and applying a lot of animal dung as manure. Transhumance based on sheep-goat rearing is prevalent between Punjab plains and the alpine pastures of the Pir Panjal Range. The cycle is adjusted with the crop-sowing periods at Bharmour so that the animals are available to provide manure. There are no evidences of direct dependence on forest based economy of the local people but they use these for timber and fuelwood. She apprehends, if these practices increase with the growing population these would become a threat to the environment. Thus, she suggests the measures to promote outmigration of growing population.

Singh and Rana\textsuperscript{36} have discussed the distribution and use of forest resources in Mandi district. They observed that 36.61 percent of the area is covered under forest. People depend on the surrounding forests for their needs of timber, fodder and fuelwood. The increasing pressure of human and livestock population has caused a lot of damage to many parts of the forest. There are only a few areas, which are not suffering from overgrazing or lopping of branches for fodder. The demand of fuelwood and charcoal has made many forests scanty and shortage is being felt. Some trees are at the verge of extermination.

Maitra\textsuperscript{37} has estimated fuelwood consumption in parts of Kulu district and found that cooking and room-heating are done by using fuelwood. The households living at about 1800 meters above mean sea level consume 15 kgs/day fuelwood during summers and 30 kgs/day during winters. On the other hand, this consumption at an altitude of 2300 meters was found to be 30 kgs during summers and 100 kgs during winters. He estimated that the current needs of the people can be met if the forest area in various parts is expanded by 22 to 65 percent. It shows that pressure on the existing forest is very heavy.
Above discussion suggests that a very large proportion of the population in Himachal Pradesh is living in the rural areas. Most of them depend directly on the exploitation of natural resources for their sustenance. Subsistence agriculture and livestock rearing are the two major components of the economy. Fuelwood is the main source of energy required for cooking and room-heating purposes. The consumption of fuelwood increases with the altitude. The increasing human and livestock population is putting more pressure on the resources and many parts are suffering from depletion and degradation.

Alam and Husain\(^38\) state that the population of Jammu & Kashmir was 5,954,009 persons in 1981. The growth rate during 1971-81 was found to be 28.95 percent, which was nearly 8.95 percent higher than that of India as a whole. Population pressure on agricultural land is increasing and farmers are extending cultivation on the vulnerable steep slopes. The state has a wide variety of temperate and sub-tropical forests, which cover about 30 percent of the total area. Fuelwood is the main source of energy for cooking in the rural areas. Kerosene and LPG predominate in the urban centres. Average annual per capita fuelwood consumption is estimated to be 3.8 quintals, 42 percent of which is constituted by twigs and branches. The dependence on fuelwood has caused widespread deforestation especially in the Narang catchment, Daksum valley, Gurez valley and slopes of the Pir Panjal Range. Due to the shortage of fuelwood, the use of cowdung, sawdust and dry-leaves is rising.

Singh\(^39\) has worked on Ladakh and found that the natural environment of Ladakh is characterised by cold-desert conditions due to which most of the parts are uninhabited. The inhabited portions constitute only 0.6 percent of the total geographical area. These are situated largely on the valleys-floors, river-terraces and alluvial fans. Subsistence agriculture and livestock rearing are the principal economic activities. Average size of landholdings varies between 0.9 acres to 3.6 acres and entire agriculture depends on irrigation. People grow naked barley, wheat, peas, buckwheat, beans etc. and alfalfa grass for fodder. The eastern higher part known as Changthang is populated by the Changpa nomads who rear pashmina-goats, sheep and yaks. They exchange inedible animal products for eatables and other items with the people of lower areas. Lots of army moved into
the region after Indo-China dispute of 1962. Also the strengthening of administration led to the establishment of many new government offices. These personnel created demand for vegetables etc. which brought about some changes in land-use pattern of the villages situated nearer to the markets. The vehicles started reaching in Leh after the Leh-Srinagar highway was completed in 1966. The enhanced communication with outside regions induced some changes in the economy which were visible around the major administrative centres. The major change came after 1974 when the area was opened up for the tourists. The tourism industry provided quick money-earning opportunities to many people around a few centres of tourist-attraction as well as those who came into the region after the industry flourished. The environmental effects of increased population in many parts are reflecting through soil and water contamination, generation of garbage and appearance of water-borne diseases.

The discussion suggests that most of the population in Western Himalayas is dependent on the agricultural activities and meet their domestic needs of food, fodder and fuel by depending on the local natural resources. The increasing population pressure has induced some adverse changes in the environment. Ladakh is probably the only area where growing population is not largely dependent on the scarce natural resources but on the tertiary activities. However, it has other type of ecological effects.

The overall discussion on the issues of environment-development interface in the Himalayas suggests that the environment is fragile. It has a limited capability to tolerate the overexploitation of natural resources or to bear the pressure of growing population. The overall analysis of these processes can be arranged in a sequential manner (Figures-1.1a, 1.1b & 1.1c). The first stage characterised by small population and sufficient resources has already passed in most of the Himalayan areas. The second stage is prevailing in some places whereas many parts have reached the third stage.

STUDIES ON THE STUDY AREA AND ADJACENT TERRITORIES

Only a few scholars have paid attention to Pangi valley. Even travellers rarely passed through this isolated region due to its location away from the main Indo-
Tibetan trade routes. Therefore, literature on Pangi valley is rather limited. Gazetteers\textsuperscript{40} are important sources giving some information about physiography, culture and socio-economic aspects. Due to the paucity of systematic and scientific research material, the relevant literature on adjacent areas like Ladakh and Lahaul part of Lahaul-Spiti district has also been reviewed. Taking into consideration the nature of description, the available material has been arranged under the following heads: -

- Studies Related to Pangi Valley
  - Historical Aspects.
  - Physical Aspects.
  - Cultural and Socio-Economic Aspects.
- Studies Related to Adjacent Territories.

**Studies Related to Pangi Valley**

**Historical Aspects**

As such no reference is available on Pangi valley in the historical texts. However, river Chandra-Bhaga has been mentioned as *Asikni* in Rigveda (Rigveda x,75.5)\textsuperscript{41} and *Acesines* by Greeks.\textsuperscript{42} Hermann Goetz\textsuperscript{43} has referred to Pangti as the old name of Pangi. Joshi\textsuperscript{44} writes, it is believed that a warrior Rajput clan came to seek refuge in this far-flung mountainous region in the medieval period. The male Rajputs went back to fight the battles and died without ever returning to Pangi. The present-day Pangwals are said to be the descendants of those Rajput females and their servants or of the persons condemned to this part by State order or a few coming from elsewhere.

Vogel\textsuperscript{45} has translated two stone-slab inscriptions found in various parts of Pangi valley inscribed in Sharda language. He found that these belong to 12\textsuperscript{th} century AD and contain the names of some people including the Raja of Chamba and the local Rana ruler.

Chabra\textsuperscript{46} has given description of copper plate inscribed in Tankri language which dates back to 8th April 1641. It records that King Prithvi Simha (Prithvi Singh) donated the village of Mimdhala (Mindal) in the Pangi Mandala alongwith its residents of that village to the goddess Chamunda. The villagers of that place
thenceforth were to be regarded as subjects of the deity thenceforth. They had to render their services and pay all dues to the deity and no longer to the King. The King made this gift on worshipping the goddess on his way from Kullu to Chamba through Lahaul and Pangj where he had to succeed to the throne.

Charak writes that before the reign of Prithvi Singh (1641-68), Pangi was under the rule of local Ranas subject to the supremacy of Chamba State. He brought the valley under his direct control by appointing the State officials and replaced the local Ranas. He was the first King to erect Kothies or State offices in Pangi valley.

**Physical Aspects**

Thomson reached Pangi valley via Sach Pass on 12th May, 1848 while going to Zanskar. He ascended up the steep slopes passing through the stretches of snow and glaciers and found the route to be very tough. He described that the valley is narrow and rugged and natural vegetation consists of pine, cedar, birch and walnut trees.

Hutchinson and Negi have given almost similar description of Pangi valley. They write that Pangi valley is formed by river Chandra-Bhaga which flows in a deep and narrow gorge between Pangi range and the Zaskar range. The valley is remarkable in its rugged grandeur and austere and the nature appears in her wildest and grandest moods. Traditional paths are narrow and dangerous thus, hardly deserving the name 'road'. Winter season is very severe and snowfall may begin even in lower parts as early as October but it does not stay covering land till early December. The whole valley remains covered under deep snow till March or April and communication with the outer world and among the different populated areas within valley is completely suspended. Food for men and fodder for cattle have to be stored for winter months.

**Cultural and Socio-economic Aspects**

Shashi has written that the Pangwals are aboriginals of Pangi region. There are a few Tibetans who are known as Bhots. Marriage is considered as an essential institution and a woman is free to divorce her husband if she is not satisfied with him. The Pangwals are God-fearing and superstitious people. Gupta writes that the Pangwals are divided into higher and lower castes. The people of the higher castes do
not eat and intermarrv with lower castes and not even with Bhots. The people of Pangi are monogamous. They are mostly engaged in the cultivation of land. Bose describes that Chenab valley of Chamba is very cold and desolate and its regional name is Pangi. The people of Pangi are called Pangiyals who are robust, gay and hard working. Unlike Lahulis they are Hindus. The area is sparsely populated.

Marh explains the houses of Pangi to be double-storied and flat-roofed. These are kutcha-houses constructed with locally available material. The lower storey is larger than the upper one and flat-roof serves as the terrace at its front. The whole family along with animals lives in the lower storey during winters.

Singh has portrayed a vivid picture of the area and aspects of socio-cultural and economic life. Mainly, the people are engaged in cultivation and also rear animals. Agriculture is main occupation in summers and spinning and weaving during winters. All the produce is meant for domestic consumption.

Oberoi, Moorti and Sharma have analysed the aspects of agricultural development taking into consideration the existing cropping pattern and yield of principal crops; problems in the adoption of modern technology and constraints in agricultural development. Parmar takes into account the problems and prospects of development of the region. He emphasises on domestication and commercialisation of some dry fruits which otherwise grow wild in the valley. He further stresses the necessity of developing communication network, which is, absent in the region. He feels, this shall help the exploitation of local resources both natural as well as human.

Basu has looked through the welfare programmes introduced by the Government and their impact on the life of people. He found a number of bottlenecks and weaknesses in the implementation of Tribal Development Programmes. Kayastha and Mishra have slightly touched upon the aspects of physical isolation and socio-economic life in general. Negi has given a running reference of the land and the people.

The unpublished M.Phil. Dissertation and a paper of Shahnawaz have included almost all the aspects of Pangi valley. He found that the natural environment of the region is inclement and socio-economic conditions of the people are very poor. Government has made some efforts towards the development of the region but it is largely confined to the establishment of infrastructure. On the other hand, local
people remain engaged largely in work to meet their day-to-day requirements of life and are not able to draw much benefits from these facilities.

Singh and Shahnawaz found that a larger proportion of the workforce is engaged in primary sector of economy. Landholdings are small and there are no wide disparities in the ownership pattern. The economy of the region is largely constrained by the environmental conditions.

Studies Related to Adjacent Territories

The studies on adjacent areas have been seen those conducted on Ladakh and Lahaul.

Raza and Singh have brought out the problems of regional development in Ladakh. They have discussed the level and nature of constraints inhibiting developmental processes and identified spatial units for planned development. They have taken the help of selected socio-economic indicators and have worked out hierarchical structure of settlements and growth points for development.

Singh has viewed the regional development of Ladakh under the dynamic frame-work of 'triangle of forces' where nature under low level of technological development plays determining role and man through his social institutions simply adapts himself to the requirements of the nature without altering much of it. Following this approach, Singh finds that harsh climate and rugged terrain are the major constraints on the agriculture of Ladakh. Traditional agricultural techniques, use of local seeds and lack of chemical inputs make entire agricultural economy of subsistence type. Though four fifths of the total workforce are engaged in agriculture but due to highly seasonal economy of summer season and low land use intensity it barely meets the food requirements. Under these conditions, many people practise pastoral nomadism to subserve their needs. Singh further writes that natural environment has caused underdevelopment of Ladakh not only economically but also educationally. Whereas on the one hand there is improper infrastructure on the other hand mountainous terrain, long distances and harsh climate make it impossible for children to utilise the available facilities. Historically, Gompas (Buddhist Monastries) have played an important role in the dissemination of knowledge. Analysing the significance of Gompas, Singh found Ladakh a rare area where organisation of
space is reflected through location, spacing and hierarchical-linkages of *Gompas*. Mann⁶⁸ too has looked into the role of monasteries in Ladakhi life and culture and found that the place and role of monasteries and its organisation in socio-cultural and techno-economic system have assumed an inherent form.

Mann⁶⁹ and Goldstein and Tsarang⁷⁰ have reinterpreted the polyandry in Ladakh where primogeniture system has been followed traditionally. But due to decapsulation of the region and recent advances that have taken place in last few decades, this system got a set-back. The impact of which has resulted into rapid population-growth and sub-division and fragmentation of land. Chatterjee⁷¹ has analysed traditional and contemporary systems of social stratification among Ladakhis. She has also looked into the changing social order and the aspects of socio-economic changes in the society.

Finally, Aima⁷² has analysed the farm economy of Leh taking into consideration the distribution and size of land holdings, cropping pattern and agricultural inputs. He finds agricultural sector quite passive and limited in expansion and suggests for the chemical treatment of soils, improvement of irrigation facilities and cultivation of off-season vegetables to strengthen the farm economy.

Chand⁷³ has done secondary sources based analysis of relief properties and drainage morphology of Lahaul and has described about the geology of the region. He identifies five geomorphic regions based on altitude, type of geomorphic processes and vegetation characteristics. Sharma⁷⁴ has briefly discussed both the internal and external aspects of kinship organisation of polyandrous Lahulas of Ghar valley. They are not stratified on the basis, of castes and creeds and have a homogenous society following Buddhism. Singh, Bhasin and Sharma⁷⁵ have given brief description of Lahaul and its society. They have included dress, language, religion, food, marriage and demographic aspects. Kuldev⁷⁶ writes that the area has uneven mountain topography with wide intra-regional physiographic variations. Most of the parts are either devoid of or have little vegetation. People are a mixture of different racial groups among whom Joint family system is most common. Only valleys with milder climate and less rugged terrain are inhabited. Literacy rate is low especially among females. About three fifths of total population constitute total workforce about half of which is engaged in agricultural production for home
consumption. Thakur, Thakur and Saini have assessed the impact of Trial Development programmes on socio-economic parameters in Lahaul. To them the physical achievements do not seem to be in consonance with the financial expenditure in the area.

The review of literature clearly shows that material available on Pangi valley is scanty and most of it is general in nature. Again, it has largely been derived from the main sources like gazetteers. A short paper by Oberoi, Moorti and Sharma is the only work based on primary observations who have adopted a good methodological approach but it deals with agriculture only. Though they have mentioned lack of irrigation as a constraint on agricultural development but have not analysed this aspect in detail. Thus, the paper has limited utility for the present study. Another short paper of Parmar seems to be based on incorrect information in some respects, e.g. he mentions the lowest altitude of Pangi as 5000 feet while it is about 7000 feet. Also, he has discussed change in work force and occupational structure. The discussion is again based on incomparable data. Some villages of Pangi were transferred to Lahaul-Spit in 1975. He has adjusted the data for 1971 but not for 1961. Thus, this data is not comparable whereas due to change in the definition of workers, the same for 1971-81 is not directly comparable. He has added up main and marginal workers for 1981 and compared these with the main workers in 1971.

Singh and Shahnawaz have attempted to make some adjustments in the spatial data at village level. They found it difficult to make adjustments in the workforce data as the data for all the workforce-categories was not published for 1981. Again, more details about the sub-categories of each category are not available below district level thus the adjustment was not possible.

The above discussion shows that there are very few systematic studies on Pangi valley. Most of the available material is general in nature and does not have much utility for the present study.

On the other hand, various works by Singh on Ladakh are quite systematic and methodical. The areas are different but some useful inferences can be drawn which are quite relevant to the present study. The unpublished research works of Chand and Kuldev on Lahaul seem to be good quality and provide some information on the adjacent part of the Chandra-Bhaga valley.
OBJECTIVES

The discussion on the study area and literature show the natural environment of Pangi valley to be quite difficult. The physiographic and climatic conditions seem to have a strong bearing on the population distribution, economic activities and the interaction within as well as with outside areas. It is also observed that population increase is quite high and people depend largely on the locally available resources for their requirements of food, fodder and fuel due to the poor means of communication.

Keeping above discussions in mind, the present study has following objectives:-
1. To study the major elements of environment in order to understand its nature.
2. To examine the relevant population-characteristics to assess their relationship with environment as well as recent processes of development.
3. To understand the food-production system and analyse various changes in it.
4. To bring out the variations in livestock-population and find out its causes and effects.
5. To look at the changes in the forest resources and reveal its effects and factors responsible for it.
6. To comprehend the availability of food from various local resources.
7. To appraise the aspects of government intervention for the development of region.

RESEARCH QUESTIONS

In the light of the above discussion pertaining to the problems of natural resources, population growth and environmental degradation as well as on the relevance of the indicators of development in terms of the satisfaction of basic needs, the present study has following research questions: -
1. What is the nature of local environment?
2. How does environment influence socio-cultural and economic life of people?
3. What is the role of natural resources in the distribution and growth of population?
4. What is the impact of increasing population-pressure on the agricultural land?
5. Is cropping pattern and its change restricted by the natural conditions?.
6. How are the people able to meet their food requirements?
7. What is the role of livestock resources in the economy of the region?
8. What is the importance of forest in local society? Is forest cover changing?
9. What are the factors and nature of environmental degradation?
10. How far the government has been successful in developing the society?

DATABASE

Accessibility to the information in terms of quantitative data or other data is important for any scientific research. As seen in the literature review, availability of research material on the relatively isolated areas/societies like that of Pangi valley is rather scanty. In the light of the topic of present study, lot of data was needed for analysis. Thus, efforts were made to procure information from various sources which include both secondary as well as primary.

Secondary Sources

It is observed that the region has small population and remained isolated until recently. The record keeping has been quite poor due to this. However, the forest resources of Pangi valley had assumed significance at least by the second quarter of 19th Century. Thus, a few related documents of the last and this century are traceable. It has been mentioned that the region was under the control of Raja of Chamba who used to get some revenue from the people of this low productive region. Thus, some records of the Princely Regime regarding this are available in the settlement office at Chamba.

Other important sources of information are the gazetteers one of which was compiled in the beginning of this century and the other in 1964. Though, both of these cover Chamba State and Chamba district as a whole respectively but include relevant information on Pangi valley. Lal Kitab (Red Book) and Patwari Records have been consulted for information related to the expansion of cultivated land and cropping pattern.

Population data at the village level has been taken from publications of the Census of India like District Census Hand Books of Chamba District from 1951 to 1991. Various other Census publications have also been consulted. These
pertaining to Himachal Pradesh, include special tables for Scheduled Castes and Scheduled Tribes, Household Population by Religion of the Head of the Household as well as Households and Household Population by Language Mainly Spoken in the Household.

Apart from these, statistical outlines and; occasional and special publications on Pangi Block, on Chamba district and Tribal Areas of Himachal Pradesh released by the Directorate of Economics and Statistics, Himachal Pradesh have also been consulted to supplement the data.

Toposheets published by the Survey of India, Dehradun on 1:50,000 scale and by the United States Army Map Services, Washington D.C. on 1:250,000 scale have been used for the analysis of topography. Along with these a Hachure Map printed in 1874 and some maps prepared from the Satellite Imageries of late 1980s and early 1990s by the H.P Remote Sensing Cell, Shimla (HP) at 1:50,000 scale were helpful in order to understand changes in the land-cover.

**Primary Sources**

It is evident from the above discussion that most of the available sources of secondary data provided information either for Pangi valley as a whole or at the village level. However, a lot of data was needed at household level for the present study. This gap was filled up by generating data through field-surveys. Fieldwork was conducted from June to November 1997 for the present study. Another field-survey was also undertaken from June to August in the year 1993 by the author for his M.Phil Dissertation and the data of this survey has been used mainly to understand the various changes only. The survey done in 1997 for Ph.D. thesis was conducted with the help of two questionnaires one for the village-level information and other for individual households.

The Village-Level questionnaire was designed to collect information at village as well as at hamlet level (Appendix-1.1). Most of the villages consist of some hamlets spread over a vast area. Empirical observations show that the characteristics of land, mainly due to slope, and availability of irrigation significantly vary over small distances. Thus, effort has been made to minimize the data-errors arising in the averages due to the variations at smaller level. The information collected at hamlet level include number of households belonging to
native and non-native people, their respective population and main occupation during summer as well as winter seasons; and the modes of their interaction in terms of trade/exchange etc. These figures were collected at social-group level for natives to avoid the overgeneralisations if there were some caste or community-wise variations in the pattern of resource-usage or differences in land as well as livestock holdings. The information regarding landuse, cropping pattern, sowing and harvesting times of various crops, modes of irrigation as well as the location and distances of sources of water was compiled in order to understand the variations and changes in these. Also the questions regarding the expansion of land, depletion of pastures and forests; damage to land; and the changes taking place as a result of developmental process were recorded at the village and hamlet levels.

The household questionnaire was divided into eight main sections (Appendix-1.2). First section included questions on the demographic aspects. It was important to know the size and age-sex composition of the families in order to calculate their food-needs and the proportionate availability of various items; and to understand the current changes in their occupation.

Second section was devoted to the information on cooking and lighting devices used by them to find out the changes in their traditional fuel-usage. Third section dealt with the agricultural aspects which was relevant to bring out the variations in the size of landholdings, cropping pattern, various agricultural inputs and outputs and to calculate the availability of food and fodder obtained from the cultivated fields.

Fourth section included questions regarding the size and composition of domestic animals and their various contributions to the household economy. This information was collected to find out the variations among these in relation to the size of landholdings as well as the family-size. Fifth section consisted of questions related to the collections from forests and pastures so as to understand the level of people's dependence on local resources and their contribution to the household economy.

Sixth section of the questionnaire included questions pertaining to the consumption pattern in terms of food, fuel and clothing in order to find out the
shift from traditional items and to know its causes and effects on the household economy. Seventh section was devoted to the questions on environmental aspects, which provided information about the nature, extent and causes of environmental degradation.

Last section had questions with respect to the aspects of change; peoples knowledge about the various developmental programmes introduced in the region and the benefits derived, if any, from these programmes.

Apart from this, a journey was taken through all the inhabited villages and many of the pastures and forested areas used by the people to observe the nature and extent of environmental degradation and to understand the processes leading to this. Apart from this, general observations were made and photographs were taken. Extensive discussions were held with the local people and the government officials in the study area.

METHODOLOGY

Any information collected without a purpose may not help in drawing any meaningful results. The objectives and research questions of the study play an important role in this regard. Certain methodology is required to collect the data and information from field in order to relate it with the objectives and research questions of the study. Thus, keeping in mind these as well as the variations in the ground realities, certain methods have been employed to accomplish the purpose of study. The used methods can be divided into two categories :-

- Data-Collection Methods.
- Data-Analysis Methods.

Data-Collection Methods

It is very important to take care in the collection of data to achieve desired results. Sampling plays significant role in this regard. However, the method of sampling varies according to the purpose and the nature of the region under study. It involved two steps in the present study. These were the selection of villages and the selection of households.
Selection of Villages

Physiographic and micro-climatic variations play important role in determining the pattern of population and land distribution as well as other resources in the areas like Pangi valley. Thus, altitudinal variations formed the primary consideration for the selection of villages. The main valley of the region extends in south-north direction and almost all the sub-valleys have east-west orientation. Most of the settlements are situated in these sub-valleys. Thus, attempt was made to capture the characteristics of various parts of Pangi valley by selecting villages from all the sub-valleys, except one, which is very small and has only three villages.

The villages were selected through the Purposive Method of Sampling. The criteria of selection used for this purpose included the altitudinal-zone, total number of villages situated in each zone; and number of households in the villages situated in each altitudinal-zone inside the various sub-valleys.

The lowest village of Pangi valley is situated at an altitude of 2300 meters while the highest is nearly 3600 meters above mean sea level. However, pastoral activities reach as high as 3750 meters. Therefore, The extent of human activity was divided into three Altitudinal Zones in order to capture the altitudinal variation in these activities. These are following :-

1. - the Higher Zone i.e. from 3250 mts to 3750 mts.
2. - the Middle Zone i.e. from 2750 mts to 3250 mts.
3. - the Lower Zone i.e. from 2250 mts to 2750 mts.

According to 1991 Census, there were 60 inhabited villages in Pangi valley. Out of these only 55 are the permanent villages. The remaining 5 were temporary seasonal camps of labourers etc. and these have not been considered for the sampling purposes.

As stated earlier, eastern slopes of the Pir Panjal Range and western slopes of the Great Himalayan Range form the region. The slopes of the Pir Panjal Range are steeper, thus, only seven villages are situated on some patches suitable for cultivation in this Range (Figure-1.3). Remaining forty-eight villages are situated on the slopes of the Great Himalayan Range. These are mostly situated in three major sub-valleys namely Sural valley, Hundan valley and Saichu valley; and two
PANGI VALLEY
LOCATION OF SAMPLE VILLAGES

19 Location Code
● Inhabited Villages
@ Sample Villages

3 Dharwas, 11 Sund Bhalauri,
18 Ponto, 20 Maler, 31 Takwas,
33 Hundan Bhalori, 44 Kumar,
48 Sach Khas, 50 Ghisal,
54 Mindal, 59 Sahil,
66 Tuan, 70 Sacha, 71 Chaurg,
82 Thandal, 92 Shaor,
94 Kulal

Figure - 1.3
minor sub-valleys known as Karyuni and Parmar valleys. Some villages in the southern parts are located on the outer slopes of the main valley along Pangi-Lahaul route.

Table 1.1
Details of the Sample Villages

<table>
<thead>
<tr>
<th>Altitudinal Zones</th>
<th>Total Villages</th>
<th>Number of Surveyed Villages</th>
<th>Name of the Surveyed Villages</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Zone</td>
<td>9</td>
<td>3 (33%)</td>
<td>Sural Bhatauri Hundan Bhatori Chasag</td>
<td>Sural valley Hundan valley Saichu Valley</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Great Himalayan - do - - do -</td>
</tr>
<tr>
<td>Middle Zone</td>
<td>20</td>
<td>6 (30%)</td>
<td>Ponto Takwas Kumar Ghisal Tuan Thandal</td>
<td>Northern part Hundan valley Kumar valley Saichu valley Saichu valley Southern part</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pir Panjal Great Himalayan</td>
</tr>
<tr>
<td>Lower Zone</td>
<td>26</td>
<td>8 (31%)</td>
<td>Mindal Dharwas Malet Sach Khas Saichu Shaor</td>
<td>Central part Sural valley Hundan valley Saichu valley Saichu valley Southern part</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pir Panjal Great Himalayan</td>
</tr>
</tbody>
</table>

Table-1.1 shows that twenty-six villages are located in the Lower Zone, 20 villages in the Middle Zone and only 9 in the Higher Zone. Attempt has been made to cover around one-third of the villages in each of the Altitudinal Zones. The villages were chosen almost equidistant upside and inside the sub-valleys. The villages having less than 20 households in 1991 were ignored as it was thought that at least 10 households (50 per cent) must be covered in a sample village. A sample smaller than this would not have given meaningful results.

Keeping the above factors in mind, seventeen villages were selected for the survey (Figure-1.2) Three villages are taken from the Pir Panjal Range. First village, namely Ponto, is situated in the northern part of the Range near traditional Chamba-Pangi route via Sach Pass (4413 mts). This village is surrounded by forest on all sides. Second village Mindal is located in the central portion near Chamba-
Pangi route via Cheni Pass (4387 mts) and also has some historical importance. Third village is known as Kulal, which is more remote toward the south of the former villages.

Rest of the fourteen villages have been selected from the Great Himalayan Range. Two villages, Dharwas and Sural Bhatori are situated at varying altitude in the northern most sub-valley (Sural valley). Each of the three village; Malet, Takwas and Hundan Bhatori are situated in the three Altitudinal Zones of the Hundan valley. Malet is a part of the administrative headquarters of Pangi valley known as Killar. Kumar village is situated in the Middle Zone of Parmar valley.

Saichu is the largest sub-valley and is situated in the central parts of Pangí. Six villages namely Sach Khas, Ghisal, Sahli, Siachu, Chasag and Tuan are situated in the various Altitudinal Zones. Sach Khas is the first village on way to this sub-valley and Tuan is the last one.

Two villages are selected from southern parts of Pangí. Thandal village is located about 5 kms upside the Lahaul-Pacific route. Shaor is the southern most village of Pangí but first on the newly constructed Lahaul-Pangí road.

The distribution of sample villages clearly shows that effort has been made to cover the vertical as well as horizontal variations among different parts of Pangí. Apart from this, observations were made in all the inhabited villages and anything found specific was noted down to incorporate in the analysis, if required.

**Selection of Households**

Villages are quite very small in Pangí. According to 1991 census, six villages out of 55 permanent villages had upto 20 households. As stated above, these were ignored for the purpose of questionnaire-survey. Thirty-one villages had 21 to 50 households whereas fourteen villages had from 51 to 100 households. Only four villages had more than 100 households while the highest being 125 households.

An attempt was made to include 50 per cent of the households in each sample village. This added to a total of 513 households (Table-1.2).
### Table - 1.2
Details of the Surveyed Households

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of Village</th>
<th>Altitude in mts</th>
<th>Total Households in 1997</th>
<th>Surveyed Households</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Native Non-Native Total</td>
<td>Native Non-Native Total</td>
</tr>
<tr>
<td>1</td>
<td>Sural Bhauri</td>
<td>3300</td>
<td>33 0 33 16 0 16</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Dharwas</td>
<td>2600</td>
<td>76 31 107 37 15 52</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Malet</td>
<td>2600</td>
<td>68 37 105 34 18 52</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Ponto</td>
<td>2775</td>
<td>35 3 38 18 2 20</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Takwas</td>
<td>3150</td>
<td>35 4 39 18 2 20</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Hundan Bhatori</td>
<td>3500</td>
<td>57 1 58 28 1 29</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Kumar</td>
<td>3100</td>
<td>53 3 56 26 2 28</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sach Khas</td>
<td>2400</td>
<td>63 23 86 31 12 43</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ghisal</td>
<td>2900</td>
<td>41 0 41 20 0 20</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Sahli</td>
<td>2700</td>
<td>29 9 38 15 4 19</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Saichu</td>
<td>2650</td>
<td>37 10 47 18 5 23</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Chasag</td>
<td>3300</td>
<td>57 2 59 28 1 29</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Tuan</td>
<td>3000</td>
<td>29 0 29 14 0 14</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Mindal</td>
<td>2400</td>
<td>55 5 60 27 3 30</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Kulal</td>
<td>2650</td>
<td>37 4 41 18 2 20</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Thandal</td>
<td>2800</td>
<td>83 0 83 41 0 41</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Shaor</td>
<td>2450</td>
<td>95 19 114 48 9 57</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>883 151 1034 437 76 513</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The households have been selected with the help of Multi-Cluster Proportionate Sampling Method. For this, all the hamlets were identified in the sample village. Then, all the native and non-native households were listed separately in each hamlet. This was done mainly because Pangi is a scheduled tribal area. Non-natives can neither possess any landed property nor have direct access to other natural resources of the area. Finally, 50 percent of the households belonging each to the natives and non-natives in each hamlet were selected for the survey. The same procedure was adopted in all the sample villages. In this way, a total number of 437 households of natives and 76 households of non-native were included in the survey, which constituted a total of 513 households.

**Data Analysis Methods**

The data does not reveal various facts or relationships unless it is processed and analysed in accordance with the controlling or dependent factors. This helps in achieving the objectives and to answer the research questions kept in mind. The detailed discussion on some methods has been given in the relevant sections of...
various chapters. However, some other methods along with an outline of these methods is presented here.

Understanding of the nature of environment has been developed through the analysis of physiography, drainage, climate and natural vegetation of the region. Physiographic analyses include altitudinal zonation and slope analysis. Slope analysis has been done using Wentworth’s method. Drainage characteristics have been studied by calculating the gradient of major streams and finding the drainage texture using Smith’s method.

The population-parameters have been analysed by looking into ratios and percentages in terms of its spatial and temporal attributes. Similarly, the landuse characteristics have been analysed by comparing the absolute and proportionate figures pertaining to various time periods. The changes in livestock population have been seen at the level of Pangi valley. Their size, composition and contributions have been compared with the family-size and farm-size.

Level of food sufficiency has been found by comparing the requirements of food and its availability from various local products used for food consumption. Similarly, the requirement and availability of fodder has also been analysed. The methodology of both these aspects has been discussed in the relevant sections. Changes in forest have been discussed by presenting the incidence of tree felling over last about 150 years. Also the pressure of local people’s needs have been seen through the quantities of various forest-products obtained by them. The aspects of Government intervention have been analysed by looking into the special financial and administrative provisions made for Pangi valley and the various infrastructural facilities established in the region.

Most of the data has been presented in the form of tables. The relationships have been drawn with the help of cross-tabulations of relevant factors. The spatial variation of some aspects has been presented with the help of maps.

ORGANISATION OF MATERIAL

Regional perspective on socio-economic development is oriented towards understanding and highlighting particular problems prevalent in the study area. This has been presented by formulating the theoretical frame work. Review of
related studies on the areas having similar environmental and human specificities is important in order to assess the gravity of the problems. This helps in setting the objectives and raising the research questions. The data and empirical evidences are required to support the theoretical framework, fulfill the objectives and meet the research questions. Certain methods and schemes are needed to analyse various observations and present the whole study. All these aspects form the part of introduction and have been included in the first chapter.

Introduction makes it clear that the theme of present research is to highlight the processes of environment-development interface in Pangi valley. It becomes important to present the environmental specificities of the study area. This has been done in the second chapter entitled the natural environment. The processes of socio-economic development are concerned with the human population, thus various population-characteristics have been discussed in the third chapter.

The major economic activities in the relatively isolated mountainous regions such as Pangi valley are based on the exploitation of local environmental resources. This requires to concentrate on the dynamics of direct and indirect interface between man on one side and economically useful natural resources on the other. The various interlinkages between population and each type of economic resources have been presented in the next three chapters. Fourth chapter pertains to the dynamics of agriculture and land-resources, fifth chapter includes discussion on pastoral and livestock resources; and the sixth chapter deals with the forest resources and processes of deforestation.

The increasing population exerts more pressure on the limited economic resources which has certain environmental and socio-economic implications. The depletion and deterioration of natural resources effect the quality of life of the people. They face many problems but have very few economic alternatives. In such situations, government extends some efforts in order to develop the society and improve its living standards. Thus, it is necessary to comprehend the living conditions and environmental problems as well as to evaluate the aspects of government intervention for development of the society. These issues have been taken up in the seventh chapter.

Finally, a summary of conclusions has been presented.
References and Notes:


Mahadevan, Chi-Hsien Tuan and V. Balakrishnan Nair, B R Publishing Corporation, Delhi, pp 423-41.
48 Thomson, Thomas (1978): Western Himalayas and Tibet, A narrative on Ladakh and Mountains of Northern India, First Published, 1852, Cosmo Publications, New Delhi, pp. 338-45.