

**ENVIRONMENT, POPULATION AND SETTLEMENTS IN
LEH DISTRICT**

*Dissertation Submitted to the School of Social Science,
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MASTER OF PHILOSOPHY

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CERTIFICATE

I, **Padma Chozom**, certify that the dissertation entitled “**Environment, Population and Settlements in Leh district**” for the degree of **MASTER OF PHILOSOPHY** is my bonafide work and may be placed before the examination for evaluation.


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CHAPTER - I

INTRODUCTION

Ever since human beings have come into existence, they have not only been adapting themselves but also transforming the natural environment. The spatial spread of diverse civilizations on the earth have evolved in response of human beings to their natural environment and levels of socio-economic development, which varies both in space and in time. Human response to nature may be observed as a triangle of forces with Nature, Technology and Institutions forming the three sides¹. Nature makes available the resource base for human survival while technology and institutions help in exploiting this resource bases. Human beings under the limits imposed by nature develop technology and institutions to improve their living conditions.

The interaction between man and environment is region specific, which differs from region to region e.g. the plain, plateau or mountainous areas will have their own sets of related inclement environmental factors. Human beings in a mountainous area adapt himself to the nature with marginal modification, while in the plains, they seem to modify nature to his needs.

In the historic past, human response to environment began with the exploitation and adaptation of nature to suit human needs, as environment played a deterministic role, due to low level available technology. But over time, with the development of technology and increase in spatial interaction, people have created a superimposed anthropogenic environment. Now the increasing scale and rate of change, whether it is unplanned or planned threatens the present adaptive capacities of many societies, particularly in the fragile areas like high altitude zones by altering their natural and socio-cultural systems. Rugged topography of high altitude mountain and their characteristic hostile climate severely limit developmental work, and thus, restrict the diffusion of technology. The poor technological development in these areas renders people to accept the greater authority of natural forces and adjust to the prevalent harsh environmental conditions in their daily activities. This is true in remote Himalayan areas, as the problem of physical

LEH DISTRICT LOCATION MAP



Not to Scale

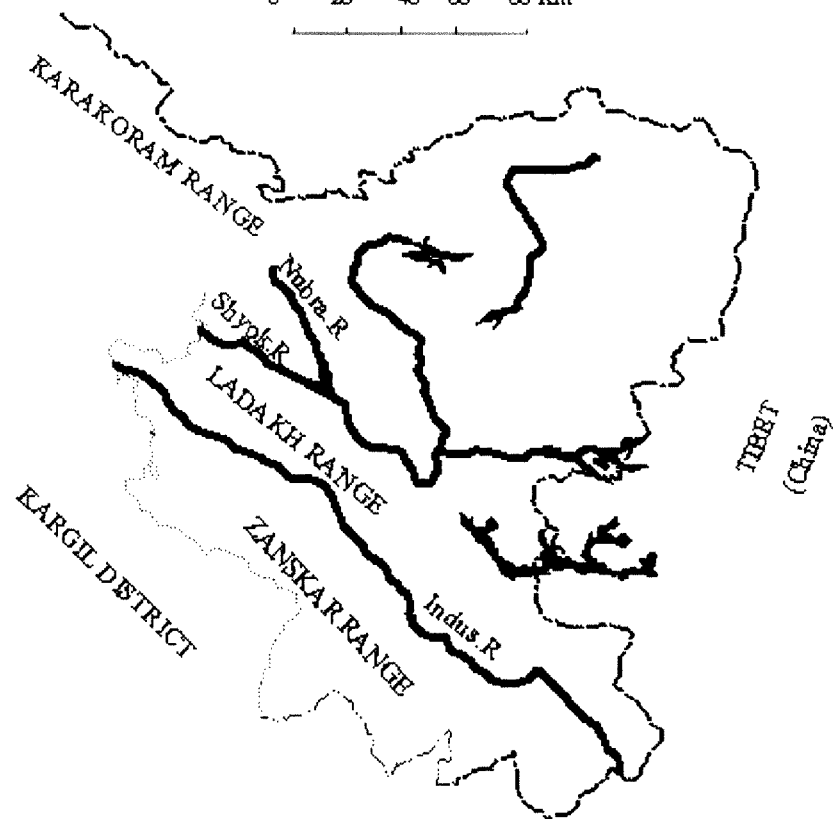
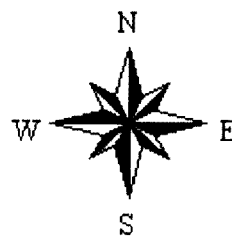
accessibility have kept them in isolation for long. Leh district was one of the most inaccessible parts of the Himalayas, a remote, resource-poor region that had witnessed little change in the technology over centuries. Harsh natural environment, characterized by arid and cold climate, rugged topography with steep slopes, and lack of forest and mineral resources, had created conditions of environmental encapsulation with little capacity to increase the potential productivity levels at operative non-mechanical level of technology.






People have adapted to this extremely harsh environment with a traditional technology by evolving socio-cultural and economic practices like agro-pastoral economy, polyandry and the Lamaistic Buddhism. Harsh mountainous topography and general inaccessibility restrict inter-regional mobility, which also, in turn, restricts development that the adjoining areas are experiencing. Population and the economic activities remained largely confined to a few favourable pockets of inhabited tract. Leh district largely remained self sufficient and remote till the 1960's. Largely due to the external influences those followed after the indo-china border dispute of 1962 and opening of Ladakh to tourists in 1974, the last few decades have witnessed rapid changes. The region came into limelight in a big way after the Indo- China border conflict of 1962. Its strategic importance was realized and a large contingent of Indian army was moved in. The strategic significance of the region got further enhanced after the Indo-Pak war of 1965, 1971 and 1999. The presence of army brought many changes in the economy and society of the area. The strategic considerations also led to the strengthening of the local administration. Consequently, a large number of new offices were established in the region. This later resulted in the in-migration of many officers and other employees. The opening of the Leh- Srinagar road and the Leh – Manali road widened the territorial linkages and monetized the economy. The most important impetus was the opening of Ladakh to tourists in 1974 and the development measures initiated by the government. While the tourism has been responsible for large scale commercialization of economy, the state government has provided the infrastructure and technological know-how. The pace of change in social values, economic standard and environmental exploitation in Leh district has been rapid compared to other areas. However, there are vast variations

Map- I.1

LEH DISTRICT

0 20 40 60 80 Km



-  International Boundary
-  State Boundary
-  District Boundary
-  Rivers
-  Lakes

within the district, where some settlements have changed rapidly with recent development, some others are still continuing their traditional livelihood and are largely untouched by modernization.

I.1 AREA OF STUDY

Leh district is situated in the eastern part of the Ladakh division of Jammu and Kashmir State between 32°15' N to 36°N latitude and 76°E to 80°15'E longitude. It is bordered by Chinese Sinkiang in the north, Tibet in the east, Pakistan occupied Kashmir in the North-west, Kargil district of Ladakh region to the west and Lahul Spiti area of Himachal Pradesh in the south. The whole of the district is mountainous region with three parallel ranges of the Trans-Himalayas, namely Zaskar, Ladakh and the Karakoram ranges (Map.I.1). Between these ranges the Indus river and its major tributaries, the Shyok, Nubra, Zaskar, Hanle and Chang-Chenmo rivers flow and most of the population lives in the valleys of these rivers. Leh district with an area of 82,665 square kilometers (including 37,555 square kilometers under illegal occupation of China)² is the largest district in the country in terms of area.

The entire region is highly mountainous with hardly any place lower than 2500 meters and mountain peaks have elevation ranging between 5000 meters to 7,000 meters making it among the most elevated inhabited region of the earth. The land surface of region can be divided into the upper zone above 4,500 meters and the lower zone between 4,500 meters and 2,700 meters. About 74 percent of the land surface is above 4,500 meters. The land below this altitude has vast stretches of barren, rugged and rocky terrain interspersed by pockets of cultivable land and a few natural pastures. The total village area accounts for only 0.8 percent of the total geographical area. Cultivated land is also scarce, constituting only 35.8 percent of the village area. Most of the villages are located below 3,600 meters. In contrast to the rugged environment of the mountain ranges, the river valleys present more hospitable and habitable

environment. The main river valleys are those of the Indus, the Shyok, Nubra and Hanle.

Climate is cold and arid and is harsh with the annual precipitation rarely exceeding 20 cm in most part of the region. It is because the region falls in rain shadow area of the Great Himalayan Range. The region experiences an extremely contrasting temperature between day and night and summer and winter. Temperature goes down to -30°C in winter while in summer it may be as high as 28°C . July and August are the hottest months having mean temperature of 20.2°C and 19.7°C respectively. January and February are the coldest month with mean temperature of -7.85°C and -6.5° respectively.

Due to the rugged topography, high altitude and cold arid climatic conditions, the population of Ladakh is very unevenly distributed. The total population of 117,232 Persons (2001) is restricted to villages occupying an area of just 393.9 square kilometers. Leh district is mainly rural with only one town. The district is divided into six blocks i.e., Leh, Khaltse, Kharu, Nyoma, Durbuk and Nubra. Leh block top with population of 32,933 persons and next position was occupied by 17786 persons, Nubra with 17367 persons, Nyoma with 8769 persons, Kharu with 7063 person. Durbuk has the lowest population with 4675 persons.

Leh district is predominantly a Buddhist district. About 77.30 percent of total population of the district professes Buddhist religion, Muslim by 13.78 percent and Christians, Hindus and Sikhs forms a tiny minority. Leh district is comprised of five ethnic group Tibeto-Mongoloids (the largest ethnic group), Mons, Dards and Baltis and Argons.

1.2 LITERATURE SURVEY

The literature available on the Leh district is scanty and severely limited. Most of the earlier works are in the form of travel accounts, systematic and

comprehensive work on the district are far from adequate. Recent decade have seen few scholars taking up study of Ladakh but their focus is mainly on the religious, social and historical aspect. Besides, most of these books are tourist oriented. Only few studies have been attempted on the area and fewer are relevant to the present study.

The available literature has been organised in three groups;

a) Historical and Physical Aspects -

Moorcroft and Terbeck³ (1820-22) were two adventure travelers, who traveled through the Himalayas for six years. Moorcroft was the first to present an academically oriented work on the Himalayan Provinces of Hindustan and Punjab, their account which still retains much of its relevance. His detailed account looks at the physical environment and the socio-economic conditions of Ladakh during that period.

Cunningham⁴ (1854), was the first who did a systematic and detailed observation of the region. He was a good observer and carried with him a number of instruments for collecting the metrological data. He gave a detailed account of historical, geographical, cultural and economical condition of Ladakh. He states that Fa- Hien and Heoi- Kong⁵ (399-400 A.D), two Chinese pilgrims, presented a hazy picture of this ancient land in their travel accounts. Ladakh has been named by them as Kie-Cha i.e. a country where snow never melts and the natives of the country are known by the name of 'men of Snowy Mountain'. According to them, the country was mountainous and so cold that no grain except barley ever ripened. His account is perhaps most accurate and authentic as for geography of the region is concerned.

Drew⁶ (1857) of Geological Survey of India, was the first to conduct a study of the geological and geomorphological aspects of different geographical units of Ladakh. Francke⁷ (1907-1979) was one of first to give an authentic account of the historical evolution of Ladakh. He describes the history, Physical set up and political events those have shaped the region and its geographical features.

Kaul⁸(1998) has viewed almost all conceivable aspects of Ladakh, especially the geographical set-up, early and late history, political developments which attended and followed in the wake of partition of the country. He has also analysed the demographic profiles of the main religious group of Ladakh and the impact of modernization on the traditional life and culture of Ladakh.

Jina⁹ (1996) has discussed varied aspects of Ladakh such as regional geography, flora and fauna, history, ancient races, social customs, religion, transport and communication system. He viewed that after 1960's due to the various steps taken by the Center and the State government, army, opening of the region for tourism and development of education greatly influenced the demographic structure of the region. Due to these, there was an increase in the growth of population, decrease in the sex ratio and economic growth in the region.

Dewan¹⁰ (2004) has emphasized on the history, religion, culture, tourism and people. He noticed that the rapid rise of population in Leh district is due to modernization and the breakdown of the old social arrangements. Nevertheless, according to him the situation is not alarming because being the most sparsely populated region, development of technology can accommodate this growing population. He noticed sudden change in rural: urban ratio which changed from 12:1 in 1971 to 10:1 in 1981.

b) Cultural and Socio-economic Aspects-

Janet Rizvi¹¹ (1983) gives a comprehensive picture of the physiography of Ladakh. She has emphasised both on the history as well as the recent changes taking place within the society of Ladakh. She has scrutinised the development programme of the Government for Ladakh which has a negative impact on the traditional bound society of the region.

Norberg-Hodge¹² (1991) discusses the socio-cultural life in Ladakh and the importance of traditional values. According to her, despite the harsh environment, the people have prospered for centuries in farming villages in Ladakh. They have learned to

make the most of the harsh surroundings by literally throwing nothing away and using almost everything at hand. She also discusses that the balance with natural environment that is the basic characteristic of Ladakhi's life is threatened by the recent force of development. Her main stress is on the losing of community interactions, people becoming money minded and losing social ties with the current development in the region.

Singh¹³ (1978) has viewed regional development of Ladakh under the framework of 'Triangle of force'. He has found that nature under the low levels of technological development plays a deterministic role and man through his social institutions, tries to adapt him to the requirement of nature. He has noted that the natural environment affects the demographic and socio-economic structure of the region.

Raza and Singh¹⁴ (1983) have analysed the problem of regional development in Ladakh. They have analysed the nature of constraints and the level of development process, identifying the spatial units for plan development in Ladakh. They have selected certain socio-economic indicators to measure the hierarchical structure of settlements in order to provide a spatial framework for development processes.

Singh¹⁵ (1991) analysed the natural environment and its role on the education diffusion in Ladakh. He found that the harsh environment had resulted in the underdevelopment of education in Ladakh. The mountainous terrain, the severe climate and the long distances make it difficult for children to take advantage of the available educational facilities. In addition to this, there are poor educational facilities making the condition worse. Besides, the traditional pastoral cum agricultural society and the Lamaistic Buddhism also acts as a constraint on the modern education development. However, the recent change, with the realization of the strategic significance of Ladakh after Indo-Pak and Indo-China wars and the opening of Ladakh to tourist had made modern education more important resulting in the development of education.

Singh¹⁶ (1992) observed that the mountainous terrain and inclement climate are the major constraints on the agriculture development of Ladakh. About 80.7 percent of the total workforce is engaged in agricultural economy but it is unable to meet the food requirements due to low productivity. The agriculture economy is subsistence type, with the use of traditional agricultural techniques and local seeds and the avenues for further development of this activity are limited. Ladakh has a seasonal economy in which no farming can be done in winters and only indoor activities like spinning and weaving are possible during winters.

Bandyopadhyay¹⁷ (1995) has observed that despite the harsh environment, Ladakhis were able to adjust their life style and maintain a better standard of living than many other Himalayans regions. They undertake hard labour, depend on a subsistence economy and make the best use of both land and water resources, grow crops that can resist extreme environmental conditions. They consumed types of food that does not require fuel for cooking and avoided wasting even the most insignificant byproduct. The shortage of agricultural land, pastures and environmental limitations have led to the evolution of a typical socio and cultural environment, which is very unique in character. The change of social system from polyandrous to a more modern society as well as the immigration from plain has resulted in the increase of population beyond the carrying capacity of the land and this in turn has caused strain on the environment.

Chatterjee¹⁸ (1985) explains that the stratification of society in Ladakh is mainly based on typical arid high altitude ecology, economy in which they are involved and their religion. In the past, Ladakhi society was divided as Rgyal-rigs, Sku-drags, Dman-rigs and the rigs-nan. The recent change after the Indo-China war (1962) and the introduction of tourism has resulted in widespread monetization of Ladakhi economy resulting in a new social class of entrepreneurs. The present Ladakhi society is divided into Ladakhis, Gara, Mon and Beda (low case) and the Muslims as Balti and Argon.

Goldstein and Tsarong¹⁹ (1987) have discussed that people inhabiting Ladakh have adapted to the inelasticity and encapsulation of the physical environment by

developing social mechanism that has prevented the fragmentation of arable land, concentration of male labour in family units and decreased the population growth through the “fraternal polyandry system”. Despite their remoteness and inaccessibility recent changes in the form of modernization and development have altered the traditional homeostatic adaptation, which ultimately has result in a situation of instability.

Bhasin and Nag²⁰ (2001) has analysed the population dynamics of four major population groups of Ladakh, i.e. Bodh, Balti, Brokpas and Arghons. They found that the Baltis have highest child population (43.2 %) resulting in high dependency rate, followed by Brokpas (40%) Bodhis (36.5%) and Arghons (32.1%). The sex ratio was lowest in the case of Baltis (951) which is mainly due to relatively high male selective out migration and less female out migration, followed by Bodhs (956) and Arghons (961). The fertility rate among Bodhs, Arghons, Baltis and Brokpas are 2.8,-1.7, 3.1 and 3.1 children per woman respectively.

Aima²¹ (1985) has analysed the occupation structure and its influence on the local economy of Ladakh. He examined the distribution of income occupation wise, family wise and caste wise. He found that exogenous factors like tourism, government sector and stationing of army have generated a great boom in the internal market of Leh for the demand of both agricultural and non-agricultural consumer goods. However, these economic gains have gone into a few hands i.e. upper strata of society in Leh town.

Aima²² (1992) has also analysed the farm economy of Ladakh. He explains that because of mountainous terrain and poor mineral content of soil, the region has a subsistence type of farming. The non-farm enterprise, which generates substantial part of their household income, is growing at a rapid rate as compared to farm occupation.

Mann²³ (1978) discussed the polyandry system of Ladakh, which came into existence to overcome the problem of scarce resources and population growth in the harsh environmental condition of the region. Besides, it also helped in overcoming the problem of insecurity to womanhood and cultivable land holdings which were usually

small were protected against fragmentation, making it economically viable. However, recent changes like education, breaking of isolation and close cultural contacts, new economic resources and opportunities and the Polyandry Marriage Prohibition Act 1941, resulted in sudden decreased in the polyandry system.

Singh²⁴ (1968) on the role of Gompa traces its hierarchical linkages as well as spacing. He observed that the organisation of space in Ladakh is reflected through the location, spacing and hierarchial linkage of Gompas. Mann²⁵ (1985) has discussed the crucial role played by monasteries, their organisation on the socio-economic and political system under the difficult ecological conditions of human existence in Ladakh. He found that monasteries influence all aspect of social, economic and political life of the Ladakhis.

Chatterjee²⁶ (1986) observed that the natural environment provides limited resource base for exploitation through human activities. The population has adapted to the conditions of limited resources through institutional structure based on the tenets of Tibetan Buddhism. Settlements in Zanskar evolved primarily as semi-closed units and settlement sites depend on availability of cultivable land and water. The response to human activities is reflected through the subsistence agro-pastoral economy. The level of development is mainly reflected by the better mobility and provision of amenities.

Sood²⁷ (1999) analysed the impact of tourism on the socio-cultural aspect of the Ladakhi society. She points out that the development of tourism has resulted in the transformation of demographic structure, commercialization of culture and religion, leading to a weakening of community bond and degradation of social values on one hand and preservation of culture, spread of new ideas and awareness of the significance of education on the other. She has found that the growth rate of population which was less than 10 percent per decade during the period 1901-1961, increased to 18.80 percent during the period 1961-1971 and then to 27.62 percent during the period 1971-1981 i.e. after the region was opened for tourists. She noticed that there was a decrease in sex ratio

due to the male selective immigration, while the literacy rate increased due to the immigration of educated people and improvement in educational facilities.

C) Other Himalayan Areas-

As the literature available on Leh district is scanty and keeping in mind the nature of the study, the scarcity of literature available becomes more acute. Therefore, some of the work based on other Himalayan areas, which bears some degree of resemblance due to the similar topography, climatic conditions and socio-cultural influences have also been taken up;

Burman²⁸(1981) analysed the pattern and change in population variables such as density, settlement pattern, education, occupation, religion and scheduled tribe composition of the Himalayan states. He also analysed the various aspects of ethnic diversity in the Himalayan states.

Moddie²⁹(1981) conducted a comparative study of 18 districts and found that the population of districts in the Himalayan areas (below 3000 m) has risen by 170 percent, while those of Gangetic plain by 127 percent and 99 percent in the case of coastal areas. He mainly focused on the demographic threat to the environment. According to him, the rapid increase in population in the Himalayan areas will ultimately results in social and environmental depletion.

Zutshi³⁰ (1985) has examined the population distribution, their urban-rural differentials, composition, literacy rate and industrial composition of workers in the eight regional units of J &K state. He found that natural environment has a strong influence on the distribution of population, while other population parameters such as population growth, sex-ratio and literacy have a strong association with socio-economic development. He found that majority of the people in Jammu and Kashmir is engaged in agriculture activities.

Chadha³¹ (1988) has discussed the rapid population growth in the Himalayas, which has doubled in the last 30 years. It is mainly due to high growth rate of population and large scale immigration from other regions. This has resulted in enhanced pressure on land and has led to the mounting demand for fuel and fodder, which in turn has led to environmental degradation.

Butola³² (1992) has analysed the relationship between spatial interaction and the level of development in Uttar Pradesh Himalayas. He has also analysed the natural constraints on the demographic and economic structure of the area and its relation with spatial interaction.

Shrestha³³ (1989) has examined the population of Nepal. He found that Nepal has a population of more than 16 million, with an annual growth rate of 2.6 percent, with 94 percent of its population living in rural areas. The land, which is the most important asset, is becoming scarce due to the rapid population growth and the per capita availability of land is only 0.16 hectares. Nepal is experiencing large scale out-migration due to its low availability of land, scarce resources, low crop yield and rapid population growth.

Karan³⁴ (1987), explains that the rugged mountainous terrain and varied climate in Himalaya have affected the population distribution. The ruggedness inhibits communication resulting in the retention of certain cultural differences as practiced by the inhabitants. The population of Himalaya tripled from 11 million to 33 million between 1901 and 1981. Average annual growth rate was 2 percent in all the areas and the population was mainly rural. The high growth rate is due to the cultural values and social institutions which have encouraged the survival of family and community through high fertility.

Karan³⁵ (1987) observed that Bhutan has the lowest population in the Himalayan region, with an average population density of 25 percent per square kilometers, with an annual population growth rate of about 2 percent. The cultivable land constitutes only 5

percent of the total area. The population pressure influences the land use here, as the per capita availability of cultivable land is 0.25 hectares only.

Mitra³⁶ (1980) has analysed the rural, physical and cultural resources of Darjeeling district. He found that majority of people are engaged in cultivation of crops, tea plantation, forestry and livestock rearing. The population distribution and settlements here are disorganized and there is an ever increasing population pressure on the available land resources.

Pokhyryal³⁷ (1994) has viewed in detail human environment and the process of socio-economic and political changes along with the patterns of land management in the land based society of Garhwal and Kumaon Himalaya.

Singh³⁸ (1999) has studied the relationship between nature and culture in Pangi valley. He found that primitive people of the region have a greater sense of ecological consciousness compared to modern people who have ignored it under the spell of development. Harsh environmental conditions have resulted in the process of agricultural production which involves division of labour and cooperation within the households.

Chibb³⁹ (1991) has found that the population divisions of Kinnaur (the lower Satluj valley, central Satluj valley, upper Satluj valley, Spiti valley, Sangla valley) is largely based on the physical aspects of land. This is similar to other mountainous and relatively inaccessible areas with predominantly subsistence agrarian and pastoral economies. However, recent exogenous influences, development of road transport and improved agricultural technology has resulted in gradual change of association between population and physical regions. Besides, the concentrations of workers and military personnel have started reshaping the demographic personality of the region.

Shahnawaz⁴⁰ (1999) has discussed the process of environment-development interface in Pangi Valley. He found that natural environment of the region is harsh and socio-economic conditions of the people are poor. He also found that available land

resources are not viable under the prevailing agriculture and infrastructural conditions. The increasing population is exerting more pressure on limited economic resources which has certain environmental and socio-economic consequences.

Uttam Lal⁴¹ (2004) discussed the deterministic role played by natural environment in Kinnaur district of Himachal Pradesh. He found that inclement environment of Kinnaur exerts a strong influence upon the size and distributional pattern of population, agriculture, cultural and other aspects of economy. Larger part of Kinnaur is uninhabited and population is mainly confined to river valleys. The low carrying capacity of the land limits the population size of villages.

I.3 OBJECTIVES

The natural environment in Leh district acts as main constraint in the distribution of population and settlement structure. The recent socio-economic changes have also resulted in a significant change in the population dynamics. In the light of the above, the following objectives have been framed for the present study;

1. To analyze the natural environment in order to understand its constraints on population and settlements.
2. To analyze the various aspect of population and change in it.
3. To analyze the settlement structure i.e. distribution, morphology and house types.
4. To identify the level of development of villages on the basis of population variables.

I.4 RESEARCH QUESTIONS

In the light of above framework and objectives, an attempt has been made to answer the following research questions;

1. What is nature of natural environment? How does it influence the population characteristics?
2. What is the distribution pattern of population? How has population undergoing change over time?
3. Do the population parameters such as growth, age-sex composition, and literacy and work participation show any relationship with physical environment, which creates problem of accessibility and connectivity?
4. What are the distribution characteristics of settlements? Do these have any relationship with the prevailing environment conditions?
5. Has the recent socio-economic development influenced the demographic characteristics?

I.5 DATA BASE

In order to fulfill the above Objectives and Research questions of the study, data from different sources has been used which are as follows;

1. District census handbook, Leh District 1981.
2. Primary census abstract, Leh district 2001.
3. Statistical Handbook, LADHC, Leh District (2000-01).
4. Government of Jammu and Kashmir, Constituency wise amenity directory of district Leh (2006).
5. Records of education office, Leh District (2001).
6. NATMO Maps

I.6 METHODOLOGY

The study is primarily based on secondary sources of data. Various statistical and cartographic techniques have been used for the calculation and representation of data on the maps.

- Percentages and ratio have been calculated for showing distribution, growth of population, literacy rate, and work participation rate and density of population and sex- ratio in order to analyze the population characteristics.
- To show the level of development and spatial variation in the villages as reflected by population parameter, a composite index has been computed. The variables have been made scale free by dividing the value of each variable from their respective mean. The row wise addition of the scale free value has been taken as the Composite Index. The formula is: ⁴²

$$C.I = \sum_{j=1}^n \frac{X_{ij}}{X_j}$$

C.I = value of composite index

X_{ij} = value of j^{th} variegate of the with village

n = No. of variables

The value of index shows the level of development. The assumption is that the higher the value of C.I, higher will be the level of development.

- ArcView GIS 3.2a have been used to construct map of the various population attributes and the level of development.

I.7 ORGANIZATION OF MATERIALS

The proposed study has been organized in five chapters. The first chapter is an introductory chapter which gives a detailed account of the relationship between environment and human beings. It also analyses the increasing role of technology that has helped man to adapt to its environment. Followed by introduction to the study area, review of literature on the region, objectives of the study, Research questions, database and methodology have been discussed.

Environment plays an important role in the underdeveloped areas like Leh district. Understanding of natural environment is important as it explain the impact of natural environment on the population characteristic and settlements. So, the second chapter deals with the role of natural environment i.e. physiography, drainage and climatic factors on the population characteristics and human settlements.

Third chapter deals with the population attributes those are influenced by the environment and recent socio-economic development. In this chapter, population characteristics such as distribution of population, growth, age-sex composition, literacy and work participation rate have been discussed. The spatial organization of settlements those have evolved in response to man and environment interaction process. Therefore, the distribution, morphology and house type of settlements have been studied.

Fourth chapter deals with the analysis of level of development of the villages as reflected by demographic indicators.

Finally, a summary of conclusions of the major findings of the study have been presented.

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CHAPTER-II

NATURAL ENVIRONMENT

The environment is a vital part of any geographical area and plays an important role in the development of a region. At an early stage of development, nature plays a dominant role in human efforts to interact with environment. It may be easier to modify the environment with the kind of technology available in one region. While, the same may not be true in other regions and human beings may need to adapt themselves to requirement of the nature.

Mountain generally have harsh environment and it is more difficult to modify the nature for procuring basic needs of human beings as well as for human settlements. Some societies in the Himalayas are at an early stage of development and have largely adapted to the requirements of environment. Leh district is one such area which has very rugged mountainous terrain and cold arid climate, has remained isolated and backward. Its isolation and backwardness is closely related to the harsh environment which has affected economic activities and distribution of population.

Leh district is one of the loftiest and remotest inhabited regions of the world. The whole area is situated at an altitude of about 2500 meters and above from the mean sea level. It is called 'high altitude' area. Rugged topography, with its high altitude, has restricted the area suitable for human settlements. Therefore, all settlements are found in river valleys those provide flat land and with more favourable climate. Out of the total geographical area of 45,100 sq kms, only 0.8 percent (393.9 sq. km) is inhabited. The mountain walls separates Leh district from the rest of the world, restricting accessibility to it only through a few passes generally situated above 4,400 meters above sea level. Thus, it remained underdeveloped. Lying in the rain shadow zone of the Great Himalayas, its climate is arid. Inclement physical environment with rugged terrain and harsh climate has been playing a dominant role on the socio-economic set-up and

distribution of population in the region. Therefore, it is important to study the following aspects of physical environmental of the region;

1. Physiography to understand the terrain and its role on population distribution.
2. Drainage to understand its contribution to economic activities and on the population distribution.
3. Climate and its impact.

II.1 PHYSIOGRAPHY

Physiography is vital part of any geographical area. Topography acts as a major factor in human efforts to modify and adapt to his immediate natural setting and is largely responsible in giving a particular direction to human activities, especially in hilly backward areas. Leh is a remote district of Jammu and Kashmir state. It remained underdeveloped due to its harsh physical setting, which resulted in its nearly complete seclusion. Rugged terrain and harsh climate has restricted population distribution to a few favourable pockets. Therefore, settled agriculture and human settlement are limited to the river valley, river terraces and alluvial fans in this region. The main physiographic units of the region are;

- (a) Mountain ranges
- (b) Plateau areas
- (c) River valleys

a) MOUNTAIN RANGES

Leh district is a mountainous region with hardly any place lower than 2,500 meters in elevation. Important ranges are the southern face of Karakoram range and Saltora range, Ladakh range and northern slopes of Zaskar range. All these ranges run almost parallel to each other. General trend of these mountain ranges is from northwest to southeast. These ranges generally provide barren rocky surface largely devoid of soil and vegetative cover. Therefore, no human settlements and economic activities are possible on these ranges. Nearly 68 percent of the total land lies between 5,000 meters and 5,900

meters above the sea level and virtually unfit for human life and vegetation. About 5.8 percent of the total land lies between 4,500 and 5,000 meters, this contains some pastures. Human settlements and agriculture are confined between 2,500 and 4,500 meters¹. The important mountain ranges of the region are;

- i) Saltora range and southern slope of the Karakoram range.
- ii) Ladakh range.
- iii) Northern slopes of Zaskar range.

i) Saltora Range and the southern slopes of the Karakoram Range

‘Karakoram’ is a Turki word which means ‘Black mountain’. It is also called the ‘shining crest of the earth’² due to its high altitude and perpetual snow cover. The southern slope of the Karakoram falls within the boundary of Ladakh region and is situated on the northeastern most part. It is separated from the Ladakh range in the south by Shyok river, which originates in the higher slope of Karakoram and flows between these two ranges. The Karakoram Range extends from Hunza in the northwest to Shyok in the east for a distance of more than 400 kms.

More than half dozen peaks of this ranges exceeds 7,500 meters in elevation. The highest peak of the Karakoram range is the Saser Kangri(7,680 meters). The entire crest line of the Karakoram range is covered with perpetual snow with a number of giant glaciers. Some these glaciers are largest glaciers of the world outside the polar regions. These glaciers are found mainly along the southern face of the Karakoram range. The important glaciers of Karakoram range are Hispar, Batura, Siachen and the Baltora glaciers. According to geologists, Ladakh was under sea millions of year’s ago³. After its upliftment, it was covered with ice cap and the massive glaciers of Karakoram are the remnants of the original Ice Age. Numerous U-shaped valleys have been created by glacial erosion. Parts of the mountains have been often shattered by periglacial action and the slopes are strewn with angular fragment of periglacial origin⁴. The glaciers are sources of water for many rivers. The ranges are mainly composed of granite and

limestone. The important mountain passes of Karakoram Range are Hispar pass (5,352m), Muztag pass (5,7000m), Saser la (5,300 m) and Karakoram pass (5,575 m).

The Saltora range is a minor twin range of Karakoram Range, which branch out at an acute angle from the main range between the Nubra river and lower Shyok river.

ii) Ladakh Range

Ladakh range is situated between Indus and Shyok rivers. It lies to the north of Zaskar range and runs parallel to it. It extends from Shyok-Indus confluence to the western border of Tibet, where Indus river bends sharply and cuts through it, separating it from Zaskar range in Rupshu plains. General trend of the range is from northwest to southeast. It is about 350 km long and 50 km wide.

Ladakh range has no major peaks and its average height varies from 5,800 meters to 6,100 meters. Slopes of this range are barren and rocks are largely composed of crystalline granite. Some of the tributaries of Indus and Shyok have cut deep valleys in this range and present a typical parallel pattern because of its steep slope. The important passes of the Ladakh range are Khardungla (5,602 m), Chorbatt pass (5,090 m), Changla (5,599 m), Digar la (5,400 m) and Tsaka la (4,724 m). Khardungla pass connects the Indus and Nubra Valleys and has highest motorable road in the world.

Its off shoot called Pangong Range runs parallel to the Ladakh Range for about 150 kms northwest from Chushul, along the southern shore of Pangong Lake. Its highest peak reaches 6,700m and northern upper slopes are heavily glaciated.

iii) Zaskar Range

It lies to the south of Ladakh range and the Indus valley. Zaskar range branch off from the great Himalayan range near 80° E longitudes and runs parallel to it. The attitude of range varies from 5,500 m to 6,200 m. This range is highly dissected and has some medium-sized glaciers, which partly feed the Suru, the Zaskar and the Khurang rivers and encloses the valleys of these rivers, which are relatively flatter and are suitable for

human settlements. Zaskar range as a whole consist of either bare rocky surface with irregular cliff or loose stone debris accumulated along the basal junction between mountain range and plateau basin-which is the product of intense denudation.⁵ The snowline of this range is at 5,500m. This great height of snow line is due to radiation of heat from the elevated plains in the surrounding area and by the reverberation of heat from the base side of the mountain⁶. Mountain above the snow line has glaciers. These are mainly small sized in the shallows around several peaks of the range. The surface of the range is chiefly disintegrated rock, and the surface of the valleys is earth or gravel.⁶ The upper rocky slopes do not support any economic activity while the lower slopes with extremely scanty vegetation can be used for grazing purposes only. These ranges are mainly composed of granite.

The Stok range is a subsidiary of the Zaskar range, lying between the Zaskar valley and the Indus valley. The major peaks of this range are the Stok Kangri (6153m), Yan Kangri (6263m), Meru (5748m) etc.

b) PLATEAU REGION

The eastern part of Ladakh is in the form of high altitude plateau known as Changthang, with an average elevation varying from 4,200 to 5,000m. It is amongst the highest inhabited lands of the world. Changthang literally means 'the northern plain' or an elevated plain, too high and cold for any purpose but pastrol use.⁷ It is a continuation of the Tibet's vast Northern plain. The plateau region is less rugged compared to the mountains and is 'wonderfully even' (Appendix PLATE.1), yet it is of little use for agriculture activity and human settlements. This is due to the very high altitude (generally above 4500 meters) and arid climate. Snowlines are at places being as high as 6,600m and snowfall is scanty. The sun's rays radiate scorching heat during daytime and at night, the mercury drops below freezing point even in the middle of summer. This results in an area of extreme climate. The region consists of;

- Lingzhithang plain – This is situated 4,500 m above the sea level. It lies between the Changchenmo valley and the Kunlun ranges. This plain is wonderfully even

as compare to other part of the plateau. The plains are doted by small lakes and have little or no vegetation. This wide plain, dry and bare, gets exposed at noon to sunrays uninterrupted and the air produces mirage.

- Rupshu plain-This is situated in the southeastern part of the Leh district. Altitude of Rupshu plain ranges from 4,600 to 5,000 meters and is one of the loftiest inhabited regions of the world. Inhabitants of Rupshu are the nomadic Changpas. There population is mainly concentrated in Hanle valley and near tso Morari lake. A few settlements are also situated near the springs and other small lakes of the region. The population density is extremely low in Rupshu plain.

The plateau region is relatively less rugged and undulating as compared to the mountains, yet it is of little use for human settlements mainly because of⁸-

- High altitude (generally above 4,500 meters) which makes the climate inhospitable.
- Aridity of land with an inland drainage that provides a limited and a highly uncertain water supply.
- Extensive rocky surfaces either with very thin soil cover or none at all.

c) RIVER VALLEYS

Physical characteristic of mountain ranges due to their rugged terrain, steep slope and rocky surface, make these uninhabitable. Under such conditions, the river valleys with flat land and lower altitude provide favourable environment for human settlements in contrast to the mountain region. Infact, most of the settlements in the district are concentrated in river valleys. The river valleys with flat land, availability of water and less severe climate favour human settlements in this region. Therefore, majority of the village are concentrated in river valleys at the elevation of 2,750 m to 3,750 meters. Thus, it is important to study river valleys. The main river valleys of the district are;

i) Indus Valley

The Indus valley is situated between Ladakh range and Zaskar range lying in the north and south respectively. Indus River enters Ladakh at Demjok and flows diagonally towards the northwest, where the river forms a U-shaped valley having almost vertical mountain walls on both side. The valley provides favourable conditions for human settlements with its flat land and warm climate. The upper course of the Indus valley is narrow, and rocky. Therefore, the upper course is sparsely populated, with limited vegetation growth and a narrow valley. The valley becomes wider and flatter towards the central course of the river i.e. from Spituk onwards. Therefore, majority of the settlements are concentrated in this part. The Indus valley covers more than eighty percent of area of the Leh district and passes through the entire length of the district from southeast to northwest. This valley has an area of about 10360 square kilometers. The width of the valley ranges between 4 km to 6 km. The important settlements found in this part are the Spituk, Leh, Chuchot, Stakna, Thiksey, Shey, Nemoo, Khalstse, Saspol and Bazgoo etc.

ii) Shyok and Nubra Valley

Shyok river originates on the southern slope of the Karakoram Range and carve out deep valley that is approximately 500 meters in width. The upper and central part of Shyok valley has rocky surface, therefore, human settlements are not found there. However, towards it lower section, due to its flat surface and suitable climate, agriculture and human settlements are possible. So all the villages, in the Shyok valley are found in the lower sections of the valley. However, this valley along with its tributary valley of Nubra river are jointly called Nubra valley.

Of all the valleys in Ladakh, Nubra valley is the most luxuriant and fertile. Its gentle slopes are covered with thick grass and flowers during summer months, giving it name of Nubra, which means the 'valley of flower' and it is an open valley.⁹ The Nubra

Valley lies to the north of the Indus valley, with the Karakoram range forming its northern boundary and Ladakh range lying to its south. The Nubra valley lies about 10,000 ft above sea level. It has an area of 23869 km², with about 206 kms in length and 276 kms in breadth.⁹ The valley bottom is composed of alluvial sand and stones over which the river flows in a broad bed with many channels that leave the main stream at various points. The mountains rise on both sides abruptly from the valley in great masses, forming walls of solid rock broken only by narrow side gorges that strike directly into the heart of the range, dividing the facing wall into enormous sections. The gorge has formed symmetrical "fans" radiating out broadly from the narrow openings and extends to the middle of the valley or beyond. On these "fans" are situated the villages, scattered throughout the valley at fertile spots. The wide open valley is flanked by high barren mountains on both sides. The area is rugged and barren with steep cliffs, but down the valley, there is vegetation cover and human settlements along the riverbed. The Nubra valley is fed by two major tributaries of the Indus-the Nubra and the Shyok, both originating in the Karakoram range, while the Nubra river rises from Siachen Glacier, in the southern slopes of the range, the Shyok river springs up from the mountains southeast of Karakoram pass. The two rivers form a giant arch and meet just above Diskit village.

iii) Hanle valley

It is situated in the southeastern part of the Leh district in Rupshu plain. The Hanle river is an important southern tributary of the Indus river, which meets the later near Loma bend. It is an important source of fresh water in Rupshu plain and provides the basis for human settlements. The valley with its high elevation (4,500m) has severe climate of extremely low temperature and extreme dryness. The glacial action has played a dominant role in shaping the topography of the catchments of this river. The vegetative cover in this area is very scanty. Vegetation occurs near the springs and lakes. The other areas are devoid of vegetation. The changpa nomads whose flocks depend on this vegetation mainly inhabit this valley.

Natural environment, therefore in the form of mountain physiography with their negative characteristic of rugged terrain, high attitude, steep slope and extreme cold climate, has limited the availability of land for economic activities and human settlements to a few favourable sites confined to valleys region especially on alluvial fans and river terraces.

II.2 DRAINAGE

Drainage refers mainly to the network of natural streams and their characteristic. Drainage plays an important role in human settlements, as it provides irrigational water for agriculture purpose in otherwise arid regions like Ladakh. Therefore, it is in the valleys of rivers that all the settlements are found in the district. These rivers generally originate from glaciers, which are formed because of accumulation of snow due to snowfall in winters. The main rivers of the district include the Indus and its tributaries Shyok, Nubra, Haule and Zaskar rivers.

a) RIVERS

(i) Indus River

The Indus River is known as 'Singee Khabab (the river rising from the Lions mouth) having its source in Tibet. It originates near Mansarovar Lake from the glaciers of the Kailash range in western Tibet at an elevation of 5,180 meters. Taking a northwesterly course, it enters Ladakh at Demjok in Changthang area. After this, the river follows its northwesterly course between the towering Ladakh range in north and Zaskar range in south. The river has a steep gradient and the valley is very narrow in its upper course. It takes a sharp turn south of Pangong Lake and cuts through Ladakh range. The gradient of the river is gentle in its central course and it is joined by the Zaskar river at Nimoo. The other important tributaries of the Indus are the wakha, Suru, Drass, Shyok, Nubra and the Hanle Rivers. The total length of Indus in Ladakh region is 430 km¹⁰. Indus is the most important river of Ladakh and is called the lifeline of the region. Indus river forms numerous alluvial fan and extensive river terraces. These provide fertile and leveled land and all-important settlements of Leh district are found on these.

ii) Shyok River

It rises on the southern slopes of Karakoram range. The river flows westward in its initial stage, then turns southeast and is joined by the Chang -Chenmo river. After that, it makes a U-turn to flow towards the northwest. It is joined by Nubra river near Diskit village. The Shyok river later on joins the Indus river about 40 km above Skardu. The total length of Shyok in the district is 489 km.¹¹ Settlements are mainly found in lower course of the river, as its upper course is turbulent and the surface is rocky, making it unsuitable for human settlements.

iii) Nubra River

The Nubra river is the right- bank tributary of Shyok river. Rising in Siachen glacier, it flows towards the south-east and joins the Shyok near Diskit. It is about 90 km in length.

iv) Hanle River

Hanle river rises on the northern slope of Zaskar range. It flows in a north-west direction and joins Indus river near Loma. Hanle river drains the area east of the Tso Morari Lake in the Rushu plain. It is the main source of fresh water river in Rupshu plain. Hanle river has a total length of about 97 kms.¹²

v) Zaskar River

Zaskar river is one of the principal left-bank tributaries of Indus. Its headwaters are the Yunan, Serchu and Tsarap, all rises to the north of the Great Himalayan range near the Baralacha pass. It flows through Zaskar range and joins the Indus below Leh near Nimoo village. It covers a total distance of about 116 kms¹³.

b) GLACIERS

Mountain ranges of Leh district, which have heights of above 6000m, are gathering ground of enormous glaciers. These glaciers found on higher slopes of the mountain ranges do not have direct economic utility. However, these are sources of many

rivers of the district, which support human settlements and economic activities. Some of the largest glaciers outside the polar zone are found on the southern face of Karakoram range. There are also some glaciers of smaller size in the high valleys or near the peaks of Zaskar range. Giant glaciers of Karakoram range are the remnants of the last Ice age, as the present day precipitation in this part is not sufficient to sustain large glaciers. Thicknesses of glacier generally vary from 120m to 300m. The important glaciers of the Leh district are the Hispar (58km) and the Batura (64km), which discharge into Indus. Biafo (64km) and Baltora (62km) glaciers contribute to the Shigar, a tributary of Indus. The Siachen (72km), discharge its melt into water Nubra river.

c) LAKES

Lakes are natural depressions filled with water and surrounded by land on all sides. Ladakh has some of the most beautiful and highest lakes in the world. Ladakh is also known as the land of crystal clear lakes. Here, lakes are known as 'Tso' and all the lakes do not have outlets, as a result their water is brackish. Due to which they do not have any economic value. However, the flocks of the nomads depend on a few patches of pasture found around the lakes. Some of the important lakes are;

i) Pangong Tso

It is the largest brackish lake in Ladakh. It is 8 kms at its broadest and 160 kms long. It is situated northeastern part of Leh, at an elevation of approximately 4,300m, and is bound on the north by Chang-Chenmo range and the Pangng range, an offshoot of the Ladakh range, is on its southern edge. Pangong Tso like other lakes has structural origins. The salt water in these lakes is due to extreme desiccation experienced by eastern Ladakh since Pleistocene period.

ii) Tsomrari Lake

Tsomorari or 'Mountain Lake' is located at a height of about 4,511m in Rupshu plain in the south eastern part of the Leh district. This lake is about 40km long, with an average width of 6 to 8 kms and a depth of more than 30 meters at the deepest point.

iii) Tso-Kar Lake

It is situated near the Tsomorari at an altitude of 4530 m above the sea level. This lake has a length of about 9 kms and breadth of about 5 kms. It is very irregular in shape. Its water is exceedingly brackish and bitter, and the whole of the ground on the southeastern shore glitters with a saline matter, which forms a thick crust¹⁴.

The other important lakes are Hanle Tso, Kyun Tso, Kiagar Tso and the Startsapuk Tso. Most of these lakes are of structural origin.

One of the opinions is that the origin of these lakes is due to the damming of old river course by the growth of alluvial fans or dry deltas of their tributary streams across them. Some are due to the elevation of a portion of the river bed at a rate faster than the erosion of stream or some are due to erosion hollows, scooped out by the glaciers. However, the latest opinion is that the depression occurred due to structural factors in which water got collected after the disappearance of last Ice Age. Most of these lakes are brackish in nature, which is mainly due to the absence of any outlets and desiccation due to high evaporation. Lakes of this district show evidence of progressive desiccations. Presence of several high level beaches and the lacustrine deposits suggest that the areas coverage of these lakes was much larger than what it is today. The desiccation was because of climatic change and in some cases resulting in complete extinction of lakes. Beside, the occurrence of vast quantities of fresh water fossils and other geological evidence indicates that these salt-water lakes are the remains of a former extensive fresh water lake. Brackish nature of their water and their situation in the arid areas has greatly reduced their economic significance. Therefore, these are used by few nomads who find pastures for their herd in the close to the lakes.

II.3 CLIMATE

Climate is an important element of physical environment that influences human life, especially in backward area like Leh district where man is largely at the receiving end. The climate greatly influences the socio-culture and economic aspects of people. The variations in different climatic elements like temperature and precipitation result in different human response, which in turn affect the distribution of population and economic activities of an area. Crop growing season is also determined by climate of an area. Influence of climate is more marked in mountainous areas, where the rigidity of climate restricts distribution of population.

Leh experiences a “high Altitude desert” type of climate due to its geographical situation. Its high elevation as the whole area are situated above 2,600 meters above the sea level and its location in rain-shadow zone of the Great Himalayan range, restrict entry moisture-laden winds of Indian monsoon, so the wind gets devoid of any moisture when it reaches Ladakh. Therefore, Ladakh is often called ‘COLD DESERT’. According to Koppens climatic classification, the region has Dwd type (extremely cold and dry winter and short cool summer) of climate. The district has only two seasons, a scorching and short lived summer and long and freezing winter.

Leh district experiences extremes of temperature and marked difference at any time of the year between day and night and between the sun and the shade. It is said that a man sitting in the sun with his feet in the shade may suffer from both sunstroke and frost at the same time. However, it is an exaggeration. But temperature differences in the sun and shade are well marked. This is mainly due its high elevation, by which the air is so rarified to hold the moisture in suspension and the great radiation of heat from the bare soil rapidly evaporates the moisture resulting in dryness of the climate, which increases with height. Due to this, Leh has a high diurnal range of temperature. Therefore, in summer the warmest day is always followed by cold night. While in winter, even if the shade temperature is below freezing point but the sun still gives warmth. Due to the limited vegetation cover, the proportion of oxygen is less compared to other places of the same attitude and there is little or no atmospheric moisture. In Leh district, precipitation

is low and all the water for irrigation comes from the melting of snow on the mountains. Variations in elevation results in variations of climate within the different parts of the district, which determines the growing season. For instance, in late May when crops are sown around Leh town (3500m), these are already half-grown in Khaltse, situated 600m lower than Leh town. The major climatic elements influencing the human settlements in a region are temperature and precipitation.

a) Temperature

Temperature is an important element of climate of Leh district because it curtails the growing season and acts as a hindrance to the development of the region. The temperature generally does not exceed 28.3° C in Leh district.

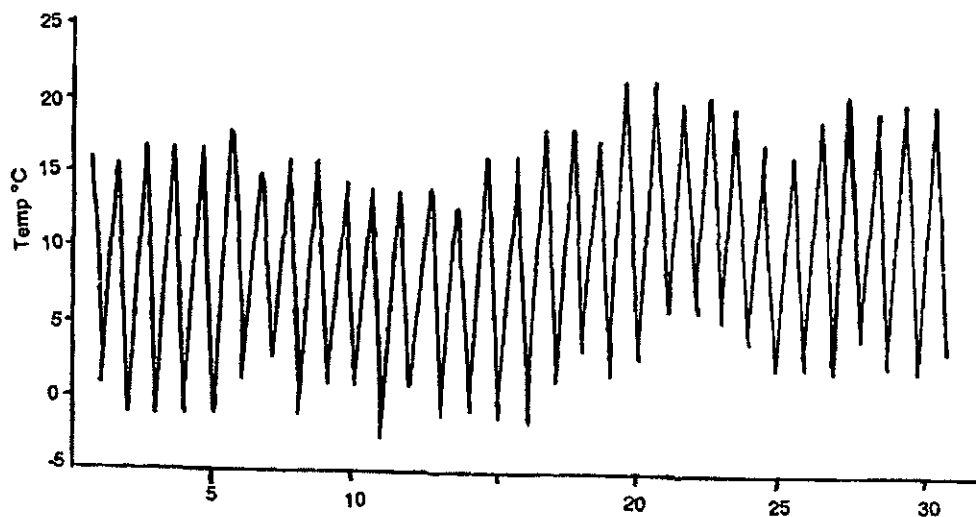
Table II.1
MONTHLY DISTRIBUTION OF TEMPERATURE AT LEH (°C)

Month	Max. Temp	Min. Temp.	Mean Temp.
January	0.7	-16.4	-7.85
February	4.9	-11.4	-6.5
March	9.3	-7.4	0.95
April	14.2	0.3	7.25
May	25.8	4.3	15.05
June	22.9	11.9	17.4
July	28.3	12.1	20.2
August	27.1	12.3	19.7
September	18.7	8.3	13.5
October	14	-2.3	11.7
November	7.7	-9.7	-1
December	1.8	-12.9	-5.55

Source: Field Research Laboratory (DRDO) Leh, 2001

July and August are the hottest months having a mean temperature of 28.3°C and 27.1°C respectively. While January and December are the coldest months with mean temperature of 16.4°C and 12.9°C respectively. Nights are cold through out the year and minimum temperature generally remains below 12°C. Mean temperature varies from -7.85° C in January to 20.2 °C in July.

FIG (II.2)



Diurnal Range of Temperature –May 1965

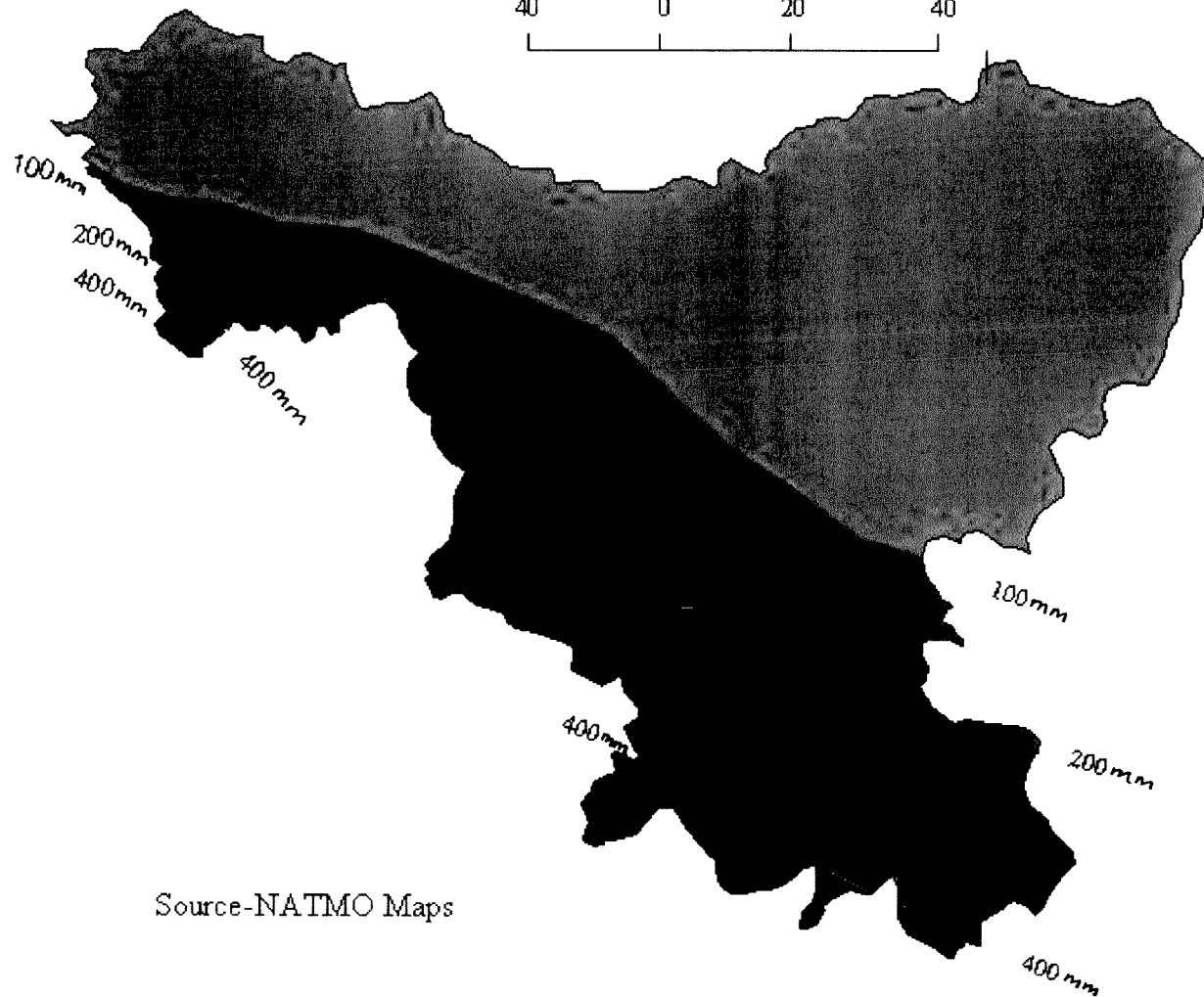
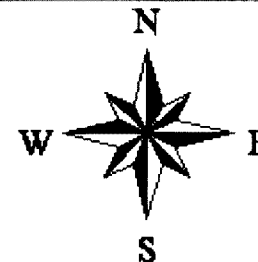
Source: Singh, H-Environmental Constraint on Agriculture in a Cold Desert.¹⁵

As stated above, there is a high diurnal range of temperature resulting in a vast difference between the temperature between the sun and the shade. This is due to high elevation and the rarified atmosphere. It has been stated that minimum temperature required for the germination of seed and plants to grow is 6°C.¹⁶ May is a sowing month at Leh. Fig II.2 shows that the mean temperature in the month of May in 1965 at Leh was 9.7°C but due to the high diurnal range of temperature, the minimum temperature values went below the critical value on 28 days of the month. Minimum temperature went even below 0°C on ten days. Often there are days when the mean temperature may be well

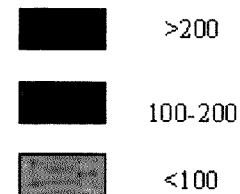
Map. II.2

LEH DISTRICT

PRECIPITATION



LEGEND



Source-NATMO Maps

above the required critical value but minimum temperature may go below freezing point. Therefore, the growing season in the region is restricted to less than 6 months and only one crop can be grown in a year in its most part of the region.

The growing season in the region varies from place to place depending on the altitude and location. At an altitude of 3,500 meters the growing period starts from May and by the end of September the harvest takes place in Leh Block. While Khaltse, situated 600 meters lower than Leh, the harvest is by mid-July and there is time for the second crop. Therefore, this block grows two crops in the growing season, though the second crop is usually a fodder crop. There are still some areas like Korzok (4600meters), where there is no guarantee that the crop will be ripen in any particular year. These are at times harvested green to serve as fodder for livestock. Therefore, the temperature and altitude determines the length of growing season in different parts of Leh district.

b) Precipitation

Precipitation is an important element of climate, which acts as a constraint on the economic activities of high altitude regions like Leh district. It is situated in the rain-shadow region in Trans- Himalayan zone. Trans-Himalayan ranges acts as an effective barrier to the moisture laden winds. These winds are devoid of any moisture when these cross the Great Himalaya range and reach Ladakh region. That is why we find luxurious plant growth towards Kashmir side of Great Himalayas range while Ladakh side is totally barren. Excessive dryness of climate is also due to elevation, by which the air is so rarified that it is incapable of holding much moisture. It is also partly due to the great radiation of heat from the bare soil, by which any moisture is rapidly evaporated. Dryness of air generally increases with height.¹⁷ Thus, most of the places receive less than 20 cms of annual precipitation. The precipitation mainly occurs in the form of snow during winters, which do not have much rate in economic activities. Western disturbance are the main source of precipitation in Leh district as in the case of rest of western Himalayan. These are responsible for 40 per cent of precipitation during December to March but

mainly in the form of snow. Therefore, precipitation plays a marginal role in the agricultural economy of the region. Agriculture has to depend on irrigation.

Table II.2

MONTHLY DISTRIBUTION OF PRECIPITATION AT LEH (in mm.)

Month	Precipitation(mm.)
January	11.8
February	8.6
March	11.9
April	6.5
May	6.5
June	4.3
July	15.7
August	19.5
September	12.2
October	7.1
November	2.9
December	8
Total	115

Source: Field Research Laboratory (DRDO) Leh, 2001

Table II. 2 reveal that, the annual precipitation is only 115 mms in Leh district. July and August with 15.6 mms and 19.5 mms respectively receives the highest precipitation. However, November is the driest month. Some precipitation is received in January and February but mainly in the form of snow. In the district, precipitation decrease as we move eastward. The precipitation map shows, the region receives 400mms of precipitation in the South-west and it decreases to 100mm of rain in the Northeast.

Thus, variation in temperature and precipitation are largely determined by geographical situation of Leh district. Its high altitude and rain shadow zone location results in cold and arid type of climate, limiting the human settlements in a few favourable areas.

It can be concluded that, the natural environment of Leh district in terms of mountain topography with their negative characteristics of rugged terrain, high altitude, steep slope and extreme climate have strongly restricted the availability of land for economic activities and for human settlements to a few favourable pockets mainly in the river valleys especially on geomorphic features of river terraces and alluvial fans.

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Chapter III

POPULATION STRUCTURE

Population in a region generally reflects environmental conditions and the socio-economic institutional development. Institutions help in interacting with environment and develop technological know-how for the maximum utilization of the existing resource base. Resource potential and climatic conditions influence the dynamics of population. These factors can make an area both attractive as well as uncondusive for human beings. Areas with favourable environment and good resource base are generally densely populated. As against this, areas with harsh terrain and inclement climate have sparse population. Leh district is one such region, where there is sparse distribution of population due to rugged terrain, extreme cold and arid climate, inadequate resource endowment and the low level of development.

It has been noticed in the second chapter, the difficult terrain and the inclement climate are the main determining factors for the isolation and backwardness of Leh district. Concentration of the human population clearly indicates that the settlements are confined to areas those are relatively flat and the land is suitable for agriculture and other economic activities. Due its location in the rain shadow zone, the region receives very scanty precipitation. Therefore, availability of water for agriculture and other activities also influence the settlements and distribution of population. As a result, all settlements are found in river valleys with flat land, favourable climate and availability of water. However, recent developments have changed the demographic personality of the district. The most important factors of change have been the Indo-China border conflict of 1962, the opening of the region to the tourists and the development measures initiated by the Government. All these have been responsible for the diversification of economy and creation of a large number of jobs. Consequently, many outsiders migrated to Ladakh leading to increase in population. As most of the government officials and people involved in tourism activities were educated males, thus, the change in sex ratio and

literacy was evident. Therefore, an attempt has been made to study the various aspects of population to understand;

1. The role of natural environment on the distribution of population.
2. The role of recent socio-economic development on the different aspects of population parameters.
3. The settlement structure and their relationship with environment.
4. House type and building material used which show the influence of environment and availability of raw material.

III.1 DISTRIBUTION OF POPULATION

The size of population in an underdeveloped region is generally determined by the carrying capacity of environment. This is closely related to physical environment like topography, climatic conditions, fertility of soil and spatial relations etc. These affect the pattern of population distribution. Size of population is linked to the nature and pattern of human development. Population distribution shows the varying nature of human adjustments to physical environment especially in hill areas. The influence of physical environment depends on the way of life of people. It means that more complex is society less is the influence of physical factors in the distribution and vice-versa. Thus, distributional pattern of population is, in fact, an eloquent expression of the synthesis of all geographical and historical phenomena operating in the area.

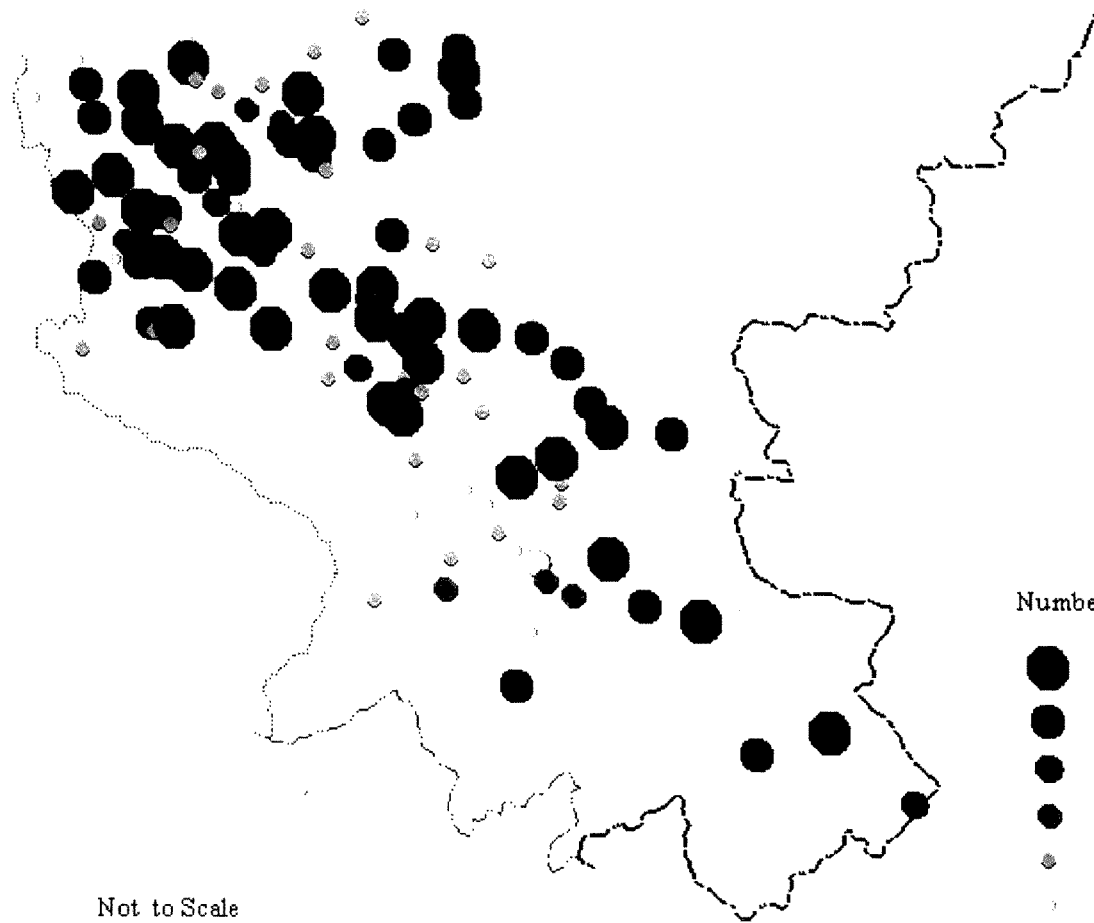
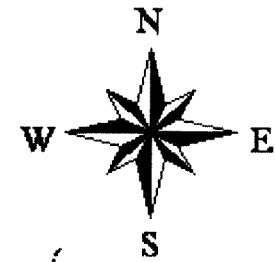
Population of Leh district is very unevenly distributed mainly due to rugged topography, high altitude and cold arid climate. These have restricted the area occupied by human beings to only 393.9 sq km out of the total 82,665¹ sq km of geographical area. Leh, the largest district in the country had small population of 1,17,232 persons in 2001, which constitute only 1.15 percent of the total population of Jammu and Kashmir state. Population is less due to rigid nature of environment and poor quality of land for economic activities. Hence, a large section of populations is confined to a few selected

Map. III.1







LEH DISTRICT

POPULATION DISTRIBUTION

2001



Number of Persons

-  >1000
-  500-1000
-  400-500
-  300-400
-  200-300
-  <200

Not to Scale

favourable pockets in the river valleys. Most of the remaining area of the district is uninhabited with rugged terrain and cold and arid desert like conditions.

Table III .1
Population distribution of Villages-2001

Size of Population	No. of villages	% of villages
less than 200	12	11.6
200-300	26	23.2
300-400	7	6.3
400-500	7	6.3
500-1000	26	23.2
Above 1000	33	29.5
Total	112	100

Sources: Computed from Census of India 2001, Primary Census Abstract.

Leh town is the only urban center in the district and is the largest settlement with a population of 28,639 persons in 2001. It constitutes about 24.43 percent of the total population of the district. This is mainly because being the only urban area, a large number of offices; schools and tourist related infrastructure are concentrated here. This resulted in settling down of large number of people in Leh town. It has become a common feature that most of the Ladakhis have their second home in Leh town. Size wise population distribution of villages shows significant variations. Smallest village is Demjok with population of only 79 persons while, largest village Choglamsar has a population of 4,897 persons. Table III.1 and Map III. 1 show that 13 villages accounting for 11.6 percent of the total village have a population of less than 200 persons. All these villages are remotely located with small geographical area such as Demjok, Thanga, Lanokor, Hudner-Dog etc. These have remote location and have remained unaffected by recent developments. About 33 villages accounting for 42.9 percent of the total villages in the district have a population of more than 1000 persons. Most of these are large villages situated near Leh town such as Choglamsar, Spituk, Thiksey, Shey, Saboo, Chushot Yokma etc. Choglamsar (4897) has the largest population due to the establishment of many new offices, schools and tourist centre to ease the pressure on Leh

town. This has resulted in large scale settling of people in this village, thus, resulting in a high growth of population. Besides, the Tibetan refugees are settled in this village.

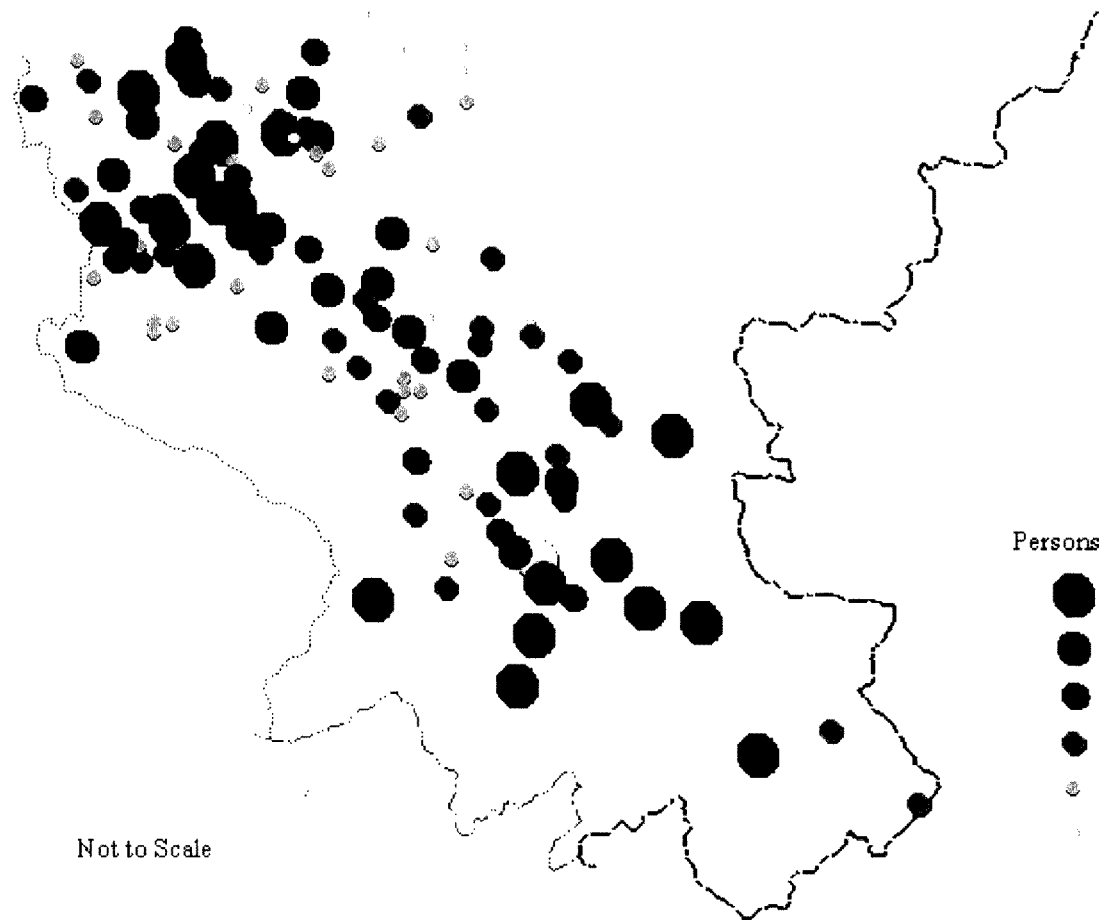
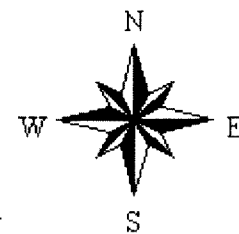
III.2 DENSITY OF POPULATION

Density of population traditionally depicts close association with the carrying capacity of agricultural land, especially in mountainous areas. Adverse role of severe climatic conditions and the inhospitable terrain is highlighted by the fact that Leh district, with a population density of 3 persons per km² is amongst the lowest densely populated districts in the country. The density of population increased from 2 in 1981 to 3 persons per km² in 2001. The region has the concept of 'Assessed Land' i.e. the area lying within the village boundaries. It is the assessed land which matters because large tracts of land outside the village boundaries are barren and has little economic significance for the local society. However, all assessed land may not be economically productive. The density of population shows the stress of population on land resources. The density of population has been calculated by dividing the total population of a village with total assessed land of that village. Therefore, actual density of the population of the district is 298 persons per km² of the inhabited / assessed area. This pressure on land becomes clearer, if we see total population in terms of total cropped area, which is 1107 persons per Km² of cropped area.

The population density of Leh town was 3112 persons per km² in 2001. There was a substantial increase, as the density of population was only 948 persons per km² in 1981. This high density of population was due to the growth of tourism industry in recent decades, leading to growth of infrastructure and jobs, attracting people to settle down in Leh town. Besides, the already existing concentration of government officials, the opening of more educational institutes attracted large number of students and teachers to settle down in Leh town.

Map No. III.2

LEH DISTRICT
DENSITY OF POPULATION
2001



Persons per Square Kilometers

- >500
- 400-500
- 300-400
- 200-300
- 100-200
- <100

Not to Scale

Table III .2
Density of Population by Villages 2001

Density of Population	No. of villages	% of villages
Less Than 100	8	7.1
100-200	23	20.5
200-300	29	25.9
300-400	13	11.6
400-500	18	16.1
Above 500	21	18.8
Total	112.00	100

Sources: Computed from Census of India 2001, Primary Census Abstract,(CD)

There are large variations in villages in terms of density of population. It varies from the lowest density of 13 persons per km² in Khemi to the highest of 4120 person per km² in Samad Rakchan..Table III.2 and Map. III. 2 show that 8 villages contributing 7.1 percent of the total villages have population density of less than 100 persons per square kilometer. All these villages are remotely located, have remained untouched by recent development and experienced outmigration of people due to the lack of employment prospects. e.g. Khemi, Chamshan Charasa, Kobat etc. Around 23 villages have population density between 100 to 200 persons per km². However, 21 villages accounting for 18.8 percent have a population density of more than 500 persons per km². The villages with high a density of population like Samad Rakchan, Korzok, Bogdang etc are villages with very small geographical area resulting in high density of population.

Choglamsar village with density of 1143 persons per km² has high density due to the settling down of large number of people related to tourism and other developmental activities and their families. Many Tibetan refugees have also been settled here. Besides,

the villages located near Leh town and administrative centers like Khaltse, Diskit and Nyoma have also recorded a high density of population.

Many changes were recorded in population density during 1981-2001. Seven villages recorded decline in density. The reasons can be attributed due to out-migration from these remote villages. As against this, villages situated close to Leh town, such as Choglamsar, Spituk, Chushot Yokma, administrative centers like Nyoma, Diskit and army center like Bazgoo, recorded a high positive change in density. This is mainly due large scale in-migration from the surrounding areas in these villages due to better economic prospects and job opportunities.

Thus, Leh district has a low density of population of only 3 persons per square km at the district level. There are large variations, with largest concentration of population found in Choglamsar while Kharnak had recorded the lowest density of population. The villages with better economic opportunities have recorded increase in density due to in-migration while remote village with poor economic opportunities seem to have suffered from out-migration.

III.3 POPULATION GROWTH

Birth and death are the two natural factors which affect natural increase. In addition, migration is also a determinant of population growth. The dynamics of population growth are influenced by birth and death rate as well as migration. Birth and death rates are generally high in backward areas due to inadequate medical facilities and lack of education. Besides, the low levels of employment opportunities available to the people lead to out-migration. This results in low growth of population in these regions. However, with the development process, in terms of better medical facilities and more employment opportunities death rate gets reduced and out-migration gets checked. As a result population increases. This is true in the case of Leh district where recent developments especially of tourism and construction have resulted in increase in population leading to high growth rate.

Table III .3

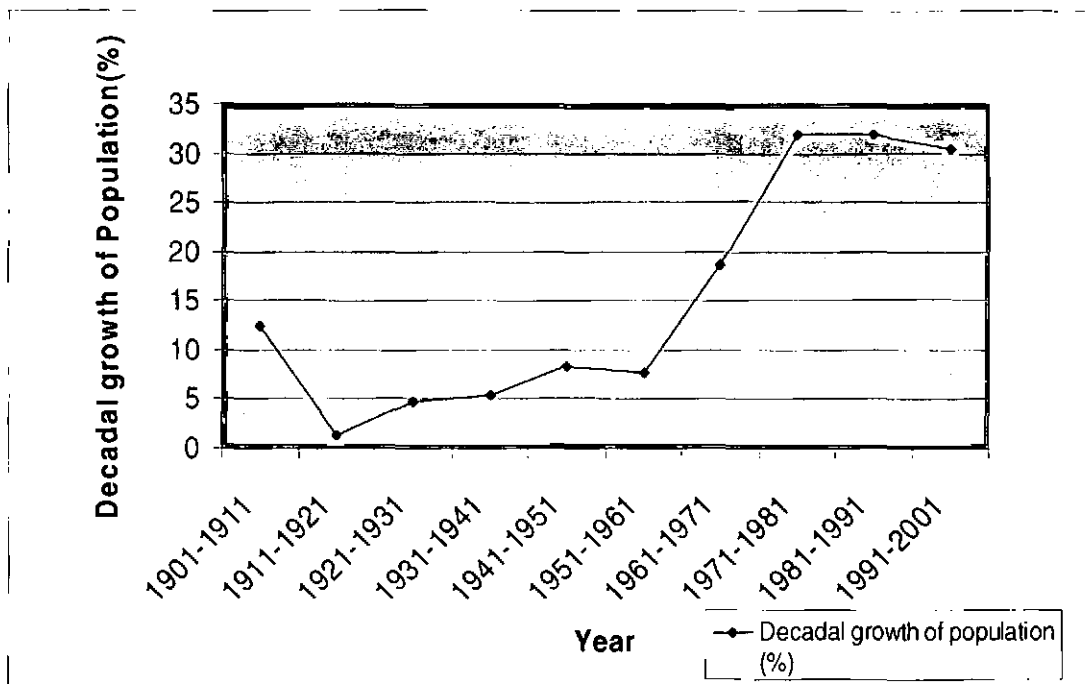
Population Growth in Leh District 1901-2001

Year	Decadal growth rate of population (%)
1901-1911	+12.45
1911-1921	+1.31
1921-1931	+4.78
1931-1941	+5.33
1941-1951	+8.3
1951-1961	+7.66
1961-1971	+18.65
1971-1981	+31.96
1981-1991	+31.91
1991-2001	+30.42

Source: District Statistical Handbook, Leh District, 2005-2006

Fig III .1

Population Growth in Leh District 1901-2001



There are large variations in the population growth over time. Table III .3 reveals that-

1. Leh district had registered a gradual increase in population ever since 1901. However, the growth of population was very low (1.31 percent) during 1911-1921, due to the following reasons-
 - The outbreak of epidemics such as influenza and small pox etc which resulted in high death rate.
 - On account of the outbreak the First World War, the British army recruited many Ladakhis.
 - The complete failure of crop production causing some starvation death further resulted in a low population growth rate.

2. The average population growth during 1921-1961 was always less than 10 percent. This was due to the prevalence of traditional social practices like polyandry. This along with many people joining monasteries (*Gompas*) contributes to low growth rate. Monks (*Lamas*) and nuns (*Chomos*) are required to live a life of celibacy. This factor curtailed the birth rate and checked the population growth.

3. The decadal population growth increased substantially to 18.65 percent during 1961-1971. It further increased by 31.96 percent in 1981 -1991. This was because-
 - After the Indo- China war of 1962, strategic significance of the region was realized and large contingent of army was moved in to the region. Many peoples migrated to Ladakh to man the needs of the army. The strategic consideration also led to the strengthening of the local administration. Consequently, a number of government offices were established in the region. This resulted in coming of many government employees. Establishment of these offices generated the need of office building and approach roads, thus,

creating jobs for labourers in construction work. Consequently, many labours migrated to Ladakh. Besides, many Ladakhis were given jobs. This further improved their socio-economic conditions and outmigration from the region was checked.

- The improvement in medical facilities during this period helped in checking death rate which has also contributed to increase in population growth.
- The development of education and improvement in economic conditions resulted in the decline of the polyandry system and also the number of people joining monasteries came down which resulted in a higher birth rate.
- Recent development especially after the opening of Ladakh to tourists in 1974 and increase in construction activity have resulted in large scale in-migration. Along with it, the out-migration from the region got checked due to the availability of many employment opportunities. It may be noted that Leh was a restricted area and it was opened to tourist in 1974. Suddenly large number of tourist, especially foreign tourists, started visiting the region. It leads to sudden development of tourism related infrastructure which attracted many people to come and settle in Leh district.

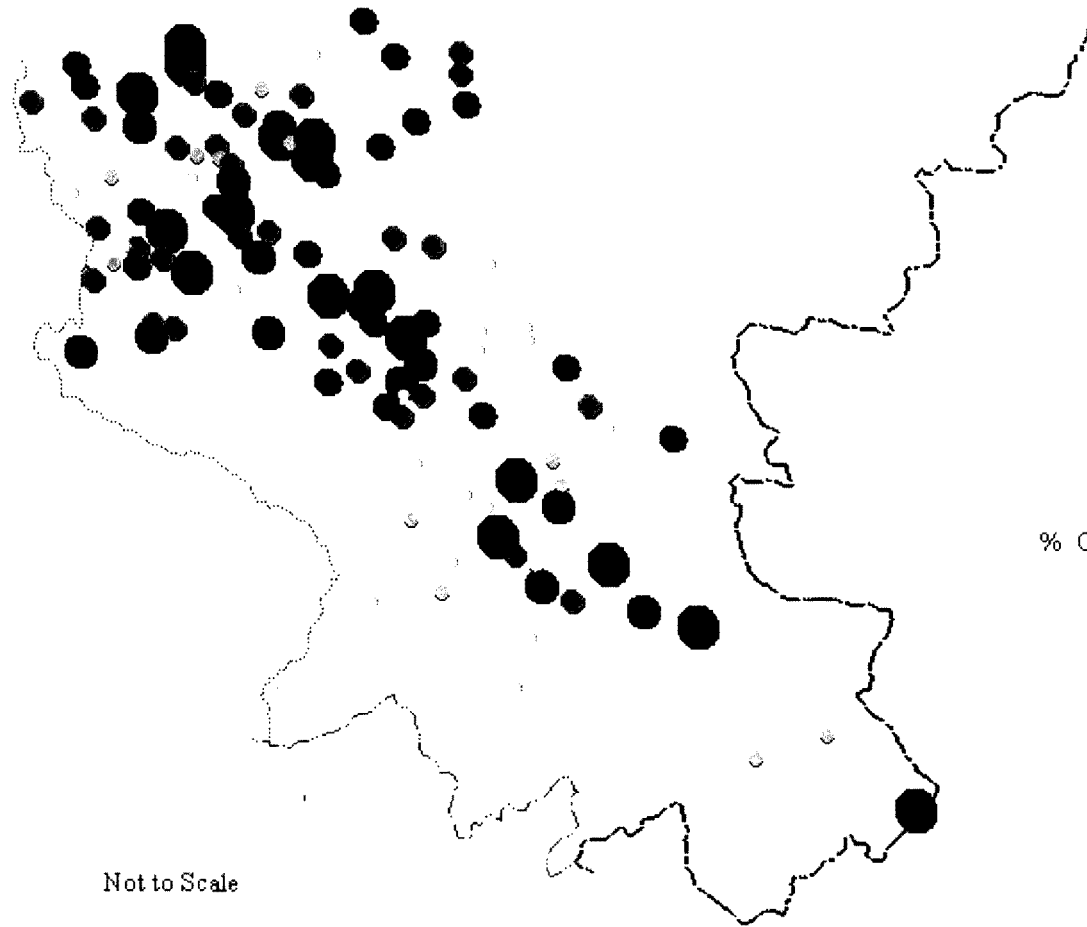
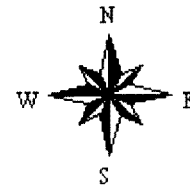
There was a slight decline of population growth to 30.42 during 1991-2001. This was mainly due to the decrease in birth rates with an increase in number of educated people and consequently, the growing awareness about the utility of family planning. The preference of small family is another factor behind slowing down of population growth. Thus, the population growth in Ladakh was-

- Slow population growth during 1901-1941.
- Marginal population growth during 1941-1961.
- High population growth during 1971-2001.

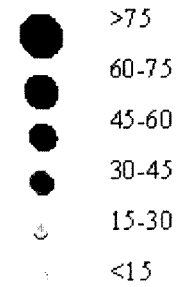
Leh town experienced a growth rate of 48.50 percent during 1961-1971. It increased to 57.96 during 1971-1981 and then to 228 percent during the period 1981-2001. This high growth rate is expected, as being the capital of the district, it has

Map. III.3

LEH DISTRICT
GROWTH OF POPULATION
1981-2001



% Growth Rate of Population



Not to Scale

experienced large scale immigration for from the surrounding areas due to availability of employment avenues in government services and tourism etc. Today, Leh town has the largest market in the district and all tourist visits Leh town. It has large number of hotels, guesthouse and restaurants. The growth of population has been calculated for 1981 -2001, as no census took place in Jammu and Kashmir state in 1991 due to political unrest.

Table III .4
Growth of Population in Villages (%) 1981-2001

Percentage growth	No. of villages	% of villages
Less Than 15	19	17.0
15-30	18	16.1
30-45	25	22.3
45-60	22	19.6
60-75	11	9.8
More than 75	17	15.2
Total	112	100

Sources: (1) Census of India 1981, Village & Townwise Primary Census Abstract, Leh (Ladakh), district.
(2) Census of India 2001, Primary Census Abstract, Leh district.

There is significant variation in the population growth of the inhabited villages which varies from negative to very high. The smallest village namely Warifsthan recorded a negative population growth of -27.1 percent, as against this, Demjok village has the largest population growth of 1875 percent. Warifstan is a remote village which seems to have suffered lot of out migration. Demjok is a border settlement on China border which nearly became uninhabited after 1962 but later on due constructions many workers and changpa nomad settled here after 1981. Table III.4 and Map.III. 3 show that out of the total inhabited villages, 17 villages accounting for 15.2 percent of the total inhabited villages have high population growth of more than 75 percent. Out of these, eight villages are small settlements with small size of population. Demjok with the

highest population growth of 1875 percent had a very small population of only 79 people, where even a small increase shows a high percentage growth. The other villages with high population growth are administrative centre such as Diskit or are army centers like Spituk, Partapore and Khalsar, others are villages situated near the Leh town like Choglamsar, Spituk, Chushot Yokma. This is mainly due to immigration. The opening of many new offices, schools and tourist related infrastructure, resulted in immigration of people in these villages. While, on the other hand 19 villages accounting for nearly 17 percent have population growth of less than 15 percent. Seven villages have experienced negative growth of population. Most of these villages are relatively remote villages with low economic opportunities resulting in large scale out migration. These are isolated villages which have not experienced much modern influences. In the case of Hemis, the negative population growth is mainly because most of the inhabitants are Lamas (monks) who remain celibate through out their life resulting in extremely low birth rate.

We may conclude from the above that the villages situated close to the Leh town, or are army centers and administrative centers with greater economic opportunities experienced high population growth. While, the villages in far off remote valleys, which were not affected by recent development have experienced either slow growth or decline in population because of out migration due to the absence of job opportunities and poor economic base in these villages. In addition, the villages with majority of lamas (monk) population also show a low population growth.

III.4 SEX COMPOSITION

Sex composition of population of a particular area is expressed in terms of number of females per thousand males. A large number of biological, social and economic factors influence sex ratio. Among these economic factors are the most potent. People get attracted to areas offering better economic opportunities. Migration for economic purpose are generally male selective in developing areas. Thus, bringing change in the sex ratio of both places of in-migration and out-migration. Low sex ratio denotes male selective migration due to the greater economic opportunities. Whereas, high sex

ratio implies lack of economic opportunities in that areas resulting in out migration. Leh district with a sex ratio 823 females per thousand male has lowest sex ratio in Jammu and Kashmir State. Besides, the difference between the urban with 611 females per thousand males and rural sex ratio of 903²female per thousand male is also quite high. This is mainly due to male selective migration to urban areas where employment opportunities are more compared to the rural areas.

Table III .5
Sex ratio in Leh District (1901-2001)

Year	Females per 1000 Males
1901	986
1911	997
1921	1029
1931	1022
1941	1011
1951	990
1961	971
1971	975
1981	870
2001	823

Sources: Census of India 2001, Primary Census Abstract,Leh district.

Fig III .2
Sex ratio in Leh District 1901-2001

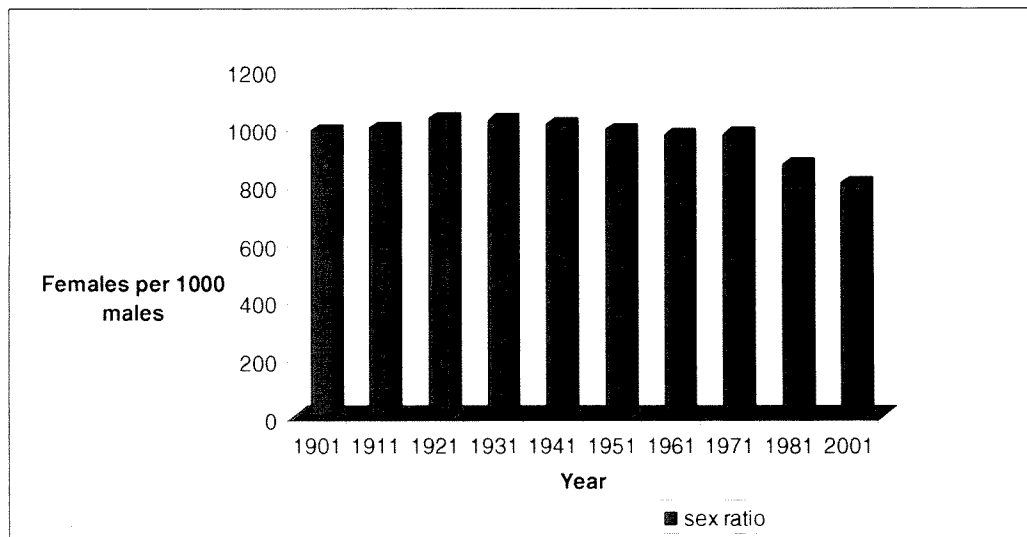


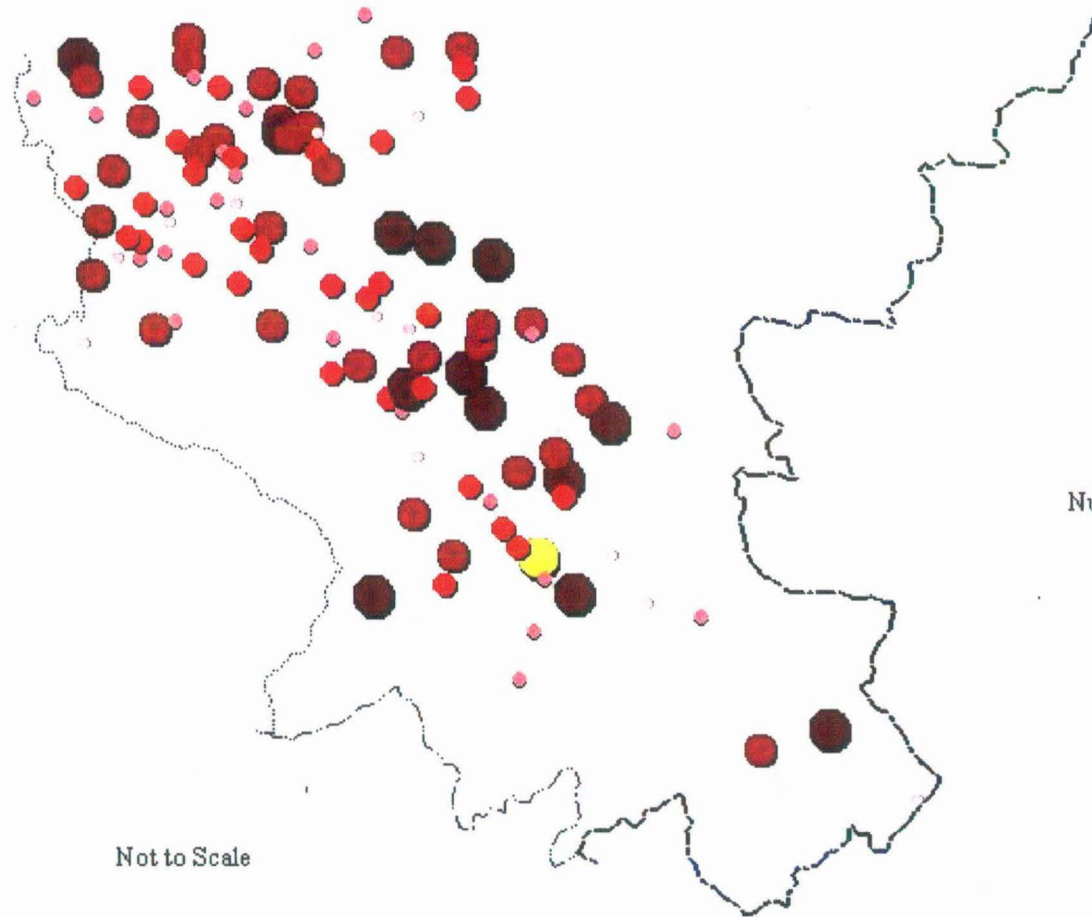
Table III.4 and Fig III. 2 show that the average sex ratio in 1901-1911 was 992 females per thousand males. From 1921-1941, the number of female exceeded over males. This is mainly due to the large scale male selective out migration because of the poor economic conditions in the region. However, the sex ratio started decreasing from 1951 onwards. The low sex ratio before 1960's was due to high infant mortality rate especially among girl children. Birth rate was low because of the practice of fraternal polyandry, where two or three brother have common wife and also due to lamaistic Buddhism, where lamas and chomos are not allowed to get married. There was further decreased in sex ratio after the Indo- China war of 1962, because the state and the Central government opened many new offices and schools and deployed army. Many Ladakhis were given jobs and some immigration started. These helped in improving their economic condition Beside, the State Government passing the Buddhist Polyandrous Marriage Prohibition Act 1941, external influences and education led to major decline in the polyandry system. All these factors helped to check the out migration. The opening of Ladakh for tourists in the summer of 1974 resulted in increase in job opportunities and establishment of private enterprises. Thus, many males migrated to Ladakh as

Map No. III.4






LEH DISTRICT

SEX RATIO

2001



Number of Females per 1000 Males

-  >1100
-  1000-1100
-  900-1000
-  800-900
-  <800

Not to Scale

shopkeepers, hoteliers and travel agents. Therefore, the decrease in sex- ratio in Leh district is mainly due to large scale male selective in- migration in the region.

The sex ratio of Leh town was 733 in 1971. It declined to 611 in 2001. This is because a large scale male selective in-migration from the surrounding region has taken place in Leh town, being the administrative centre, central business district of Ladakh region and tourist centre. Large scale construction work going in Leh town, attracted many labours from other regions.

Table III.6
Sex ratio by villages - 2001

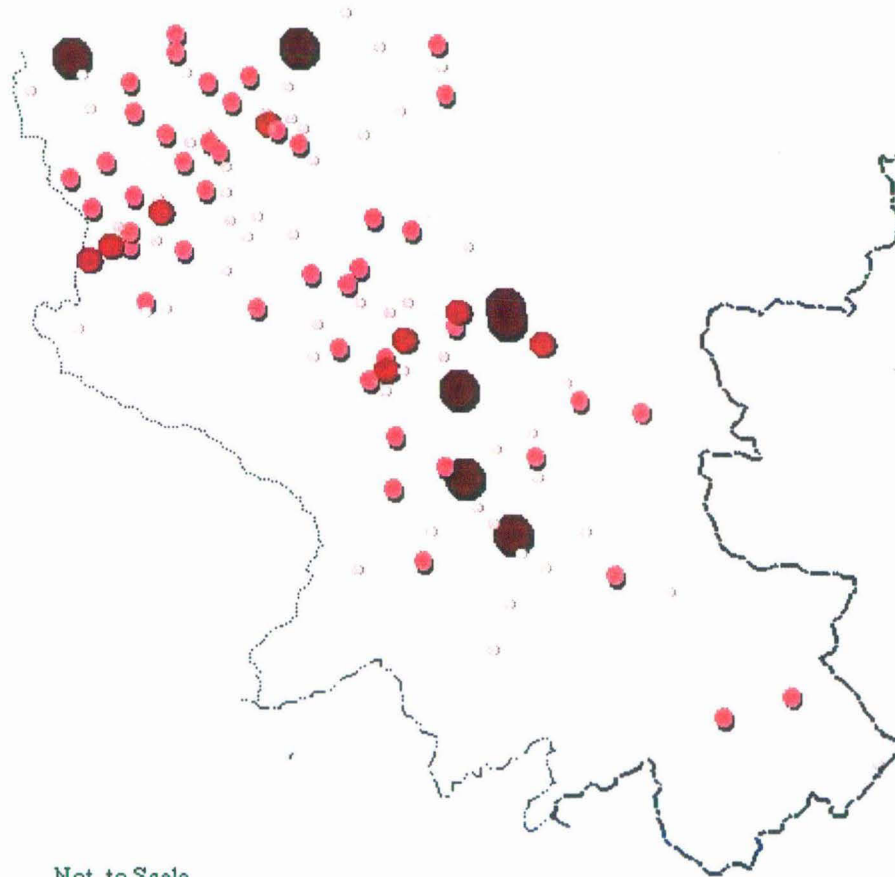
females per 1000 males	No. of Villages	% of villages
less than 800	13	11.6
800-900	24	21.4
900-1000	30	26.8
1000-1100	31	27.7
More than 1100	14	12.5
Total	112	100.0

Sources: Computed from Census of India 2001, Primary Census Abstract, Leh district

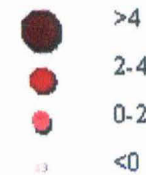
The above table and Map. III.4, represent the village wise distribution pattern of sex ratio in Leh district in 2001. The above table shows that 12.5 percent of total villages have a high sex ratio of more than 1100 females per thousand males. These are mainly remote villages, which suffer from male selective out migration due to the limited resources and the absence of economic opportunities. These isolated and inaccessible villages also have remained untouched by recent developments experienced by other part of district, resulting in higher rate of out migration. Where as, there are 13 villages with very low sex ratio of less than 800 females per 1000 male. This includes villages those are – Gompa villages like Hemis and Thiksay, due to the concentration of male lamas in these monasteries village. Other such villages are administrative centers like Khaltse,

Map.III.5

LEH DISTRICT
CHANGE IN SEX RATIO
1981- 2001



Females per 1000 Males



Not to Scale

Diskit, Nyoma, where many male employees have been posted to man the administrative jobs.

Table III.7
Change in Sex ratio by villages 1981- 2001

% change of sex ratio	No. of Villages	% of villages
Less Than 0	54	48.21
0-2	44	39.28
2-4	7	6.25
More than 4	7	6.25
Total	112	100

Sources: (1) Census of India 1981, Village & Townwise Primary Census Abstract, Leh (Ladakh) District
(2)Census of India 2001, Primary Census Abstract, Leh district

There has been a significant change in the sex ratio in the last two decades. It has declined from 871 in 1981 to 805 in 2001. Table III.7 and Map.5, show that 54 villages accounting for 48 percent of the total villages have recorded a negative change in sex ratio from 1981 to 2001. Whereas, only about 13 percent of the villages have experienced an increase in sex ratio for the same period.

The above analysis shows large variations in sex ratio in leh district. This is mainly due the sex-selective migration in the region. Out migration of males from remote villages in search of jobs makes the sex ratio of the villages quite high. Whereas, the male selective in-migration of government officials and the other workers related to tourist activities like shopkeepers, travel agents, hoteliers, taxi drivers etc makes the sex ratio low in this region. Therefore, administrative centers, tourist centers and Gompa village (due to the concentration of male lamas) have low sex-ratio.

III.5 LITERACY

Census has defined literacy as the ability to read and write a simple message with understanding in any language. Improvement in literacy is of pivotal importance for the development of a traditional society. It generally reflects the level of modernization of the people, which enables them to utilize resources of the region more effectively. About 58.24 percent of population of Leh district was literate in 2001, which is comparatively higher compare to the state average of 47.39 percent.

Table III .8
Percentage of Literate 1961-2001

Year	Male	Female	Total
1961	20.08	1.69	10.88
1971	26.77	4.82	15.77
1981	36.76	12.09	25.15
2001	75.60	46.51	58.24

Source: District Statistical Handbook, Leh District, 2005-2006

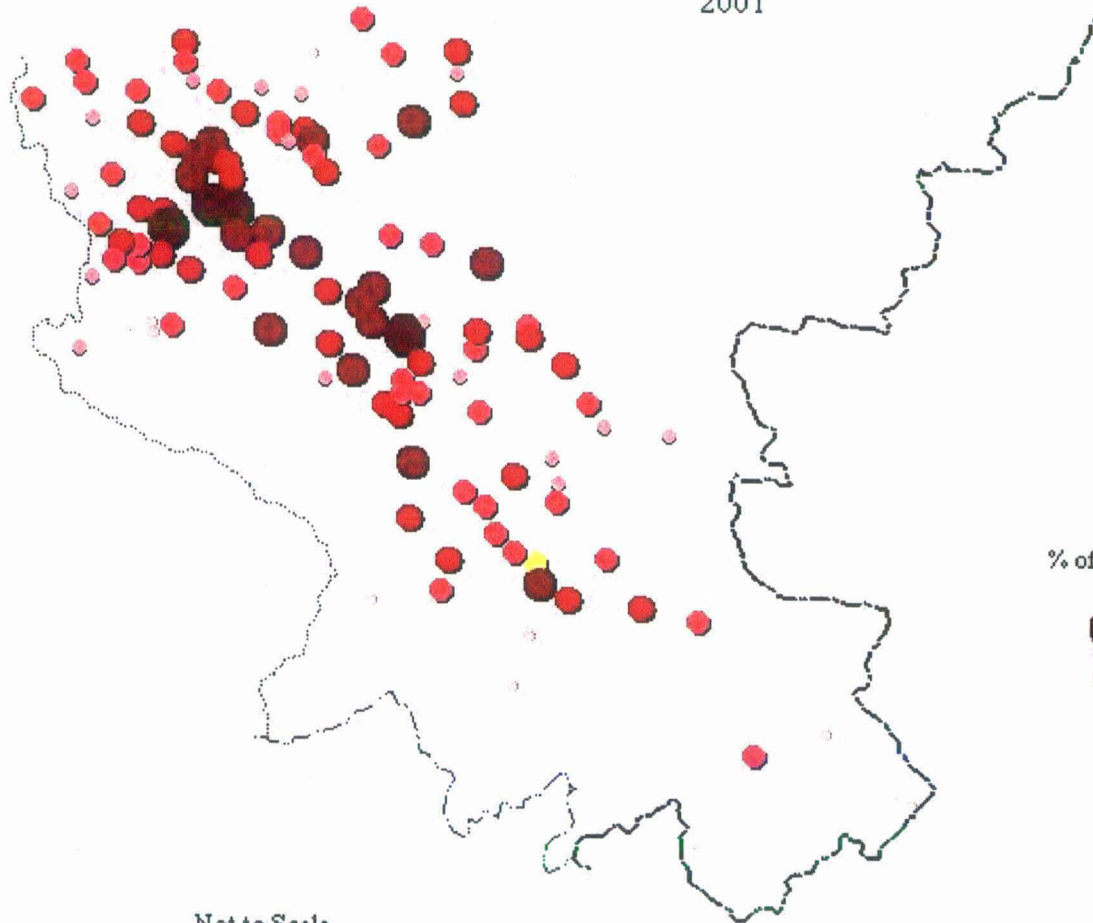
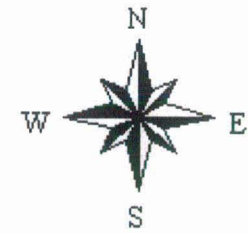
The above table shows a substantial rise in literacy in Leh district from 1961 to 2001. Ladakh was traditionally an educationally backward region with limited number of schools and the people did not properly realize the importance of modern education. Education was, largely limited to religious instructions imparted to the lamas (*monks*) and chomos (*nuns*) in monasteries³. However, the scenario changed after the Indo- China war, as large contingents of the army moved in and local administration was strengthened. A large number of schools were opened, but most of them functioned very poorly as the modern education had low relevance to the local rural based society with an agricultural economy, combined with large distances to school and poor economic conditions of the people. Therefore, Leh district had a very low literacy rate of only 10.8 percent for 1961. However, due to recent changes, a large number of jobs have been created in hotels,

Map III.6

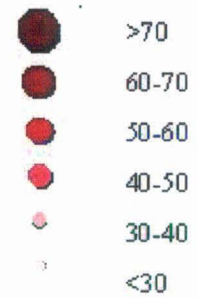
LEH DISTRICT

LITERACY

2001



% of Literate to Total Population



Not to Scale

offices, schools and army. All this raised the importance of modern education. Besides, the general development of the region has resulted in an improvement of educational facilities. The number of student going for higher education to areas outside Ladakh had also increased substantially in recent times. Due to this the literacy rate increased from 15.77 percent in 1971 to 25.15 percent in 1981. It further increased to 58.24 percent in 2001.

There was also a sharp increased in female literacy rate, which rose from 1.69 percent in 1961 to 46.51percent in 2001. It is mainly because like other backward areas, women had little opportunities for education. Besides, the poor economic condition and lack of educational facilities further aggravated this situation. As a result, very few women belonging to families of government officers and elite families, and the chomos (*nuns*) who like the lamas (*monks*) have not obtained any formal education were literates. However, the recent socio-economic development after 1970's enhanced awareness as well as aspiration of the people. These helped in raising female literacy. Whereas, in the case of males, the literacy level was better in the same period.

Table III .9
Distribution of villages According to Literacy 2001

Literate (%)	No. of villages	Percentage of Villages
Less than 30	9	8.04
30-40	17	15.18
40-50	37	33.04
50-60	29	25.89
60-70	17	15.18
Above 70	3	2.68
Total	112	100

Sources: Computed from Census of India 2001, Primary Census Abstract, Leh district (CD)

Leh town had 81.83 percent of literacy in 2001. It was a significant improvement from 1981, when the literate population was only 44.7 percent. This growth is primarily because of immigration of educated people for jobs. There was a large variation in literacy across the villages of Leh district. It varies from lowest literacy rate of 8.7 percent in Samad Rakchan village to the highest of 76.5 percent in Bazgoo village. The above table and Map. III.6 show that 20 villages accounting for 17.86 percent of the total inhabited villages had high literacy rate of above 60 percent in 2001. Out of these 3 villages have literacy rates above 70 percent. While, nine villages accounting for 8.04 percent have low literacy rates of less than 30 percent. A study of villages according to their literacy rate shows that high literacy is recorded in the following villages—

1. Administrative centers such as block headquarters where mostly educated government employees both locals and outsiders have settled. e.g Khaltse, Diskit and Nyoma etc.
2. Villages situated near the Leh town e.g. Ranbirpor, Saboo, Thiksay, Phyang Chushot Yokma and Choglamsar etc.
3. Villages with monasteries like Hemis, Thiksay and Phyang etc. This is mainly due to the concentration of Lamas who are considered literate without any formal education.
4. Villages located near to army centre like Bazgoo, Karey and Nimmo etc.
5. Other villages situated on the Leh- Srinagar and the Leh-Manali road like Khaltse, Saspol, Timosgang, Shey etc

Villages with low literacy rates are-

1. Those situated in remote areas or which are small in size have low literacy rate e.g Saman Rakchan, Warifsthan, etc.

2. Villages like Korzok and Kharnak, which are inhabited by nomadic Changpas have low literacy due to the irrelevance of modern education to their nomadic way of life. Besides, lack of education facilities in these villages also result in low literacy.

Female Literacy

Female literacy is an important measure of social awareness especially in tradition bound societies. It is more important than male literacy as an educated woman play an important role in the development of the entire family. It also indicates the level of development of a society. The female literacy rate of Leh district was 46.51 percent in 2001, which is lagging far behind the male literacy rate of 75.60 percent.

Table III .10
Village wise Percent Female Literacy, 2001

Literate Female (%)	No. of Villages	% of Villages
Less than 30	32	28.6
30-40	30	26.8
40-50	25	22.3
50-60	22	19.6
Above 60	3	2.7
Total	112	100

Sources: Computed from Census of India 2001, Primary Census Abstract, Leh District

About 55.4 percent of the villages of Leh district have female literacy below 40 percent. About 28.6 percent of villages fall under the lowest bracket of female literacy that is below 30 percent. Two village Demjok and Samad Rakchan had less than 10 percent female literate. Both these villages are remotely located and mainly inhabited by changpa nomads. There was no school in Demjok. There were only 3 villages with more

than 60 percent literate females. Khasltse with highest female literate of 63 percent is the block headquarter, many educated females have been posted here for administrative. The presence of higher secondary school, attracted many students to settle down. It is located on Leh-Srinagar highway. Timosgang and Saboo other two villges with high female literacy. Saboo, located near Leh town, have experienced lot of development.

Table III . 11
Change in Literacy 1981-2001

Change in %literatees	No. of villages	%of villages
Less Than 10	8	0.7
10-20	15	13.5
20-30	37	33.3
30-40	30	27.0
40-50	18	16.2
Above 50	3	2.7
Total	111⁴	100

Sources: (1) Census of India 1981, Village & Townwise Primary Census Abstract, Leh(Ladakh) District.

(2) Census of India 2001, Primary Census Abstract, Leh District.

The change in literacy rate shows that except one village i.e. Warifsthan, the other villages showed a substantial increase in literacy rate during 1981 to 2001. The change in literacy rate varies from -28.6 in Warifsthan to high literacy growth of 58.62 percent in Bazgoo. About 23 percent of the villages have literacy growth of less than 20 percent. In majority of the villages, i.e. 45.9 percent have a literacy growth of more than 30 percent. Whereas, three villages have a literacy growth of more than 50 percent. The village wise change in literacy rates indicates that villages that are administratively and economically important or are army centers or are situated close to the Leh town experienced increase in literacy. The presences of proper educational facilities have also

helped in the rise of literacy. On the other hand, villages situated in remote parts of the district where there are no proper education facilities and those suffering from out migration of the literate population for jobs, experienced low growth of literacy. While in the case of Hemis, gompa villages with concentration of lamas who are literate without formal education have recorded a negligible growth in literacy. This is because the population in this village has remained almost constant. While in the case of Kharnak and Korzok villages, inhabited by changpas nomads, show low change in literacy.

Educational Facilities

The problems of low literacy in an area get accentuated due to the inadequate educational facilities. Despite the hostile terrain and climate In Leh district, the Government has shown considerable interest in the development of education. Consequently, 110 villages accounting for 98.21 percent of the total village have educational facilities. Only Thanga and Demjok, inhabited by nomads are without schools. Teacher: pupil ratio in the region is 1:10. School enrollment ratio in the district has been near 100 percent except in some nomadic villages. However, unlike in the rest of the country, Leh district has a higher dropout among boys compare to girls.

Table III .12
Educational Facilities in Leh District 1981-2001

Number of institution	1981	2001
No. of Primary Schools	182	182
No. of Middle Schools	44	53
No. of High Sec Schools	14	29
Collages	0	1

Sources: (1) Census of India 1981, Village & Townwise Primary Census Abstract, Leh(Ladakh) District
(2)District Statistical Handbook, Leh District, 2005-2006

About 110 villages accounting for 98.21 percent of its total villages have educational facilities in Leh district. Thang and Demchok villages are without even a primary school. Table III.12, shows that the number of Middle school increases from 44 in 1981 to 53 in 2001. The number of higher secondary school increase from 14 in 1981 to 29 in 2001. The district has only one college, there was no college in the district in 1981. So we find that though the number of educational facilities is adequate for the small population of the district, major problem lies in the qualitative aspect due to the poor infrastructure and lack of trained teachers. But the condition is improving with the Government Development plans like the Operation New Hope and the Sarva Shiksha Abhiyan.

III.5 OCCUPATIONAL STRUCTURE

Workforce forms the backbone of any society, be it a developed or underdeveloped. However, the nature and characteristics of the workforce vary from region to region. A number of geo-climatic, socio-economic factors and human aspirations influence occupational structure of a region. Traditionally like other backward areas, majority of the workforce was engaged in primary activities like agriculture and animal rearing in Leh district. However, after the Indo- china war of 1962 and Indo-Pak war of 1965 and 1971, large contingent of army was moved in. Lot of job opportunities came up for local people. Army unit like the Ladakh Scouts and other para-military force such as Indo-Tibetan Border Police (ITBP) and Indo-Tibetan Border Force (ITBF) were strengthened. These provide jobs to many Ladakhis. Infact, most of the families had atleast one member involved in army related activities i.e. either as army personnel or as *collies* or potter. The employment avenue further increased after the opening of the region for tourism in 1974. Many people got jobs as travel agent, hoteliers, taxi drivers and tourist guide. Along with tourism, other infrastructure in the form of roads and schools has been developed in the district, creating jobs on construction sites. All these above factors resulted in diversification of economy. Consequently, the occupational structure changed with the number of workers involved in primary activities decreasing

from 58.49 percent in 1981 to 37.92 percent in 2001 and the share of tertiary workers increasing from 25.12 percent in 1981 to 56.56 percent in 2001.⁵

Table III .13
Work Participation Rate 1981-2001

Year	1981	2001
Total	50.39	49.6
Male	59.46	58.32
Female	40.15	38.97

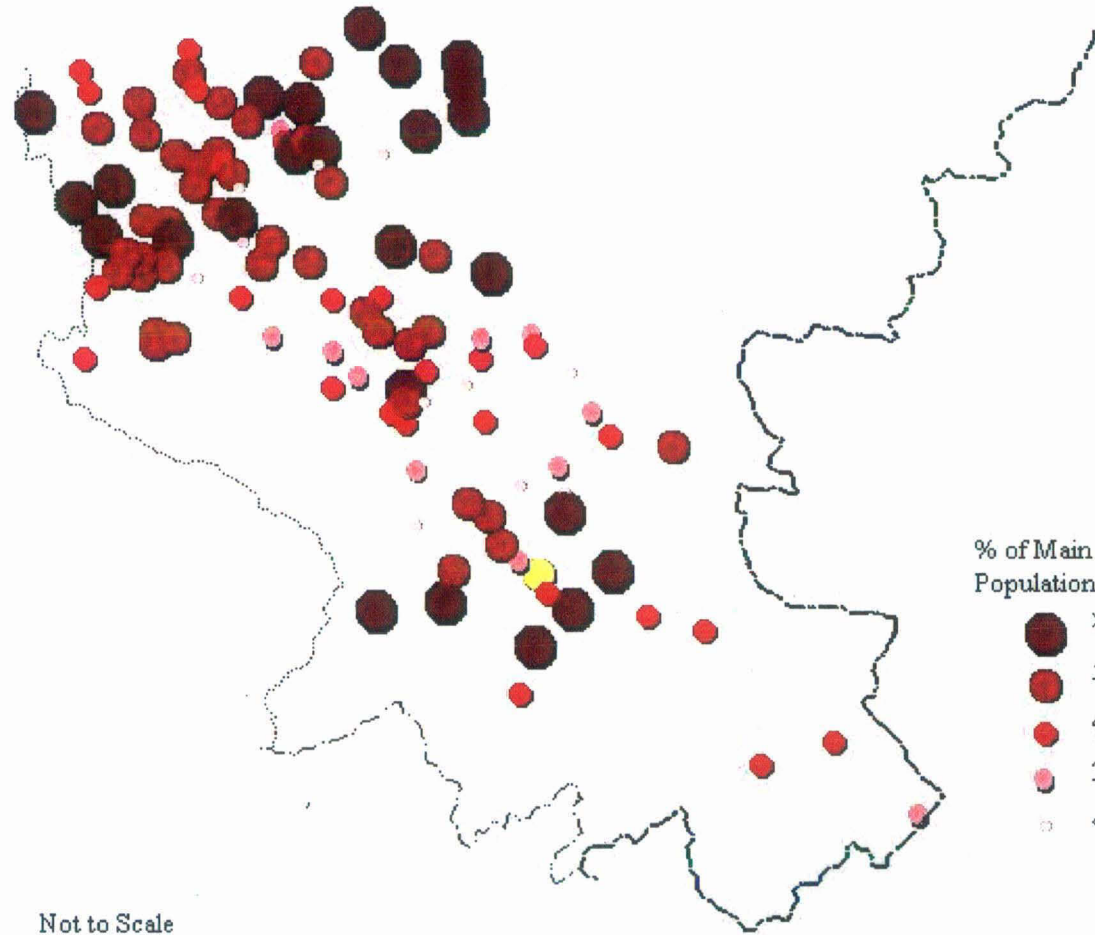
Sources: Census of India 2001, Primary Census Abstract, Leh District, (CD)

Workers constituted 49.6 percent of the total population in 2001 in Leh district, However, there was a decline in percentage of worker force from 50.39 percent in 1981 to 49.6 percent in 2001 (Table III .13). This was mainly due to the decline in the number of people engaged in agricultural activities, as the number of cultivators came down from 58.49 percent in 1981 to 37.96 percent in 2001. This is because many people who were earlier enumerated as cultivators switched to tourism related jobs. Many activities related to the tourism are seasonal in character and are confined to two or three month in a year. Thus, the workers engaged in these activities sometimes do not qualify to be included in the category of workers. Along with this, many hotels, guesthouse and restaurant are run as family enterprises and the workers involved in these are not enumerated as workers.

Map.III.7

LEH DISTRICT

MAIN WORKERS (2001)



Not to Scale

Table III .14

Proportion of Main Workers to Total Population by villages-2001

% of Total workers	No. of Villages	% of villages
Less Than 30	12	10.71
30-40	11	9.82
40-50	26	24.11
50-60	42	37.50
More than 60	21	18.75
Total	112	100

Sources: Computed from Census of India 2001, Primary Census Abstract, Leh District,(CD)

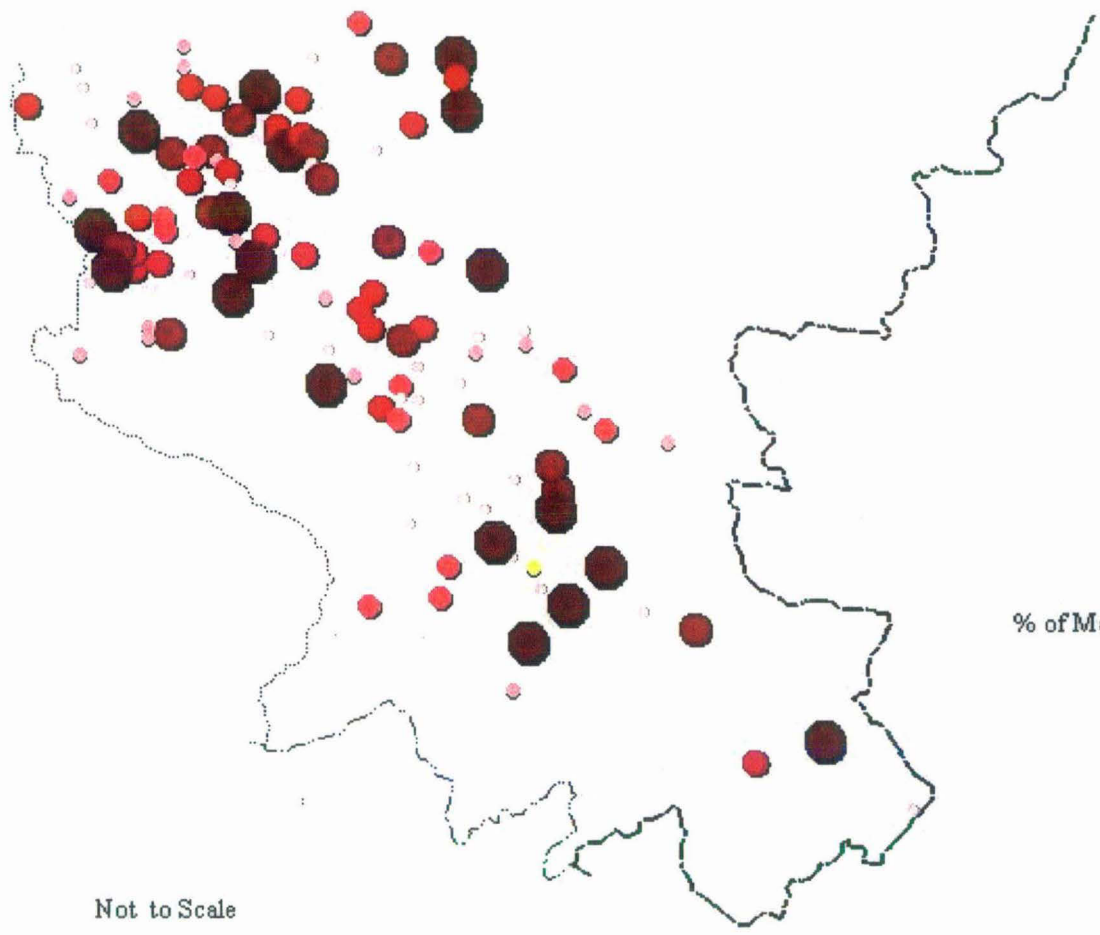
About 56.25 percent of the total village have work participation rate of more than 50 percent in 2001(Table III.14 and Map.III.7). These mainly included villages that are predominantly agricultural in character, where all the family members work on the fields and are enumerated as workers. Many of such villages are situated in far off areas like Tanyar, Tegar, Deggarr and Kobet. On the other hand, 12 villages have the proportion of main worker to total population less than 30 percent. Out of these villages, Lakjung, a small remote village in Nubra block has recorded the lowest work participation rate of 7.7. Carrying capacity of land is usually small in these villages. They work in agriculture fields and to supplement their income they also work as porters or laborers but in 2001 census enumeration, these workers were included in marginal or non-workers. These villages also suffered out migration of people to other villages with better economic opportunities. Gompa village like Hemis have also recorded low work participation rate. This was due to the concentration of non-working lamas (monks) population. The lamas are not involved in any kind of manual labour. As according to one clause of the code of conduct, prescribed by Lord Buddha, no lama (*monk*) is expected to indulge in physical labour. It is believed that manual work by a lama would result in the death of numerous life bearing objects.⁶ Several villages which have seen a lot of development in recent years like Nimoo, Kharoo, Choglamsar, Chushot Yokma have also recorded a low percentage of workers. This is because many workers involved in tourist and transport

Map.III.8







LEH DISTRICT

CHANGE IN MAIN WORKER

1981- 2001



% of Main Workers to Total Population

-  >30
-  20-30
-  10-20
-  0-10
-  (-10-0)
-  <(-10)

Not to Scale



related activities are family workers and others involved are employed seasonally. Thus, they are not enumerated as workers. This is also true for the Leh town with a work participation rate of 49.92 percent.

Table III .15

Change in Proportion of Main Workers by villages 1981-2001

Change in Total workers	No. of villages	% of villages
Less Than -10	26	23.21
(-10) - 0	16	14.29
0-10	14	12.50
10-20	23	20.54
20-30	15	1.34
Above 30	18	16.07
Total	112	100

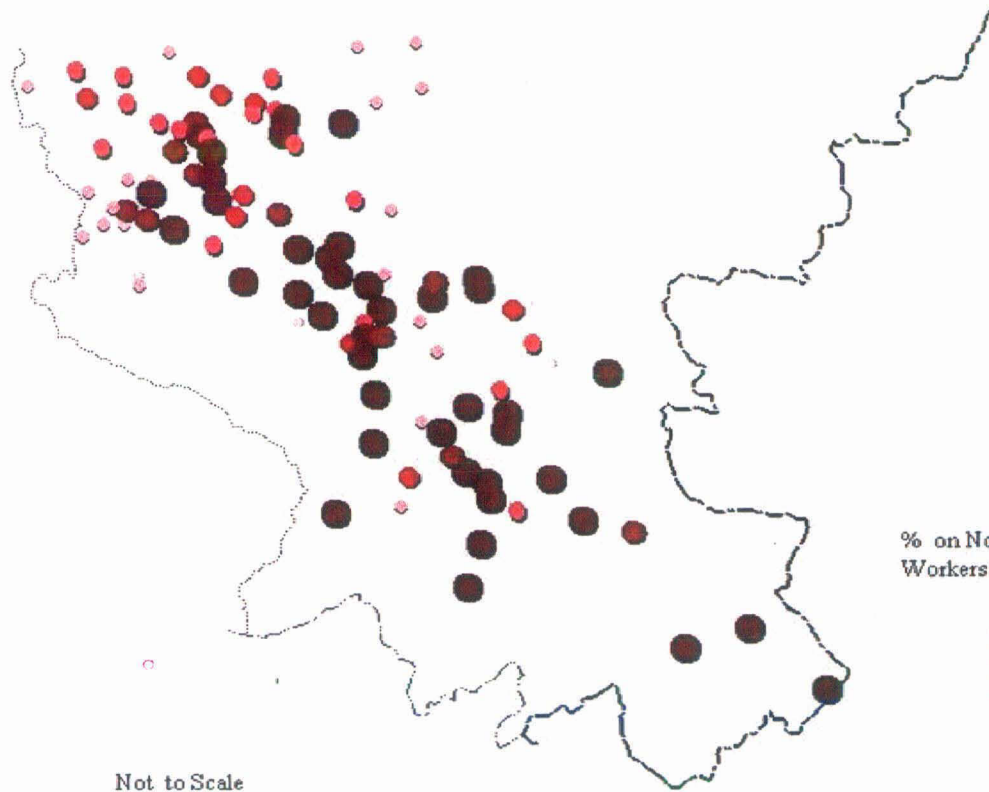
Sources: (1) Census of India 1981, Village & Townwise Primary Census Abstract, Leh, (Ladakh) District.

(2): Census of India 2001, Primary Census Abstract, Leh District,(CD)

The above table and Map III.8, indicate there was a decline in the proportion of workers in many villages. About 42 villages accounting for 37.5 percent of the total villages show a decline in the proportion of workers ranging from -49.7 for Hemis to -0.3 in Man-Pangong. On the other hand, 16.07 percent of the total villages had an increase in proportion of workers of more than 30 percent. Tanyar had the highest increase of 66.5 percent. The change can be attributed to more rigorous enumeration in 2001, when many workers who were earlier counted as main workers were now included in marginal or non-workers. It is true of Gompa (*monastery*) villages where even lamas seem to have been counted as workers, as the case of Hemis. Besides, the new shift to tourism did not qualify the workers to be counted as main workers due to the short seasonal character of employment in these activities.

Map III.9

LEH DISTRICT
NON-PRIMARY WORKERS
2001



% on Non-primary Workers to Total Workers

- >50
- 40-50
- 30-40
- 20-30
- 10-20
- <10

Not to Scale

Table III.16**Percentage of Non- Primary Workers in villages-2001**

% of Non-Primary Worker	No. of Villages	% Of Villages
Less than10	15	13.4
10-20	22	19.6
20-30	17	15.2
30-40	8	7.1
40-50	11	9.8
More Than 50	39	34.8
Total	112	100

Source: Census of India 2001, Primary Census Abstract, Leh District, (CD)

Picture of occupational structure will become clearer if one look at the workers engaged in non-primary activities, as these activities have a higher productivity. Besides, the socio-economic developments of a region generally lead to a shift of workers from the primary sectors to the non-primary sector. About 80.4 percent of total workers in Leh town are involved in non-primary activities. This is expected because being the district headquarter a large number of offices, schools and business activities are concentrated in the town. Due to increasing importance of Ladakh as tourist spot, new constructions are taking place in the form of hotels, guesthouse and restaurants. Thus, large scale immigration of labours is taking place. There are large variations of workers in non-primary activities in villages. Table III .16 and Map. III.9 highlight that 15 villages have less than 10 percent of workers in non-primary activities. This includes remote villages without any new economic opportunities, which lead to out-migration of the people to villages with greater economic opportunities. While 39 villages accounting for 34.8 percent have more than 50 percent non-primary workers. These mainly include villages with army centers like Anlay, Samad Rakchan, and Nimmoo, where people are employed as porters, construction workers and other related activities. Besides, villages close to the

Leh town which has seen lot of recent development like Choglamsar, Chushot Shamma, Spituk have a higher percentage of non-primary workers. Apart from this, there are small some remote village like Likchey with small workforce and even a small number of people engaged in non-primary activities push up their share in percentage terms. Beside, some road construction to link these villages have been taken up in recent years.

It can be concluded from the above discussion that the influence of the harsh natural environment and low availability of resources as well as the recent socio-economic developments have a strong bearing on the population characteristic of Leh district. Population is mainly concentrated in areas suitable for agriculture. However, the recent developmental activities have brought many changes in this pattern by generating economic opportunities. Such activities have resulted in more male mobility, thereby bringing about changes in various aspects of population. Villages those are close to Leh town, administrative centres, tourist centres, near army centres and along the highways have experienced high population growth, high literacy, low sex ratio and higher work participation rate. While, remote as well as small villages have seen low population growth, low literacy rate, high sex ratio and low work participation rate mainly in primary activities.

III.6 Settlement structure

Settlement is a generic term. It is a term with different implications. In geography, however, it appears to mean an established way of life, where people have ceased to wandering and stay for some time with fixity and certainty in respect of time and space.⁷ Settlement generally includes interaction of a given group of people and consists of an area of residence, social and economic activities. Therefore, the idea of settlement includes permanence, habitation and interaction.⁸ In the beginning settlements had simple forms and close relationship with the physical environment, but with the advancement of civilization and technological knowledge, settlements have become more and more complex. Settlement structure still reflects the influence of physical environment in most underdeveloped predominantly rural areas. Leh district, exhibits an



PLATE III.I Settlement Around Gompa, at Lingshed village

example of underdeveloped rural area where physical environment in terms of rugged terrain and low availability of water and some cultural factors have determined the settlement structure.

Settlement studies are an important theme of Human geography, as these involve the study of visual imprints made by human being in terms of cultural landscape in the process of occupancy. These imprints vary from one culture to another according to the physio-cultural settings and human ability to change the natural features.⁹

There is one town and 112 habited and one uninhabited Census villages in Leh district. In most cases, each village consists of group of hamlets. These hamlets are very small in terms of area and population to be given a separate status, therefore, these have been grouped together to form a village for convenience of enumeration. There are a total of 189 hamlets. These are mainly situated in areas where water and land are suitable for cultivation. There are some other hamlets that have developed as an offshoot of large villages e.g. Skampari, Housing colony, Ibex colony etc.

Origin, Site and location of settlements-

The origin of settlements in Leh district has number of religious myths those have been responsible in determining Gompa and village site.¹⁰ In some villages religious prediction had determined the site of the Gompas and subsequently, villages were established near these Gompas to sustain the lama population, who do not work on land (PATE. IV.1). All the settlements in the district have a small Gompa or are located near a large Gompa. Some other villages like Ranbirpore and Chuchot originated after the annexation of Ladakh by the Dogra ruler's¹⁰ and by the Balti ruler respectively. While in some other cases, colonies such as Skampari, Housing Colony, Skalzangling and Ibex colony, developed due to the population pressure in Leh town.

The sites of settlement in mountainous area Leh district are mainly determined by the factors of physical environment like lower altitude, gentle slope, availability of water



PLATE III.2 On Valley Floor of Indus river, Spitik village



PLATE III.2 On Glacio-fluvial Fan, Stok village
Source-Google Earth

and soil cover for cultivations. Consequently, villages in the district are situated either on valley floor (PLATE III.2) or glacio-fluvial fan(plate III.2) or river terraces¹¹. Most of the land is uninhabited. The villages in Leh district are found clustered in two areas. These are the narrow tract running south-west to north-east i.e. the valley of Indus river with major clustering around Leh town and the Nubra valleys containing the village of the Nubra and Shyok rivers.¹² A few settlements are also found in the valleys of smaller tributaries of Indus river such as along Hanle river in the Changthang region.

Most settlements in the district are situated on Indus river and its tributaries. However, some settlements are situated at the confluence zone of streams.e.g. Diskit village at the confluence of Nubra and Shyok river. Some settlements are located on old trade routes which follow these valleys e.g. Bazgo, Timosgang etc. Most of the villages are situated on relatively the flatter land but some settlements for protection sake and to conserve the scarce cultivable land were built on the hill sides.

Settlement patterns are the expressions of space organization by culture group therefore reveal important facts about the structure and resource perception of that culture group.¹³The culture and level of technology of a society will determine how it perceives the environment around it and how it will interact with it. As these vary, village forms also show variation. It is the physical characteristics of the terrain those influence the settlement patterns in mountainous area. Most settlement in Leh district follows the prime stream of district- the Indus and its tributaries. Therefore, linear type of settlement is found in Leh district. Their location is mainly influenced by suitability of terrain interms of low elevation, gentle slope, availability of water and adequate soil cover to sustain plant root.¹⁴ As seen in the second chapter such factors are met in lower valleys experiencing milder climate and having flat surface. Therefore, most of the villages are situated in a linear manner along valleys of Indus, Nubra, Shyok and on other small tributaries like Hanle.

Many of the settlements in Leh district are dispersed made up of few hamlets. (Plate III.3). They are highly associated with the dissected topography. However, some



PLATE III.3 Dispersed Settlement near Chuchot village

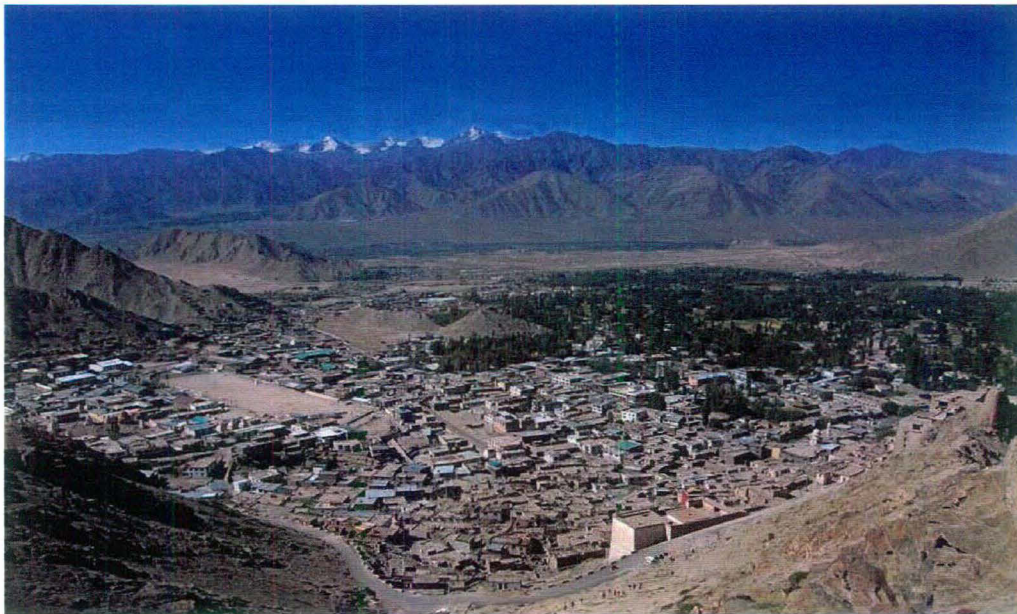


PLATE III.3 Compact Settlement at Leh Town

settlements like the Leh town (Plate III.3) and villages around it like Choglamsar have compact or nucleated settlement pattern. Leh town being the economic centre of the district experience large scale settling down of people. Choglamsar acts as a twin town to Leh town. Many new offices, educational institutes, hotels and shops have been shifted here. The Tibetan refugees are also settled in Choglamsar. All these had resulted in compact settlement of Choglamsar. However, there are some villages like Lingsed, where settlement pattern compact is due the religious factor. Therefore, all the houses are concentrated near the *Gompa* (PLATE III.1).

The morphology of the settlement varies from region to region and is governed by physical and cultural factor. It manifests itself in the physical form and structures including the layout of the street and spacing of the buildings. In Leh district, like other Trans-Himalayan regions, the dwellings are well adapted to environmental factors which not only determined the nature of building material but also roof structure. They have no clear street pattern. The house type has been changing in recent decades with increase in outward linkages and advent of new techniques in architecture, yet they reflect the cultural heritage of the people.

III.7 House Type

House type in a region largely depends upon the natural environment i.e. the terrain, climatic conditions, the availability of building materials and the economic conditions of the people. House type is basically guided by the availability of building materials and climate In Leh district.

The house type in the district has the following characteristics;

1. It is basically guided by the availability of raw materials and climatic conditions.
2. Religion plays an important role in determining the location, the orientation of the house and even placing the main entrance. A new house is never built without



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PLATE III.4 Traditional Ladakhi House

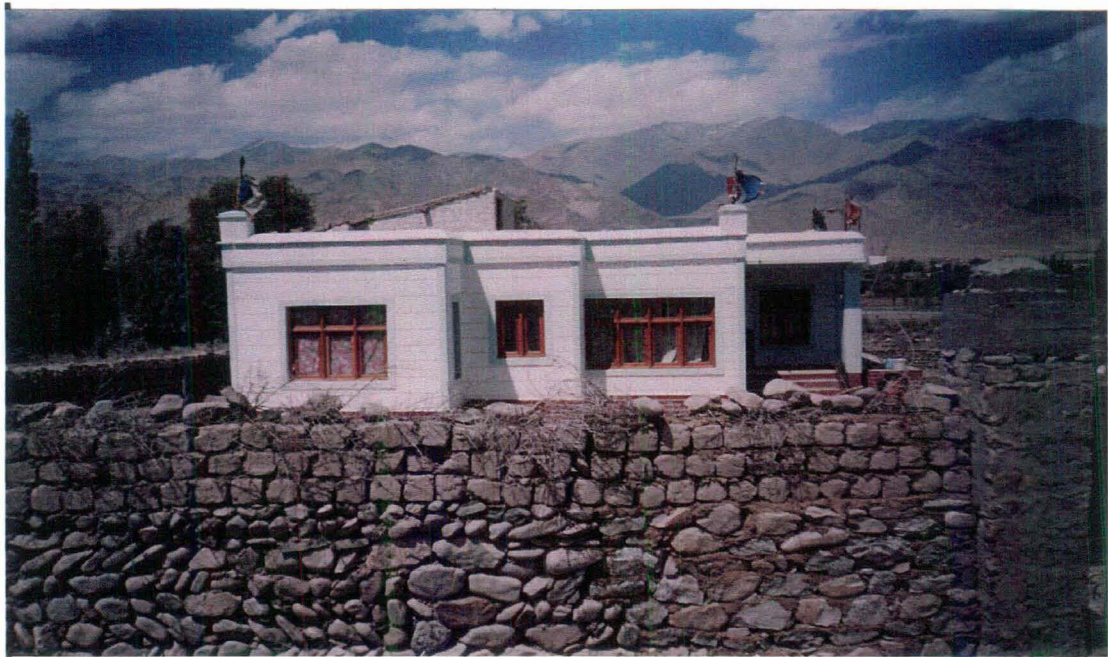


PLATE III.4 Modern house in Ladakh



PLATE III.4A Ladakhi lady making gur-gur tea in a Traditional kitchen

consulting the lama or an astrologer (*Onpo*). Architectural plan often reveals ethnic connections and rituals.

Traditional Ladkahi houses are usually large structure of two or three storied (PLATE.III.4). Houses in Ladakh are rectangular in shape. Ground floor of the house is commonly used as cattleshed, to store fodder and as toilet collection pit. This is most effective protection against cold during winter months. It serves as an air cushions, thus, not only saving the room temperature from coming down due to the outside influences but also contributes to the warmth which emerges from the cattle's body. Besides, it also helps the cattle from the extremely chilling cold.

First floor is mainly used as living room by the family members. It consists of kitchen, store room (*zod*) and guest room. Kitchen is the most important room of the house. It is where food is cooked and eaten and guests are received. Kitchens are usually the largest room in house. Along one wall, a row of elaborate wooden shelves (*langs*) are filled with dazzling array of vessels of every size. A large shiny black stove (*thabs*) is the focal point of every house. (PLATE.III.5)

Large part of the house is kept for storage, as for more than six months of the year nothing grows outside. After the kitchen, is the main storeroom, it is always kept at the side which receive least amount of sunlight, ensuring that it remains cool in the heat of the summer. It is filled with large wooden cask (*zama*) to store *chang* (local drink), clay pots for milk and its products. Grain is traditionally stored in *bang-ah* (grain store), pit made in the store room floor. Pits were used to store large quantity of grain because the region is cut-off from other part of the country for more than six months. The *bang-ah* (grain store) also protects food grains even if the houses collapse due to natural calamities or destroyed by fire.

The top floor consists of guest room and the prayer room (*chodkhang*). Prayer room is the most sophisticated and expensive part of the house. It is like a small gomba filled with religious texts, the household deity, statues and *thankas* (scroll painting).

Significant changes have come about in house structures in recent decades due to the development of communication and socio-economic development of people. Modern houses are generally single or doubled storied (PLATE.III.4). Externally, these resemble houses of other parts of the country. But the interior sections still have a traditional touch. Ground floor in these houses comprises of living room, store room and the bedrooms. Separate cattle shed and a fodder-store for the animals is built within or outside the courtyard.

Roofs of houses are always flat, in response to the low precipitation. Snowfall is so light that roofs of building are cleared of snow by sweeping it off with broom. Rainfall is equally low, with the result that major trunks of the district are barren, uncultivable and uninhabited. Ceiling is formed of poplar spars, laid one to one and a half feet apart over the walls. The intervening gaps between them are covered with willow branches placed in straight or sometimes at different angles, in the alternate intervals, so as to form a herring bone pattern. Roof of large rooms especially of the kitchen is always supported by wooden pillars (*ka*). The whole surface is finally plastered with 4" to 5" thick mud coating. In some places, *Yagzas*, a shrub, which is believed to last for hundreds of years, is layered before the mud coating. The *yagzas* helps in water proofing the roof. Roof is bordered by a jet black border, about one and a half feet wide, made from the mixture of soot and clay. Roofs are used for storing alfa- alfa grass (*ol*) and shrubs due to maximum sunrays required for drying up of grass. Besides, it also protects the mud and limestone walls of the house from rain water. This grass is used as fodder for cattle during the winter season when nothing grows.

Floor of the house is plastered with mud but some rooms like the main kitchen and guest room have wooden floor in some houses. Door of the houses generally faces east, as this is considered auspicious. Doors and windows have beautiful wood carvings. The windows are usually small. However, in recent decades there has been an addition of a glass room called *shelkhang*. Here, out of the four walls, two have glass windows, such

rooms are now found in majority of the houses (PLATE III.4). These windows mainly face the eastern and southern sides, to get maximum rays of sun.

Religion plays an important role in determining house site, its orientation and construction. Usually, the construction of house never proceeds without the approval of lama (monks). Even the date of construction is fixed by him. He comes to bless the land and free the site of evils spirits and devils. He uses a brass mirror to reflect it on all the surroundings, thus, capturing the *sadak*, the spirit of the earth in order to protect them from harm during construction. The mirror is carefully place in a box, where it remains until the construction is finished. After this, the lama opens the box and sets the spirit free.¹⁵ *Khangston* (house warming function) is celebrated after completion of house, all the relatives and villagers (*ulpa*), congratulates the owner with (*kalchor*) gifts or *chang* (local wine).

The building material consists of locally made sun dried mud-bricks and stones for the walls. The walls are often three feet thick, that serves to moderate the extreme climate. After that, it is plastered with fine clay called *mar-ka-la-ga*, literally meaning butter-mud. Then, the walls are whitewashed with limestone. From the foundation to a few feet, the walls are made of stone. Poplar trunks and willow branches are used for making roof and the poplar is also used for windows and doors.

There has been a significant change in the building material used due to the development territorial linkages and economic development of people especially around Leh town, Leh-Srinagar road and the administrative headquarters. Truckloads of cement, wood, concrete and glass are imported from other area. Majority of houses now use cement, glass, wood and concrete in constructions. Recently some houses with slanting iron sheet roofs have also come up around Leh town. It is because rainfall seems to have increased since the last two or three decades.

There is division of houses in Leh district that is *Khangchen* (main house) and *khangbu* (small house). This custom of division between *Khangchen* and *Khangbu* arise

in response to the various social and religious duties (*thhal*), the main house has to perform in the village. Therefore, when the eldest son gets married he inherits all the family's holdings including the house. The parent moves into small house (*khangbu*) with the other children. Their houses are always situated near by and in some cases they even stay in the same building but with a separate kitchen. There is constant cooperation during field work and social customs, and they spend lots of time together.

The above discussion shows that, physical environment and socio-religious factors are the major determining factor for the site and origin of settlements in Leh district. Availability of water, flat land and adequate soil cover are the main factors that determine the pattern and site of the settlements. Therefore, all settlements are found in river valleys. Settlements form linear pattern of distribution along the valleys in Leh district. The house type in the region is adapted to environmental requirements. It is basically guided by the availability of raw material and climatic conditions. However, many changes have started coming in with modernization in recent decades.

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Chapter –IV

LEVEL OF DEVELOPMENT AS REFLECTED BY POPULATION PARAMETERS

Basic objective of development is to improve the quality of life of the people. Idea of economic determinism was very strong in nineteen fifties and early sixties. The general view of that time was that if economic growth, especially GDP (Gross Domestic Product) was taken care that would automatically take care of other aspects. Consequently substantial economic development took place. But this aspect of development could not occur properly in third world countries as it was accompanied by the poverty, illiteracy, malnutrition, hunger, structural inequality and regional disparities¹. All this made the earlier view of development unsustainable as it neglected the role of population in the development process. Due to this, a new view emerged which explained that along with development, direct measures for improvement of quality of life are also essential. This is because of bi-directional relationship between the population and the processes of development. Population characteristics on the one hand, respond to the requirement of the development process and may on the other hand, be determined by and reflect the level of development². The relationship between population and development becomes more discernible in backward societies which are at early stage of development. Population in these areas tends to concentrate in certain favourable geographical areas. This concentration of population mainly depends on the carrying capacity of land and the availability of economic opportunities in mountainous area. Their availability varies from village to village, which lead to regional disparities. These regional disparities induce a process of outmigration from backward region to more developed regions. This outmigration results in lowering of total population, population growth rate higher sex ratio and reflects economic backwardness.

Development involves a sequential growth of not only economic growth but also of other aspect related to social and cultural set-up. Different societies give different response to stresses in development process. It mainly depends upon the technological know how, awareness of the people and accessibility, and these inturn induce differences

in the level of development. These variations in the level of the development are accompanied by differences in population characteristics. Therefore, an attempt has been made to understand the level of development reflected through various population attributes.

Some villages due to the favourable environment and recent changes have seen more development compare to others in Leh district. Thus, an index of development has been computed at the village level to identify these disparities. In order to measure the level of development various steps are involved. One of the most important step is the selection of variables which could give a true picture of the complex phenomena of development as reflected by the population attributes. Later, these variables need to be converted into statistically meaningful indicators which are composed to form an index of development. Development is a complex phenomena. Generally, the level of development is a reflection of mutual interaction among physical, demographic and techno-economic and socio-cultural processes. The following seven indicators have been selected to measure the level of development in each village of Leh district. The analysis has been done at village level taking all the 112 inhabited villages. It needs to be mentioned here, that Leh town has relatively much higher level of development has excluded from this analysis. Its high value would have distorted the village values of index due to statistical reasons.

Before constructing the index of development, it is important to know relevance of the indicators in an area like Leh district. It may be noted that these are not the best indicators of population parameters but are the best that could be squeezed from the limited data available from census record at the village level. An attempt shall be made to explain the study at Ph.D level with the help of primary data collection.

Table V.1
Indicators of Level of Development

Sr. No.	Variables	Indicators
1	Population	Size of the population of the Villages
2	Population Growth	Annual Growth Rate from 1981-2001
3	Sex- ratio	Number of Females per 1000 Males (Negative)
4	Literacy	Percentage of Literates to total population
5	Female Literacy	Percentage of Literate females to total female population
6	Work Participation Rate	Percentage of workers to total population
7	Non-Primary Workers	Percentage of workers in Non-primary activities to total workers

1) Population: The size of population is an important indicator of development in mountainous areas like Leh district where it is influenced by the rugged terrain and the limited carrying capacity of land. As stated earlier population gets concentrated in few favourable areas. It also indicates economic diversification in hilly areas like Leh district where the inhospitable living condition are responsible for limited man power. Thus, larger size of population of village shows better environment and the higher carrying capacity of the land as well as economic diversification. Thus, more the population in the villages, higher is the level of development.

2) Population Growth: The population growth is another important indicator of development which represents both the present time and the future human potential. A higher population growth rate in the villages of Leh district reflects a higher carrying capacity of land as well as economic opportunities which has resulted in excess of immigration over outmigration.³ Thus, a higher population growth rate in villages means better economic base.

3) Sex ratio: Sex-ratio is negative indicator of development in hilly areas. The change in sex ratio is mainly due to migration. It is generally found that there is a male selective out migration from backward area to developed regions. This leads to excess of females in villages suffering from out migration and excess of male in economically more developed villages. This is true in the case of Leh district, where due to the limited resources and economic opportunities in villages, the male population migrates to developed villages with better economy. Thus, lower sex-ratio means higher economic development or the level of development in Leh district.

4) Literacy Rate: Literacy is an important indicator as it shows the socio-cultural and technological advancement of a society. It also reflects the social consciousness of the people. Literacy contributes to development as well as gets affected by development. Thus, villages with higher literacy rate show higher socio-economic development.

5) Female literacy: The disparities between the male and female literacy are very high in underdeveloped regions. Besides, the roles of female literacy in remote areas are even greater as a literate woman plays an important role in the development of the entire family. It also indicates the social development. Thus, the higher female literacy shows higher awareness and relatively higher level of development.

6) Work Participation Rate: The work participation rate is another important indicator as the workforce forms the backbone of all the societies. A higher share of

workers to total population in a village indicates contribution of more people towards the prosperity of village.

7) Non- Primary Worker: Higher work participation rate can be due to high participation of children in work force. Therefore, to avoid this shortcoming and to show diversification of economy percentage of non-primary workers have been taken. Beside, with the economic development there is shift in occupational structure from the primary sector to the non-primary sector. Since, the non-primary workers have a higher productivity than though primary activity, a village dominated by non-primary workers is characterized by larger production and thus has a higher level of development.

In order to rank the villages according to the level of development, composition of the values has been done. The values of indicator chosen for the study cannot be composited directly as these are incomparable because of their different scale. Therefore, these values are made scale free by dividing each value of the population indicator in the column with their respective mean. The scale free values, thus obtained were added to construct composite indices for each village. These values of index show the level of development. The general assumption is that, the higher the value of composite index, higher will be the level of the development.

The formula used for constructing the index of development is

$$C.I = \sum_{j=1}^n \frac{X_{ij}}{X_j}$$

C.I = value of composite index

X_{ij} = value of j^{th} variagate of the with village

n =No. of variables

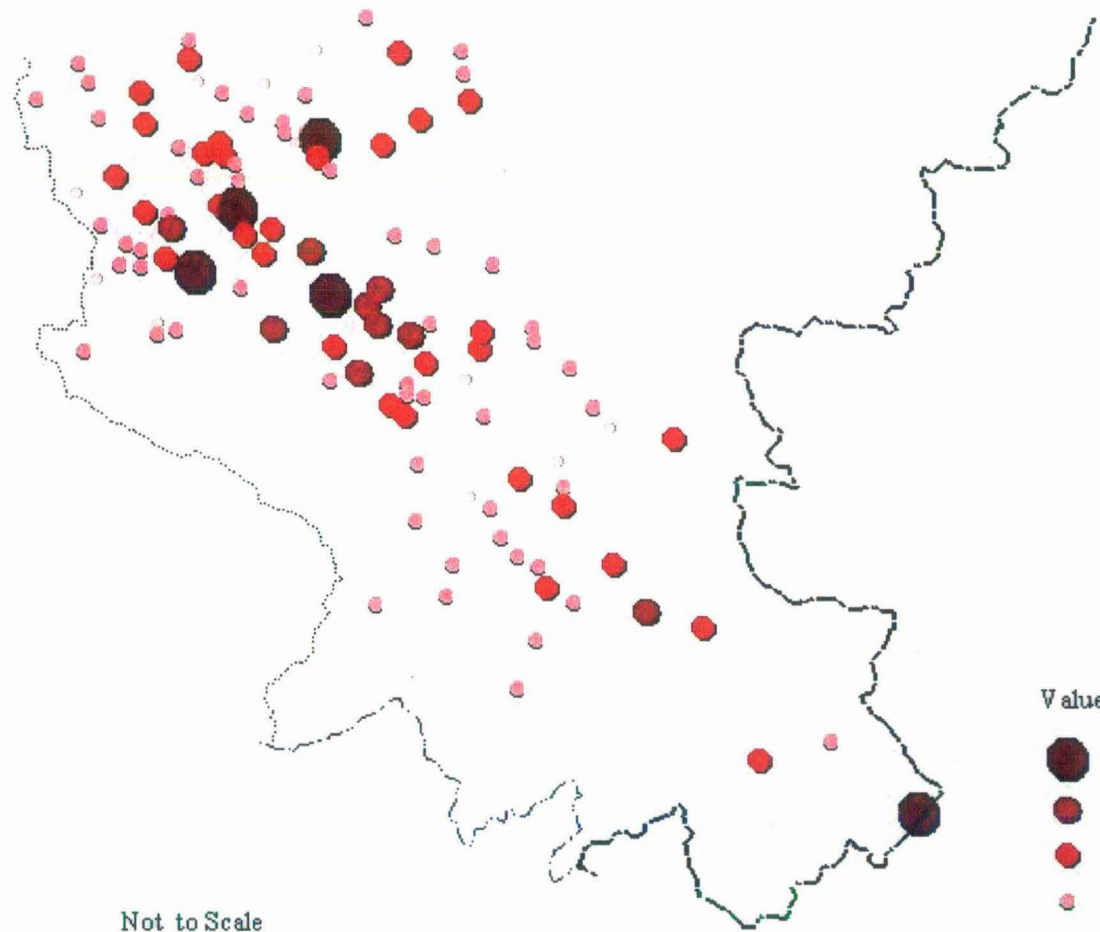
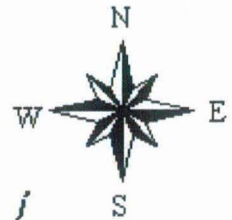
Values of each variable have been given in Appendix I

Map. IV.1






LEH DISTRICT

LEVEL OF DEVELOPMENT

2001



Value of Index

-  >10.97
-  8.99-10.97
-  7.01-8.99
-  5.03-7.01
-  <5.03

Not to Scale

The final stage in the exercise is the categorization of the villages into groups. Standard Deviation (S.D) of the index value has been taken as interval from the mean in order to group the villages in different categories.⁴

Table v.2
Levels of Development

Category	Value of C.I	Rank	No. of Villages	% of Villages
More than Mean + 2 S.D	>10.97	I	5	2.7
Mean + 1 S.D to Mean+2S.D	8.99 to 10.97	II	9	11.6
Mean to Mean +1S.D	7.01 to 8.99	III	30	26.7
Mean -1S.D to Mean	5.03 to 7.01	IV	57	49.1
Less than Mean-1S.D	<5.03	V	11	9.8
Total			112	100

The table and Map IV.1 shows that majority of the villages occupy fourth rank in the level of development. Infact, nearly 58.9 percent of the villages are in the fourth and fifth ranks, indicating low level of development. Only 5 villages accounting for 2.7 percent of the total villages which have composite index more than 10.97. These villages are Choglamsar, Spituk, Demjok, Bazgoo and Diskit. Their high rank can be attributed due to large population, high population growth, higher literacy rate and higher share of total workers. Choglamsar is important villages, situated close to Leh town. Some of the office, schools, and tourist related infrastructure have been shifted to this village in order to reduce the pressure in Leh town. Infact, it acts as twin town to Leh town. Spituk is an important village situated near Leh town. It has an army cantonment, Leh airport and famous Spituk monastary. Bazgoo is located near army cantonment. Deskit is an

important village and is the administrative headquarter of Nubra block. However, Demjok is an exceptional case where the high composite value is mainly due to the high population growth, while all its other indicators have very low values. Infact, it is backward village of nomads but due to very high population growth because small base jumped it to first rank.

There are nine second ranking villages with a composite value of 8.99 to 10.9. These include villages those are either near Leh town like Saboo, Chuchot Yokma, Chuchot Shamma, Phyang, Ranbirpore or are of tourist interest as in the case of Thiksey and Shey. Some are administrative headquarter like Khaltse and Nyoma also come in this category of developed villages.

The IIIrd ranking villages are 30 in number. These villages are characterized by high sex- ratio and small size size of population. They have suffered outigration to more advanced areas for employment purpose. Some of these villages are located close to the IInd ranking villages such as Karoo, Sakti, Matho, Alchi, Lekir etc.

The IV ranking villages comprises of the largest number of villages with 57 villages. These have a composite index value of 5.03 to 7.01. These villages have low economic opportunities which resulted in outmigration of the people to other areas with better economic prospect. Thus, these villages are characterized by low population growth, low literacy and female literacy and low share of non-primary workers.

The Vth ranking villages are the most backward in Leh district with a composite index value of less than 5.03. The category includes 11villages. These villages are Odmaroo, Kanjil, Largaib, Lonokor, Hundar Dog, Shang, Sharang, Phockchey, Photoksar, Leido and Warifstan. Village with lowest development is Warifstan which is situated in very remote area. Being situate on international border it has with inhospitable living conditions and has remained untouched by recent development measures. All the other villages are small villages situated in far off areas with weak economic base. These

villages recorded low population growth, high sex ratio and low work participation rate. The following observation can be made from the village wise values of index-

1. The villages situated near to the Leh town have experienced lot of recent development and have gained high value of the composite index. These are Choglamsar, Spituk, Saboo, Chuchot Yokma, Thiksey and Shey etc.
2. The villages situated near army settlements have also shown high level of development e.g. Spituk, Basgoo, Phiyang, Nimmoo, Anlay etc.
3. Besides, administrative centers have also the higher level of development e.g. Diskit, Khaltse and Nyoma, etc
4. Villages of tourist interests have got high level of development e.g. Thiksey, Shey, Spituk and Stok etc
5. Small remote villages situated in far off areas, with weak economic base are still backward and have got low rank in the index.

It can be concluded from the above discussion that there is high order disparities in the level of development among the villages in Leh district. Village situated near the Leh town have experienced lot of development. Tourism has brought lot of development in villages of tourist interest mainly those having Gompas. Administrative centers and villages situated near the army settlement have experienced significant development. However, most villages in remote areas are yet to reap the benefit of development.

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CHAPTER V

SUMMARY OF CONCLUSIONS

- I.1 The interaction between man and environment is region specific, which differs from region to region, that is, the plain, plateau or mountainous areas will have their own sets of related environmental factors. Human beings in a mountainous area adapt themselves to the nature with marginal modification in early stage of development, while in the plains, they seem to modify nature to meet their needs.
- I.2 Inclement environment and isolation from the rest of the world had created a condition of environment encapsulation in Leh district, like other remote Himalayan regions. There is limited capacity to increase productivity with the available non-mechanical technology. People had adapted to this harsh conditions by evolving socio-cultural and economic practices like agro-pastoral economy, polyandry and lamaistic Buddhism. This inturn affected the different aspect of population. Physiography and arid climate seriously restrict the extent of population distribution and economic activities to a few favourable pockets.
- I.3 The region experienced rapid change after the Indo-China border dispute of 1962, opening of Leh-Srinagar and Leh-Manali road and opening of Ladakh to tourism in 1974. These resulted in diversification of economy and provided the people with greater economic opportunities. Due to these factors, there was a drastic change in the population set-up of the region. Migration was an important factor of change in population attributes.
- I.4 Leh district is diverse both in physical as well as human aspects. The situation in the district has improved over the years. However, there are large variations in level of development within the district.

- II.1** Leh district has predominantly rugged mountainous terrain and is one of the remotest inhabited regions of the country. Whole area is situated at an altitude of about 2,500 meters and above from the mean sea level. It is called 'high altitude' area.
- II.2** The entire region is an elevated territory, with main mountain ranges and valleys running parallels to each other north-west to south-east direction.
- II.3** About 68 percent of the total land lies between 5,000 meters and 5,900 meters above the sea level in Leh district. It is virtually unfit for human life and vegetation. About 5.8 percent of the total land lies between 4,500 and 5,000 meters, this contains some pastures. Human settlements and agriculture are confined between 2,500 and 4,500 meters.
- II.4** Important mountain ranges of Leh district are southern face of Karakoram range, Saltora range, Ladakh range and the northern slope of Zaskar range. All these ranges run parallel to each other. The Karakoram and Saltora range mark the northern boundary while the Zaskar range forms the southern boundary. Saser Kangri is the highest peak of Karakoram range. These ranges, situated above 5,000 meters, with barren rocky surface are largely devoid of soil and vegetative cover. These do not support any human settlement and economic activity. The lower are lying between 4,500 meters to 5,000 meters supports some pastoral activity.
- II.5** Changthang, the eastern part of the district, is in the form of high altitude plateau, with an average elevation exceeding 4500 meters. The plateau region is wonderfully even, yet it is of little use for agriculture and other economic activities due to the high altitude, arid and cold climate and extensive rocky surface. The region consists of Lingzhithang and Rupshu plain. It is dotted with brackish lakes. As harsh environment do not support settled agriculture therefore, it is mainly inhabited by the nomads called changpas.

- II.6** River valleys form very important geomorphic feature of the area. Most of the settlements in the district are found in the river valleys, which provide relatively flat land with adequate soil and water for cultivation. The valleys are situated between the altitudinal range of 2,750 meters to 3,750. Indus, Nubra and Shyok and Hanle are the main valleys of the district. The entire district lies in Indus basin. Indus is the master stream forming long and wide valley. Therefore, most of the settlements are found here.
- II.7** The general direction of Indus river is from southeast to northwest. It originates near Mansarovar lake from glacier of the Kailash range. It enters Ladakh at Demjok. Shyok, Nubra, Hanle and Zaskar are the important tributaries of the Indus in the district.
- II.8** Glaciers are found on higher part of mountain ranges. These do not have any direct economic utility. However, these are the source of the perennial rivers and thus indirectly provide water for irrigation.
- II.9** Lakes found in the eastern part of the district are brackish in nature. This is due to the absence of outlets and extreme desiccation due to high evaporation. Most of these lakes are of structural origin. Their brackish nature and high altitude location have greatly reduced their economic utility. However, herds of livestock of nomads depend on the pastures found around the lakes.
- II.10** Climate is harsh with cold-arid conditions. This is due its high elevation, mountainous physiography and its situation in the Trans-Himalayan rain shadow zone. Due to the high elevation and rarified air, there is high diurnal range of temperature. Precipitation is very low. It is mainly in the form of snow in winters caused mainly by Western disturbance. It has little contribution to the agriculture economy of the district. Therefore, agriculture is mainly dependent on irrigation. The region has a very short growing season of less than six months. Within the

district, there are variations in the length of growing season depending on altitude and location.

- III.1** Natural environment being hostile exercises a strong influence upon the distribution of population and size of population. Most parts of Leh district are uninhabited. Population is confined to a few favorable pockets in the river valleys. Low carrying capacity of land limits the population size of villages. However, administrative centers and villages near Leh town have large population.

- III.2** Rising rate of population growth in Leh district is mainly due to migration. Recent developments especially after the Indo-China border dispute of 1962 and opening of Ladakh to tourists in 1974, have resulted in in-migration. Besides, out migration from the region got checked due to availability of job opportunities. Inter village variations of population growth indicate that village with better economic opportunities have experienced large scale immigration resulting in higher growth of population. While remote village with weak economic base and absence of job opportunities have experienced slow growth rate due to the out migration. Apart from migration, declining death rate with the coming in of medical facilities, declining polyandry system of marriage and Lamaism have contributed to higher growth rate of population in recent decades.

- III.3** Large variations are seen in sex ratio in Leh district. This is mainly due the sex-selective migration in the region. Out migration of males from remote villages of Leh district makes the sex ratio quite high. Whereas, the male selective in-migration of government officials and the other workers to cater tourist needs like shopkeepers, travel agent, hoteliers, cooks etc makes the sex ratio low in Leh town and better off villages. Therefore, administrative centers, places of tourist interest and Gompa villages due to the concentration of male lamas have low sex-ratio.

- III.4** Leh district has registered a substantial rise in literacy. However, there is a large gap between male and female literacy. Administrative centers, villages near Leh town or army centers or Gompa villages have recorded high literacy rate. Whereas, small remote and villages inhabited by the nomads have low literacy. Educational facilities have also improved in recent decades.
- III.5** Agriculture is the main stay of the population. However, there was a considerable increase in population engaged in non-primary activities. These happened after the diversification of economy took place due to the external influences those followed with the moving in of army in 1962, opening of Ladakh for tourism in 1974 and the development measures initiated by the government. Higher work participation is found in predominantly agricultural villages. Remote villages and villages with concentration of non-working-Jama have recorded lowest share of workers. But, some villages which have seen lot of development recently have also recorded low share of workers. This is because many workers involved in tourist and transport related activities are mainly family workers and the others are employed seasonally, as a result they are not qualify to be enumerated as main workers.
- III.6** Natural environment being hostile exercises strong influence on settlement structure. Low altitude, gentle slope, availability of water and soil cover for agriculture are factors those determine the pattern and site of settlements. Most of the settlements are situated either on valley floor or glacio-fluvial fan or river terraces. Very large area of the district is uninhabited. Settlements are mostly located in clusters in two areas i.e. along the Indus valley and Nubra valley. The later contains the valley of Nubra and Shyok rivers. Many of the settlements are dispersed made up of a few hamlets. Compact settlements can be seen in the case of Leh town and villages around it. Some Gompa villages are also compact in nature.

III.7 Houses types in Leh district are guided by the availability of raw material and climatic conditions. Traditional house are large with of two or three storied structure. Houses are generally rectangular in shape. Large part of house is kept for storage as nothing grows for more than six month of the year. Prayer room (*chodkhang*) is most important part of the house. Roofs of houses are flat in response to low precipitation. Houses are constructed using locally available raw material like sun dried bricks, mud, *mar-ka-la-ga* (butter mud) for the wall, poplar trunks and willow branches for roofs, windows and doors. However, many changes have started coming in house structure with modernization in recent decades. Therefore, in modern constructions, cement, glass and wood are used for construction. Religion plays an important role in determing house site, its orientation and date of construction.

IV.1 Development index shows high order disparities in level of development among villages in Leh district. Villages situated close to Leh town or army centers or administrative villages or of tourist interest show higher level of development. Remote village with weak economic base are still backward and have recorded low level of development.

IV.2 Five categories of villages have been worked out according to the index of development. Maximum numbers of villages are in fourth category. Choglamsar, Spituk, Demjok, Bazgo and Diskit are in the first rank of index of development. Their high rank can be attributed due to large population, high population growth, higher literacy rate and higher share of total workers. Demjok, a backward village of nomads also falls in this category. It is due to very high population growth because of small base. Otherwise it is a backward village. All its other indicators have very low value. The lowest ranking villages are small villages situated in far off areas, with weak economic base.

APPENDIX.1

Village	Total pop/ \bar{X}	Pop Growth/ \bar{X}	Sex-ratio/ \bar{X}	Literacy/ \bar{X}	Female Lit/ \bar{X}	Wpr/ \bar{X}	Non- prm wrk/ \bar{X}	C.I
Thanga	0.110	2.185	1.238	0.934	1.120	0.920	0.179	6.685
Taksi	0.901	1.207	1.093	0.833	0.551	0.951	0.478	6.013
Turtok	2.186	1.241	0.962	0.837	0.673	1.083	0.684	7.666
Chulungkha	0.324	2.228	1.157	1.066	0.982	0.984	0.094	6.836
Bogdang	1.839	1.556	1.073	0.861	0.549	0.994	0.326	7.197
Warisfistan	0.300	-0.836	0.913	0.404	0.263	1.097	0.183	2.324
Khemi	0.724	1.188	0.919	0.985	0.749	1.190	0.091	5.847
Panamic	1.013	0.954	1.150	1.072	1.020	1.433	0.361	7.003
Kobet	1.268	1.145	1.090	1.012	0.898	1.460	0.368	7.240
Hundri	0.269	0.702	1.125	0.743	0.598	1.192	0.637	5.268
Odmarroo	0.496	0.405	1.065	0.808	0.481	1.459	0.191	4.905
Tirchy	0.354	0.735	0.926	1.101	0.904	1.143	0.714	5.878
Skuru	0.319	1.159	1.021	0.860	0.700	1.040	0.909	6.007
Largiab	0.479	0.834	0.848	0.814	0.685	0.897	0.210	4.767
Skarpuk	0.545	1.294	1.130	0.981	0.968	0.789	0.868	6.574
Partap Pore	0.655	1.717	1.174	0.889	0.839	0.938	0.470	6.682
Hundar Dog	0.131	0.605	1.138	0.661	0.634	1.288	0.107	4.565

Hundar	1.389	0.427	1.091	1.109	1.144	1.081	0.573	6.815
Diskit	2.767	2.454	0.687	1.402	1.432	1.202	1.362	11.307
Chamshan Charasa	1.083	0.933	0.958	0.819	0.806	1.319	0.219	6.137
Tegar	1.147	1.151	1.033	1.043	0.938	1.530	0.254	7.095
Sumoor	0.958	1.133	0.749	1.380	1.412	1.409	0.437	7.478
Lakjung	0.654	1.059	0.979	0.935	0.909	0.155	2.321	7.012
Khalsar	0.253	1.855	0.953	0.948	1.191	0.310	2.151	7.661
Khardong	0.933	1.099	1.100	1.044	0.984	1.133	0.541	6.835
Degar	0.360	0.887	1.204	0.899	0.970	1.516	0.606	6.442
Khemakhungiu	0.257	0.869	1.350	0.872	0.970	0.995	0.354	5.665
Tanyar	0.241	0.204	1.208	1.243	1.316	1.927	0.168	6.307
Durbok	0.975	0.070	1.079	1.013	0.877	0.713	1.403	6.130
Tagste	0.986	-0.257	0.876	1.050	0.974	0.936	2.074	6.639
Shachokol	0.809	1.195	1.060	1.058	1.017	0.553	0.713	6.405
Man Pangong	1.180	0.982	1.102	0.911	0.728	0.729	0.616	6.248
Kariam Choshul	1.961	1.212	0.901	0.740	0.497	1.139	1.782	8.232
Likchey	0.254	1.584	1.064	1.192	1.225	0.577	2.381	8.277
Tukla	0.330	0.662	1.257	0.806	0.797	0.575	2.317	6.744
Kungiam	0.542	1.281	0.992	0.942	0.797	1.291	1.728	7.573
Teri	0.220	0.452	1.238	0.886	0.896	1.149	1.810	6.651

Himya	0.338	0.832	1.015	0.936	0.703	0.644	2.132	6.599
Tarchit	0.300	1.606	1.045	0.949	0.781	1.165	1.070	6.915
Kharnak	0.424	-0.753	1.180	0.429	0.639	1.194	2.345	5.459
Kerey	0.408	1.281	0.925	1.387	1.412	0.978	1.627	8.019
Kistmang	0.225	0.703	1.234	1.065	1.261	1.247	0.686	6.422
Samad Rakchan	0.654	0.095	0.892	0.181	0.189	1.203	2.350	5.564
Karzok	1.528	-0.162	0.928	0.408	0.363	0.812	2.347	6.224
Chumathang	0.643	1.669	0.728	0.986	0.999	1.332	1.468	7.826
Nyoma	1.491	1.461	0.773	1.235	1.155	0.967	1.980	9.062
Mood	0.752	2.203	0.930	0.907	0.858	0.985	1.089	7.725
Anlay	2.263	0.380	1.112	0.828	0.750	0.816	2.355	8.503
Koyul	0.614	0.529	1.253	0.480	0.459	0.947	1.874	6.155
Demjok	0.100	8.587	0.838	0.448	0.150	0.785	1.997	12.906
Dah	0.685	0.900	0.936	1.007	0.939	1.325	0.279	6.071
Hanoo	1.308	0.716	0.944	0.705	0.640	1.127	0.735	6.174
Temisgam	1.560	0.737	1.064	1.438	1.668	1.112	1.163	8.742
Tia	2.000	1.305	1.140	1.173	1.316	1.139	0.684	8.757
Skur Buchan	2.823	0.382	1.103	1.026	1.127	1.311	0.485	8.257
Damkhar	1.895	1.138	0.953	1.076	1.294	1.147	0.385	7.888
Leido	0.343	-0.332	1.001	0.700	0.698	1.247	0.155	3.811

Takmachik	0.815	0.928	1.084	1.014	1.119	1.448	0.398	6.805
Skinding	0.278	0.479	0.846	1.165	1.155	1.045	0.414	5.383
Khaltse	1.460	1.687	0.658	1.560	1.677	1.259	1.389	9.690
Saspochey	0.264	0.786	0.967	1.176	0.974	1.062	0.622	5.852
Hemmis Shyk Pachan	1.197	0.587	1.125	1.346	1.421	1.077	0.686	7.440
Nurla	0.520	0.333	0.951	1.272	1.484	1.017	1.082	6.659
Suspol	1.671	1.179	0.948	1.456	1.593	1.061	0.941	8.849
Alchi	0.937	0.767	0.898	1.223	1.389	1.031	1.053	7.299
Wanla	1.255	1.207	0.928	0.976	0.973	1.176	0.249	6.764
Geraman Gu	0.484	0.701	0.964	0.946	1.107	1.097	1.156	6.457
Tarhipti	0.149	0.237	0.952	1.165	1.363	1.136	0.284	5.286
Lamayouro	0.900	0.626	0.808	0.954	0.809	1.022	0.340	5.459
Kangil	0.358	0.726	1.076	0.736	0.718	0.855	0.413	4.882
Lingshet	0.958	1.320	0.830	0.737	0.717	0.939	0.167	5.669
Photoksar	0.274	0.888	0.935	0.413	0.568	1.032	0.000	4.110
Youl Chong	0.349	1.261	1.054	0.596	0.610	1.058	0.310	5.239
Likir	1.281	0.580	0.852	1.304	1.232	0.965	1.568	7.782
Ney	0.707	0.894	1.013	1.222	1.239	1.038	0.558	6.671
Umla	0.138	1.274	0.893	1.185	1.105	0.404	1.190	6.190
Bazgoo	2.224	2.898	0.429	1.593	1.365	1.445	1.602	11.556

Nimmoo	1.437	0.974	0.963	1.367	1.415	0.429	2.332	8.918
Taroo	0.582	0.886	1.101	1.354	1.411	1.178	0.923	7.434
Phey	0.364	1.331	0.983	1.237	1.552	1.188	0.863	7.518
Fiang	2.490	1.022	0.906	1.416	1.441	1.030	1.072	9.379
Spituk	5.485	2.438	0.978	1.225	1.439	0.846	1.923	14.335
Saboo	2.124	1.620	1.022	1.430	1.607	0.937	1.573	10.312
Nang	0.431	1.003	1.035	0.806	0.825	1.067	0.445	5.613
Shey	2.422	1.414	0.994	1.272	1.415	1.124	1.284	9.925
Thiksey	3.099	1.060	0.712	1.420	1.353	1.169	1.386	10.199
Rambir Por	1.159	2.799	0.463	1.570	1.382	1.121	1.612	10.106
Chuglamsar	6.191	2.213	0.971	1.176	1.358	0.543	2.297	14.750
Rumbak	0.311	0.348	1.037	1.016	1.143	0.911	0.489	5.255
Stok	1.857	0.835	0.893	1.225	1.324	0.761	1.644	8.540
Chuchat Yakma	2.509	1.388	1.083	1.405	1.509	0.613	1.700	10.207
Chiling Sumda	0.291	0.829	0.917	0.942	0.935	1.070	0.058	5.041
Skiumarkha	0.540	1.217	1.020	0.712	0.764	0.909	0.000	5.162
Chuchot Shama	1.819	0.956	1.094	1.355	1.468	0.652	1.802	9.147
Chuchoot Gongma	2.037	1.168	0.970	1.209	1.227	0.914	0.880	8.404
Mathoo	1.628	0.802	0.930	1.074	1.128	0.843	1.377	7.783
Kharoo	0.264	1.304	1.064	1.146	1.128	0.878	1.446	7.229

Lanokor	0.110	0.869	1.238	0.742	0.784	0.536	0.463	4.742
Chemrey	1.520	0.337	1.071	0.993	1.068	0.828	1.190	7.007
Sakti	2.077	0.038	1.071	1.111	1.103	0.735	0.957	7.091
Phokchy	0.365	0.293	1.344	0.764	0.715	0.869	0.017	4.368
Shara	0.345	1.020	1.285	0.931	0.930	0.948	0.358	5.816
Stakna	0.508	1.261	0.829	0.995	1.085	1.267	0.584	6.531
Changa	0.257	-0.090	1.297	0.862	0.893	1.095	1.938	6.251
Igoo	1.362	0.820	1.021	0.890	0.735	0.424	1.101	6.352
Sharangs	0.330	0.596	1.095	0.615	0.633	0.691	0.476	4.436
Meroo	0.239	0.028	1.065	1.036	1.163	1.188	0.849	5.568
Upshi	0.180	0.278	0.915	0.924	0.917	1.069	1.465	5.748
Shang	0.306	0.056	0.970	0.938	0.839	1.099	0.317	4.526
Hamis	0.210	-0.387	0.404	1.330	1.373	0.620	1.863	5.413
Matselang	0.489	0.411	1.081	1.077	1.168	0.277	1.757	6.261
Gia	0.876	0.655	1.015	0.893	0.789	1.192	0.317	5.737

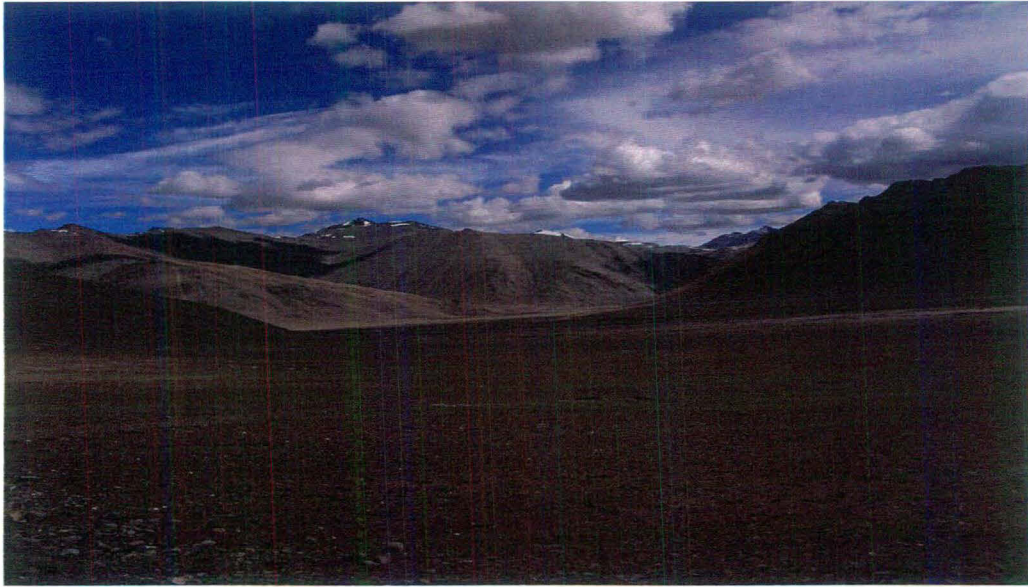


PLATE Appendix 1 Changthang – A High altitude plateau, with relatively flat surface but not suitable agriculture and human settlements due to high altitude and scarcity of water.



PLATE Appendix 2 Changpa nomads - inhabitants of Changthang plateau, with their herds of livestock

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