

# Natural Environment of Cold Desert Region Zaskar (Ladakh)

Chhering Tandup

Asstt. Prof. Earth Sciences Department, Institute of Mountain Environment, Bhadarwah Campus, Jammu University

**Abstract-** The study of man-environment relationship has great importance today. Human beings interact with their environment from the early stage of development to modern lives. In the process of this interaction they modify and transform environment. Environment plays determining role in the early stages of development where society essentially adapts itself to the limits laid down by it. As development proceeds onwards, the subservience to it gets progressively reduced and the process of cooperation and interaction begins. Present paper is based on analysis of secondary data published by different sources. Arc viewGIS 10 has been used to construct various kinds of maps in this paper. The natural environment of Zaskar presents a very harsh and fragile system. This region experiences heavy snowfall during winter caused by the western disturbances. Zaskar Tehsil is an underdeveloped area where existing use of natural resources is limited due to the low level of technology and harsh environment presented by rugged topography and very cold climate.

**Index Terms-** Natural Environment, Development, Fragile Environment and Technology

## I. INTRODUCTION TO ZASKAR

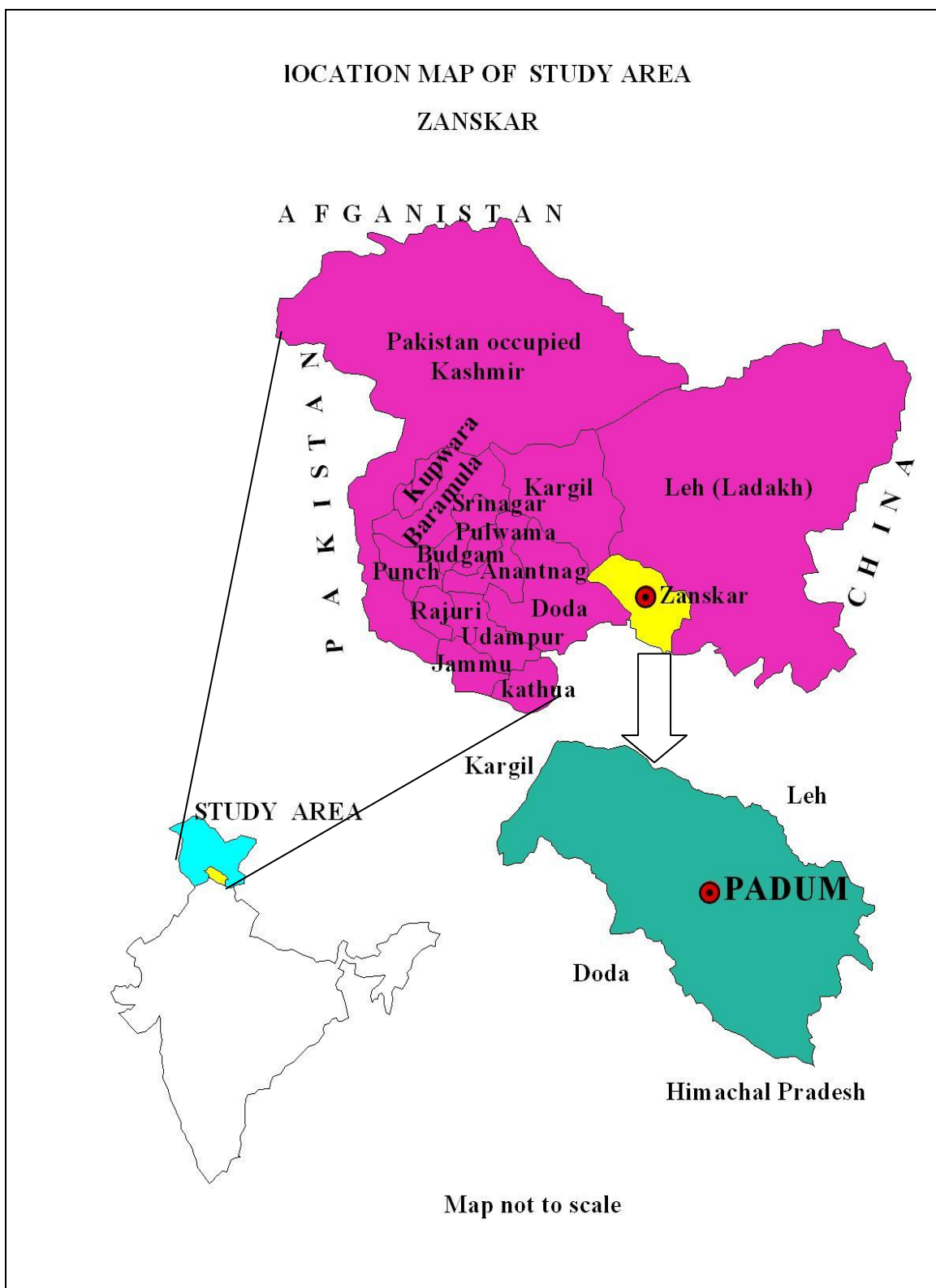
Nomenclature of Zaskar comes from the local word “Zangskar” meaning white copper. Zaskar is basically a Buddhist area with a small Muslim population. It covers area of some 7000 Km<sup>2</sup> and is situated at an elevation between 3500 and 7000 meters above the mean sea level. Its climate is very severe and it remains cut off from the rest of the world from November to June when only limited helicopter service is its only link with outside world. The region remains snow-covered during winters and movement of people comes to nearly standstill even within the region. Winter is severely cold and nearly no outdoor activity is possible for four to five months. People live in small houses build of stone, mud and wood. Human beings and domestic animals share the same cooking-cum-sleeping room on ground floor during winter months. Domestic animals are grazed on natural pastures in summers but have to be stall-fed during winters.

The villages are mostly situated along the two main tributaries of Zaskar River. The first one, the Stot, has its source near the Pensi-La (4400m.) pass. The second branch is formed by two main tributaries known as *Kurgiakh-chu* with its source near the Shingo-La and *Tsarap-chu* with its source near the Baralacha-La. These two rivers unite below the village of Purne to form the Luknak River also named *Lingti* or *Tsarap*. The Luknak-Chu then flows north westwards along a narrow and

precipitous gorge towards the Padam village where it unites with Stot River to form Zaskar River.

The Great Himalayan Range is to the south west and it separate Zaskar from Kishtwar and Chamba districts. To the northeast lies Zaskar Range separating Zaskar from Leh district. Zaskar River is the only drainage outlet for whole Zaskar region. It cuts a deep and narrow gorge through the Zaskar range.

This topographical configuration makes access to Zaskar difficult from all sides. Communication with the neighboring Himalayan areas is maintained through mountain passes or along Zaskar River. The river freezes during winter months and provide a route to Leh district. This is called *Chader* route. People track on this route during winter from December to first week of February to reach Leh. The easiest approach is from Kargil through Suru Valley and Pensi La pass. It is along this route that only road to Zaskar was built in 1979 to connect Padam with Kargil. Remoteness of this region also explains why only a few western travelers have visited this area until recent times. Tibetologist Alexander Csoma de Körös was the first Europeans to visit Zaskar in 1823. Moreover, because of its strategic location close to border with Pakistan and China, Zaskar was declared a restricted area and was reopened to foreigners only in 1974.



**Map No. I.1**

### **The Natural Environment**

It is necessary to comprehend natural environment of Zaskar in order to understand its social, demographic and economic set-up. Therefore, this paper has been dedicated to the study of its natural environment.

The natural environment of Zaskar presents a very harsh and fragile system. This region experiences heavy snowfall during winter caused by the western disturbances. Zaskar Tehsil is an underdeveloped area where existing use of natural resources

is limited due to the low level of technology and harsh environment presented by rugged topography and very cold climate. The following aspects of natural environment of Zaskar have been looked into in this paper.

- I. Physiography
- II. Natural Drainage
- III. Climate
- IV. Rocks and Minerals Resources
- V. Flora and Fauna

### **I. Physiography:**

Physiography of any area is related to constant changes occurring over geological time. These are subjected to modifications of surface configuration caused by natural agents those operate in an orderly progressive cyclical sequence. All these physical, chemical and biological changes help in the modification of the earth's surface.

In general, the entire region of Zaskar is an elevated territory presenting a system of alternating valleys and mountain ranges except the eastern part, which is a plateau. The mountain ranges are most important physiographic feature of Zaskar in terms of areal coverage. The region can be divided into mountain ranges and river valleys in terms of physiography. The following are the important mountain ranges of Zaskar region.

#### **I.1 The Mountain Ranges:**

The mountain ranges of Zaskar are:

- a. The Northern face of the Great Himalayan Range
- b. The Zaskar Range

##### **a. The Northern face of the Great Himalayan Range:**

Most of the southern part of Zaskar region is occupied by the Northern face of the Great Himalayan Range. The average height of the Great Himalaya is around 6100 meters. The Zaskar lies on the leeward side of the Great Himalayan Range. This northern part of the range also make boundary with the districts of Lahaul, Spiti and Chamba of Himachal Pradesh and Doda and Kishtwar district of Jammu and Kashmir. The main passes of the Great Himalayas linking Zaskar are Umasila (5930 m.), Potula (5716 m.), and Shingola (5100 m.).

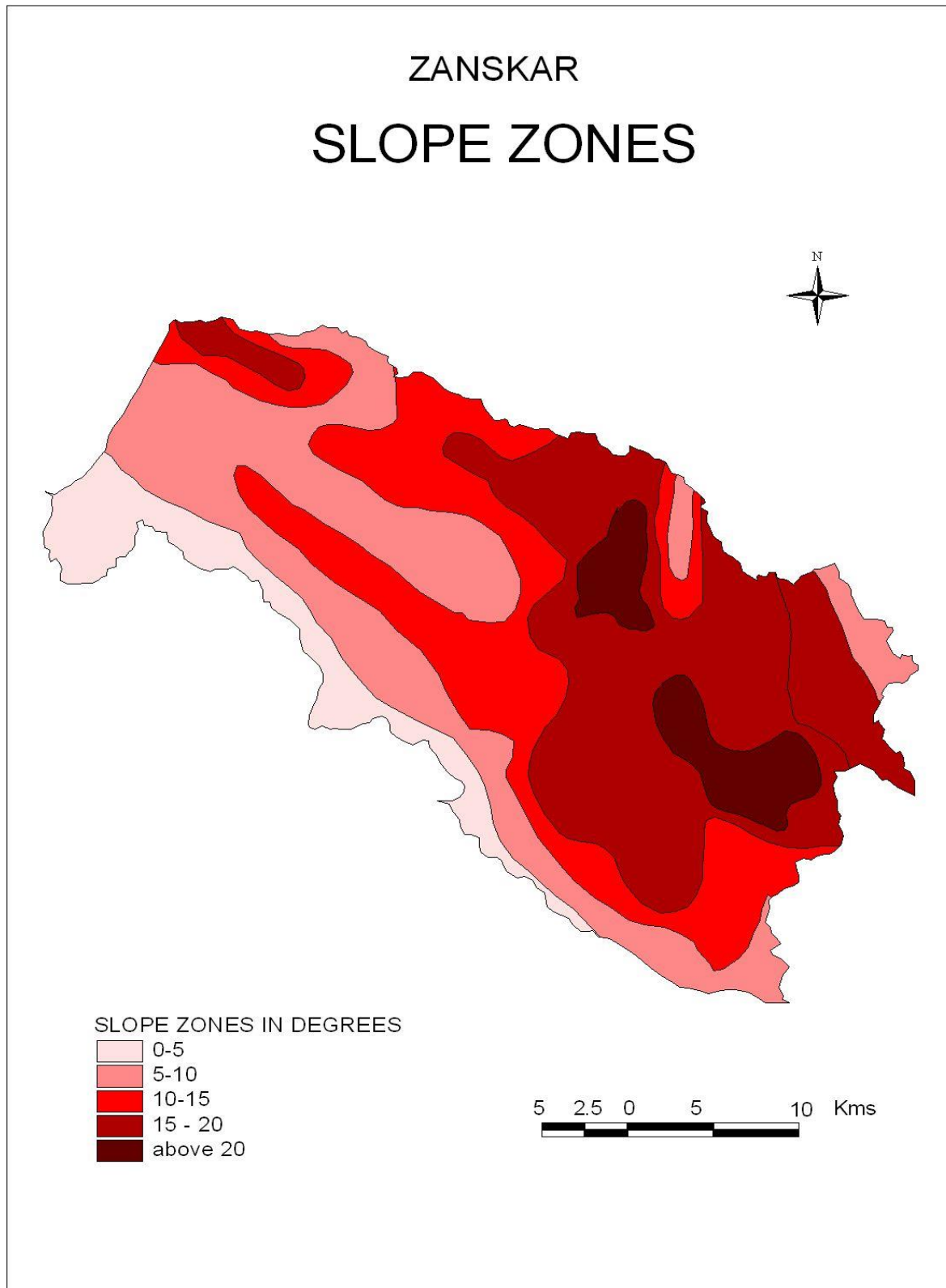
Map no.I.2 shows the slope of the Great Himalayas lies between  $0^{\circ}$ - $5^{\circ}$  and  $5^{\circ}$ - $10^{\circ}$  in most parts. It is because the descend on northward side is gentle. The slope is steep in its eastern part compared to western part.

##### **b. The Zaskar Range:**

Zaskar range is the most important mountain range of Zaskar tehsil. This range runs parallel to the Great Himalayan Range, and is situated to its north. The only access to the main inhabited valleys of Zaskar tehsil is through high passes situated in the Zaskar Range, the Great Himalayan Range and their off-shoots. The most important passes of Zaskar Range are Pensila (4400m.), leading to Kargil situated to the North-West, Purfila (3950 metres), Namatsela (4350 metres), Charchala (5200 metres), Shapodakla (5648 metres) leading to Leh in the North - East and the Phirtsela (5250 metres). Mostly this range presents barren rocky surfaces. Its lower slopes provide some natural pastures during summer months. It can be inferred from Map

no.I.1 that the Zaskar Range contains maximum slope ranging between  $5^{\circ}$  to above  $20^{\circ}$ . The eastern part of this range has steeper slope compared to the western part. The Zaskar Range nearly separates Kargil district from Leh district. The Ladakh Range runs parallel to the Zaskar range and is located to its north.

Slope zones have been shown on map I.2. Analysis of slope is very important. Slopes influence the availability of cultivated land for other human activities. The eastern part of Zaskar lies between the slopes of  $15^{\circ}$  to  $25^{\circ}$ . Slope of lower parts of the Great Himalayan Range, is between  $10^{\circ}$  to  $15^{\circ}$ . The high summits under snow fields and glaciers have comparatively gentler slopes ranging from  $0^{\circ}$  to  $5^{\circ}$ . Slopes in the Stot valley are comparatively gentler than Luknak valley.



**Map I.2**

## **I.2 The River Valleys:**

The main rivers of the Zaskar are the Stot River and the Luknak River. The river valleys have fertile soil, and are used for agricultural activities. The main river valleys are as given below.

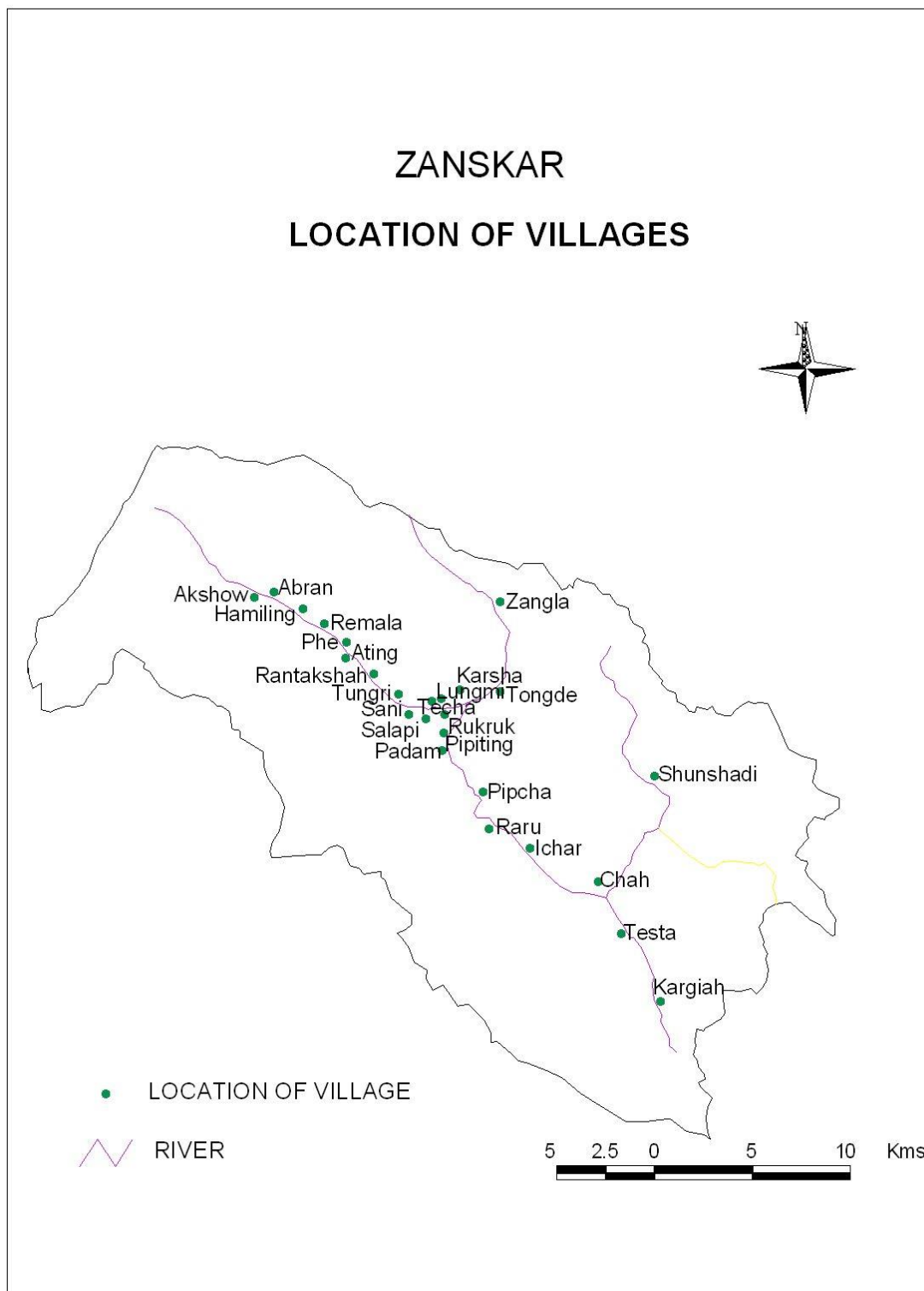
### **a. The Stot River Valley:**

The Stot valley begins from Pensila pass opening the Zaskar region towards Kargil in the north. The descent into the main Stot valley opens out into a wide U- shaped valley. The entire Stot valley presents a series of talus cones and glacio-fluvial fans along the slopes those have been deposited over the moronic deposits formed earlier. The Stot River valley is dotted with rural settlements on both sides of the river. The settlements are mostly situated on river terraces or on fans. It can be seen from map no. I.3 that main villages of this valley are Akshow, Abran, Hamiling, Remala, Phe, Ating, Rantakshah and Tungri. Beside these villages, there are also many other small hamlets.

### **b. The Zaskar Valley:**

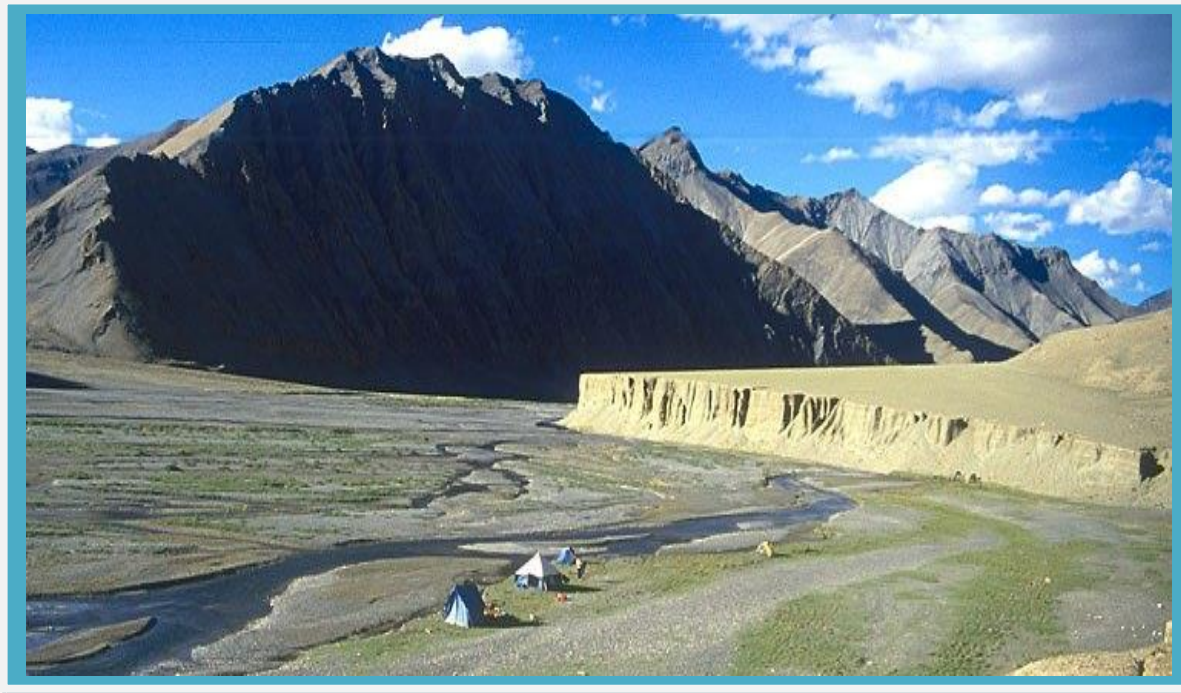
Central plain begins from Tungri village, which is warmer as compared to the Stot Valley. The two major rivers of Zaskar,

the Stot and the Luknak meet near the Karsha village. After confluence of these two rivers, the river comes to be known as Zaskar River. It may be mentioned that the name Zaskar is used for the river, a mountain range and the Tehsil of Kargil district. This area forms the Central valley, and most villages of Zaskar are settled in this part. Main villages as shown in map no. I.3 are Sani, Salapi, Padam, Pipiting, Tescha, Rugruk, Lungmi, Tongde, Karsha and Zangla. Geologist named, Drew noted the presence moraines at Stongde and Padam, and river terraces occupying much of the valley floor.



**Map I.3**





**Plate no. I.1 River Terrace and plain used for tourist camp.**



**Plate no. I.2 Extensive Central plain of Zaskar.**

### **c. The Luknak River Valley:**

This valley is the warmest valley of Zaskar because of being an enclosed valley. This valley is more favourable for the growth of vegetation. Land of this valley is more fertile. The occurrence of settlements in this valley is similar to those in the Luknak valley. The main villages as shown in map no.I.3 of this valley are Pipcha, Raru, Icher, Chah, Shunshadi, Testa and Kurgiah.

### **I.3 Glaciers of Zaskar:**

The glacial history of the region is the most evident from many glaciated features found in the region. The Zaskar River runs through a deep unglaciated rocky gorge, but the upper Zaskar and the Stot rivers have broad, straight or gently curving glaciated valleys with floors width up to 3 km. These valleys are covered with fluvial and glacial deposits.

There are several terminal moraines in the Zaskar and the Stot valleys marking the extent of glaciers in the past. The physical environment of Zaskar is essentially one formed by glacio-fluvial geomorphic processes. Mountain glaciers deeply

eroded the original valley, depositing debris along the lower parts of the valley. Landforms resulting from glacial erosion and deposition can be seen in a number of features ranging from arêtes, cirques, cols, truncated spurs and glacial troughs, to a range of morainic deposits in Zaskar.

Beside the glacial landforms, fluvial landforms can also be seen in Zaskar. Thus, the high altitude mountainous Zaskar region can be considered to have undergone glacial, and subsequently, glacio-fluvial and fluvial action, with weathering and mass wasting being the dominant processes involved in sculpting the present topography. The main glaciers of Zaskar are;

#### **a. Drung Drang Glacier (5940 m.):**

The largest glacier of Zaskar is the Drung-Drang glacier and this once extended down to the Stot valley. The height of this glacier is 5940 meter above the mean sea level. The Drung-Drang glacier as shown in the plate no.I.3 is the source of Stot

River. This glacier is located below the Pensila pass at the base of the Great Himalayan Range.

#### **b. Shingo La Glacier (5200 m.):**

It is the second important glacier of Zaskar which lies on the trekking route from Darcha to Padam. It is situated at height of 5,200 meters. Beside these glaciers, there are many other glaciers, out of which, the Stongdey glacier is situated above the Stongdey village, 18 Kms to the north of Padum in Zaskar. It is a large glacier with several feet deep snow. The Gyalpa Kanglaza glacier (3505 meters) is situated above Padam. It is a small glacier. Padam, the tehsil headquarter of Zaskar, gets water from this glacier. The Chorala glacier lies in between Karsha and Tungri villages near the summit. Kumil glacier lies at the summit above villages between Shila and Kumik. The Haftal glacier occupies at the summit above Sani and Stara villages in Zaskar.



**Plate no. I.3 Drung Drang glacier: The largest glacier in Zaskar**

#### **I.4 Lakes of Zaskar:**

There are a few lakes in Zaskar, largely caused by rapid aggradation and incision by rivers and glaciers. The largest lake, *Tsho Phu* Lake near Tantak, is a striking and beautiful sight as it occupies a glacial trough dammed by moraine and gravels. The other important lakes are twin lakes on the Pensila pass called *Statso* and *Latso* at 4400 metres. There are about six small kettle lakes. Among these the most important lake lies near Sani village in the middle of Zaskar valley. This lake is known as *Sanitso*. Traditional local folklore suggests the presence of a larger lake in Central Zaskar in historical times.

#### **I.5 Passes of Zaskar:**

Pass is lower part of crest which provides access to areas situated to its two sides. It is called *La* in Ladakhi and Tibetan languages. The crest of a pass is named as "*La-tre*" and the foot of the pass as "*La-tsa*". These passes are used for connecting

different parts in mountainous regions. The main passes of Zaskar include;

#### **a. Pensi La Pass (4400 mts):**

This pass separates Suru valley from T-shaped Zaskar Valley lying at a distance of 140 km from Kargil on Kargil-Padam road. It closes in October and re-opens in July due to heavy snow fall. Most of trekkers use this trekking route from Kargil or from Panikahr via Rangdum-Gompa to reach Zaskar. After crossing Pensila pass they reach Abran, Phey and finally Padam.

#### **b. Umashi La Pass (17370 feet) :**

It is situated in between Kishtwar and Zaskar. In old days, it was traversed by Jammu, Punjab and Kishtwar traders who visited Leh and other markets in central Asian countries.



### c. Shingo La (5096 mts.):

This is a very important pass for trekking from Darcha to Padam. It takes around 7 to 8 days by trekking. Now there is planning to construct a road from Padam to Darcha via Shingo La.

### d. Pota La (5716 mts):

Through this pass one can go for trekking to reach Pangri valley of Chamba district of Himachal Pradesh. The other important passes are *Phirtsela* (5250 mts), *Shapodak la* (5648mts) *Chacharla* (5200 mts), *Namt sela* (4350 mts) and *Purfila* (3950 mts). All the above passes play a very important role in communication and trade with surrounding regions.

### I.6 Soils of Zanskar:

Rugged, arid, cold, mountainous conditions of Zanskar influence the depth, texture, and compositions of soils in Zanskar. Soil becomes a prime determinant of land suitable for agricultural use, especially since steep slopes and ruggedness greatly limit the availability of the total land area. The soils of Zanskar are characterized by glacial moraines which determine the soil texture. The texture is important in soils because it determines the ability of the soil to retain moisture and transmit water to the layers below. Soils range from gravelly and sandy loams on the alluvial fans to sandy and silty loams on the flood plains in Zanskar. By and large, the soil texture in Zanskar is sandy loam. Sand particles are usually coarse. Soils are characterized by low organic matter and poor water retention capacity. The soil texture of Ladakh has been shown in table no.I.1.

**Table I.1 Percentage Analysis of Soil in Ladakh and Zanskar.**

Place	Coarse	Fine Sand	Salt	Clay	Texture
Drass	0.88	19.82	53.90	25.00	SC
Kargil	6.44	61.10	3.30	20.50	LC
Leh	4.17	24.83	2.50	8.50	LS
Suru	1.00	58.55	28.50	12.00	L
Zanskar	3.77	34.83	15.00	25.50	SL

SC = Silt Clay; LC = Loamy Clay; LS = Loamy Sand; L = Loam

Source: Sagwal, S.S., *Ladakh: Ecology and Environment*, Ashish Pub. House, New Delhi, 1991, pp.21.

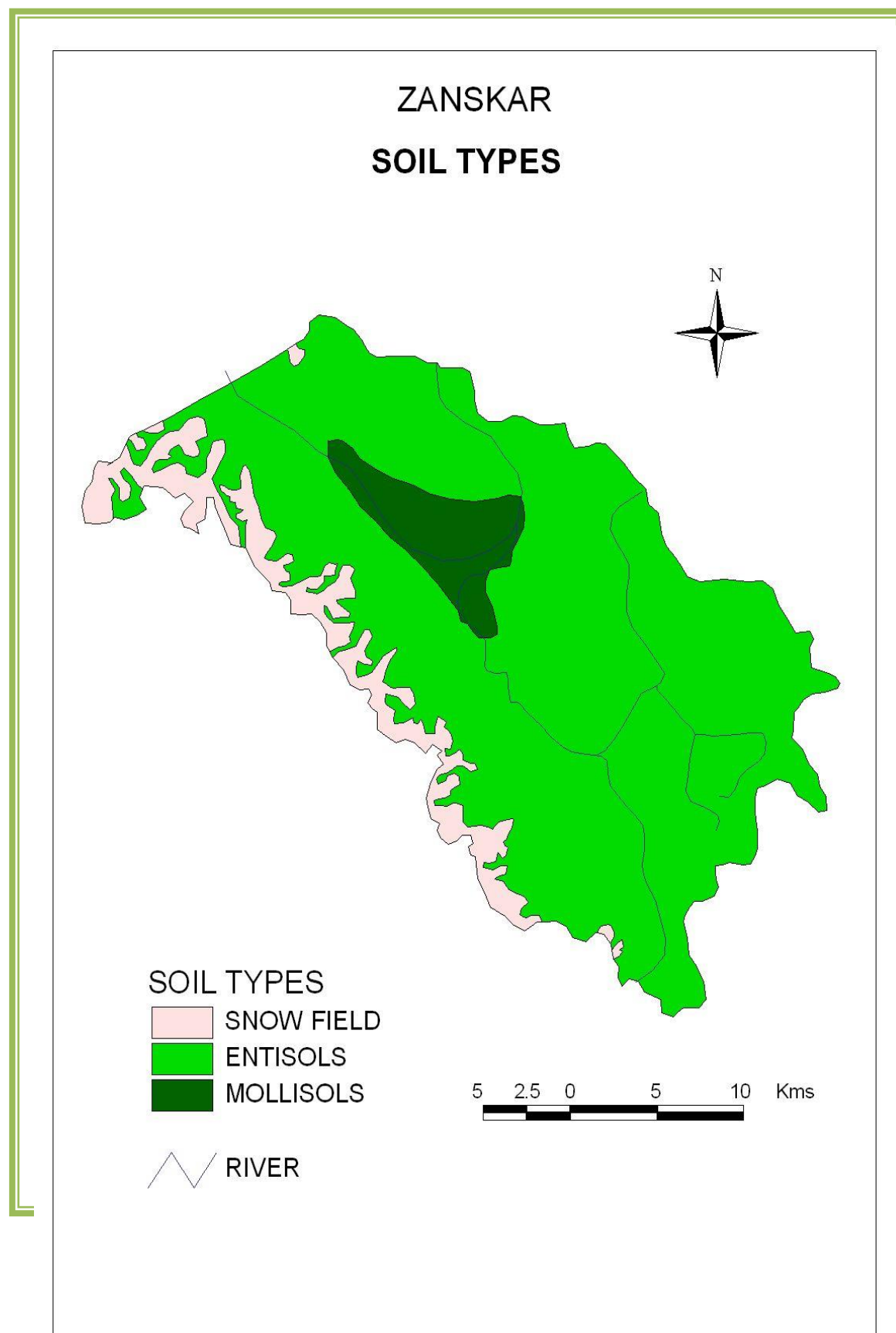
Soil map of Zanskar (map no.I.4) shows two types of soil in Zanskar. These are entisols and mollisols. It can be seen from this map that the mollisols are mainly found in the river valleys and entisols cover maximum area of Zanskar region. Most of the western part of Zanskar is covered by snowfields.

### 1. Stot River:

Stot River originates from *Drung-Drang* glacier near *Pensi la* (4400 mts.) and flows eastward to reach the Central valley covering a distance of 60 km. It meets Luknak River near Padam and forms Zanskar River. Haftal River, Akshow River and Ating River are the main tributaries of Stot River.

## II. NATURAL DRAINAGE OF ZANSKAR

Main river of Zanskar is Zanskar River itself. This river is the result of the confluence of mainly two rivers, namely Luknak River and Stot River. These major rivers join each other near Karsha village, and thereafter, it becomes Zanskar River. Zanskar River joins Indus near Nimo village of Leh. It covers the total distance of about 370 km. This is one of the main left bank tributaries of the Indus River in Ladakh. Confluence of Zanskar River with Indus River can be seen in plate no. I.5.





**Plate no. I.4 Luknak and Stot River before meeting near Karsha village.**



**Plate no. I.5 Confluence of the Zaskar River with Indus at Nimu (Leh)**

## **2. Luknak River:**

It is the second most important tributary of Zaskar River. Headwaters of Luknak River result from *Yunan*, *Sarrchu* and *Tserap* streams, all of which rise to the north of the Great Himalayan Range near Baralacha la. The river follows the North-West direction. The Kargyak River is an important tributary of Luknak River. *Sha-de*

River is also a tributary of Luknak which meets *Tserap* River and flows towards North direction and meets *Kargyak* River near Chah village. These form Luknak River, and meet Stot River, near Karsha Village.

A hierarchy of stream orders as (shown in map I.5) is important in accessing the spatial aspects of hydrological processes. The map shows a large number of first order streams which is a typical feature of mountains. Major tributaries attain

third or fourth order and the master stream i.e. Zaskar River has fifth order. The stream ordering gives a rough idea about the volume of water in each stream.

### III. CLIMATE

Climate of Zaskar is characterized by great range in temperature from cold to very cold and by excessive dryness.

#### IV.1 Temperature:

Climate is very extreme. Winter experiences extreme cold while during summer, temperature may exceed 25°C. There are wide variations in day and night temperatures. Temperature falls as low as -40°C in some of the lofty inhabited villages during winter. With the excessive dryness of the climate, Zaskar has a very low of moisture in the atmosphere. Lakes and rivers freeze in winter and serve as pathways. Vegetables and fruits become very hard, even egg becomes solid, therefore, it is a very difficult life in winter and people have to melt ice to get water. Cunningham says, "It is due to elevation, by which the air is so rarified as to be incapable of holding much moisture in suspension. It is also partly due to the great radiation of heat from the bare soil by which moisture is rapidly evaporated. Dryness of air increases with height, and the temperature of dew point is very low. Thus, dew formation is quite unknown in more elevated districts." <sup>1</sup>

#### IV.2 Rain and Snowfall:

There is very low rainfall in Zaskar. Rainfall recorded, is around 12 mm by John Crook and Henry Osmaston in the month of July. But snowfall is very heavy in Zaskar. Pensila pass (4400 m.) gets blocked by several feet of snow which make it very dangerous. Sometimes after heavy snowfall even avalanches occur. At times, the region experiences more than five meters of snowfall in Lower valleys.

#### IV.3 Winds:

Due to dry climatic conditions, wind blows with high velocity sometimes with a velocity of 50 to 60 km per hour. Generally, high wind speed is noted after 2 p.m. which results in dust storms. Dusty wind blows daily in Zaskar in summer. Dusty snow wind occurring during winter in Zaskar can be seen in plate no.I.7.

granite, middle part has limestone and sandstone while the northern part has anorthosite. Zaskar is quite rich in some mineral sources which are still to be exploited. These include borax, aquamarine, chromite, lime, gold, platinum, gypsum, sulphur and copper. Zaskar nomenclature is derived from "Zangskar" which means white copper. Gold is found in the bed of Zaskar River. Elaborated investigations on the occurrence of gold have not been conducted as yet.

#### IV.1 Flora of Zaskar:

##### a. Trees

Trees are scarce in Zaskar region, and most of these trees are willows and poplars. These trees are planted and long branches are cut from full grown trees. These branches are then put in water for a fortnight and then planted and watered regularly. In the winter months, these saplings are completely bandaged to protect them from severe winter.

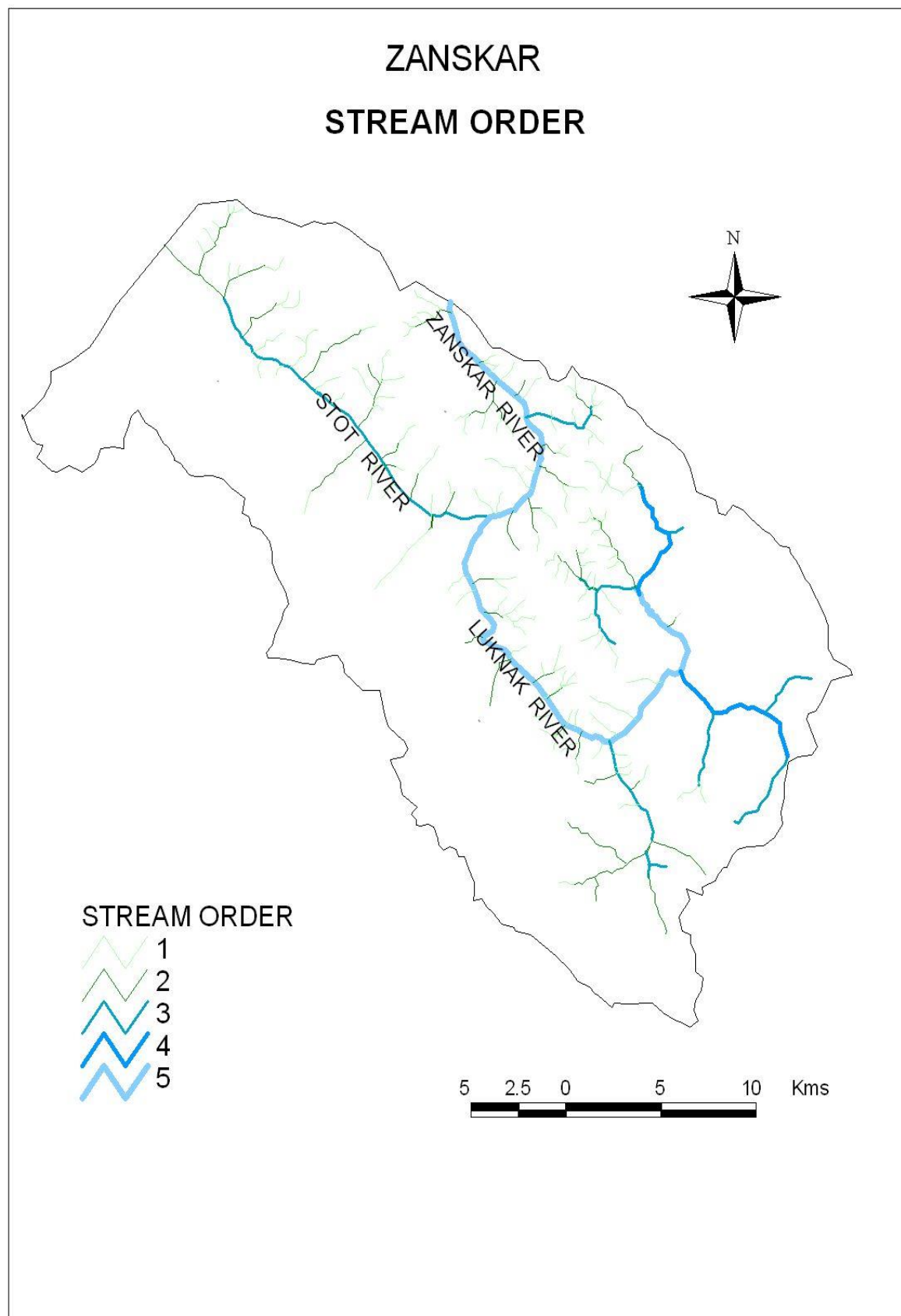
### IV. ROCKS AND MINERALS OF ZASKAR:

Mainly three types of rocks are found in Zaskar (Map no.I.5). These are granite, anorthosite and limestone and sandstone. The map shows that southern part is covered with

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<sup>1</sup> Alexander Cunningham, "Ladakh Physical, Statistical & Historical" Sagar Publishers, Varanasi

Mansion, 72 Janpath, originally published in 1854 New Delhi.







**Plate no.I.6 Padam (headquarter of Zaskar) during winter.**



**Plate no. I.7 Storm during winter in Zaskar.**

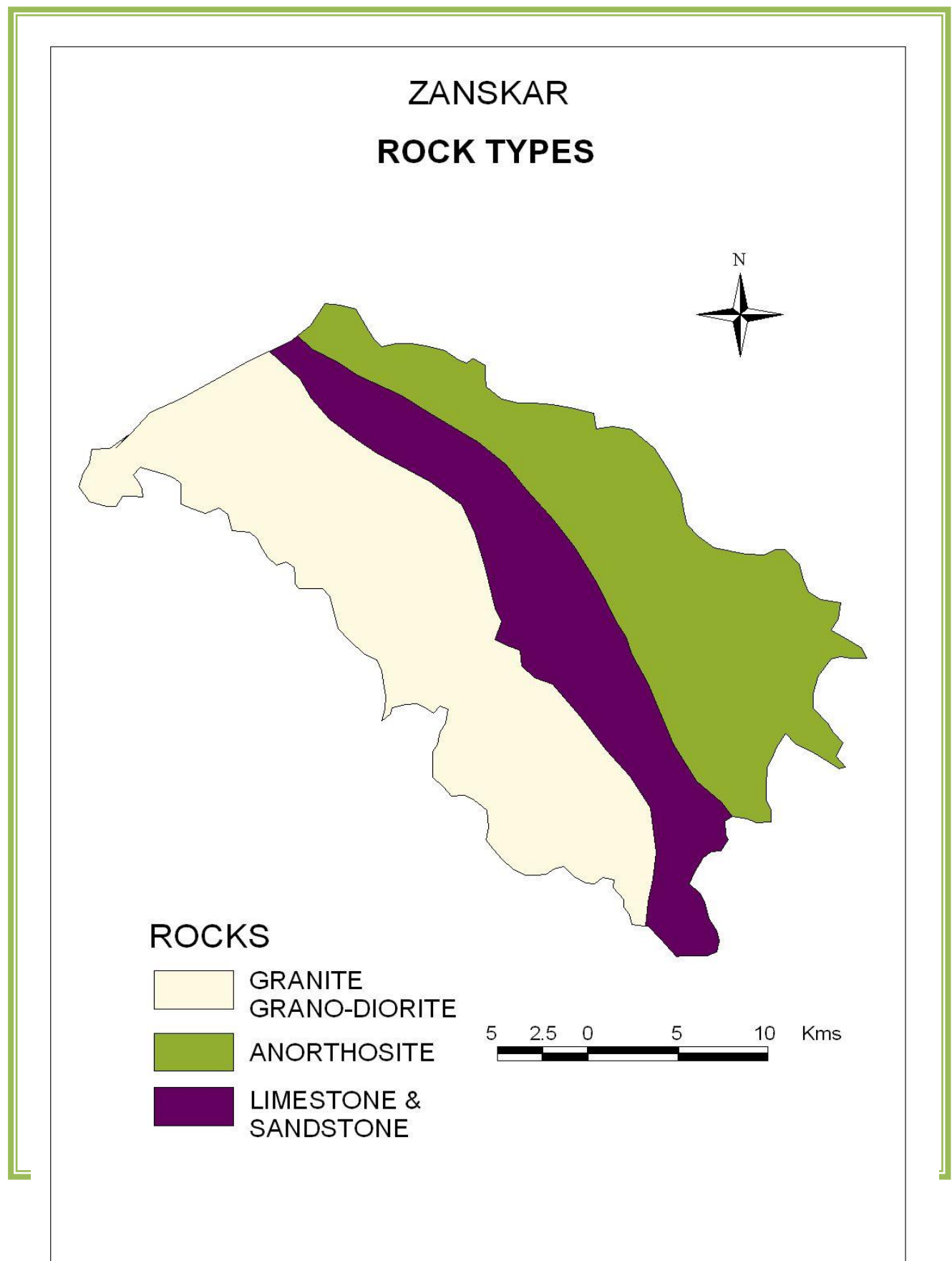
**b. Medicinal Plants in Zaskar:**

Many medicinal plants (Table No.I.3) are found in Zaskar region which are used by people for various purposes. There are hundreds of other such plants which may be useful for pharmaceutical industry but adequate research work is yet to be under taken in this area. Proper survey and adequate research work in the field of the



**Plate no. I.8 Rocks of Zaskar.**

medicinal plants is likely to improve the economy of Zaskar. The FRL (Field Research Laboratory) is doing work in this field at Leh. They are growing some medicinal plants (Plate no.I.9). It can be seen from table no. I.3 that various kinds of plants are found in the region which are used to treat many diseases like asthma, stomach disorder, cold and cough and fever etc.







**Plate no.I.9 Varieties of medicinal plants growing in fields.**

**Table I.3 Medicinal Plants in Zanskar & Ladakh**

	<b>Medicinal plants</b>	<b>Uses for</b>
1.	<i>Ephedra geradiana</i>	Asthma
2.	<i>Saussurea obvallata</i>	Cold and cough
3.	<i>Artemisia</i>	Deworming
4.	<i>Mentha longifolia</i>	Stomach disorder
5.	<i>Dactylorhiza hatagirea</i>	Energy tonic
6.	<i>Herminium monophyllum</i>	Kidney disorder
7.	<i>Aconitum napellus</i>	Fever
8.	<i>Ulmus wallichiana</i>	Hair shine
9.	<i>Podophyllum hexandrum</i>	Cancer
10.	<i>Fritillaria</i>	Asthma
11.	<i>Gentiana</i>	Energy tonic
12.	<i>Colchicum</i>	Joint pain

Source: Field Research Laboratory Leh

## **VI.2 Fauna of Zanskar:**

Zanskar is famous for its exotic variety of animals. Some of the wild animals found here are;

### **a. Wild animals of Zanskar:**

Zanskar is homeland for many wild animals. Mountain deer is found in abundance in Zanskar. They roam in large herds and are in fact rather aggressive. If one is out hunting and does not take proper precautions, these deer have been known to attack the hunter in a herd and even kill them. Snow Leopards live in the under reaches of the mountains of Zanskar. They live at the height between 19,000 to 21,000 feet above the sea level in Zanskar. Moreover, there are some other wild animals like bear, wolf, fox and ibex etc.

### **b. Domestic Animals:**

There are varieties of domesticated animals which are used for different purposes in Zanskar. These domestic animals include ponies, asses, horses, sheep, goats, yaks, dogs, and fowls.

Pony is a very important domestic animal in Zanskar. The Zanskari ponies are short, although very active and hardy. Yak is another important animal of Zanskar, and is also known as the "ship of snow". The yak tail, a fine spray of hair, is considered to be holy and is used in temples and Gurdwaras as *Chaur*. *Dzso* are bred by crossing a yak and with a common cow. *Dzso* looks more impressive and beautiful since it has long hair which is black and white. In some cases these hair are reddish brown and white. Their tails are also used as the sacred *Chaur*.

It can be concluded from the above discussion that Zanskar is a high altitude, rugged, mountainous region with a harsh climate. This has resulted in a limited resources base, where cultivable land is limited to the zone below 4,000 meters. Water is scarce and there are no forests, mineral or fuel resources. People of Zanskar have adopted themselves to harsh environment of the region according to needs, and the physical environment of Zanskar is one of the determining factors influencing the society of Zanskar.

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## AUTHORS

**First Author** – Chhering Tandup, Asstt. Prof. Earth Sciences, Department, Institute of Mountain Environment, Bhadarwah Campus, Jammu University, e-mail: [chheringgeo@gmail.com](mailto:chheringgeo@gmail.com)