

VOL. 1

DISCOVERING THE **HIMALAYA**



S.S. NEGI

DISCOVERING THE HIMALAYA

VOLUME ONE



S.S. NEGI



INDUS PUBLISHING COMPANY
NEW DELHI

Preface

Stretching in an arcuate shape for about 2400 kms from Kashmir in the north-west to Arunachal Pradesh in the north-east, the Himalayan mountain chain is the most fascinating feature on the face of the earth. A considerable part of the Himalaya lies in India, while Nepal occupies the central Himalaya and Bhutan forms a part of the eastern Himalaya.

The Himalayan mountains encompass a variety of eco-physiographic terrains ranging from the hot and dry tropical/sub-tropical lands occurring in its southern fringe to the temperate and arctic areas of the snow-bound higher slopes and finally to the cold deserts of the Tibetan plateau in the north.

This region has a complex ecology, geology, physiography, drainage, forest wealth and wildlife. It is inhabited by millions of people belonging to different religions, communities and races. This encyclopaedic handbook covers all major dimensions of the Himalaya and the people inhabiting this mountain chain.

This book set in two volumes contains a vast wealth of information on all aspects of the Himalaya and will serve as a handy reference book for scholars, researchers, mountaineers, tourists and all those who have love and inquisitiveness for the Himalaya.

I am grateful to my friends and colleagues who have inspired me in my writing endeavours. Thanks are due to my family for their self-denial and to the publishers for motivating me to prepare this encyclopaedic work.

SHARAD SINGH NEGI

Contents

Volume One

<i>Preface</i>	5
1. GEOGRAPHICAL PROFILE	9
2. CLIMATIC CONDITIONS	56
3. MOUNTAINS AND VALLEYS	73
4. SOIL TYPES	92
5. GEOLOGY AND STRUCTURE	103
6. DRAINAGE SYSTEM	166
7. FORESTS	191
8. IMPORTANT HIMALAYAN TREES	244
9. WILDLIFE	280

Volume Two

10. NATIONAL PARKS, SANCTUARIES AND BIOSPHERE RESERVES	311
11. HISTORICAL PROFILE	339
12. PEOPLE AND COMMUNITIES	372
13. LANGUAGES	419
14. TEMPLES AND MONASTERIES	429

8 Discovering the Himalaya

15. RELIGION AND CULTURE	439
16. ENVIRONMENTAL PROBLEMS AND CONSERVATION	459
17. ADMINISTRATION AND POLITY	510
18. ECONOMIC SCENE: PRESENT AND FUTURE	518
19. PLACES OF INTEREST	542
<i>Appendices</i>	566
<i>Index</i>	571

Geographical Profile

The Himalaya are the most magnificent feature on the surface of the earth. This mountain chain forms a gigantic arc stretching from the Nanga Parbat peak in the north-west to the Namche Barwa massif in the east. The Himalaya extend for a length of about 2400 kms from west to east and vary in width from 150 to 300 kms.

The great poet Kalidas had described this mountain system in the following words. "There is a mountain in the north, ensouled by Divinity named Himalaya, the king of all mountains. Stretching from east to west it is located on the earth as a measuring rod." The Himalayan ranges stand guard over the Indian subcontinent. These mountains are responsible for bringing rains to many parts of the region lying to the south of it. They also prevent the cold and dry winds of Central Asia from entering India. Hundreds of rivers and streams rising from the Himalaya carry water to the parched plains of northern India. Thus, the Himalaya are intimately related to the well-being of millions of people living in the Indian subcontinent.

The Himalaya are amongst the youngest mountain systems of the world. There is definite evidence to prove that these mountains rose from the sea. They are rising even today. However the constituents of this mountain chain have not formed simultaneously hence the disparity in their size, structure and elevation.

PHYSICAL SETTING

The Himalaya is made up of four distinct physical regions. These are:

Siwalik hills—A series of low hills running parallel to the main Himalayan arc. The Siwalik hills are very well developed in the

western and central Himalaya, east of which they gradually merge with the lower Himalayan foothills. Some of the highest mountain tops in the Siwalik hills may be about 1000 mts in elevation.

Lower Himalaya—This region consists of the lower hills lying to the south of the main Himalayan ranges. Longitudinal valleys known as the dun valleys may separate the lower Himalaya from the Siwalik hills. In many areas the lower Himalaya rise abruptly above the dun type valleys e.g., the Mussoorie ridge. The highest mountain peaks in the lower Himalaya may be over 3300 mts in elevation.

Higher Himalaya—This comprises of the main Himalayan ranges. It forms an arc-shaped wall all along the periphery of the Indian sub-continent. Very high mountain peaks occur in this region, the highest being Mount Everest in Nepal.

Trans-Himalaya—Across the snow-clad peaks of the main Himalaya lies a vast table-land having an average elevation of over 3000 mts. Conditions are akin to those prevailing in Tibet and thus this region has also been termed as the Tibetan Himalaya.

The following is a brief geographical description of the various geo-political units of the Himalaya.

JAMMU AND KASHMIR

The state of Jammu and Kashmir occupies a position of strategic importance. Its borders touch Pakistan, Afghanistan and China. It has an area of 2,22,800 sq kms though a part of it is under the illegal occupation of Pakistan and China. There occur several passes in the high mountains which have been used by travellers since times immemorial. These are the Karakoram pass (5575 mts), the Lanak La pass (5486 mts), and the Zoji La pass (3529 mts) in Ladakh; the Burzil pass (4199 mts) in Gilgit; and the Babusar pass (4173 mts) in Chilas. The Pir Panjal range which forms the southern boundary of the Kashmir valley has the following important passes—Banihal (2832 mts), Deosai (3765 mts) and the Pir Panjal (3494 mts).

The Jammu and Kashmir within the ceasefire line is divided into three provinces and ten administrative districts. These are:

1. Ladakh—Leh and Kargil

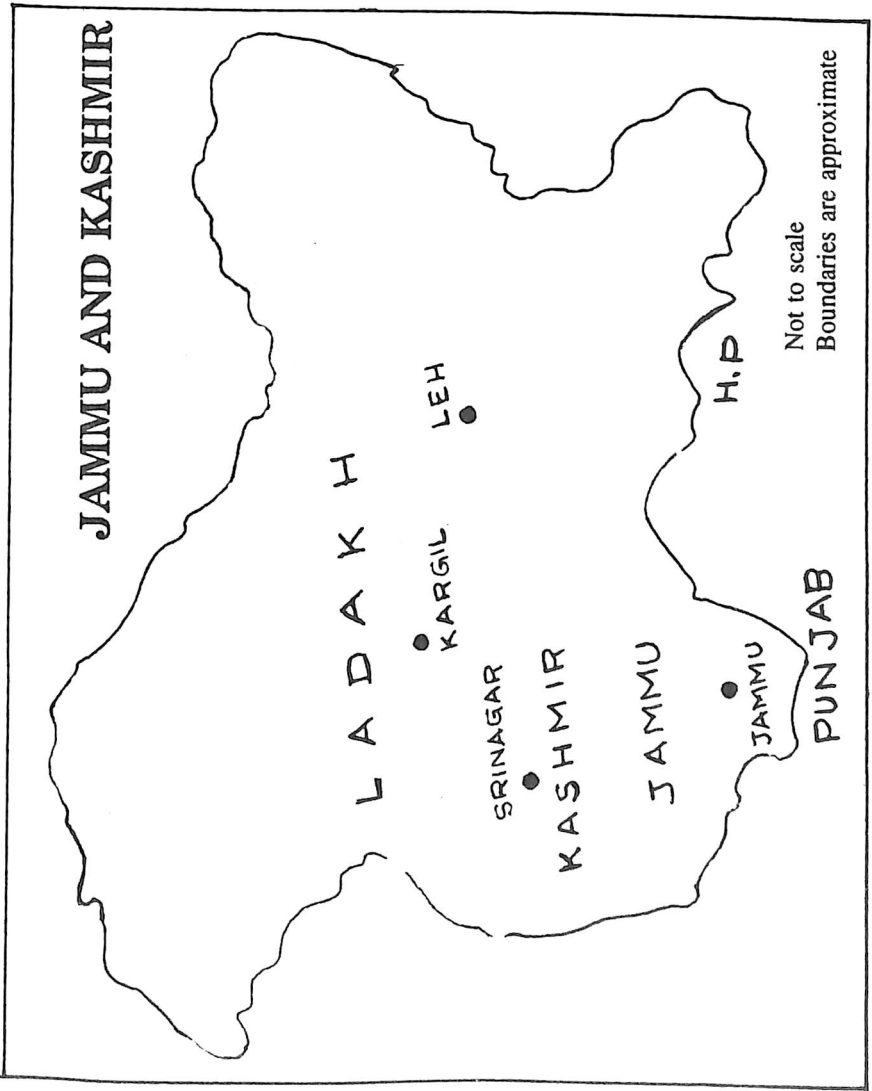


Fig.1. Map of Jammu and Kashmir.

2. Kashmir province—Anantnag, Srinagar, and Baramula
3. Jammu province—Doda, Udhampur, Jammu, Kathua, and Poonch

Beyond the ceasefire line lie Gilgit, Gilgit Wazarat, Tribal territory, Chilas, Muzaffarabad, Mirpur and parts of Poonch, all of which are a part of Jammu and Kashmir.

Physiography

Jammu and Kashmir state adorns the physical personality of India like a crown. Its physiography is centered around a series of complexly folded mountain systems. The entire region consists of mountain ranges interspersed by longitudinal valleys. The mountains represent the anticlines whereas the valleys are the synclines of the main Himalayan folds. Jammu and Kashmir is made up of the following physiographic units:

1. *Kandi tract*—This is a narrow strip of ravines in the south-western part of the state. It is bounded by the rivers Jhelum and Ravi. The general slope is towards south-west. The area is highly dissected by the tributaries of the rivers Chenab and Ravi.

2. *Jammu hills*—The Jammu region is made up of the low rolling Siwalik hills which rise above the plains of Punjab. These hills have an average elevation of about 600 mts after which they end abruptly in steep escarpments. Interspersed within these hills lie NW-SE trending long strike valleys representing the basins of subsequent streams. The river Tawi drains this tract. The hill ranges situated towards north may attain an elevation of 1800 to 2400 mts.

3. *Dun valleys*—North of the Siwalik hills lie longitudinal valleys known as the dun valleys. These are bounded in the north by the lower or lesser Himalayan range—the Pir Panjal. The two typical dun valleys are of Udhampur and Kotli.

4. *Pir Panjal*—This is the lower or lesser Himalayan range that rises abruptly above the Jammu hills. It consists of high mountain ranges having an elevation of 3500 to 5000 mts. The Pir Panjal have NW-SE trend and continue towards east to merge with the Dhauladhar range of Himachal Pradesh. The south-facing slopes of the Pir Panjal are steep as compared to the gentler slopes towards the Kashmir valley.

There are three important mountain passes across the Pir Panjal. These are—the Pir Panjal (3494 mts), the Bundil Pir (4200 mts) and the Banihal (2832 mts). The main approach road to the Kashmir valley is across this range.

5. *Kashmir valley*—The Kashmir valley is a broad, open valley bounded in the south by the Pir Panjal range and in the north by the main or central Himalayan ranges. It is a structural basin representing an old lacustrine bed having a length of about 135 kms and a maximum width of about 40 kms. The valley has an area of about 4865 sq kms, thus making it the largest valley in the entire Himalayan range. The average elevation of the Kashmir valley is 1600 mts. The river Jhelum and its tributaries drain this valley.

Several remnants of the old lake are found in the valley. These include the Wular, Dal and Nagin lakes. The morainic deposits of pleistocene glaciation have developed flat-topped terraces. These are the *Karewas* which are better developed in the southern part of the valley.

6. *Great Himalaya and Zaskar ranges*—North of the Kashmir valley lie, NW-SE trending high mountain ranges. This includes the Zaskar range which runs more or less parallel to the main Himalayan range. These ranges terminate in the Nanga Parbat massif which forms the western boundary of the Himalaya. In the main Himalayan range there are about 13 peaks with an elevation of over 6000 mts. Most of the other peaks tower to over 4500 mts. A large number of glaciers descend down its northern as well as southern slopes.

The great Himalayan range separates the valley of Kashmir from the Tibetan plateau. It also shelters this region from the cold, dry winds of Central Asia. Some of the important mountain passes in these two ranges are the Zoji La (3529 mts), Chilung La (4401 mts), Poat La (5716 mts), and the Burzil (4816 mts).

The Zaskar range merges with the main or great Himalayan range in central Ladakh south-east of the Nanga Parbat massif. The eastern part of the Zaskar range is known as Rupshu which consists of intricately ramifying glaciated ranges of crystalline rocks. Rupshu is drained by rivers and streams which debouch into a few saline lakes and marshes.

7. *Hazara range*—The Hazara range is a trans-Indus range. It

resembles the main Himalayan range in structure and physiography. There are about 17 peaks with an elevation of over 5000 mts.

8. *Ladakh range*—The Ladakh range is a prominent range of the trans-Himalayan region. It is situated between the rivers Indus and Shyok. The Ladakh range stretches from the confluence of the rivers Indus and Shyok and upto the western border of Tibet where there is a sharp bend in the course of the river Indus. It is comprised primarily of crystalline rocks. There are a number of peaks of an elevation of over 6000 mts. The main mountain passes are the Chorbat (5090 mts), Digar La (5400 mts), Khardung La (5602 mts), Chang La (5599 mts) and Tsaka La (4724 mts).

9. *Karakoram range*—The Karakoram range lies in the trans-Himalayan zone. It extends for a length of about 400 kms from the Shyok river in the east to Hunza in the north-west. The entire tract all along its crest is covered by a layer of snow. A large number of glaciers make their way down its northern and southern slopes. A number of peaks in this mountain range have an elevation of over 7500 mts. These include the K2 (8611 mts), Broad Peak (8056 mts), Gasherbrum (8000 mts) and the Trivor (7788 mts). Amongst the largest glaciers are the Siachen, Biafo, Rimo, Chogolungma and the Baltoro.

10. *Aksai-Chin*—This region occupies the north-eastern part of Kashmir. It is a high altitude, severely denuded peneplained surface of an inter-montane plateau. The average elevation is over 4500 mts with relict tracts of higher elevation soaring to over 6000 mts. There are a number of salt lakes in this region.

Drainage

Jammu and Kashmir is drained by the river Indus and its tributaries. The main rivers draining Ladakh are the Indus, Hunza, Shigar, Shyok, Saltro, Nubra, Zaskar, Hanle, and the Galiwan. The Kashmir valley is drained by the rivers Jhelum, Kishen Ganga and the Liddar. The Jammu region is drained by the river Chenab, Jhelum, Poonch, Bhoga and Tawi.

Climate

Jammu and Kashmir experiences a wide range of climatic conditions. These range from the hot sub-tropical climate of Jammu to the

extremely cold arctic climate of Ladakh. Leh is the coldest place with temperatures dropping down to -30°C , whereas Jammu is the hottest with the mercury rising to over 40°C . Precipitation is received both in the form of snow and rains. Ladakh is cold and dry with very scanty rainfall. The Kashmir valley is cut off from the monsoon winds by the Pir Panjal range. It also does not feel the impact of the Central Asian climate prevailing north of the great Himalayan range in Ladakh. The valley experiences a peculiar climate that is governed by the numerous lakes and marshes occurring there.

Cultural Setting

Jammu and Kashmir is the home of a number of races. The Dogras dominate the Jammu region. They are primarily Hindus and speak Dogri. The Gujars and the Gaddis are concentrated in Poonch and Udhampur. These people are believed to be Rajputs who have migrated from the plains.

Kashmiri Muslims dominate the Kashmir valley. They are believed to have converted to Islam in the 13th and 14th centuries. The Muslims of Kashmir valley are Sunnis and Shias, of whom the former are in a majority. Kashmiri Hindus also inhabit the Kashmir valley amongst whom Brahmins or Pandits are dominant.

The people living in the Ladakh region are known as Ladakhis. They are primarily Buddhists. The Gilgit Baltistan region is inhabited by a mixture of Dards and Ladakhis. These people are both Buddhists and Muslims.

Administrative Units

1. *Kathua*—This is a small district adjacent to Gurdaspur district of Punjab. It lies on the main entry point to the state of Jammu and Kashmir. The tract consists primarily of plains spreading between the rivers Ravi and Tawi. It is highly dissected by small tributary streams most of which are seasonal in nature.

2. *Jammu*—This is an important district whose headquarters are at Jammu, the second biggest city of the state. This district lies in the foothills of the Siwaliks. The tract is drained by the river Tawi and its tributaries. Jammu is the railhead for going to Srinagar. This district produces a large quantity of wheat.

3. *Poonch*—This is another district lying south of the Pir Panjal range. The terrain consists of both the foothill slopes and a small plain tract. The tract is drained by the river Poonch and its tributaries.

4. *Udhampur*—Udhampur district lies to the south of the Pir Panjal range. It is nestled at the base of this massive range. The terrain comprises of low rolling Siwalik hills in the south and the steep slopes of the lower Pir Panjal in the north. The headquarters of this district are located at the garrison town of Udhampur. The national highway from Jammu to Srinagar passes through this tract.

5. *Doda*—This is a large district lying in the valley of the river Chenab. The topography is extremely rugged with the tract being drained by the river Chenab and its tributaries. It borders the Chamba district of Himachal Pradesh. Main towns are Doda, Kishtwar and Bhadarwah.

6. *Anantnag*—This district lies in the western part of Kashmir valley. The headquarters are located at Anantnag from where the road to Pahalgam bifurcates from the national highway leading to Srinagar. The terrain is almost flat with steep slopes of the Pir Panjal range in the south. This district produces a large quantity of paddy and apples.

7. *Baramula*—This is another densely populated district with the headquarters at Baramula, a strategic town located at a point from where the river Jhelum escapes from the Kashmir valley to the plains. A part of this district lies in the Kashmir valley including the famous Lolab valley, known for its rich forests and apple orchards.

8. *Srinagar*—This is a small but prosperous and densely populated district occupying the central part of the Kashmir valley. The topography is flat and the tract is very fertile. The headquarters are at Srinagar, the capital of Jammu and Kashmir state. The town and its surrounds are drained by the river Jhelum. Srinagar is one of the most attractive tourist centres of India.

9. *Leh and Kargil*—These form a part of the Ladakh region. The topography is extremely rugged. Leh and Kargil are the two most important towns of this tract. It is a cold and dry region producing very meagre crops. The population is very sparse. This region is rapidly coming up as an important destination of tourists.

HIMACHAL PRADESH

The state of Himachal Pradesh has an area of 56,019 sq kms. Its borders touch Uttar Pradesh, Haryana, Punjab, Jammu and Kashmir, and Tibet. It is a mountainous region known for its pristine natural beauty that includes gurgling streams, conifer-clad slopes and snowbound peaks that seem to reach up to the skies.

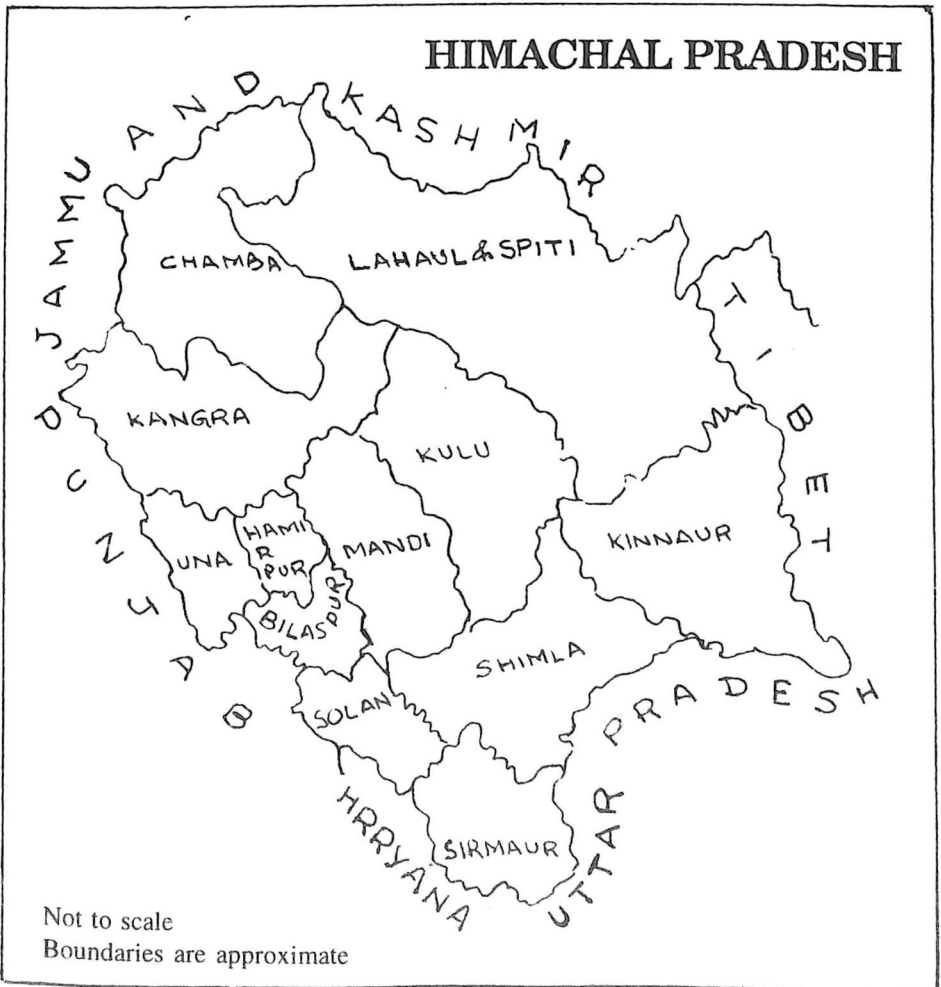


Fig. 2. Map of Himachal Pradesh.

The state of Himachal Pradesh is divided into the following twelve districts—Sirmur, Solan, Kinnaur, Shimla, Bilaspur, Mandi, Kulu, Lahaul & Spiti, Una, Hamirpur, Kangra, and Chamba. The state capital is at Shimla.

Physiography

The low rolling Siwalik hills occur on the boundary of Himachal and Punjab-Haryana. The entire state consists of hills and mountains ranging in elevation from about 450 mts to over 6500 mts. It is a complex mosaic of hills, valleys and snow-clad peaks. The white snow-covered mountain ranges are the most prominent physiographic feature of Himachal Pradesh. These are the Dhauladhar, the Pir Panjal, the great Himalaya and the trans-Himalayan ranges. These are visible from a great distance. The steep mountain slopes are covered with coniferous and broad-leaved forests, meadows, pasturelands and terraces, often clinging precariously to the mountain sides. The valleys lying amidst these mountain ranges contain gurgling streams, torrents, terraced fields and fairy tale villages.

There is a general increase in elevation from west to east and from south to north. The state may be divided into the following major physiographic divisions (from south to north):

1. Outer Himalaya or the Siwaliks
2. Lower or Lesser Himalaya
3. Main or Great Himalaya
4. Trans-Himalaya

Outer Himalaya or the Siwaliks

These are the outermost hills of the state that stretch along its southern boundary from east to west. Average elevation is 600 mts with steep southern slopes that usually gently dip into longitudinal valleys known as the duns. The southern slopes gradually merge with the Indo-Ganga plains (forming parts of Punjab and Haryana). The south-facing slopes of the Siwaliks are usually in the form of escarpments with an abrupt drop to the plains. The crest consists of jagged peaks.

Longitudinal valleys occur between the Siwaliks and the lower Himalayan ranges. These are known as the dun. Gansser (1964)

described these valleys in the following words, "The conspicuous longitudinal depressions called duns are not only the result of the constant structural trend parallel to the Himalayan range but also show the facies changes of the Siwalik rocks from north to south the lithology remaining constant along the strike . . ." Some of the important dun valleys occurring along the southern belt of the state are the Kiarda dun, south of Nahan and the Chakki dun, south of Nurpur. The dun valleys are highly fertile and support a dense population.

Scrub forests cover the south-facing slopes of the Siwaliks whereas sal forests are found on the northern slopes in the east; and miscellaneous broad-leaved forests in the west. This indicates that the north-facing slopes are moister. Some of the important towns located in the Siwalik hills are Paonta, Nahan, Sarahan (Sirmur), Nalagarh, Kunihar, Hamirpur, Una and Nurpur.

Lower or Lesser Himalaya

This physiographic division occupies the central part of Himachal Pradesh. It consists of a series of mountain ranges rising abruptly above the low rolling hills. These are—

1. *Mussoorie ridge*—The imposing Mussoorie ridge runs west from Mussoorie and crosses into Himachal Pradesh north of Satun, where it is cut through by the Yamuna river. Thereafter it runs to the north of the Giri river before culminating in the Churdhar massif. The Chour peak (3647 mts) is the highest peak in the lower Himalaya south of Shimla.

2. *Shimla ridge*—The Shimla ridge marks the watershed of the rivers Indus and the Ganga. Or in other words, the slopes on the western side drain into the Arabian sea whereas the water from the eastern slopes finds its way to the Bay of Bengal. The Shimla ridge drops to the Satluj gorge.

3. *Pir Panjal*—The Pir Panjal is the largest and the most impressive range of the lower Himalaya. It bifurcates from the great or main Himalaya near the bank of the river Satluj forming the waterdivide between the rivers Chenab on the one side and the Beas and Ravi on the other. Thereafter, it bends westwards and runs towards the Dhauladhar range before crossing over into Jammu and Kashmir state.

4. *Dhauladhar*—This majestic snow-clad range rises abruptly over the plains of Punjab. It bifurcates from the Pir Panjal range at the mountain knot of Bara Banghal. Thereafter it runs in a NW-SE direction all along the southern flank of the state before crossing over into Uttar Pradesh where it merges with the main Himalaya. The Dhauladhar has been cut by the river Ravi through a gorge south-west of Chamba town; by the river Beas at Larji; and by the river Satluj at Rampur. The snow-clad peaks of the Dhauladhar range rising abruptly above the famous Kangra valley present a fascinating panorama.

The lesser or lower Himalayan ranges are clothed with coniferous and broad-leaved forests which include oaks, chir pine, deodar, blue pine, fir, spruce, hemlock, rhododendron, chestnut, walnut, sub-alpine and alpine pastures. The main towns located in this physiographic unit are Rajgarh, Solan, Shimla, Rampur, Mandi, Kulu, Manali, Baijnath, Palampur, Dharamsala, Dalhousie and Chamba.

Main or Great Himalaya

The main or great Himalayan range comprises of a towering snow-clad ridge that runs along the north-eastern border of the state and then turns southwards, separating the trans-Himalayan zones of Pooh, Lahaul and Spiti from the rest of the country. It consists of a number of peaks having an elevation of over 6000 mts. Some of the famous passes across this range are the Rohtang (3915 mts), Kangla (5248 mts), Bara Lacha (4512 mts), Kunzam (4551 mts), Parnag (5548 mts), and the Pin Parbati (4802 mts).

The river Satluj has cut a deep gorge across the main Himalayan range. It separates the drainage of the river Beas in the south from that of the river Spiti in the north. The slopes are steep and in Kulu area this range rises abruptly over the broad open valley, thus marking a sharp increase in elevation.

The southern slopes are clothed with deodar, blue pine, fir, spruce, moru and kharsu oaks, hemlock, rhododendron, betula, sub-alpine and alpine meadows. The northern slopes are largely devoid of vegetation except for occasional tufts of grasses that come up at lower elevations in summer. This towering range acts as a barrier for the SW monsoons, thereby depriving the tracts lying to the north of rain.

Trans-Himalaya

This physiographic unit comprises of areas lying to the north of the main or great Himalayan range. It is a zone of an average elevation of over 3000 mts. Conditions resemble those found in Tibet. Rainfall is very low as the moisture-laden SW monsoon clouds are unable to cross the main Himalayan range. The district of Lahaul & Spiti and Pooh tehsil of Kinnaur district lie in the zone.

The Zaskar range stretching south-eastwards from Ladakh is the most prominent mountain range of the trans-Himalaya of Himachal Pradesh. It separates Spiti and Kinnaur from Tibet. There are number of peaks having an elevation of over 6500 mts in this range. It has been cut across by the river Satluj through a gorge at Shipki.

The trans-Himalayan zone is largely devoid of forest vegetation. These occur along channels formed by snow-melt waters. Occasional tufts of grasses come up on the mountain slopes during the summer months.

Drainage

Himachal Pradesh is drained by a number of river systems, these are—

1. *The Chenab* system consisting of the rivers Chandra, Bhaga, Chenab and their tributaries.

2. *The Ravi* system consisting of the river Ravi which originates north of the Dhauladhar and its tributaries.

3. *The Beas* system comprising of the river Beas which originates near the Rohtang pass and its tributaries, e.g. the Parbati, Harla, Saing Tirthan and Uhl.

4. *The Satluj* system consisting of the river Satluj that rises in Tibet and its tributaries, e.g. the Spiti and Baspa.

5. *The Yamuna* system comprising of the river Yamuna that flows along the eastern boundary of the state and its tributaries, e.g. the Giri, Pabar, Tons and Bata.

Climate

Himachal Pradesh experiences diverse climatic conditions due to

the wide variation in altitude ranging from 400 mts in the southern tract to over 6500 mts in the main Himalaya and in the areas lying across it. Kayastha and Mishra (1971) state, "In general, the climate of this area is distinguished from the Punjab plains by a shorter and less severe hot weather, a somewhat higher precipitation and colder and more prolonged winter. The two main climatic characteristics of the region are the seasonal system of weather and the vertical zoning. The climatic conditions vary from hot and sub-humid tropical in the southern low tracts to temperate, cold alpine and glacial in the northern and eastern high mountains. Lahaul and Spiti experience drier conditions as they are almost cut off by the high mountain ranges . . ."

The total annual rainfall received increases from the plains to the hills upto the towering mountain ranges beyond which it drops abruptly. The tracts lying near the plains of Punjab and Haryana are the hottest and the coldest areas are in Lahaul, Spiti and Pooh where the mean minimum temperature in winter may drop down to -30°C .

Natural Vegetation

Forests are very widely distributed in Himachal Pradesh. They are found in almost all parts of the state except in the tracts under a permanent cover of snow or in trans-Himalayan zone. The natural vegetation may be grouped into the following zones on the basis of altitude and climatic conditions:

Zone	altitude (in mts)
Alpine	over 4100
Sub-alpine	3600-4100
Temperate	1650-3600
Tropical and sub-tropical	upto 1650

Cultural Setting

Himachal Pradesh has an average population density of about 50 persons per square kilometre. The population is concentrated in the lower and higher hills. The tracts of Lahaul, Spiti and Pooh, lying across the main Himalayan range, are very sparsely populated.

The people of Himachal Pradesh are mainly Hindus, Muslims, Sikhs, Buddhists and Christians. Lahaul, Spiti and Pooh are inhabited by many Buddhists who follow a Tibetan way of life.

Agriculture is the main source of income. Other occupations include animal husbandry, fruit farming, business, government service including soldiering and employment or labour in state projects. Many Himachalis have a fairly high standard of living as compared to the inhabitants of the other mountain tracts.

Administrative Units

The state has been divided into the following administrative districts.

1. *Sirmur*—This is a small district occupying the south-eastern corner of the state. It was a small princely state earlier. The headquarters are at Nahan, a small town located on the Siwalik hills. The river Giri divides this district into two unequal halves. The fertile valley of Paonta lies along the border of this district with Uttar Pradesh. Its southern boundary touches Haryana. Important towns are Renuka, Paonta, Nahan and Rajgarh.

2. *Solan*—This is another small district in south-eastern Himachal Pradesh. The headquarters are located at Solan. It extends from the plains of Haryana to Solan and across the river Giri to Chail. Slopes vary from moderate in the lower hills to very steep around Chail.

3. *Shimla*—District Shimla covers a large area in central Himachal Pradesh. The headquarters are in Shimla which is also the capital of Himachal Pradesh. Important towns are Shimla, Rampur, Theog, Chopal and Kotgarh. Shimla district produces apples and other fruits.

4. *Kinnaur*—This is a border district lying partly in the higher Himalaya and partly in the trans-Himalayan zone. Its headquarters are located at Peo though the old headquarters were at Kalpa. Its borders touch Tibet. Important towns of this district are Kalpa, Nichar, Chinni, Peo and Pooh.

5. *Bilaspur*—This district lies in the lower hills of central Himachal Pradesh. Its headquarters are at Bilaspur, a small town that has been constructed on the slopes above the Bhakra reservoir. The old town has been submerged under the reservoir. The slopes are gentle in the lower reaches and very steep towards north. The

Chandigarh-Manali national highway passes through this district. Its border touches Punjab in the south.

6. *Mandi*—The headquarters of this district are at Mandi, an old town located along the river Beas. It lies in the lower Himalaya of central Himachal Pradesh. Important towns are Mandi, Karsog and Sundarnagar. The Chandigarh-Manali highway passes through this district.

7. *Kulu*—This is a fairly large district located in the lower and higher Himalaya of central Himachal Pradesh. It covers the entire Kulu valley formed by the river Beas on its journey down to the plains. The headquarters are at Kulu. Other important towns are Manali, Bhuntar, Katrain and Naggar.

Kulu district is famous for its enchanting natural beauty and apples. Thousands of tourists visit Kulu valley each year. It is also well-known for its annual Dussehra fair.

8. *Lahaul & Spiti*—This district is comprised of two distinct physiographic units—Lahaul that is drained by the rivers Chandra and Bhaga, and Spiti which is drained by the river Spiti. The headquarters are located at Keylong in the Lahaul valley. Lahaul is very cold and dry. It is hemmed by high mountains on all sides.

Spiti valley is more remote and desolate than Lahaul. The highest peak is Shilla (7025 mts). Important towns in this district are Keylong, Kaza and Koksar.

9. *Hamirpur*—This is a small district located in the foothills of central Himachal Pradesh. Its headquarters are at Hamirpur. The slopes are gentle in the southern tract with steep slopes on the small hillocks that occur on the northern part of the district.

10. *Una*—This is another small district located in the foothills of central Himachal Pradesh. Una is the district headquarters and the most important town. The slopes vary from gentle to steep. It is in a dun-type valley.

11. *Kangra*—The famous Kangra district lies at the base of the imposing Dhauladhar range. It stretches from the crest of this snow-clad mountain range to the plains of Punjab. It is one of the most prosperous districts of the state. Important towns are the district headquarters Dharamsala, and Baijnath, Palampur, Kangra and Nurpur.

12. *Chamba*—This is the western-most district of Himachal

Pradesh. Its northern part is drained by the river Chenab and the southern part by the river Ravi. The headquarters are located at Chamba, situated on the banks of the river Ravi.

The valley of the river Chenab is known as Pangi. It is very remote and under-developed. This valley is rich in forests and wildlife. A large number of glaciers descend into the valley. Bharmour, in the upper valley of the river Ravi, is another remote part of this district. Some of the important towns of this district are Chamba, Dalhousie, Banikhet and Bharmour. It produces apples and other fruits. Dalhousie, Khajiar and its surrounds are visited by thousands of tourists each year.

GARHWAL

Garhwal is a part of the Uttar Pradesh Himalaya. Its borders touch Tibet in the north, Himachal Pradesh in the west, the plains of Uttar Pradesh in the south and Kumaun in the east. The Garhwal hills are known for the four *dhams*—Badrinath, Kedarnath, Gangotri and Yamunotri, all of which are the destination of countless Hindu pilgrims each year. The famous Sikh shrine Hemkund Sahib is also located in Garhwal. This region is the source of the rivers Ganga and Yamuna, two of the most important rivers in northern India.

Garhwal is comprised of the following districts—Dehradun, Tehri, Uttarkashi, Pauri and Chamoli.

Physiography

The Garhwal Himalaya may be sub-divided into the following physiographic units (from south to north).

1. Outer Himalaya or Siwalik Hills
2. Lower or Lesser Himalaya
3. Main or Great Himalaya

Outer Himalaya or Siwalik Hills

The Siwalik hills extend all along the southern boundary of Garhwal from the Yamuna gap at Kulhal in the west to the forests of Dhikala in the east. They bound the Dehradun valley by an almost unbroken wall. The average elevation of the crest is over 700 mts. It consists

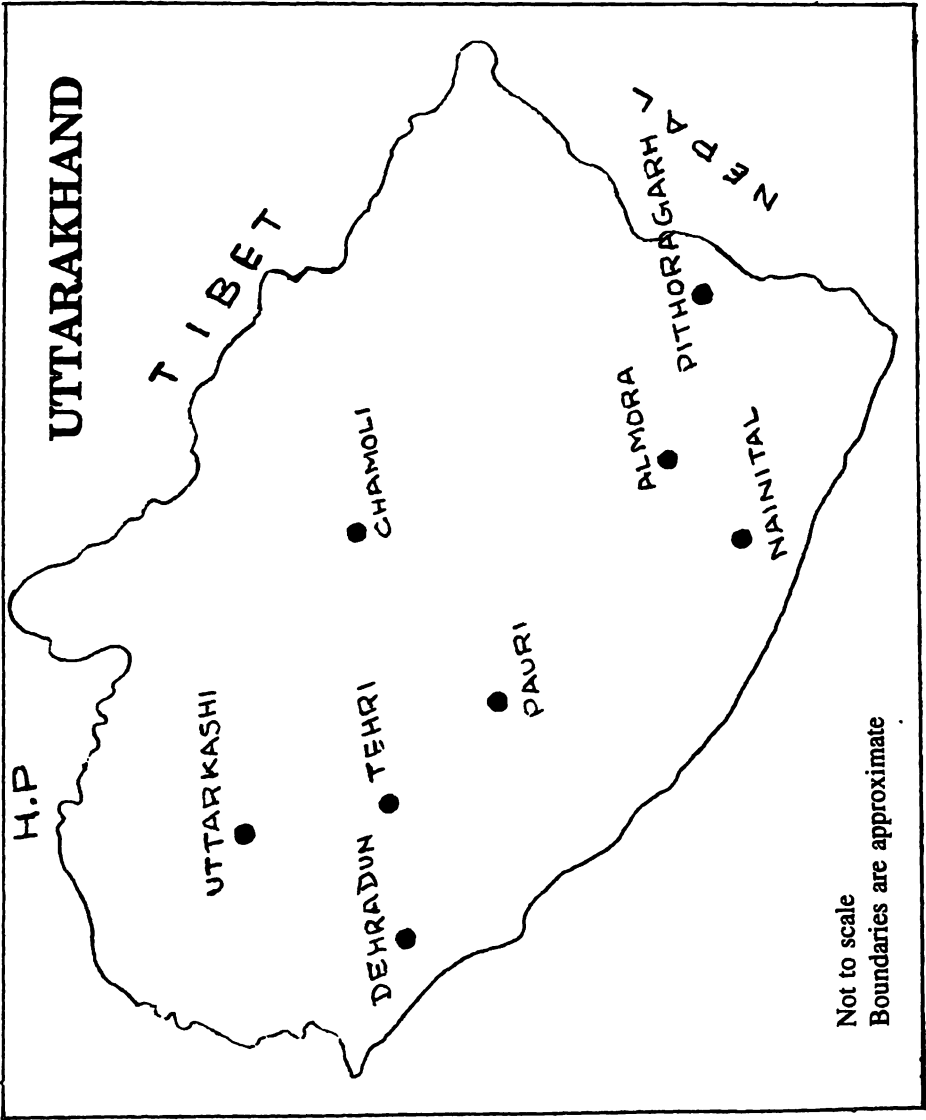


Fig. 3. Map of Uttarakhand.

of a series of jagged peaks. The southern slopes of the Siwalik hills are steep whereas the north-facing slopes are gentler. The Siwalik hills are covered with dense sal forests in the lower tracts and chir-pine forests at the ridge tops. Khair and shisham forests are found along rivers and streams.

Raus or seasonal streams are a very conspicuous feature of the Siwalik hills of Garhwal. These streams bring down a considerable quantity of debris during the monsoon season and cause widespread damage to life and property. They are dry for the rest of the year.

Longitudinal structural valleys occur between the Siwaliks hills in the south and lower Himalaya in the north. They are known as the duns, the most prominent being the valley of Dehradun, which is about 35 kms long and 25 kms wide. It is bounded by the river Ganga in the east and the Yamuna in the west. The Dehradun valley has been filled with recent sediments brought down from the lower Himalayan ranges to the north and the Siwalik hills to the south.

Lower or Lesser Himalaya

This is the largest physiographic unit of Garhwal. It extends from the dun valleys in the south to the main or great Himalayan ranges in the north. The lower Himalaya of Garhwal is made up of a number of hill ranges. The prominent ones are—

1. *Mussoorie ridge*—This is an imposing ridge which towers over the Dehradun valley. The Mussoorie ridge has an average elevation of over 2000 mts and extends from the Yamuna gap in the west to the Ganga gap in the east. The south-facing slopes are steeper than their northern counterparts. The river Ganga has cut across this ridge near Rishikesh. To the north of the Mussoorie ridge lies the valleys of the river Aglar (a tributary of the river Yamuna) and the river Bhagirathi.

2. *Nag Tibba ridge*—The Nag Tibba ridge is another prominent ridge of the lower Himalaya. It has an average elevation of over 2500 mts and is bounded in the west by the river Yamuna. In the east it extends to the Bhagirathi gap beyond which it is broken into a series of mountain ranges.

3. *Pauri ridge*—This is another towering ridge with an average elevation of over 2000 mts. It is named after Pauri town that is

situated along its top. This imposing ridge extends from the Alaknanda valley at Srinagar in the west to the hills of the central Kumaun in the east.

4. *Mayali ridge*—This is an almost north-south-trending ridge forming the waterdivide of the rivers Bhagirathi and Alaknanda. Its eastern slopes are drained by the river Bhilangana and the western slopes by the river Mandakini. A number of offshoot ranges merge with the Mayali ridge. These include the prominent Kwila ridge in the east.

5. *Gopeshwar ridge*—The Gopeshwar ridge runs in a more or less east-west direction along the northern part of the lower Himalaya of Garhwal. It is cut off by the river Mandakini in the west and by the Alaknanda river in the east.

The lower Himalayan ranges are clothed with chir-pine, oaks, deodar, bluepine, fir, spruce, rhododendron, hemlock and sub-alpine forests.

Main or Great Himalaya

The main or great Himalayan range forms the northern border of Garhwal. The snow-clad mountain peaks with an average elevation of over 6500 mts extend from east to west like a gigantic wall. This zone consists of a magnificent series of peaks. These include Bandarpunch (6315 mts), Gangotri (6614 mts), Kedarnath (6940 mts), Chaukhamba (7138 mts) and Kamet (7756 mts).

The important glaciers that come down from the slopes of the great or main Himalaya are the Yamunotri, Gangotri, Bhagirathi Kharak, Satopanth, east and west Kamet and the Kathling glaciers.

The lower slopes of the great or main Himalaya bear blue pine, fir, spruce, deodar, rhododendron, sub-alpine and alpine forests.

Drainage

The Garhwal hills are drained by the Yamuna, Bhagirathi and Alaknanda river systems.

1. *The Yamuna* rises in the upper reaches of western Garhwal. The river Tons and Aglar are its main tributaries in Garhwal.

2. *The Bhagirathi* rises from the Gangotri glacier. Its main tributaries include the river Bhilangana.

3. *The Alaknanda* rises from the snows beyond Badrinath. Its

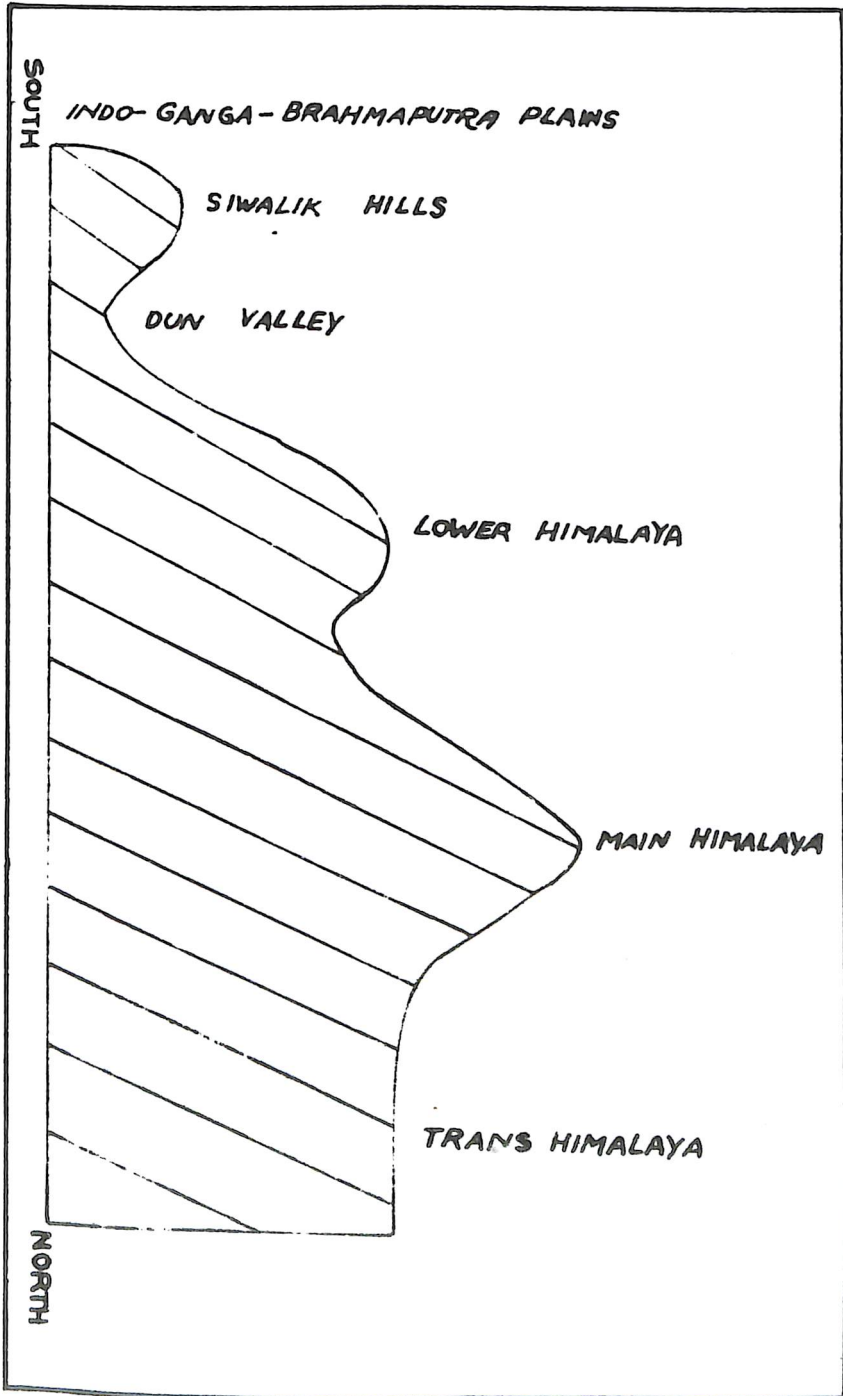


Fig. 4. Physiographic section across the Himalaya.

main tributaries are the Dhauliganga, Pindar, Nandakini and Mandakini.

The rivers Bhagirathi and Alaknanda combine together at Deoparyag to form the river Ganga which flows through Rishikesh to enter the plains near Haridwar.

Climate

The climatic conditions prevailing in the Garhwal Himalaya vary widely. Tropical and sub-tropical climate is experienced in the Siwalik hills and the foothills of the lower Himalaya. The interior river valleys also experience a sub-tropical climate. A temperate climate prevails at higher elevations while arctic and sub-arctic conditions are experienced in areas above or near the snowline.

The tract adjacent to the plains of western Uttar Pradesh are the hottest whereas the lowest temperatures are experienced above the snowline in the higher Himalaya. Rainfall is fairly widespread all over Garhwal. Bulk of the total annual rainfall is received from the SW monsoons. Winter rains are also common. At higher elevations, precipitation is in the form of snow.

Natural Vegetation

The Garhwal hills are rich in forests. The prominent forests found in this region are:

1. Sal forests
2. Khair-sisso forests
3. Lower mixed scrub forests
4. Chir-pine forests
5. Ban, moru and kharsu oak forests
6. Deodar forests
7. Mixed deciduous forests
8. Fir and spruce forests
9. Upper mixed scrub forests
10. Sub-alpine forests
11. Alpine scrub and pastures.

Administrative Units

Garhwal is made up of the following districts:

1. *Dehradun*—This district lies in the south-western foothills of Garhwal. It includes the famous Dehradun valley which produces a high quality scented table rice. It also has fruit orchards. This district extends from the crest of the Siwalik hills in the south to the river Aglar at the base of the northern slopes of the Mussoorie ridge. The headquarters are located at Dehradun, a fairly large town. Other important towns are Mussoorie, Rishikesh, Herbetpur, Vikasnagar, Shaspur and Chakrata.

2. *Tehri*—The headquarters of this district are located at Narendranagar, a town established by the former ruler of Tehri state. This district extends from the banks of river Ganga at Muni-ki-Reti and upto the border of Uttarkashi in the north. The slopes in the lower tract and along river terraces is moderate, however it is very steep in the upper hills. Important towns are Muni-ki-Reti, Deoparyag, Mayali, Tehri, Ghansali, Narendranagar and Chamba.

3. *Pauri*—This district is also known as Garhwal district. It stretches from the foothills of Kotdwara to the border of Chamoli district in the north. Its headquarters are located at Pauri. It is drained by the rivers Nayar, Ramganga and Alaknanda. This district is rich in forests. Important towns are Pauri, Kotdwara, Landsdowne and Srinagar.

4. *Chamoli*—The headquarters of Chamoli district are located at Gopeshwar, a newly built town located atop a ridge. The entire area of this district falls within the catchment of the river Alaknanda. Its important towns are Badrinath, Joshimath, Pipalkoti, Chamoli, Gopeshwar, Nandparyag, Karanparyag, Sonparyag, Tilwara, Rudraparyag and Gauchar.

5. *Uttarkashi*—This district occupies the north-western corner of Garhwal. It is drained by the Yamuna and Bhagirathi river systems. The northern tract of this district is under a permanent cover of snow. It is very rich in forests. The upper catchment of the river Tons bears almost virgin forests. Important towns are Uttarkashi, Gangotri and Barkot.

KUMAUN

The Kumaun hills occupy the north-eastern part of Uttar Pradesh. To its north lies Tibet, to the east is Nepal, in the west is Garhwal,

and the plains of western Uttar Pradesh lie in the south. It covers a vast hilly terrain from the lower hills in the south to the snow-clad peaks of the higher Himalaya in the north. The administrative headquarters of Kumaun is at the beautiful tourist resort of Nainital.

Kumaun is famous for its natural beauty, rivers, lakes and forest-clad slopes. Lakhs of tourists visit Kumaun each year. The other important places of tourist interest are Ranikhet, Almora Kausani and Pithoragarh. It is divided into four administrative districts viz, Nainital, Almora, Pithoragarh and Rudrapur.

Physiography

Kumaun can be divided into the following physiographic units (from south to north):

1. Outer Himalaya or Siwalik Hills
2. Lower or Lesser Himalaya
3. Main or Great Himalaya

Outer Himalaya or Siwalik Hills

This physiographic unit consists of a chain of low hills of narrow width running in a more or less NW-SE direction all along southern Kumaun. This range is very well developed in the Haldwani and Dhikala areas. The average elevation of the crest of these hills varies from 750 to 1200 mts. The southern slopes are steeper than their north-facing counterparts. Towards north, these hills gradually slope into longitudinal valleys—the duns. Such a valley has been formed by the river Ramganga near Dhikala. Mixed dry forests occur on the south-facing slopes whereas sal forests occur on the northern slopes and in the terai-bhabar tract adjoining the plains of western Uttar Pradesh.

A large number of perennial as well as seasonal streams drain the Siwalik hills of Kumaun. The most prominent river of this tract is the Ramganga which flows for a considerable distance within the Siwalik hills before debouching into the plains. Seasonal torrents emanating from the Siwalik hills are known as *sots* in Kumaun. These cause widespread erosion during the monsoon season when a large quantity of water gushes down the usually drybeds, removing valuable topsoil, boulders and rock fragments from the upper slopes

and depositing them over the fields and human settlements in the lower reaches.

Lower or Lesser Himalaya

The lower or lesser Himalaya rise abruptly above the Siwalik hills and the dun valleys. This unit occupies the central portion of Kumaun. The prominent ranges which form a part of this physiographic unit are—

1. *Ranikhet ridge*—This ridge runs along the course of the river Ramganga. It bears dense coniferous and broad-leaved forests.

2. *Almora ridge*—The Almora ridge lies in central Kumaun. It towers over the surrounding mountains and valleys.

3. *Nainital ridge*—This ridge lies to the north of Nainital town. It surrounds the lake from almost three sides. Thick forests cover the north-facing slopes.

4. *Bageshwar ridge*—This is an almost north-south trending ridge that towers over the valley of the river Sarju. It originates from the main Himalayan ranges and descends southwards before dividing itself into a number of off-shoot ridges.

The lake land of Nainital also lies within the lower Himalayan zone. It has its own characteristic features. The lakes are confined to a tract that is about 25 kms long and 4 kms wide near the southern fringe of the lower Himalaya of Kumaun in Nainital district. The Nainital lake is the largest amongst these basins. The others are Bhim Tal, Naukuchiya Tal, Sat Tal and Puna Tal which lie to the east of Nainital in low-lying open basins. There are three more lake basins in this tract which are very small and often remain devoid of water. These are the Khurpa Tal, Sukha Tal and Saria Tal.

Main or Great Himalaya

The main or great Himalayan range occupies the northern part of Kumaun. It hems the region from the north and separates it from Tibet, which lies further north. The great Himalayan zone of Kumaun is about 50 kms wide. The average elevation varies from 4800 mts to 6000 mts, culminating in a crest whose peaks often rise to an elevation of over 6500 mts. The important peaks of Kumaun Himalayan are Nanda Devi (7817 mts), Dunagiri (7066 mts), Trisul

(7120 mts) and Nandakot (6861 mts).

The slopes are very steep and a large number of glaciers slowly make their way down the U-shaped valleys. The Pindari glacier—source of the river Pindar—is the most important amongst these. The Milam glacier is another prominent glacier of this tract.

The higher Himalayan zone bears high altitude vegetation in the lower slopes. These include deodar, fir spruce, high level oaks, rhododendrons, hemlock, betula, sub-alpine and alpine forests and meadows. The upper slopes are devoid of vegetation as they remain under a thick blanket of snow all round the year.

Drainage

The Kumaun hills are drained by the following river systems:

1. *Kali system*—The river Kali flows along the eastern border of Kumaun. It drains a large part of the region. The main tributaries of the river Kali, which originate from various parts of Kumaun are the Dhauliganga, Goriganga, Sarju and Ladhiya.

2. *Ramganga system*—This river system drains the southern tract of Kumaun. It rises in the lower Himalayan zone and flows in an almost SSW direction before entering the plains through the Siwalik hills near Dhikala.

Climate

The Kumaun hills too experience a widely varying climate that ranges from tropical and sub-tropical in their southern tract, and alpine or arctic at higher elevations. The following climatic zones have been identified on the basis of altitude and microrelief.

Climatic zone	Altitude (in mts)
Tropical and sub-tropical	below 900
Warm temperate	900-1800
Cool temperate	1800-2400
Cold	2400-3000
Sub-alpine/sub-arctic	3000-4000
Alpine/arctic	over 4000

The hottest areas are in the southern hills which lie adjacent to

the plains of western Uttar Pradesh. The average temperature decreases towards north though the valleys experience a hot tropical climate. Bulk of the precipitation is received from the SW monsoons. Winter rains too cause widespread precipitation all over Kumaun. Snow accounts for a major part of the total annual precipitation in the higher hills.

Natural Vegetation

The Kumaun hills support a diverse natural vegetation. These include the following forests: sal, khair and shisham, lower mixed scrub, chir pine, mixed deciduous, ban, kharsu and moru oaks, upper mixed scrub, deodar, blue pine, fir and spruce, rhododendron, betula, sub-alpine and alpine scrub and meadows. The nature and composition of the natural vegetation varies with altitude, slope, aspect and precipitation. The main forest types of Kumaun have been discussed in detail in the Chapter on 'Forests'.

Administrative Units

The Kumaun hills have been divided into the following four administrative districts:

1. *Nainital district*—This district occupies the south-eastern part of Kumaun. Its headquarters are located at Nainital. This district is well known for its beautiful lakes and the hill stations that have developed around them. The southern tract of this district includes a narrow belt of terai and bhabar lands which are strewn with boulders. Nainital district has a well developed network of roads. It produces a large quantity of apples, pears, peaches and other fruits. Important towns of this district are Haldwani, Kathgodam, Nainital, Bhowali and Bhim Tal.

2. *Almora district*—The headquarters of this district are located at Almora, an old town situated atop a 2000 metre high ridge. This district is well-known for its rich forests and for the beautiful hill stations which attract thousands of tourists each year. Kausani is famous for its snow-views. Below it is the flat valley of the river Gomati, where at Baijnath there are a number of ancient temples.

The garrison town of Almora is also much frequented by visitors. It stands atop a pine-covered ridge. Almora district produces

maize, paddy and potatoes. Apples and other fruits are also grown in the hills and valleys. Important towns are Almora, Kosi, Kausani, Ranikhet, Dwarahat, Ganai and Bageshwar.

3. *Pithoragarh district*—The northern border of this district touches Tibet. To its west lie Chamoli and Almora, in the east lies Nepal, and in the south lies Nainital district. Its headquarters are located at Pithoragarh. The northern tract of this district is almost entirely covered by snow. There are a number of remote valleys such as the upper Darma and the Ghori Ganga. A large number of glaciers descend down the great Himalayan range which forms the northern boundary of this district. The traditional road leading to the Mansarovar passes through Garbyang and Dharchula before ascending to the Lipu Leh pass and across it into Tibet.

The southern part is more developed and has a good network of roads. Important settlements are Pithoragarh, Ascot, Tawaghat, Munsiri, Garbyang, Dharchula, Thal and Didihat.

4. *Rudrapur district*—This is a newly created district in the terai tract of Kumaun.

NEPAL

Nepal is an independent country that spreads over the central Himalaya in a more or less rectangular shape. It is about 630 kms long from west to east and about 200 kms wide. The total geographical area of Nepal is 1,57,850 sq kms. Nepal occupies a buffer position between two giant neighbours i.e., India and China.

Nepal is known for its unique natural beauty, snow-clad peaks, raging torrents, conifer-covered slopes, terraced fields and friendly hill folk. Its economy depends, to a large extent, on tourism. The capital is located at Kathmandu.

Physiography

The country can be divided into the following physiographic units (from south to north):

1. Outer Himalaya or Siwalik Hills
2. Lower or Lesser Himalaya
3. Main or Great or Central Himalaya
4. Trans or Tethyan or Tibetan Himalaya

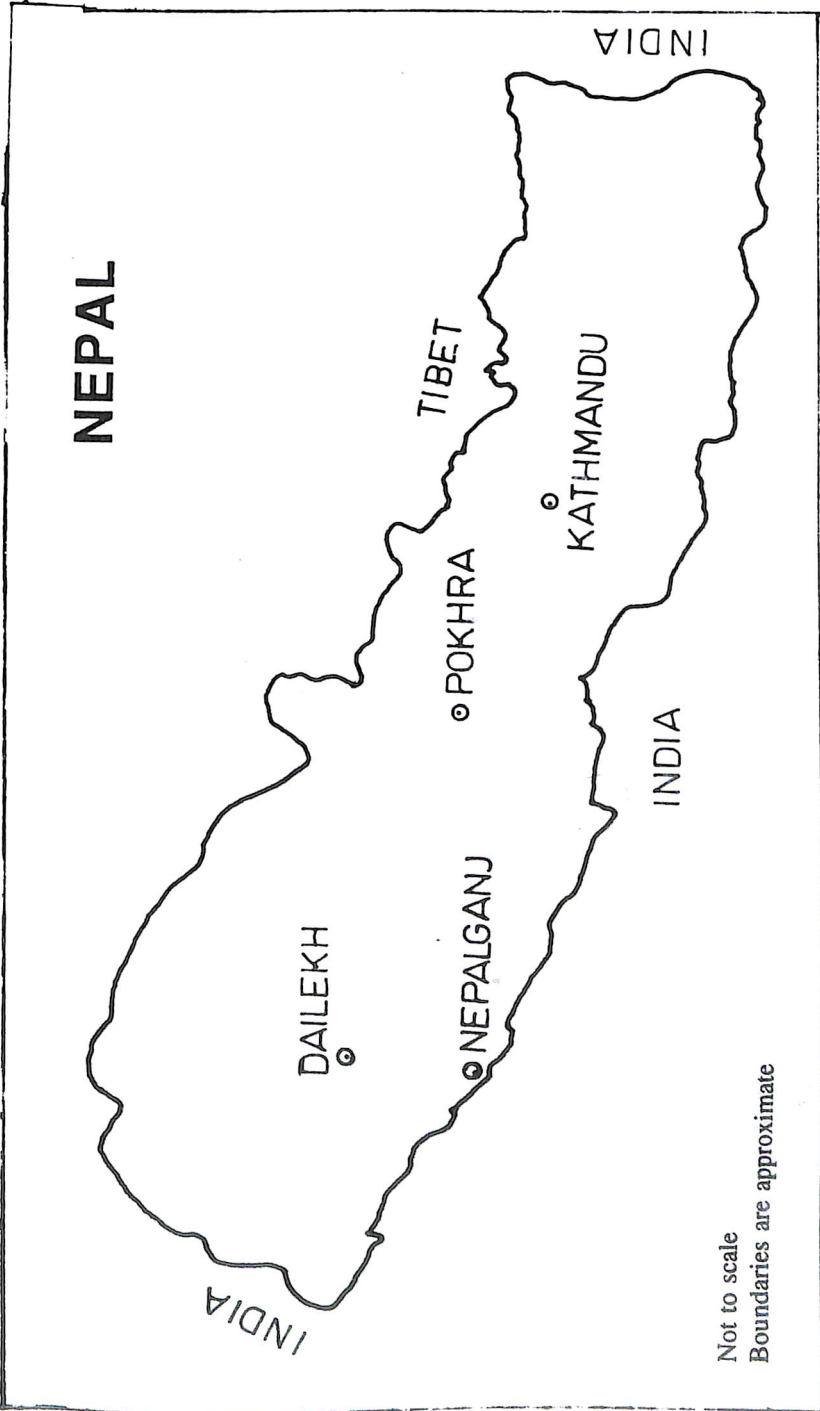


Fig. 5. Map of Nepal.

Outer Himalaya or Siwalik Hills

This is the southernmost physiographic unit of the country. It consists of the low rolling Siwalik hills which extend in an almost NNW-SSE direction. This physiographic unit may further be divided into the following:

1. *Terai-Bhabar tract*—The tract lies to the south of the Siwalik hills. It comprises of a gentle terrain that slopes towards south. The terai-bhabar tract gradually merges with the plains of north Bihar. Dense sal forests cover the entire area. Vast patches of these forests have been cleared to pave the way for agriculture. A number of rivers and streams originating either in the Siwalik hills or from the mountain ranges to the north, drain the terai-bhabar tract.

2. *Siwalik or Churia-Muria hills*—The Siwalik hills of Nepal are a part of the Siwalik belt that runs all along the Himalaya. These mountains have been termed as the Churia-Muria hills in Nepal and are best developed in the eastern and central part. The south-facing slopes are steeper than their northern counterparts. These hills are covered by sal, khair, sissoo and dry mixed forests.

3. *Dun valley or Bhitri Madhesh*—Narrow longitudinal dun valleys occur between the Siwalik hills in south and the lower or lesser Himalaya in the north. These are fertile valleys and support a dense population. Some of the dun valleys of Nepal are the Kamala, Narayani, Chitwan, Dang and Rapti valleys.

Lower or Lesser Himalaya

The lower or lesser Himalayan zone of Nepal is about 85 kms wide. The average elevation is over 2000 mts with the general relief gradually sloping towards south. The lower or lesser Himalaya are known as the Mahabharat Lekh in Nepali and have been termed as the midlands by Hagen. Bose (1972) has expressed the opinion that the Mahabharat Lekh is a prominent mountain range of the lower Himalaya of Nepal.

The lower Himalaya is comprised of a number of east-west-trending mountain ridges which form the waterdivides of the three major river systems of Nepal. The famous valley of Kathmandu also lies within the lower Himalaya. The slopes are covered by forests varying from chir pine in the lower tract to deodar, fir,

spruce and rhododendron at higher elevations. These forests have been under an intense biotic pressure during the past three decades primarily due to the high density of population in this tract which is increasing day by day. The hills of this zone merge with the main or great Himalaya in the north and drop down to the dun valleys or Bhitri Madhesh in the south.

Leban (1972) has sub-divided the main Himalaya of Nepal into—

- Western high Himalaya
- Arid high Himalaya
- Central high Himalaya
- Eastern high Himalaya

Main or Great Himalaya

The great or main Himalaya hems the northern tract of Nepal like a gigantic wall. It has a width of about 25 to 30 kms. All major peaks of the Nepal Himalaya are found in this zone. These include the Mount Everest (8848 mts), locally called Chomolungma (mother goddess of earth), the highest peak in the world. Amongst the 14 major peaks of the world, nine are found in Nepal. Apart from Mt. Everest, these are the Kanchanjunga (8598 mts), Makalu (8481 mts), Cho Oyu (8153 mts), Lhotse (8511 mts), Gauri Shanker (7146 mts), Dorje Lakpe (6989 mts), Ganesh Himal (7406 mts), Langtang (7239 mts), Annapurna I (8090 mts), Machhapuchre (6993 mts), Manaslu (8156 mts), Dhaulagiri (8167 mts), Api (7132 mts), and Saipal (7031 mts).

Bhatt (1981) states, "Many major rivers cut V-shaped valleys through the main Himalayan chain, with gorges as deep as 1400 to 2500 mts. Of these, the Kali Gandaki in central Nepal is perhaps the deepest gorge in the world, 30 mts wide and 5600 mts deep."

Some of the mountains which constitute the lower or middle Himalaya are—

- Humla-Jumla mountains
- Baitadi mountains
- Dailekh mountains
- Piuthan mountains
- Baglung mountains

—Mahabharat Lekh

Leban (1972) has referred to these mountains as the 'midlands' and 'transitional mountains'.

The mountain peaks are covered by a thick layer of snow. Glaciers make their way down the U-shaped valleys. The southern part of the great or main Himalayan zone is forested. The forests range from deodar, oaks, fir spruce and sub-alpine forests to alpine scrub and meadows.

Trans-Himalaya

Small tracts of Nepal lie to the north of the main Himalayan wall. This is known as the trans-Himalaya or the Tibetan marginal land. The Manag Bhot is the largest such patch. The average elevation is over 4500 mts. Conditions resemble those found in Ladakh, Lahaul, Spiti and Pooh. The main Himalayan range forms the southern boundary of the trans-Himalayan zone. Towards north this zone merges with the Tibetan plateau.

This is a cold and dry area with a scant growth of vegetation. Snow-fields and glaciers occur in the upper slopes. Stunted trees have come up along the channels formed by snow-melt waters in the valleys. Dusty winds tend to blow in the afternoons. Winters are very severe with temperatures dropping down to levels much below the freezing point.

Drainage

Nepal is drained by the following three major river systems:

1. *Ghagra system*—The Ghagra river system drains western Nepal. The river Karnali is the longest tributary of the Ghagra system. It rises beyond the main Himalayan axis, in the springs of Mapcha Chungo, south of Mansarovar in Tibet. Other tributaries of the Ghagra system are the Seti and the Bhari.

2. *Gandak system*—The Gandak river system drains central Nepal. The main river is the Kali or the Krishna Gandaki. Other important tributaries of this river system are the Seti Gandak that drains the famous Pokhra valley and the river Marsiandi.

3. *Kosi system*—The Kosi river system drains the eastern part of the country. The river Sapt Kosi is the most important river of

this basin. As the name suggests, it is joined by seven major rivers—the Sunkosi, Arun, Barun, Tamur, Indrawati, Bholakosi and the Dudhkosi.

Climate

Like most parts of the Himalaya, the climate of Nepal tends to vary with altitude, latitude, aspect, physiography and local conditions. The following climatic zones have been delineated on the basis of altitude:

Climatic zone	Altitude (in mts)
Tropical and sub-tropical	below 1200
Cool temperate	1200-2400
Cold	2400 to 3600
Sub-arctic	3600 to 4400
Arctic	over 4400

The southern parts of the country are the warmest while the northern areas are the coldest. Bulk of the precipitation is received from the SW monsoons.

Natural Vegetation

Nepal is endowed with a rich and diverse natural vegetation. The nature and composition of the forests varies with altitude, precipitation, aspect, slope, geology and soil conditions and micro-climate. The main forests of Nepal are sal forests, khair-sissoo forests, chir pine forests, oak forests (low, middle and high level oaks), deodar forests, lower and upper mixed deciduous forests, fir and spruce forests, sub-alpine forests and alpine scrubland meadows.

Geographic Units

Nepal may be divided into the following geographic units:

1. *Ghagra basin*—This basin includes almost all of western Nepal. In the southern tract of this unit lie the dun valleys, amongst which the Rapti dun is the most prominent. This area adjoins the plains of India. The central part of this unit consists of a number of

mountain ranges with intermittent valleys. The snowy ranges form the northern boundary of this unit. Important towns are Libangaon, Pyuthan, Dailekh, Thalara, Talkot, Vaitadi, Bilauri, Dhangarhi, Bijauri, Kumbher, Nepalganj, Bhairwa and Lumbini.

2. *Gandak basin*—This basin occupies the central part of Nepal. It spreads to the trans-Himalayan zone of Mustang Bhot in the north; the Dhaulagiri massif in the west; the Kathmandu valley in the east; and to the plains of northern Bihar in the south. The southern tract of this basin is more densely populated than the northern areas. Important towns are Muktinath, Butwal, Tansen, Riribazar, Baglung, Beni, Dana and Leta.

3. *Pokhra valley*—This is a beautiful valley drained by the river Seti Khola, a tributary of the Kali Gandaki. The Annapurna Himal lies in the backdrop. It is believed that this valley is the exposed bottom of a lake which was formed by a natural dam created by the rise of the Mahabharat Lekh and its associated ranges. Pokhra is the largest town in the valley. There are a number of lakes viz., the Phewa Tal, Bagnas Tal and the Rupakot Tal.

4. *Kathmandu valley*—This is another flat, circular valley with a radius of about 20 kms. It is drained by the river Bagmati and its tributaries. The Kathmandu valley is also an exposed lake bottom. Its average elevation is about 1600 mts. Climate is mild with warm and sultry summers and fairly cold winters. Important towns are Kathmandu (the capital of Nepal), Patan, Bhaktapur, Pashupatinath, Bodinath and Trisuli.

5. *Kosi basin*—This basin drains eastern Nepal. It is formed by the river Kosi and its tributaries. The Everest region forms a part of this basin. Elevation varies from 600 mts in the southern hills to over 8000 mts on the Everest massif. Main towns are Chatra, Dhankuta, Ilam bazar, Namche bazar, Chispani and Barabisa.

Administrative Units

- | | |
|----------------|------------|
| 1. Darchula | 7. Kailali |
| 2. Baitadi | 8. Bajura |
| 3. Dandeldhura | 9. Achaam |
| 4. Kanchanpur | 10. Humla |
| 5. Bajhang | 11. Mugu |
| 6. Doti | 12. Dolpa |

- | | |
|------------------|---------------------|
| 13. Jumla | 45. Kathmandu |
| 14. Tibrikot | 46. Bhaktapur |
| 15. Dailekh | 47. Lalitpur |
| 16. Jagarkot | 48. Makwanpur |
| 17. Surkhet | 49. Parsa |
| 18. Bardia | 50. Bara |
| 19. Banka | 51. Rautahat |
| 20. Rukum | 52. Sarlahi |
| 21. Rolpa | 53. Mahottari |
| 22. Sallyan | 54. Dhanusha |
| 23. Pyuthan | 55. Sindhupalchok |
| 24. Dangdoekhuri | 56. Kavra Palanchok |
| 25. Mustang | 57. Dolakha |
| 26. Myagdi | 58. Ramechhap |
| 27. Baghing | 59. Sindhuli |
| 28. Gulmi | 60. Solokumbu |
| 29. Arghakhanchi | 61. Okhaldhunga |
| 30. Kapilvastu | 62. Khotang |
| 31. Mananga | 63. Udayapur |
| 32. Parbat | 64. Sirah |
| 33. Kashki | 65. Saphthari |
| 34. Lamjung | 66. Sankhusabha |
| 35. Syangja | 67. Bhojpur |
| 36. Tanahu | 68. Dhankuta |
| 37. Palpa | 69. Terhatum |
| 38. Rupandehi | 70. Sunsari |
| 39. Nawalparasi | 71. Morang |
| 40. Gorkha | 72. Taplejung |
| 41. Dhading | 73. Panchthar |
| 42. Chitwan | 74. Ila |
| 43. Rasuwa | 75. Jhapa |
| 44. Nuwakot | |

EASTERN HIMALAYA

The eastern Himalaya includes the Darjeeling hills, Sikkim, Bhutan and Arunachal Pradesh. It encompasses an area of about 1,22,802 sq kms. Even though this region is a distinct physical entity, it is diverse politically, culturally and geographically. The eastern Himalaya is bounded in the west by Nepal, in the south by north

Bengal and the Assam valley, in the east by the river Brahmaputra and in the north by Tibet. Even though the four geographical constituents of this region differ in size, population, structure, natural resources and political set up, their problems are similar. This region has gained importance after the Chinese invasion of 1962.

Physiography

The eastern Himalaya have been divided into the following physiographic units:

1. Outer Himalaya or Siwalik Hills
2. Lower or Lesser Himalaya
3. Main or Great Himalaya

Outer Himalaya or Siwalik Hills

The outer Himalaya is made up of Siwalik type hills that rise upto an elevation of about 450 mts in a series of knife-like ridges from the Brahmaputra plains. These hills are about 10 to 15 kms wide. The south-facing slopes are steeper than their northern counterparts.

Prasad (1971) states, “. . . this is called the *Duars* in Bhutan. The mountains rise sharply and abruptly from the narrow *Duars* and are cut into deep gorges by rivers liable to sudden floods. The narrow strip of the *Duars* contains access to the 18 strategic *Duars* (door or passes) through the Himalayan foothills leading into the mountainous central Bhutan”.

The Siwalik hills are well developed almost all along the southern tract of the eastern Himalaya. These hills extend into the greater part of southern Arunachal Pradesh till the mountains curve around the Brahmaputra valley east of which the Siwalik hills lose their identity to be replaced by a series of low hills with gentler slopes. Further towards east, these low hills merge with the lesser or lower Himalaya.

North of the Siwalik hills lie a series of longitudinal valleys which extend to the base of lower or lesser Himalaya. These longitudinal valleys are filled with freshly laid down alluvium that has been brought by rivers and streams draining both the Siwalik hills in the south and the lesser or lower Himalaya to the north. The longitudinal valleys are not very well developed in the southern

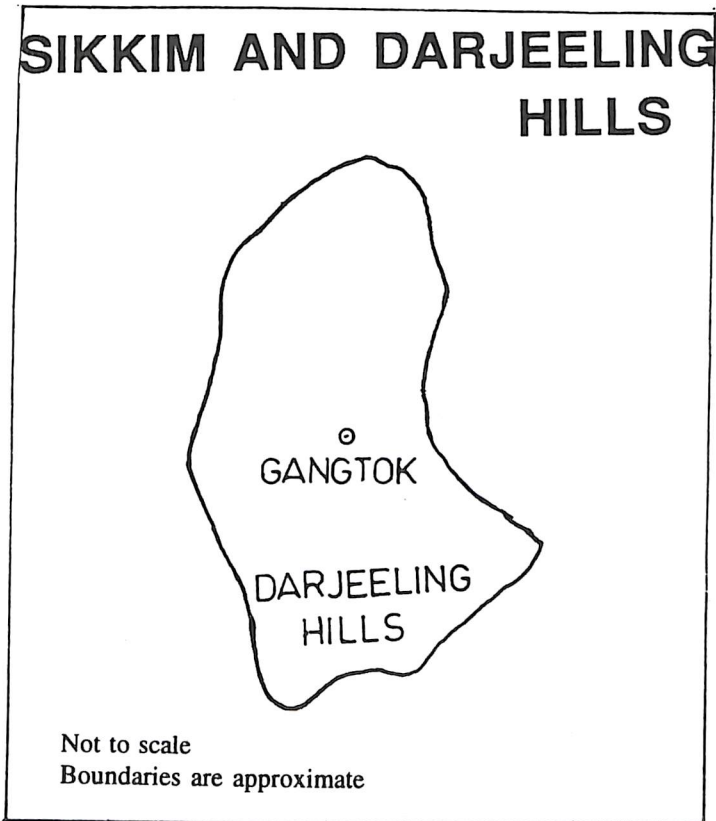


Fig. 6. Map of Sikkim and Darjeeling Hills.

part of Arunachal Pradesh where the Siwalik hills tend to quickly merge with the lower Himalayan ranges to the north. In certain tracts, the lower Himalaya rise abruptly above the low outer Himalayan hills with no clear cut demarcation between the two physiographic units.

Lower or Lesser Himalaya

The lower or lesser Himalayan belt occupies the central part of this region. It is made up of a number of ridges, many of which are almost north-south-trending. Some of the prominent ridges of the lower or lesser Himalaya are:

1. *Darjeeling ridge*—It rises above the plains of north Bengal and is cut off by the river Teesta in the east.

2. *Kalimpong ridge*—This ridge is separated from the Darjeeling ridge by the gorge of the Teesta river.

3. *Singalila and Donkhya ranges*—These lie in the northern part of the lower or lesser Himalaya of Darjeeling and Sikkim.

4. *Gangtok ridge*—The town of Gangtok is situated atop this ridge.

5. *Thimpu ridge*—The town of Thimpu is situated on this ridge.

The general elevation of the lower Himalaya decreases towards south. Average altitude varies from 3000 to 3500 mts. These mountain ranges support diverse forms of vegetation that range from pine and scrub forests at lower elevations to sub-alpine forests in higher tracts.

Main or Great Himalaya

This is the great mountain wall that separates the eastern Himalaya from Tibet. It extends from the Kanchenjunga massif in the west to the Namche Barwa peak in the east. Describing this zone, Prasad (1971) states, "The Great Himalaya in the north of the region consists of snow-capped ranges (above 7000 mts) and high valleys running down from the great northern glaciers. These ranges separate the complicate structure of the Himalaya from the flat or undulating table land of Tibet. Spurs from the Great Himalaya radiate southwards forming watersheds such as the Black Mountain range which forms the watershed between the Sankosh and the Manas rivers and divides Bhutan into two parts both administratively and ethnologically."

The width of this zone is about 60 kms. There are a number of fertile valleys in its southern tract which produce foodgrains during the summer months. A number of mountain passes occur in this mountain wall. These include the Thag La, Tulung La, Dom La, Andra La and the Kaya La. Temperate, sub-alpine and alpine vegetation occurs at lower elevations while the upper reaches are under a permanent cover of snow.

Drainage

The eastern Himalaya is drained by the following major river systems:

1. *Teesta system*—The river Teesta rises from the Zemu glacier

in Sikkim. It drains a major part of Sikkim and the Darjeeling hills. Its main tributaries are the Lhonak, Lachung and Rangit.

2. *Torsa system*—This river system drains south-western Bhutan. It is also known as the Amo Chhu.

3. *Raidak system*—The Raidak river system drains western Bhutan. Its main tributaries are the Thi Chhu, Paro Chhu and Há Chhu.

4. *Sankosh system*—The river Sankosh rises in the snows of the main Himalayan ranges as the Mo Chhu. It drains a part of central Bhutan.

5. *Manas system*—The Manas river system drains parts of the central and eastern Bhutan. Its main tributaries are the Mangde Chhu, Chamke and Kurd.

6. *Kameng system*—This river system drains a part of Arunachal Pradesh. Its main tributaries are the Bichom and Tenga.

7. *Subansiri system*—The Subansiri river system drains a large part of Arunachal Pradesh. Its main tributaries are the Yuma Chhu and Chaval Chhu.

8. *Lohit system*—This river system also drains a part of Arunachal Pradesh.

Climate

Climate conditions tend to change rapidly within short distances primarily due to sharp changes in topography, aspect and altitude. The foothills experience a hot and humid, sub-tropical climate. Cool temperate conditions prevail in the lower Himalayan zone while the main or great Himalayan ranges experience alpine (arctic) conditions. Bulk of the precipitation is received from the monsoons which bring rain to the eastern Himalaya as early as in May. Snowfall is experienced in the tracts above an elevation of about 2500 mts. There is a short summer season during which there are frequent showers. The average maximum temperature may rise to about 40°C. Sub-zero temperatures are experienced in winter in the northern tract.

Natural Vegetation

The varying edaphic, climatic and topographic conditions have reflected on the natural vegetation of the eastern Himalaya. The

forest types range from tropical evergreen in the foothills to temperate evergreen in the middle mountains and coniferous at higher elevations. Sub-alpine and alpine forests are found near the snow-line.

Geographic Units

The eastern Himalaya is made up of the following geographical and political units:

Darjeeling Hills

The Darjeeling hills form a part of West Bengal. They comprise largely of the outer and lower Himalaya ranges. The southernmost tract comprises of the Siliguri area which is a transition zone between the outer Himalaya and the plains of north Bengal. The Darjeeling hills lie mainly to the south of the Rangit river gorge. In its west is the southern extension of Singalia range.

Tiger hill (2567 mts) is the highest point of this area. It lies in the centre of the Darjeeling hill tract. A number of spurs radiate downwards from the Tiger hill. Extending to the north of this hill is the Darjeeling ridge upon which spreads the famous mountain resort of Darjeeling. Extending to the south of the Tiger hill is the Dow hill spur on which the town of Kurseong is situated. This spur then descends to the plains. Extending to the east of the Tiger hill is the Tadakh spur on which lie the famous Mongpu cinchona plantation. The western spur radiating from the Tiger hill descends to the town of Ghoom, the highest point on the Siliguri-Darjeeling road and extends further in the form of a 2500 mts sharp-edged ridge which joins the Singalila mountain range near Manibhajan below Sukila Pokhri.

The Kalimpong ridge is situated to the east of the Teesta gorge. It is a small hill station located amidst dense forests. The Darjeeling hills are famous for producing high quality tea. Fruits and vegetables are also grown on the mountain slopes. These hills are also the destination of thousands of tourists each year. Important towns, besides Darjeeling and Kalimpong are Ghoom, Kurseong, Teesta bazar, Pul bazar, Mongpu, Manjhitar and Siliguri.

Sikkim

The state of Sikkim is bounded in the north by Tibet, in the east lies Bhutan, in the west is Nepal, and the Darjeeling hills lie to its south. It has an area of 7096 sq kms. Bose (1972) states, "Sikkim, lying between the Singalila and Dongkya ranges to the west and the east, has its northern border along Tibet, coinciding roughly with the central Himalayan axis running between Kanchanjunga and Chomolhari (7314 mts) on the Bhutan-Tibet border. The eastern half of this part of the Himalaya lies north of the Chumbi valley in Tibet. This is the only part of the Himalaya which lies exclusively in Tibet. The Chumbi valley south of it is again the only south-sloping valley, which takes its rise from the Himalaya and lies in Tibet . . ."

The Singalila range runs south from the Kanchanjunga massif and lies between Nepal and Sikkim. It is covered by snowy peaks. The Singalila peak (3679 mts) lies at the tri-junction of Nepal, Sikkim and the Darjeeling hills. Further south of this range are the famous tourist spots of Phalut (3596 mts), Sandakphu (3323 mts) and Tangu (3063 mts).

In the east, the Dongkya range forms the border between India and Tibet and extends south along the Bhutanese border. In the north, it culminates in a towering 7134 mts high peak. This range lies at an average elevation of over 5000 mts.

Almost half of Sikkim consists of high mountains that are perpetually covered by snow from which descend numerous glaciers, the prominent ones being the Zemu and Talang. Population density is very sparse with nomadic tribes ascending to the alpine meadows during the summer months.

Southern Sikkim is densely forested. Villages and towns are generally situated between an elevation of 1000 and 2000 mts. Gangtok is the capital of this state. It is located on a 1800 mts high ridge. Gangtok is an important tourist resort and a centre for grains, vegetables, fruits and wool. It is connected to Siliguri by a good motorable road. Other important towns of Sikkim are Mangan, Singhik, and Lachung. There are a number of large settlements along the Darjeeling-Gangtok highway.

Sikkim is made up of four administrative districts:

1. North district with headquarters at Mangan.
2. East district with headquarters at Gangtok.
3. South district with headquarters at Namchi.
4. West district with headquarters at Gyalshing.

Bhutan

Bhutan lies to the east of Sikkim. Its northern boundary touches Tibet, whereas to its east lies Arunachal Pradesh, and the Brahmaputra valley in the south. Northern Bhutan consists of a great arc of snowy ranges from which descend snow-fed rivers. This mountain wall stretches from the Chomo Lhari (7314 mts) in the west to Kulhla Kangri (7541 mts) in the centre and further towards east of the Bhutanese border with Arunachal Pradesh. The northern tract is a glaciated terrain with amphitheatres, truncated spurs, U-shaped valleys and waterfalls. Population is very sparse and there are a few settlements. These include a few Dzongs (forts) and monasteries. Shepherds migrate to the alpine meadows clinging to the snow-covered mountains during the summer months.

Central Bhutan consists of V-shaped valleys, interlocking spurs and terraced river basins. The town of Paro is located in one such basin. Most of the rivers have carved out spectacular gorges through the lower Himalayan ranges. Average elevation of central Bhutan varies from 1200 to 2200 mts. This tract is densely forested.

The southern part of Bhutan is made up of the low rolling Siwalik hills. The population density is high and a number of large settlements occur on the Indo-Bhutan border. Phuntsholing is the largest town in southern Bhutan and it lies on the main entry point into the country.

Western Bhutan is drained by the Amo Chhu river whose upper catchment falls within the Chumbi valley. It is a very turbulent river and causes devastating floods from time to time. Further east are the rivers Paro Chhu and Wong Chhu which join at a small town named 'Confluence' by road builders. The towns of Paro and Thimpu are located in the upper catchments of these rivers. The river Mo Chhu drains a part of central Bhutan. Much of central and eastern Bhutan is drained by the river Manas and its tributaries. The upper catchment of the river Manas is very remote.

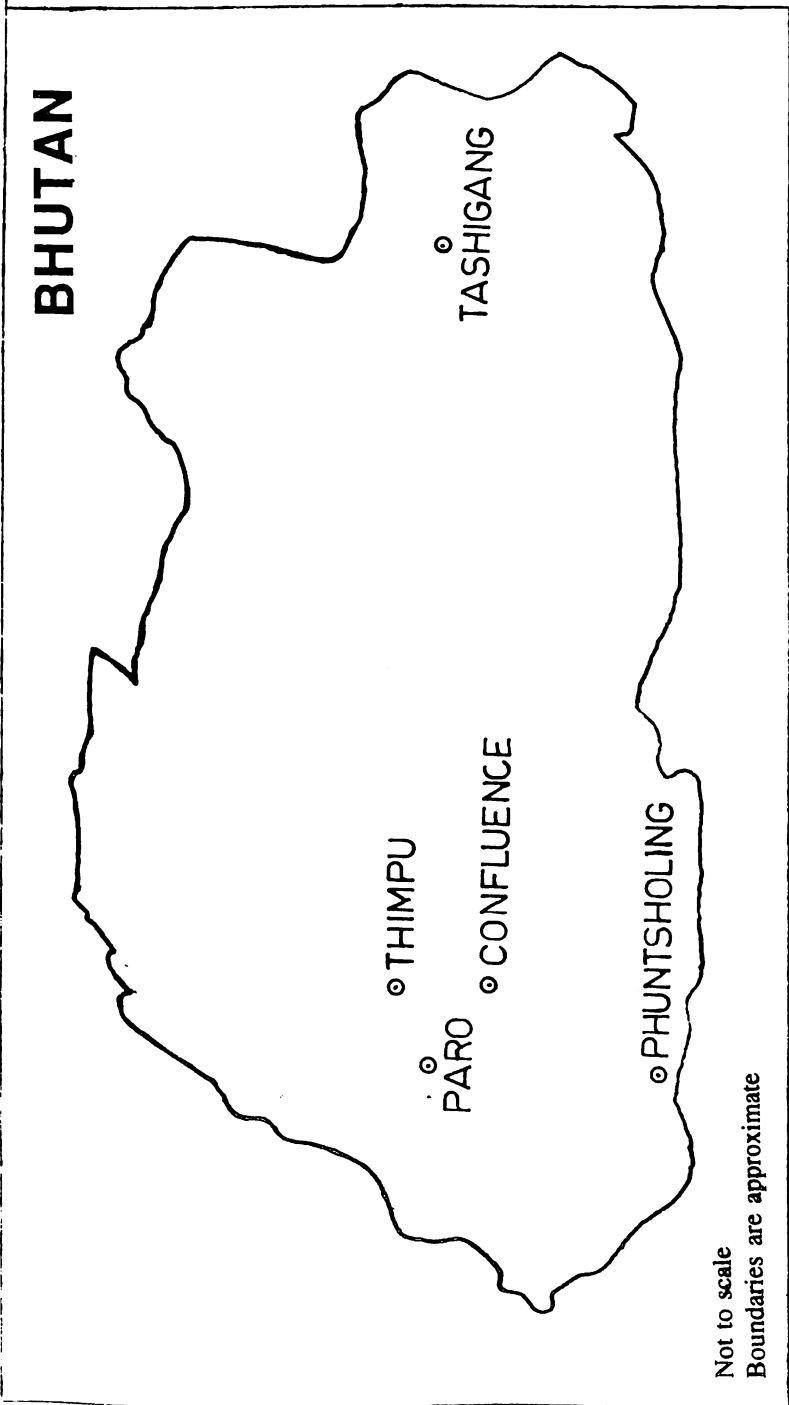


Fig. 7. Map of Bhutan.

Important towns and settlements of Bhutan are Thimpu, Paro, Phuntsholing, Ha Dzong, Confluence, Punakha, Byakar Dzong, Tashigang, Samchi, Chuko, Pelela, Chirag, Sarbhang, Shemgang and Geylegphug.

Administrative Units

Bhutan is divided into the following 17 administrative districts:

- | | |
|---------------|--------------------|
| 1. Chirang | 10. Pemaghatshal |
| 2. Daganna | 11. Samchi |
| 3. Gasa | 12. Jongkhar |
| 4. Geylegphug | 13. Shemgang |
| 5. Ha | 14. Tashigang |
| 6. Jakar | 15. Thimpu |
| 7. Lhuntshi | 16. Tongas |
| 8. Mongar | 17. Wangdiphodrang |
| 9. Paro | |

Arunachal Pradesh

Arunachal Pradesh lies to the east of Bhutan. It has an area of 83,743 sq kms of which a part lies outside the Himalaya. It was a remote area during the British period and till the Chinese invasion of 1962. Since then it is being developed at a fast pace. Rustomji (1981) states, "The Chinese advance into Tibet in 1950 made it clear that the north-east frontier could no longer be neglected as a low-priority area. It was vital that the tribal people should understand that they were part and parcel of India and that they should not be lured by blandishment from across the northern borders to transfer their allegiance to the Chinese . . ."

The northern part of Arunachal Pradesh consists of snow-bound peaks, arising from the great Himalayan mountain wall that separates Arunachal Pradesh from Tibet. The Kangto (7089 mts) group of peaks forms the western part of this mountain wall. There are a number of snowy massifs on this range. The great Himalayan range terminates in the Namche Barwa peak (7756 mts). The central tract of this state is rugged. It consists of V-shaped valleys and forested hills. Southern Arunachal Pradesh is made up of a number of low rolling hills.

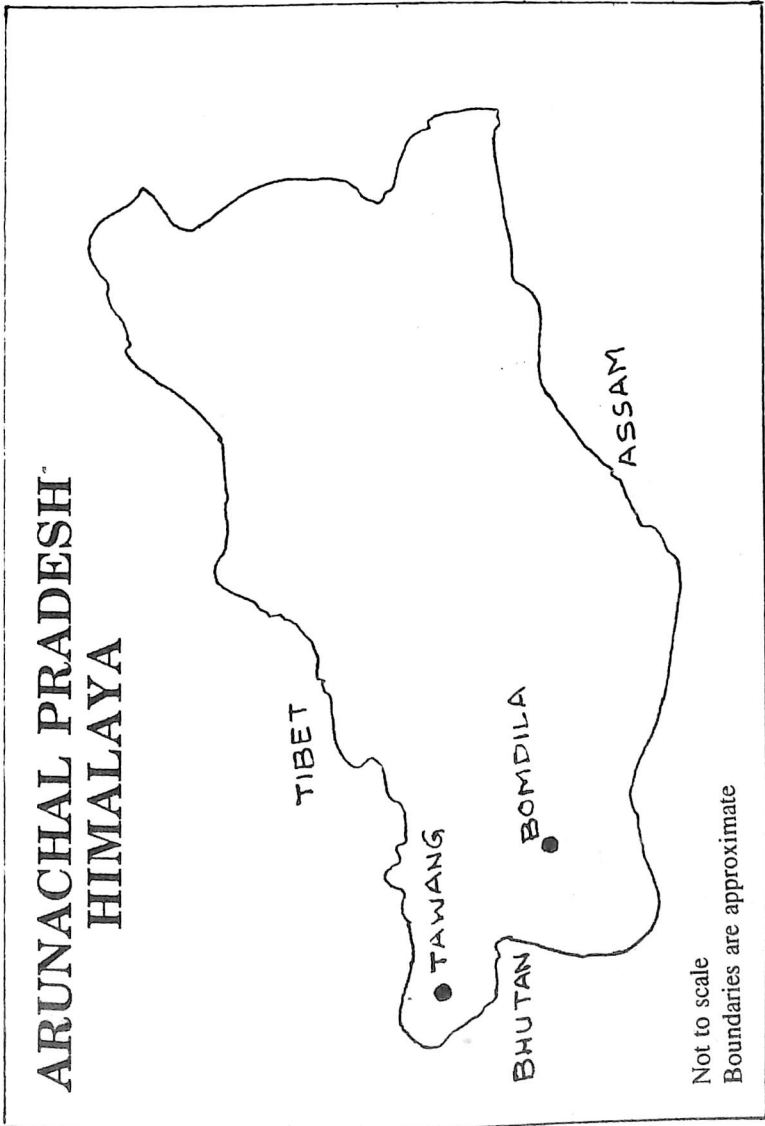


Fig. 8. Map of Arunachal Pradesh Himalaya.

A number of rivers have penetrated the great Himalayan range to enter the lower and outer Himalaya. In the west is the river Manas whose headwaters cross the main range near Bum La pass (4331 mts). The second river is the Subansiri and its two tributaries the Yame Chhu and the Chagul Chhu which have cut across the main Himalaya near Longju.

In the north-west corner of Arunachal Pradesh is the longitudinal valley of the river Tawang, a tributary of the Manas. The famous Twang monastery is situated in the upper slopes. The basin of the river Subansiri includes the Miri and Dafla tribes. The Abhor hills consist of the watershed between the rivers Subansiri and the Brahmaputra.

Important towns of Arunachal Pradesh are Tezpur, Zero, Itanagar, Along, Pasighat and Walong.

Administrative Units

Arunachal Pradesh is divided into the following five administrative districts:

1. Kameng district
2. Subansiri district
3. Siang district
4. Lohit district
5. Tirap district

NOTES AND REFERENCES

- Bhatt, D.D. (1981). Nepal Himalaya and Change, *Him. Asp. Change*, ed. Lall & Moddie, pp. 253-277, New Delhi.
- Bose, S.C. (1972). Geography of the Himalaya, National Book Trust, New Delhi.
- Gansser, A. (1964). Geology of the Himalayas, Int. Sci. Publ., N.Y.
- Kayastha, S.I. and Mishra, S.N. (1971). Himachal Region—India: A Regional Geography, Nat. Geo. Soc. India, Varanasi.
- Kharakwal, S.C. and Nityanand (1971). U.P. Himalaya—India: A Regional Geography, *ibid*.
- Negi, S.S. (1985). Himalayan Ecology: An Introduction, BSMPS Publ., Dehradun.

- Negi, S.S. (1990). Handbook of the Himalaya, Indus Publ. Co., New Delhi.
- Prasad, J. (1971). Eastern Himalyas—India: A Regional Geography, *ibid.*
- Rustomji, N.K. (1981). Sikkim, Bhutan and India's North-eastern Borderlands: Problems of Change, *Him. Asp. Change*, pp. 236-252, New Delhi.
- Wadia, D.N. (1975). Geology of India, New Delhi.