CHAPTER - 1

PHYSICAL BACKGROUND OF THE STUDY AREA: UTTAR PRADESH HIMALAYAS
The Himalayas 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. It extends for a length of about 24000 kms. from west to east and varies in width from 150 to 300 kms. (Fig. 1)

The Himalayas could be divided into six physiographic regions:

1. Jammu and Kashmir
2. Himachal Pradesh
3. Garhwal
4. Kumaun
5. Nepal
6. Eastern Himalayas

The Uttar Pradesh Himalayas comprises of Garhwal and Kumaun regions (Fig. 1). It extends from 29°5' N to 31°25' N latitude and 71°45' E to 81° 00' E longitude. This well-defined physical region is bound by the river Tons in the west and the river Kali in the east. Starting from the foothills of the Himalayas in the south, this region extends up to Indo-Tibetan international boundary in the north. It measures on an average 357 kms. from east to west and 294 kms. from north to south thus covering an area of approximately 46,485 sq. kms. It comprises of all the administrative units of Chamoli, Uttarkashi, Tehri, Pithoragarh, Nainital, Almora, Pauri and Dehradun Districts.
The Uttar-Pradesh Himalayas, hereafter Garhkum Himalaya, is situated centrally in the long sweep of the Himalaya and forms a rather transitional zone between the prehumid eastern and the rather dry to subhumid eastern and the rather dry to subhumid western Himalaya. It looks like the crown of Uttar Pradesh & stands guard to the Upper Ganga Plain (Singh, R.L., 1971). The layout of Uttar Pradesh Himalaya is mostly uneven, the minimum and maximum elevations being respectively 1,000 m and 7,817 m above the mean sea level.

1.1 GEOLOGY:

The Himalaya was formed by the mightiest thrusting of the earth layers and their rise is analogous to Nappe formation of Alps- a tangential process. Upheavals and compression resulting in excessive rock-folds, faults, thrust planes have changed much of their original and primitive structure. They are young with sharp relief features viz., pyramidal peaks, knife, edge, high ridges and deep abysmal valleys. Many geological surveys have been made in various parts of the Himalayas, but even now geologically much of the area is yet to be known. Wadia states that "large part of the Himalayas is yet unexplored, not only the geology but even the main features of the orography and geography are not well known over the years (Wadia, D.N. 1966).

Burrard and Hyden, in 1907 presented for the first time the structure of the Himalayan zone, based on the scattered information of the Himalayas. Auden, J.B. (1934, 1953) Heim and Ganssar (1936) and Captain Strachey (1951) have presented their works on Kumaon region. Eminent geologists Krishnan and Ganssar have done excellent work on the geology
Fig. 1.1
of the Himalayas. Among the recent works, some regional studies done by Pandey (1963) and Valdiya and Mishra (1961) are highly appreciable. The advanced Centre of Palaeontology and Himalayan Geology (Chandigarh) has also published a number of Geological studies on the Himalayas (Saxena, M.N., 1966).

Himalayan mountains consists of simple anticlinal structure. Most of the part possesses relatively soft cretaceous and tertiary sandstones. The major geological formation in this region are related with the age from pre-cambrian to cretaceous (Krishnan M.S., 1960). Wadia, (1966) divided it into three broad stratigraphical zones:

1. Outer of sub-Himalayas (Siwaliks)
2. Central (Lower or Lesser) Himalayas (Himachal)
3. Higher or Greater Himalayas (Himadari)

The main Central Thrust demarcates the Higher and the Lesser Himalayas and a Main Boundary Fault separates the Lesser Himalayas from the outer of sub-Himalaya. The altitudinal zones of this region also coincides with this division. Outdoor activities or tourism regions, both religious and secular, also closely alley themselves with this universal division.

1.1.1 Siwaliks:

Skirting the Upper Ganga Plain, stretches (NW to SE) the foothill-belt of the Siwalik ranges of low heights (300-600 m), which is composed entirely of tertiary and upper tertiary sedimentary river deposits. The detrital thickness of this region, abounding in miopleistocene sand, gravel and
conglomerates, varies from 4,570 to 6,100 m. "The lithology is suggestive of the deposition of water- worn debris of the Granite core of the Central Himalayas in the long and broad valley of the Siwalik River (Wadia, D.N., 1961).

As one emerges from the plains, the beds of sandstone and pebbles (Nahan) appear on the scene in variegated hues of violet, pink, red and green. "Subgreywakes with associated chocolate brown appear to the west of Ramnagar in the middle Siwaliks", (Tandon, S.K., 1971).

Geologists believe that Siwalik in the south are buried under the alluvium of the Ganga. The exposed belt, however, passes through the northern part of Saharanpur, the southern part of Dehradun and Garhwal and the middle part of Nainital.

To the north, Siwaliks are backed by a discontinuous series of longitudinal vales known as Duns such as Dehra, Kontri, Chaukhamba, Patli and Kota. Of them Dehradun (35 Km. long and 25 Km. wide) is the biggest and most developed in urban and out-door facilities. These duns have been filled in only recently from gravels derived from the Central Himalaya. They rise to the height of 350 m from the plains.

The Siwaliks bear testimony to the extreme youth of the Himalayas and promise rich recreation resource in their beautiful landscape scenery- waterfalls, river banks, contact zones of plains and mountains and the forested slopes. With grand Himalayan scene in the backdrop contiguity to densely populated and urbanised area in the Upper Ganga plain and with adequate rail- road connectivity, the entire Siwalik region
1.1 Snow Clad Himalayas in the Garhwal Region
can easily become an outstanding intermediate type of resource for tourism. Indians seek recreation too religiously, and only those old religious centres get a little spurt which serve as gateway to Himalayan shrines. In the eastern region Kathgodam, being railhead and gateway to resource based area of Kumaon, can stir good tourism activity.

On the basis of lithology and the degree of induration the Siwaliks may be divided into three units :-

1. The Lower Siwaliks

Sandstones of the lower Siwaliks are relatively more compact and indurated than those of the Middle and Upper Siwaliks. It is composed of medium to fine grained compact grey coloured sandstones, interbedded, with minor siltstones, shales and some clays.

2. The Middle Siwaliks

The Middle Siwaliks consist of essentially fine to medium grained salt and pepper sandstones with some siltstones and clay beds. These sandstones are friable due to cementation.

3. The Upper Siwaliks

The Upper Siwaliks are embedded with conglomerates and sandstones. The pebbles of the conglomerates consist of sandstones, quartzites, limestones, shales, phyllites and slates.
1.1.2 **Lesser Himalayas**

Bounded by the Main Boundary Fault to the south and the Main Central Thrust to the north, stretches the zone of Lesser Himalayas approximately in seventy-five kilometers. It is a crystalline zone of unfossiliferous (or poorly fossiliferous) sediments with complex tectonics. Rocks have been compressed and metamorphosed to such an extent that they vary in age from Algonkian to the Eocene (Wadia, D.N., 1961). Lithological variations present a mosaic of colours—buff, cream, white, purple, pink, grey, green, yellow and slaty, presenting a feast to the eye. The variety is pronounced in Uttarkashi region where investigations proved that Dharasu, Singuni and Uttarkashi thrusts have affected rock variation 'from highly schistose coticule quartz'. Lithostratigraphical variations are pronounced in Almora-Askot and Baijnath region in the east. The main structural feature is the extension of Simla-Krol belt (with its overlying deposits of infra krol, krol sandstone, krol lime and Tal quartzites) from west to east (Burra, S.G. and Haydon, H.H., 1907). This krol-belt constitutes most important tourism resource base of the region. The Lower Himalayan zone may be divided into three main structural features:

1. **Krol Belt**
2. **Deobar Tejam Belt**
3. **Almora- Dudatoli Crystalline Thrust Sheet**

1. **Krol Belt**

The Krol belt stretches from Shimla region in the northwest to Nainital region in the south-east. This belt has overlying deposits (Auden,
J.B., 1934) and consists of four types of rocks namely Infra Krol, Krol Landstones, Krol Limestones and Tal Quartzites.

The Krol thrust oversides a structural and erosional gap in the Siwaliks (Ganssar, A., 1964). This superimposition of relief may be compared with the northern margin of the Alps in Europe (Singh, R.L., 1971). The southeast region of Nainital has numerous local faults in different directions and this region has become extremely complicated by crushing and crumpling of faults. Thus the region is full of tectonic complications with tectonic slips and mass glidings (Kharkwal, S.C., 1969).

2. **Deobar- Tejam Belt**

The Deobar-Tejam zone is made of enormouslly thick limestones and dolomites topped by thick sections of quartzites. The main characteristics of the area as described by Ganssar as "a peculiar steep zone with some quartz. Conglomerates, highly crushed quartzites and conspicuous amygdaloidal epidote diabases" (Ganssar, A., 1964).

It may be divided into two belts in the eastern Lower Kumaon Himalaya, i.e. Badolishera- Pithoragarh zone in the south, and Chamoli-Tejam Zone in the north which is separated by the Askot- Bajnath crystalline thrust. This zone consists of thick-bedded dolomites and crystalline limestones, which are invariably overlaid by quartzites and intervening phyllites.

3. **Almora- Dudatoli Crystalline Thrust Sheet**

The Almora- Dudatoli thrust lies in the north of Krol thrust of
Nainital. Pre-Cambrian formations are represented by the great Almora-Dudatoli thrust zone. It separates the liner sedimentary zone of the Lower Himalayas, which is also called Deoban-Tajam zone. The formations of this zone are of pre-cambrian and paleozoic era. It stretches from the Shimla area in the northwest to Kali valley in the southeast. The occurrence of older formations (Almora-Dudatoli thrust zone) over the younger one of precambrian and paeozoic (Deoban-Tejam) is, however, a general phenomenon throughout the Himalayas.

The Almora-Dudatoli thrust sheet forms a huge crystalline mass metamorphosed and mostly reversed rocks with complex character. Some important rocks of Dudatoli region are phyllites, schists, flages, quartzites and gniesses. The lithology is much similar to metamorphosed Chandpur of middle Jaunsar.

With verdant hills, furrowed ridges, dales and vales cataracts and calm waters of the lakes, this region easily becomes Uttar Pradesh’s paramount tourism resource base, where average relief of ridge ranges between 1,500 and 2,700 metres and the valley bottoms are between 500 to 1,200 metres.

As one traverses from the Siwaliks, the mountains rise abruptly and 'the mystery and thrill of travel is upon one in the Himalayas.' In the words of Smythe: 'Unimaginative is he who can gaze upon the Himalaya from the lower foothills or the plains, and not sympathise with the simple, child like adoration of the Hindu for Ganges to minister to their needs'. (Symthe, F.S., 1932). The 'White radiance' of Grand Himalayas, the beauty
of glorious sunrise and sunsets and the grand Himalayan panorama can be enjoyed from the ridges of Mussoorie, Ranikhet, Almora and Kausani, developed for outdoor recreation.

Lakes, as compared to Alps and other mountain systems, are not very common feature in the Himalayas. Nevertheless, an important belt of lake-basins (25 km. long and 4 km. broad) occurs near the outer fringe of lesser Himalayas. Nainital, as lake district, is Uttar Pradesh’s outstanding outdoor recreation resource centre with developed tourist amenities. With Naini as nucleus, Bhimtal, Naukuchia, Sat, Puma and Malva Tals (lakes) attract visitors in large number. The lake basis of Khurpatal, Sukhtal and Sariatal are too small to mention. Flood-washed Gohna lake (Garhwal), once trout fishing centre, is no more now. Diurital, lying some 16 km, to north of Ukhimath has not been developed for outdoor recreation.

The origin of these lakes is still doubtful and uncertain. Geologists have placed different views on the subject. Thomas believes that the recent earth movement and diversified lithology were the two main factors responsible for their origin. (Thomas, A.N., 1952) Ball, however, considers the Kumaon lakes to be of landships origin. Avoiding the controversy Wadia sums up: "while a few may be due to differential earth-movement like faulting, others may have been produced by landships, glaciers, etc. (Wadia, D.N., 1961).

1.1.3 Greater Himalayas

The Higher Himalaya region lies to the north of the Main Central Thrust. It spreads over 50 km. Formed of simple tectonics, it is a region of unsurpassing natural beauty, adorned by glaciers, huge-U-shaped valleys,
horns and glacial lakes. The main central thrust separating the Higher Himalayan Zone from the Lower Himalayan Zone is well outlined by the Kali gorge and the valleys of the Goriganga and the Pindar rivers. The crystalline sheet of the Higher Himalayan Zone is made of old metamorphic rocks and is composed of a series of highly fossiliferous sediments. The main rocks of the zone are quartzites, magmatites, genisses, granites, schists, dioritic amphibolites etc. It is however, a difficult and inaccessible area with an average relief between 4,800 and 6,000 metres, culminating into some of the highest peaks of Asia, viz; Bandar Ponch (6,315 m) Kamet (7756 m) Nanda Devi (7,817 m) Dunagiri (7,066 m) and Trishul (7,120 m).

Some of the giant glaciers such as Gangotri, Milan and Kedarnath (largest after Karakuram glaciers) can be seen here (Wadia, D.N. 1961). The present landforms in Himalayas show ample evidence of ice-sculpture. Presence of the fluvio-glacial drifts and matter, glacial lakes, formed of plugging of valleys (e.g. Hemkund, Rupkund, Satopanth, Chobarital and Chaukhamba) and broad glacial terraces are the evidence that their region was affected by at least one glacial age (Wadia, D.N., 1961). The glaciated scenery of this region has often been compared to the Yellowstone or Yosemite National Parks of the U.S.A. "The entire natural landscape is well preserved for Hindu pilgrimages" (Singh, T.V., 1973).

Aryans with wonderful landscape tastes, paid homage to the greatest and most formidable of all the mountain system that they had come across and finally.

1.2 Relief:

This region has a varied and complex relief. There are many
ranges of mountains running in a general direction from northwest to southeast. The slope is steeper towards the southern side and gentle towards the north. The main rivers of the northern India, viz. the Ganga, the Yamuna and the Kali, rise from this region and constitute three major river systems. The area is studded with lakes which follow the general trend of the ranges and is studied with their situation form a characteristic feature in the area. On the basic of physiographic attributes this region may be divided into three major relief zones:

i) **Himadri (Greater Himalaya):**

The *Himadri* (Greater Himalayas) ranges run nearly along the international border of the country in this region, where glaciated topography is well-preserved. The Himadri is 50 km. wide and has the highest elevation which are approximately more than 4,000 metres where several high pases, viz., *Lipu-Lek* (4,966 m), *Darma* (5,329 m), *Niti* (5,579 m) *Mana* (5,609 m) and *Jelu Khaga* (5,329 m) are situated joining the region with Tibet. Some Himalayan peaks, famous for their heights, are situated here viz. *Nanda Devi* (7,817 m), *Kamet* (7,756 m) *Trishul* (7,120 m), *Nilkantha* (6,597 m) *Dunagiri* (7,066 m) *Bandar Punch* (6,315 m), *Gangotri* (6,141 m) and *Kedarnath* (6,940 m). The slopes and peaks are covered with several hundred metres thick ice covers, which make many glaciers like Milam, Gangotri, Pindari, Bhagirathi, etc.

The Greater Himalayan ranges are deeply cut by the headwaters of the rivers Ganga (*Bhagirathi* and *Alaknanda*) the Yamuna and the Kali (Sarda). The cross profiles of these valleys show convex form with steep
valley walls reflecting the rising phase of the Himalaya and also the younger characteristics of the rivers (Singh, R.L., 1971).

The river Ganga forms the main valley of this region and drains a very large portion. The Ganga (Bhagirathi) rising from the Gomukh glacier (6,614 m) which is 30 kms. long and 2 to 4 kms wide, cuts a fantastic gorge among the granites of the central axis of the Greater Himalayas. The Yamuna rises from Bandar Punch range and it has two tributaries i.e., the Tons and the Giri. The valley of Kali (Sarda) forms the eastern boundary of the region which ends on the Nepal border. Himadri may be divided into two relief sub divisions- a) Himadri ranges, and b) Himadri valleys.

ii) Himanchal (Lower Himalaya):

The Himanchal (Lower Himalaya) is situated between the ranges of Greater Himalayas in the north and the Siwaliks in the south. Lower Himalayan ridges have a general elevation of about 1,500 m to 2,700 m and the valley bottoms between 500 m to 1,500 m with a width of 75 kms. The region is full of a variety of landscapes developed in different parts.

The lacustrine basins and river terraces are dominant features of this region. The valleys of the river Ganga and its tributaries are in young stage of profile development. They are immature, as they have been subjected to rejuvenation again and again. The main Boundary Thrust seperates this region from Duns. The ridges of the region, with highly compressed and altered rocks are seperated from each other by deep valleys.
There is a lake basin near the outer range of the Lower Himalaya which makes a zone of approximately 25 kms in length and 4 kms. in width. The lake region of Kumaon is dotted with big and beautiful lakes. The area around Nainital alone has ten lakes. Some important lakes of the region are Naini lake, BhimTal, Naukuchiya Tal, Sat Tal, Khurpa Tal, Sukha Tal, Sarai Tal etc.

The Sukha Tal, a lake with no water, is situated near Nainital while the Gohna lake is in the Garhwl Himalaya in the valley of a tributary of Alaknanda named Birahi Ganga. The Diuri Tal is another important lake lying 10 kms. the northeast of Ukhimath.

The origin of these lakes is still ambiguous and doubtful. Thomas believes that the frequency of the lakes in this small region may be connected with the recent movement. The irregularly eroded surface of Siwaliks over which the Krol Nappe has moved must have contributed to the formation of the surface irregularities, consequent upon the breaking up of the thrust mass. Thus, the region has too sub- divisions : a) Himanchal ranges and hills, and b) Himanchal valleys and lake- basins.

iii) The Siwaliks (Sub-Himalayan Tract) :

The term 'Siwaliks' is used for a range of narrow and low hills which lie almost parallel to major ranges of the Himalayas. It stretches in north west to southeast direction and forms the outer range of the Himalayan system. The hills of Siwaliks are broken up and are seperated from the Lower Himalayan spurs by a series of structural lowlands. The height of the Siwaliks varies roughly from about 550 m to 1,350 m. Ranges of Siwaliks
are intersected by numerous Siwalik rivers, such as *Dabka, Baur, Nihal* and *Bhakra* at several places. These rivers have carved out their deep valleys. These ranges are lithologically quite different from those of Lower Himalayan ranges. The southern slopes have steep scarps and the northern slopes descend gently to the flat floored structural valleys called Duns.

The sediments of *Duns* are brought recently from the upper ranges (Himanchal and Himadri) and filled up in this region, which is 350 m higher than the plain. Many Duns are found in Uttar Pradesh Himalayas, as *Dehradun, Kothri Dun, Chaukhamba Dun, Patri Dun* and *Kota Dun*. Siwaliks may be divided as a) Duns and b) Siwalik ranges.

1.3 **Drainage System**:

Indians being essentially religious, bathing in rivers was prescribed as an important outdoor religion activity. At several places *ghats* were, therefore, fitted in their banks where pilgrims thronged in multitudde to take dip periodically. Some of them are venues of national bathing festivals. These bathing stations were carefully selected with an eye on panoramic beauty of the surrounding landscape. Most popular sites are where the river rises from the Himalayan glaciers meanders and the junctions of the two streams- *prayagas*. These *prayagas* near the sources of the rivers were held most sacred, perhaps for reasons of natural benediction, physical charm and unique quality of waters. While the spirit of religion flows into these rivers, their recreational value can hardly be underestimated, particularly near congested urban centres where they are the soul venue of "breathing out". (Even in the KAVAL towns of Uttar Pradesh, we are almost working up to a crisis in user based outdoor recreation facilities.
The urban explosion and the consequent centripetal growth has resulted in the squeeze on whatever open spaces, play grounds and parks we have had in a city area. Rivers and other minor water bodies (lakes, tanks etc.) can play a vital role in the aesthetics and recreational life of a city water sports, viz. Swimming, boating, angling, skiing and other secondary water contact activities can be developed.

Undoubtedly, Uttar Pradesh, has a wonderful river system in the Ganga with her many tributaries and distributries that drain the entire state. The Himalayan region is drained by the three streams, namely; the Ganga System, the Yamuna system and the Kali system: the first two are of pilgrim/tourist importance. All of these rivers have their sources in the Himalayan glaciers and have sculptured wonderful landforms, deep gorges, and transverse valleys that present a spectacle of enchanted scenery. In higher regions rapids and water falls cascading over the cliffs (sometimes from hanging valleys) thunder down most of the day and go silent as the freezing night advances, adding serenity, calm and mystery to the place. The Ganga, with its parent streams of the Bhagirathi and the Alakananda, appears more conspicuous on the scene.

The Bhagirathi is considered to be the main source of the Ganga though the Alakananda, the Dhauli Ganga, the Pindar and the Mandakini have also been considered as good source rivers (Bose, S.C., 1968). The Bhagirathi, all along her course, commands a most imposing natural scenery with beautiful incised meanders, expanses of natural terraces (traces of intermittent rise of Himalaya), truncated spurs and Himalayan meadows. The morphoecological setting all around the valley also presents a scene
of pastoral and botanical beauty- wild plants, fruits trees, the paddy terraces, nomadic Gujjars with their herds of buffalo, sheep farms and the colourful Monal all mix into one harmonious whole.

Rising from the Gangotri glacier (30 km. long and 2 km. wide) the river can be seen emerging from the ice cave of Gaumukh. Over the Gangotri rise the horn-peaks of Bhagirath Parwat and Shivalinga - a pilgrim site. Cutting the granite gorge the river turns at right angle. Beyond Gangotri the valley is broad and choked with glacial tills. The interfluve consists of razor sharp ridge and snow covered pinnacles. At Jangla the JADH Ganga meets the Bhagirathi amidst the most spectacular granite scenery. "Both rivers are supposed as antecedent to the rise of the Himalaya (Bose, S.C., 1968). The entire valley from Gaumukh to Jangla is a pilgrim/tourist resource based area.

Alaknanda is the main tributary of Bhagirathi, which rises from the eastern slopes of Chaukhamba peak (7,138 m). The river Alaknanda flows 147.5 kms. from its origin to its confluence point. The Chaukhamba and its satellite peaks, permanently covered with snow, form the snow parting between the Gangotri group of glacier to the west and the Bhagirathi group to the east. There is a popular belief that Vedas and other Hindu scriptures were composed in this 'Valley of Gods'. Alaknanda collects the water of such resource rivers as the Saraswati (meeting the Alaknanda at Keshav Prayaga) the Bhyunder Ganga (the Valley of Flowers), the Dhauli (at Vishnu Prayaga), the Mandakini (Nanda Prayaga) the Pindar (at Karan Prayaga), the Mandakini (Rudra Prayaga) and finally dissolves herself into the Bhagirathi at famous Deva Prayaga. All these rivers and Prayagas are
most sacred to Hindus and attract large number of pilgrims and tourists every year.

Rising from the twin glaciers of Bhagirathi Karak and Satopanth, the river skirts the Nilkantha and the Narayan Parvat and flows past to the holy shrine of Badrinath where the valley opens out into circular undulating plain made of glacial till. Here Narand Narain peaks (6,500 m) stand assentinels on either side of the valley. At Badrinathi, the Rishi Ganga meets the Alaknanda. To the north of Badrinath, Vasudhara cascades between the Bangneu and Pawegarh peaks from the height of 150 metres.

This glaciated scenery, including Nanda Devi, Dunagiri, Nanda Ghunti, Trishul and many other giant peaks, has been preserved for Nanda Devi Sanctuary, perhaps, the biggest of its kind in the world. The Nanda Devi, National Park, at present is closed to the public.

The Mandakini rises from Chorabari glacier (Kedarnath peak) and has another sacrosanct Hindu shrine of Kedarnath at its source. The temple stands on a platform of loose and unconsolidated glacial till material. The strange phenomenon of disappearing waterfalls on the Mandakini flanks would not seem to be mystery.

The Pindar Ganga rises from the famous Pindar glacier which attracts trekkers from all over the country. The glacier lies in the shadow of Nanda Devi and has accommodation facilities at Phurkia (3,202 m), situated 8 km. away from the glacier snout. Pilgrim interest is confined to the junction of Karn Prayaga lying enroute to Badrinath. Other valley aspects are characterised by hanging valley, truncated spurs, and talus slopes. Green grassed moraine platforms, known as Bugiayals, where sheep graze, add
pastoral charm to the landscape.

In the union of the Bhagirathi and the Alaknanda the mighty Ganga is born at Devprayaga. The tortuous journey in the grand Himalaya comes to its last phase at Lachhman Jhula and the river seems to enjoy an interlude in the Dun-country to cut across the Siwaliks at Haridwar. The valley aspects from Rishikesh to Devprayaga are marked by dense forested slopes on both the sides of the valley and panorama of natural beauty, in which the river chuckling and foaming over the boulders plays hide and seek with the interlocking spurs.

The Yamuna system is related with the river Yamuna, which is the third most important river of this region. This system covers western portion of the region and river Yamuna flows 112.5 kms. from the origin to the other end of the region. The Yamuna system drains parts of the district of Dehradun, western part of Uttarkashi and Tehri districts. The Yamuna, which rises from the Yamunotri glacier, on the southwest slopes of Bandar Ponch, is torrentially rapid with her more turbulent tributary, Tons, in sculpturing Himalayan landscape into beauty. In their upper reaches both seem to have experienced rejuvenation on account of intermittent upheavals; the paired terraces and the entrenched meanders bear ample witness to this phenomenon. Meeting at Kalsi, the Yamuna emerges out of the lesser Himalaya and braiols in the Dun Valley for gentle slope gradient.

The Yamunotri shrine near the source of the river, with low geysers and hot springs around (temperature 90.4° C) is the crowning glory of the river. For the rest, she performs well on the plains by having some of the best historic sites and religious scenes laid on her banks.
The river, after collecting the waters of the Chambal from the south dissolves finally into the mother stream at Allahabad, after running a course of 1,376 km. to its confluence. The area existing to the west and east of the Yamuna has been a region of perennial cultural evolution throughout historic times.

The Tons is the biggest tributary of the river Yamuna. The volume of water brought by this river becomes nearly double to that of the river Yamuna. The river Yamuna and the Tons flow separately cutting Mussorie ranges into deep valleys and meet together at Kalsi. The Giri, another important tributary of the river Yamuna comes from further north west of the Tons, bringing water from southeast Himanchal Pradesh. The Giri joins the river Yamuna in Kiarda Dun Valley.

The Kali river system is denoted by the name of the river Kali, as this is the most important river of this system. This river system covers eastern portion of the region, in which the river Kali flows for a distance of 195 kms. from the plan of origin to the point exit from this region. The river Kali, which rises near the India-Nepal- Tibet, tri-junction follows a southwesterly course and runs almost at right angle to the lower Himalayan and Siwalik ranges. This system covers the district of Pithoragarh and the eastern part of Almora and Nainital districts. The Kali system drains near about one-fourth portion of the region. The river Kali has two headwaters, i.e. the Kala Pani and the Kuti Yankti.

The Kala Pani and Kuti Yankti headwater, as a source of water to the river Kali, are situated in the east and the west of the river respectively.
The *Kala Pani* is a collection of perennial springs while the *Kuti Yankti* takes its origin from the snow field of Himadri. Receiving water from these head waters, the *Kali* river flows in a southwest direction upto Jauljibi (120 km. away) where it is joined by another tributary *Gori Ganga*. Another important tributary of the *Kali* is *Sarju*, which brings a large amount of water and after flowing 105 kms. from the origin it meets *Kali* at Pancheshwar, 45 kms. below Jauljibi. Further down, *Lohawati and Ladhia* join *Kali*, which are its two important tributaries. *Kali* enters into the Ganga plain at Bamles.

1.1.4 **Flora and Fauna**:

Flora and fauna of Uttar Pradesh are vital tourism resources. Shorn off their green mantle, our beautiful mountains and hills would be bare rocks and without the colourful fauna these lush green meadows and verdant hills would be wanting in the 'romance of wilderness'; the soft twitter, the sweet chirp and the wild cries of forest birds and animals are 'vital feelings of delight' which a mountain sojourner would look for. They, indeed, are our precious national heritage.

1.4 **Flora**:

The concept of forest recreation in India is comparatively of recent origin. The creation of National Parks and Wildlife Sanctuaries, borrowed concept, has taken root in India.

The forests of Uttar Pradesh show diversity in composition because of their wide geographical and altitudinal distribution. The Himalaya has a natural cover of vegetation ranging from subtropical forests to sub-arctic vegetation.
Systematic surveys about the vegetation cover of Uttar Pradesh Himalayas have not yet been conducted properly, hence very limited literature is available. Hooker (1909) and Champian (1909) have presented very comprehensive material on the vegetation types of Himalayas for the first time. Osmastan, Schweinfurth and G.S. Puri also contributed towards the vegetation cover of Uttar Pradesh Himalayas.

According to Champian, the Himalayan region can be divided into six vegetation belts according to height above sea level.

1. Upto 3,000 ft. Tropical moist deciduous (sal trees)
2. 3,000 - 6,000 ft. Sub-tropical, pine trees (often upto 7,500 feet on the southern slopes)
3. 5,000 - 11,000 ft. Moist temperature: mainly conifers, some oak trees.
4. 6,500 - 8,000 ft. Dry temperature; often conifers (mainly in drier inner valleys)
5. 9,500 - 11,500 ft. Alpine; denses small crooked trees, firn and rhododendrons.

Following the classification proposed by Champian, Rautela in 1963 classified the vegetation of Kumaon into three types according to the altitude.

1. 248 - 1,350 m (800-4,500 feet) - Sub tropical zone
2. 1,350 - 1,900 m (4,500-6,250 feet) - Temperate zone
3. 1,900 - 3,050 m (6,250-10,000 feet) - Alpine zone
The main feature of the forest types of Uttar Pradesh Himalaya is that the forest stretches from northwest to southeast direction according to the extension of mountain ranges.

In the light of above classifications, it is possible to divide Uttar Pradesh Himalaya into four main forest zones (Singh R.L., 1971).

1. Sub-tropical zone (below 1,200 metres)
2. Temperate zone (1,200 - 1,800 metres)
3. Sub-alpine zone (1,800 - 3,000 metres)
4. Alpine (3,000 - 4,500 metres)

**Sub-Tropical Zone**

This zone is characterised by greater rainfall (250 cms or more annually) with fairly warm temperature (40°C). The climatic conditions of this zone make the soil rich with humus for the growth of vegetation. The sub- Himalayan tract of this region is covered with plants of sub-tropical zone. This vegetation zones occurs upto the height of 750 metres towards northern slopes and upto the height of 1,200 metres towards the southern slopes.

*Sal (Shorea robusta)* the most prominent species of this region, is usually found upto the height of 1,525 metres. *Sal* forests are typical high forests, as trees attain a height of usually 25 metres and occasionally 35 metres. These trees shed their leaves with the beginning of dry season. *Sal* trees are of great commercial value as they fulfil the needs of household purposes. Scientific forest management has also focused largely on the
development of sal trees. Environmental aspects influence the distribution of sal trees, as in ‘duns’, the northern aspect displays tendency towards pure sal forest and southern aspect towards mixed forest. Sal trees are quite prominent along the courses of rivers.

Besides sal (Shorea robusta), the other species are also found in this zone are haldu, (Adina, cordifolia); dhuari (Largerstromia purviflora); sain (Terminalia tomentosa) and tun (Cedrela toona). Bhyunal is another important tree of this region which usually grows in the valleys and lower hill slopes. Mango, pipal and banyan trees of plains are also found on the lower slopes of the hills.

In the low rainfall and high rainfall regions dry deciduous and moist deciduous trees appear. The floristic composition in dry deciduous is angle marmelos, dry bamboo- break (Dendrocalamus strictus), etc., and in the moist forest is Kanyu (Holontela integrifolia) Kuri (Nyetanth esarbottrists) semal (Samlia mala bariea), amaltas, dhundi, etc.

Temperate zone:

This zone of forests occurs between sub-tropical and sub-alpine zone from 1,500 metres to 1,800 metres. The temperate forests appear upto 1,900 metres towards the southern slopes and upto 1,800 metres towards the northern slopes (Osmastan, A.E., 1927). Here broad leaved evergreen trees are mixed with conifers. The dominant tree in this zone is chir or chil (Pinus roxburghic longifolia), which is light green in colour and forms an open forest of 20-30 metres height. There are few shrubs and under-growth grass which appear during the monsoon. Just before the rainy
season, the ground is covered with the long needles (Syn. P. Longifolia) very slippery to walk on, especially when on steep slopes. Forest fixes are very common features during the winter when the vegetation is dry (Tyagi, N. 1991). The *chir* trees with high quantity of resin are highly inflammable.

The *Chir* produce useful timber for furniture, boxes, buildings and railway sleepers. Resin is tapped extensively from these forests, from which turpentine oil is obtained. The process of resin collection gives employment to large number of people in Kumaon. The valley of Giri and the Tons rivers are full of *Chir* trees. They are also found extensively in the Yamuna, Bhagirathi and Alaknanda river valleys. Extensive forests appear round Ranikhet and Almora. As the height increases the *pine* trees give way to oak trees.

**Sub-Alpine zone:**

This vegetation zone starts from 1,800 metres and continues upto 3,000 metres. The forests of this zone covers a considerable area of the region. It can usually be divided into two strips i.e. (i) the Lower sub-alpine zone, and (ii) the higher sub-alpine zone.

The lower sub-alpine zone is dominated by oak trees. There are three types of oak- *Quercus incana*, *Quercus dilatata* and *Quercus Semicarpifolia* with evergreen stiff, leathery and serrated leaves. The prominent associates of banj Oak (*Quercus incana*) in burns (*Rhodoterdron aboreum*). Rododerdron trees with their scarlet bloom in May and June are found around Chakrata and in Ganga Valley when tourists arrive in large number Rhododerdrons appear in different sizes and shapes, i.e. trees
and shrubs. It is not liked by animals. Banj oak is used for making agricultural implements due to its hardened wood. It is also used as fuel. It gradually becomes harder with the elevation and it gives place to moru oak (Quercus dilatata) in higher altitudes. It is the mightest of the three dominant oak trees, attaining 20-30 metres height. Kharsu Oak (Quercus Semicarpifolia) grows just above moru oak (Quercus dilatata).

In the higher sub-alpine zone, the varieties of trees differ according to the elevation. Cypress (Cupressus torulosa) is the most dominant tree from 2,000 to 3,000 metres. Its fine durable wood is commonly used in construction and also as timber and railway sleepers (Spate, O.H.K., 1967). The tree attains a height of 20 metres. Blue pine (Pinus excelsa), silver fir (Abies pindrow) and Spruce (Picea morinda), may be seen from the height of 1,900 metres to 3,000 metres. Blue pine (Pinus excelsa) frequently grows in poor soil and on steep slopes. Birch (Betula utilis) is found from 2,950 metres to 3,600 metres in Bhagirathi valley above Gangotri and at some other locations. Birch trees are usually bent at the base by the pressure of snow. Its bark is used as a substitute for paper. Some undergrowth ferns and alpine herbs are also found. The conifers are rarely higher than 20 metres. The birch trees and other broad-leaved trees are 6 to 10 metres tall. Walnut, and Chestnust also grow in the Bhagirathi, Alakananda and Pindar Valleys. Thin bamboo thickets called 'ningala' are extensively found in the area specially around Almora. All types of conifers provide huge quantity of wood for different purposes.

Alpine Zone:

The birch (Betula utilis) of higher sub-alpine zone continues to
grow in the Alpine zone also. The vegetation makes the upper-most limit of
the tree line, i.e. 4,200 metres and some times may be seen in small patches
even on higher elevations. Above this line there exist temperate grasslands
upto the snowline (4,500 metres). The environmental aspects generally
give way to shrubs in the northern part and grasses in the southern part.
Alpine grasses provide highly nutritive grazing grounds. Pao, Glyceria and
Festuca are the main species of grasses. Some medicinal and plenty of
'Gaggaf', a scented shrub, grow in Pindari and Nilkanth valleys. It is collected
to produce incense. There are a number of varieties of medicinal shrubs
available in higher Himalaya which are yet to be explored and put to use.
Mamiri, a kind of root, is also collected in Uttarkhand. It is used in makings
'Surma' an ash-like material applied in the eyes. Ratan-iyot another shrub
is collected in Yamunotri region.

There is a large variety of flowers in alpine meadows as in the
Valley of Flowers. A good numer of herbs found in the region are getiana,
primula, saifraga, geranium, astem, etc. Palsatillum, aconitum are important
medicinal plants.

1.4 Flora and Fauna:

A large number of forest types, developed under wide range of
climatic conditions, have given birth to varied, colourful and fascinating
wild-life in the region. Magnificent and magesic tigers, elephants, snow-
leopard, brown bears and monal pheasant in the Alpine region, all speak of
the rich and rare wildlife treasure found here. Indeed, deprived of this
splendid fauna, these forests would only be a store house of timber and
would cease to thrill the lovers of nature and tourists.
Wild animals are not only integral part of national heritage but they are potential tourism resource. Some of our best animals are threatened with extinction, others have become rare and most of them are daily dwindling in number. Earlier the killing of wild animals was regarded as a sports but lately, the worldwide tourist movement has changed the outlook of the people on wildlife. A new recreational value has begun to be attached to wildlife and it is preserved and protected for all its aesthetic, economic and recreational value. To protect the wild species and to enable visitors to view them in their natural habitat, Government has created special areas, National Parks and Sanctuaries. In Uttar Pradesh Himalayas a number of parks and sanctuaries have come up, viz. Kedarnath Sanctuary, Valley of Flowers National Park, Corbett National Park, Govind Wildlife Sanctuary, *Nanda Devi* National Park (closed to visitors) and *Rajaji* National Park. The representative wildlife of these regions are elephant (*Elephas maximus*), India's tourist symbol, tiger (*Panthera tigris*), Panther (*Panthera Pardus*), Sloth bear (*Melursus wisinus*), Swam deer (*Cervus duvaucelli*), spotted deer (*Axis axis*), hog deer (*Axis porcinus*), barking deer (*Muntiacus munjak*), four-horned antelope (*Teraceros quadricornis*) and many colourful birds. In the Alpine zone there are some rarest animals found in India, Monal pheasant, (one of the most beautiful birds) brown bear (*Ursus thibetanus* only found in this region of Uttar Pradesh) snow leopard (*Panthera unica*), musk deer (*Moschus mochiferus*), thar (*Hemitragus*) are rare animals. Lakes in Nainital district, the *Ram Ganga* and the *Kosi* rivers invite *mahasheer* (Indian Salmon) anglers.

1.5 Climate:

Climate is a vital tourism factor. It works both as motivator and
dissuader of tourist traffic. Torust-peak and off-peak periods, in many cases are related to weather regimes found at the centre. An obvious fact, that tourists seek besides other things, sparkling bracing quality of weather, makes it a tourism merchandise. In India cool Himalayan resorts attract large number of climate seekers during summer when the sub-continent, particularly the Great Indian Plain, becomes a furnace heat. People like to relax, revitalize, and repair (often rejuvenate) after prolonged exposure to urban life, fatigue and continued sedentary pre-occupations, at centres which have invigorating climates with strong uplifting effect. While tourists, the world-over, are out to discover new lands and people, they invariably seek the same ideal climatic conditions that promote physical or outdoor activity.

Uttar Pradesh Himalayas with a latitudinal spread of 29°5' - 31°25' N and 77° 45'- 81° 00' E, have a milder and soother, approaching ideal conditions for human comfort, while the plains burn and parch in April, May and early June. Apart from Indian tourists number of foreign visitors are seen in these regions originating from all parts of the world.

1.6 Climatology of Recreation:

Severe hot and dry weather conditions mark the seasons beginning from March. In the summer months, the valley experience hot steamy tropical climate, and valley winds in narrow valleys are conspicuous features of the weather of this region. The comparatively warmer, milder and soother climate of the hills attract visitors from hot and burning plains. Nainital (19.7°), Mussoorie (19.9°C) temp people on the plain with their moderate tempertures and adequate amount of relative humidities.
and often the festival of light (Diwali) heightens the joy of it. On the Himalaya however, snow begins to fall and shrines are closed: pilgrim flod their way home.

In December mercury drops to as low as 3° to 4°C and there is considerable amount of percipitation largely in the form of snow on the northerly Himalayas. In January the cool and mainly dry season is at its height and "all things that love the sun are out of doors". Often the night temperatures touched the freezing point and in extreme cases goes below it (Singh, R.L., 1971). Snow falls on the hills as low as 1220-1525 metres (Spate, O.H.K., 1967).

It is seen that Tourists leave their homes to destination irrespective of weather regimes, favourable or unfavourable. Practically every month is full week tourists, whether it be scorching summer or sultry rainy months.