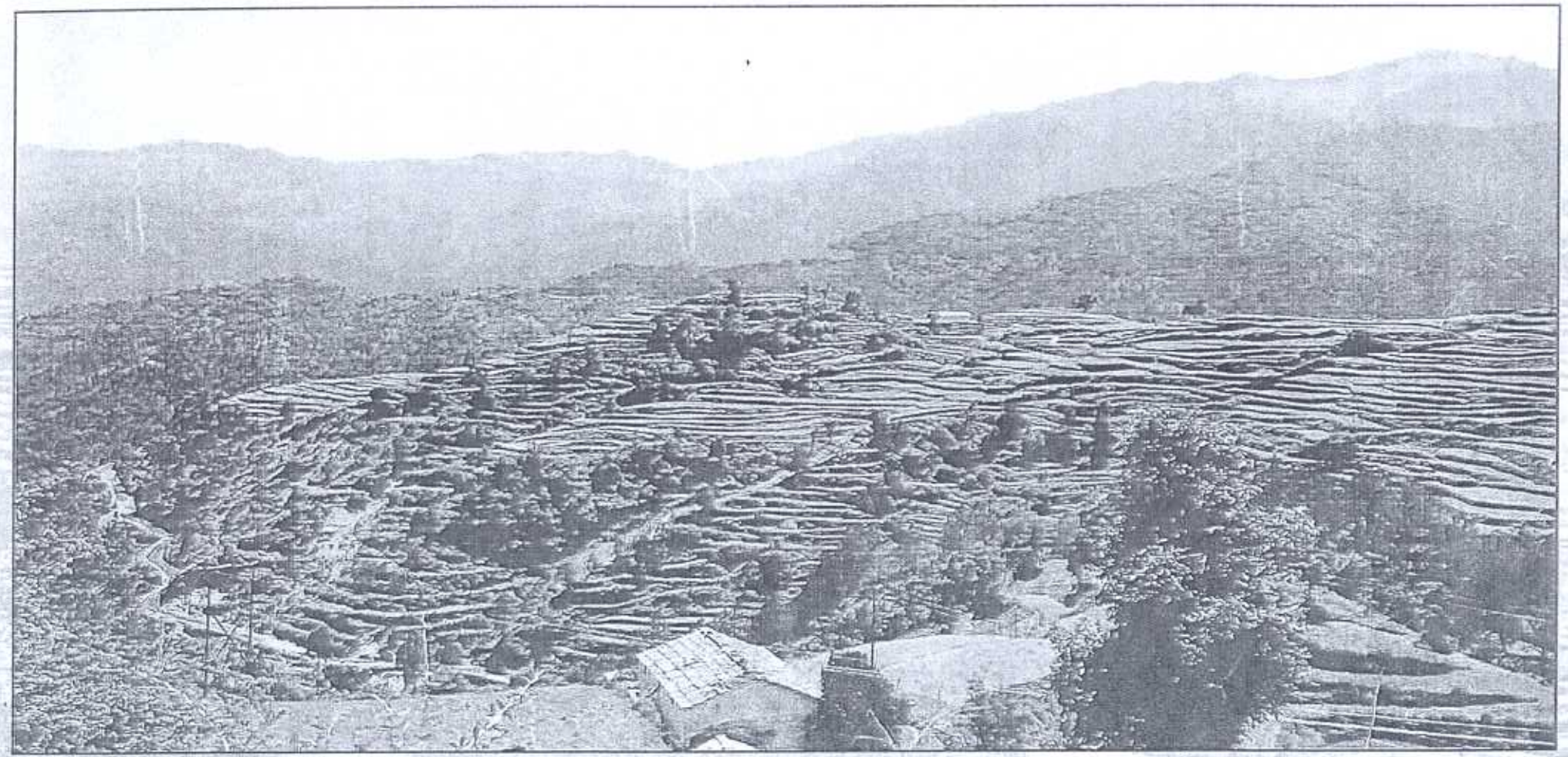
Report – Stage II

FEASIBILITY STUDY FOR SELECTION OF SITE FOR LOCATING THE PERMANENT CAPITAL OF UTTRAKHAND



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LOCATIONAL CRITERIA

1.0 INTRODUCTION

The State Capitals are the engines of growth of the States and hub of economic, social, political, administrative, educational and sports activities. A State Capital while functioning as the administrative centre must also possess the ability to direct the State onto the path of development and growth. A Capital should be able to fulfill the basic needs for the growth and development of the State as well as the future requirement needs. Moreover, Capital cities are temporal seat of administrative and legislative functions and act as a major employment generation centers.

1.1 INTRODUCING THE DISTRICTS

The State of Uttrakhand is located at a longitude of 77°34'27" E to 81°02'22" E and latitude of 28°53'24" N to 31°27'50" N. The State at present comprises of 13 Districts, 86 cities/ towns and 1620 villages. The total area of the State is 53, 483 sq.km. which constitutes 1.69 percent of the total area of the country. The hilly part of Uttrakhand constitutes 88 percent of total reporting area, out of which forest area alone constitutes approximately 70 per cent and agriculture area is very low, at approximately 11 per cent. The rest 19 per cent area comes under miscellaneous categories. Enough land is required to cater to all the Capital functions efficiently. The state of Uttrakhand has tremendous potential of developing tourism industry due to the beautiful landscape, religious places, trekking trails, national parks, mountain peaks and historical and archeological sites. Apart from tourism, the rural population is engaged in agriculture. Doon valley, Nainital district, Udham Singh Nagar and Haridwar districts produce large quantities of food

grains. The region also holds good promises for developing herbal pharmaceutical industry owing to abundant medicinal plants. It is hoped that by development and proper exploitation of its natural resources, Uttrakhand can overcome its economic backwardness. Similarly, the location of site for permanent capital can also be exploited to correct some of the regional imbalances present.

As discussed in the report of Stage 1, the conceptualized criteria are applied to the districts of the State of Uttrakhand and then the results combined to identify areas where the proposed state capital could be located. These criteria are given in detail as follows:

1.2 CENTRALITY

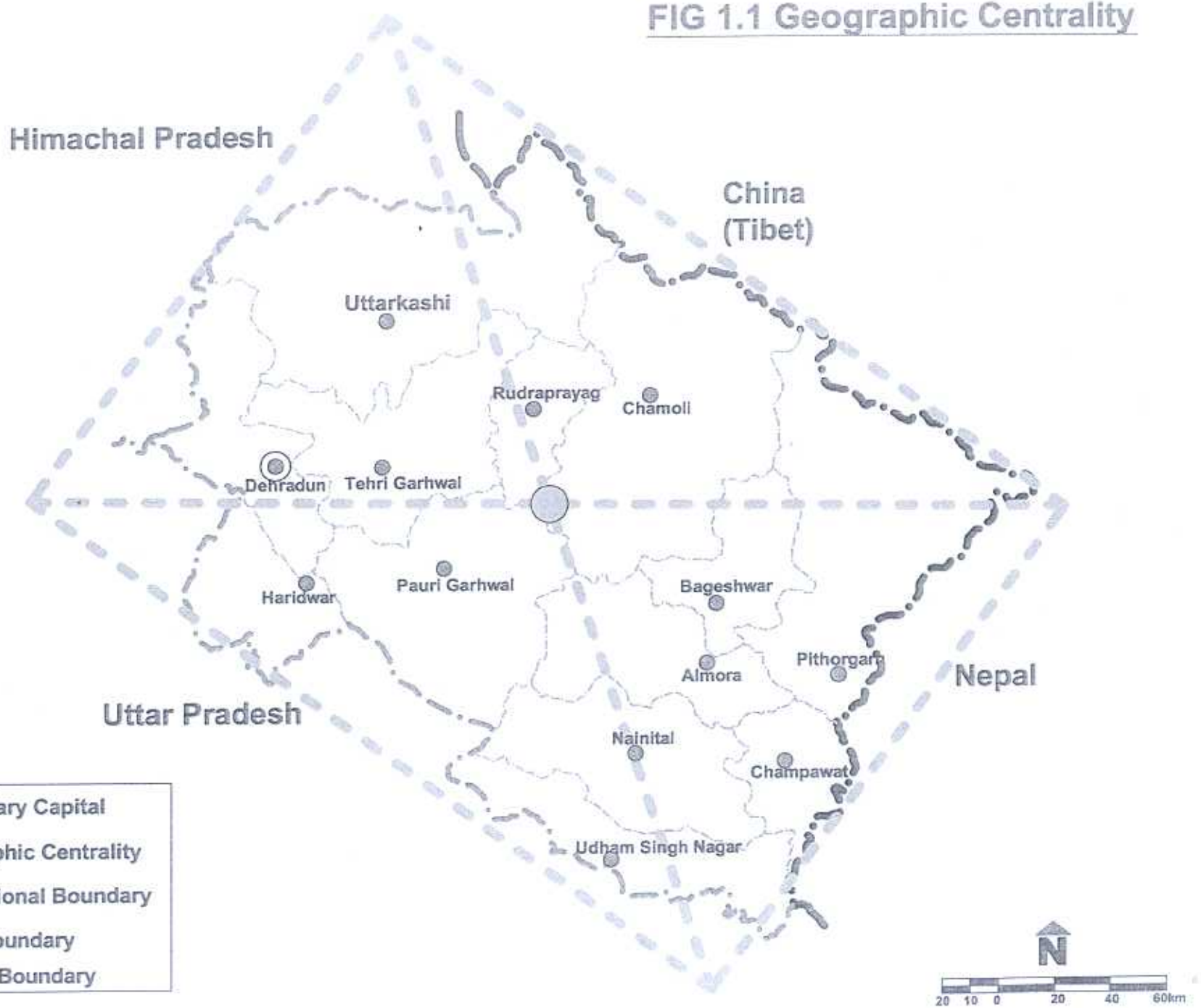
This criterion has been analyzed in two ways:

a. Geographical Location
b. Population Distribution

1.2.1 Geographical Location

Geographical centrality is based on physical boundaries of the State. The shape of Uttrakhand is more or less of a rectangle of 225 X 310 km, as close as possible to the State boundaries. The diagonals of the rectangle are drawn and the point of intersection gives the geographic centre of the State. Approximately, this centre falls on the boundary of Chamoli and Pauri Garhwal, about 20km away from Gairsain, an important village in the vicinity (Fig. 1.1). This alone

FIG 1.1 Geographic Centrality



shows geographical centrality of Gairsain. However, as mentioned in the report of stage I, this is not a very suitable criterion in hilly areas.

1.2.2 Population Distribution

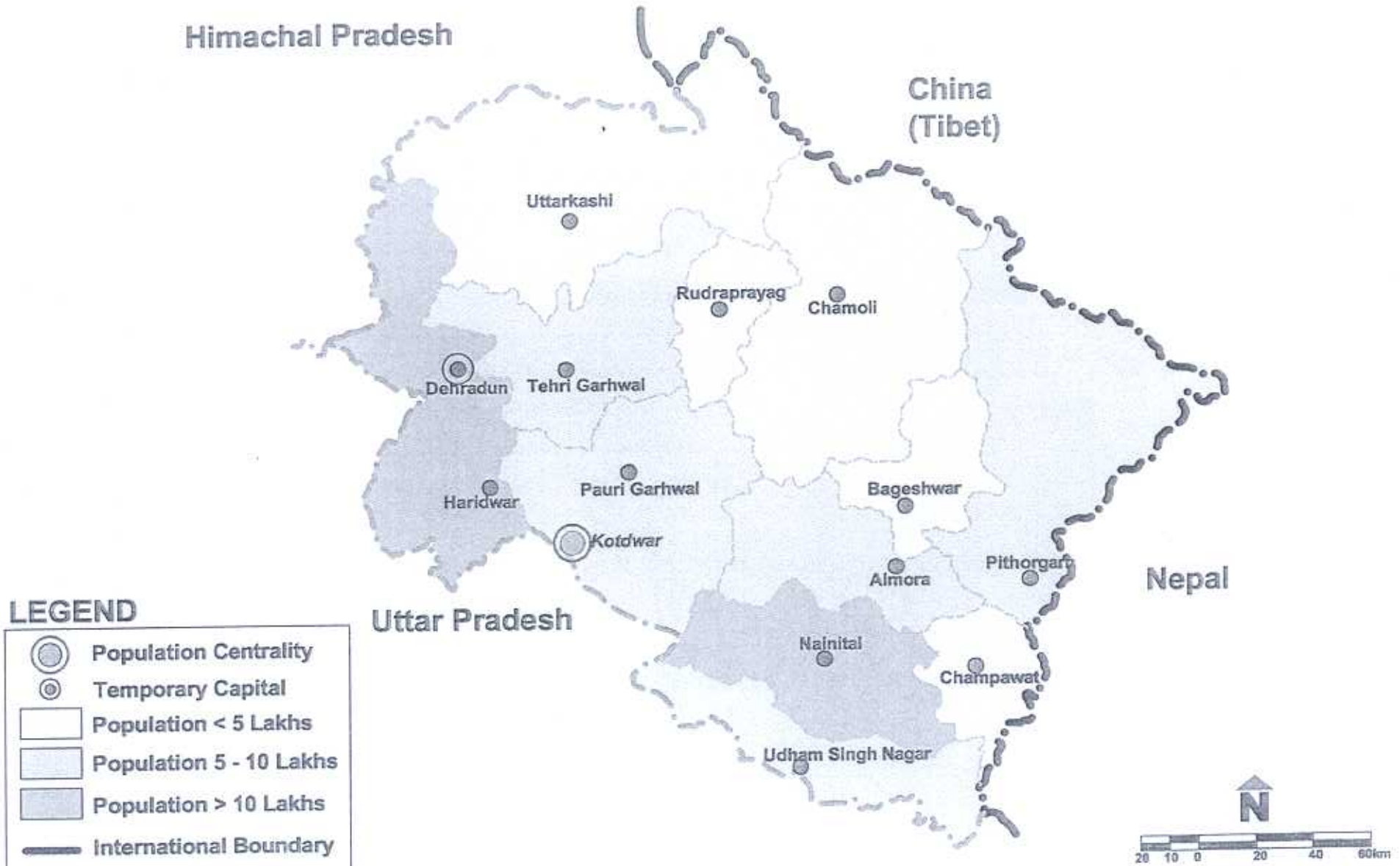
This essentially means the central location with respect to the population distribution in the State. The centre of gravity (centre of mass) is calculated by assuming the thirteen districts of the state, to be the thirteen geographical areas with population of the respective districts as their masses.

TABLE1.1 UTTRAKHAND: POPULATION DISTRIBUTION BY DISTRICT, 2001

District	Population
Almora	8,36,617
Bageshwar	2,24,172
Champawat	1,97,000
Chamoli	4,54,871
Dehradun	10,25,679
Haridwar	11,24,488
Nainital	15,40,174
Pauri Garhwal	6,82,535
Pithoragarh	5,66,408
Rudra Prayag	2,00,451
Tehri Garhwal	5,80,153
UdhamSingh Nagar	9,14,861
Uttarkashi	2,39,709

Source: Census of India, Provisional Population Tables, 2001.

FIG 1.2 Population Centrality



Source: Drawn from Census of India,Provisional Population Table,2001

Approximate centre points of these geographical areas are marked assuming that the population of the district is concentrated at that point (Fig.1.2). Table 1.1 gives population of the State by districts for the year 2001. The two axes X and Y are taken as reference at the extreme left of the state and the co-ordinates of each of the assumed centers of the districts are calculated in terms of horizontal and vertical distances from X and Y axis, respectively.

The co-ordinates of centre of gravity (CG) can then be calculated using:

$$CG(x) = \frac{P1x1 + P2x2 + \ldots\ldots\ldots\ldots\ldots\ldots + Pnxn}{P}$$

$$CG(y) = \frac{P1y1 + P2y2 + \ldots\ldots\ldots\ldots\ldots\ldots + Pnyn}{P}$$

Where P = total population of the State

P1, P2..... Pn = population of each district

X1, x2..... xn = horizontal co-ordinates of district centres

y1, y2.....yn = vertical co-ordinates of district centres

X, y = co-ordinates of the centre of gravity of the state

The co-ordinates of centre of gravity of population lie at 115.28 km, 127.28 km respectively from the reference axis. This point lies somewhere in the district Pauri Garhwal, near Kotdwara, as shown in Fig1.2, indicating centrality in respect of population distribution. However, Kotdwara is not considered as a node for population centrality because it is only showing the centrality due to the population density of Dehradun and Haridwar in one side and Nainital on the other and not a centre of population by itself.

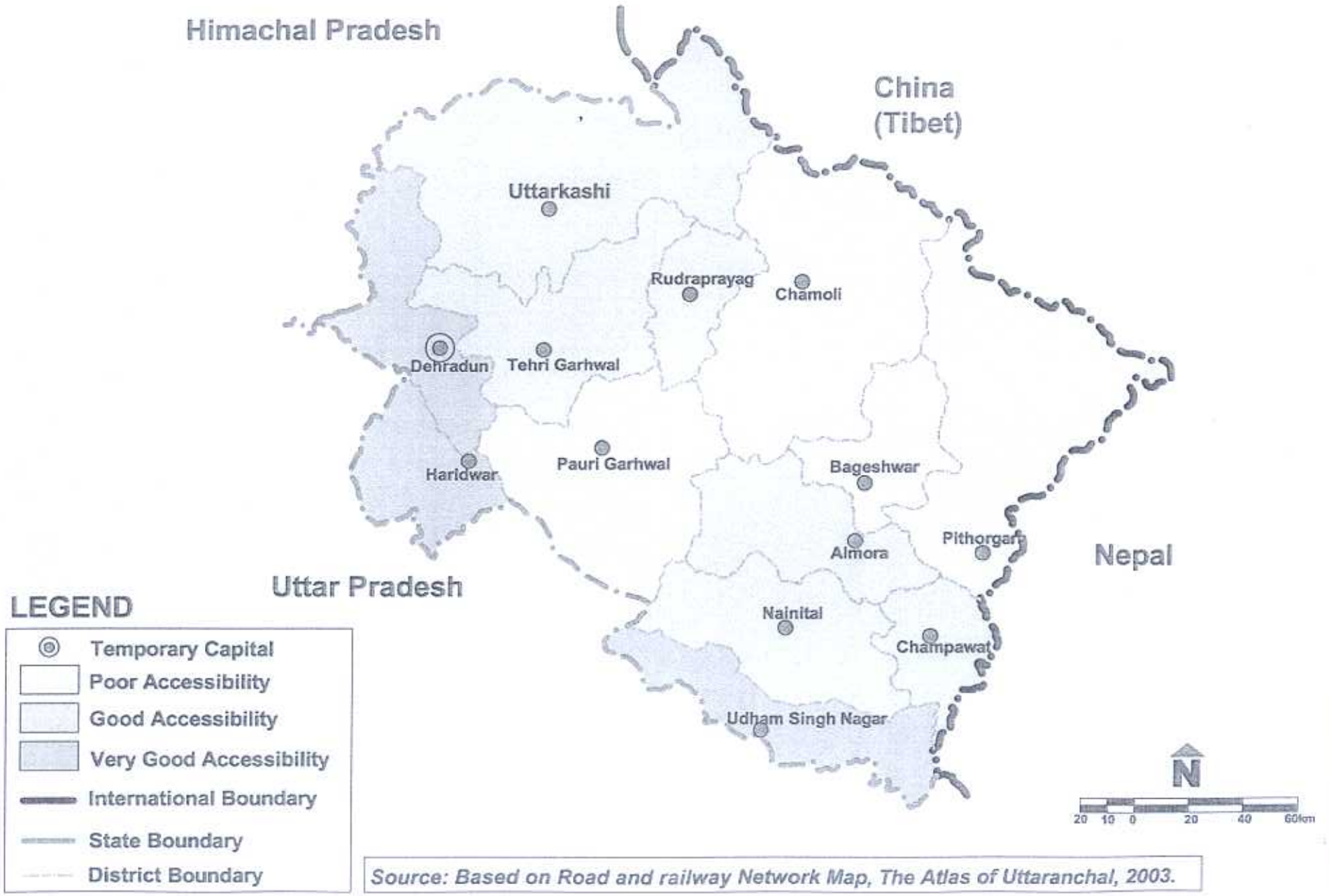
1.3 Accessibility by Road

The term 'Accessibility' is understood as the ease with which one place can be reached from the other. For this purpose, a 'Shortest path matrix' was formulated within the State of Uttrakhand. Then from this matrix, a 'Shimbel Index' was calculated. 'Shimbel Index' is a measure of accessibility, which indicates the number of links needed to connect any node with all other nodes in the network by the shortest path matrix; the total for each row gives the 'Shimbel index'. The nodes having lower 'Shimbel index' is more accessible.

However, due to the hilly region, the concept of 'Shimbel Index' could not fit in our case study and hence gave illogical results. Therefore, the 'Shimbel Index' method was subsequently dropped.

Keeping in view the physiography factor of the State, a simpler index method has been formulated and a new weightage has been assigned. In this method, the accessibility has been calculated based on the Road and Railway network density (length in km. per unit area) of each of the districts as given below. These densities were further assigned weights in the order of 0, 1 & 2.

FIG 1.3 Accessibility by Road



Source: Based on Road and railway Network Map, The Atlas of Uttaranchal, 2003.

Table1.2 ACCESSIBILITY OF DISTRICTS IN UTTRAKHAND (based on Road and Railway Network Density)

DISTRICTS	TRANSPORTATION DENSITY	WEIGHTS ASSIGNED
Haridwar	0.096	2
Udham Singh Nagar	0.079	2
Dehradun	0.058	2
Rudraprayag	0.042	1
Tehri Garhwal	0.033	1
Nainital	0.031	1
Almora	0.025	1
Champawat	0.022	1
Uttarkashi	0.022	1
Chamoli	0.017	0
Pauri Garhwal	0.015	0
Bageshwar	0.014	0
Pithoragarh	0.012	0

Source: Based on the Road and Railway Network Map, The Atlas of Uttaranchal, 2003.

1.4 PHYSICAL FEASIBILITY

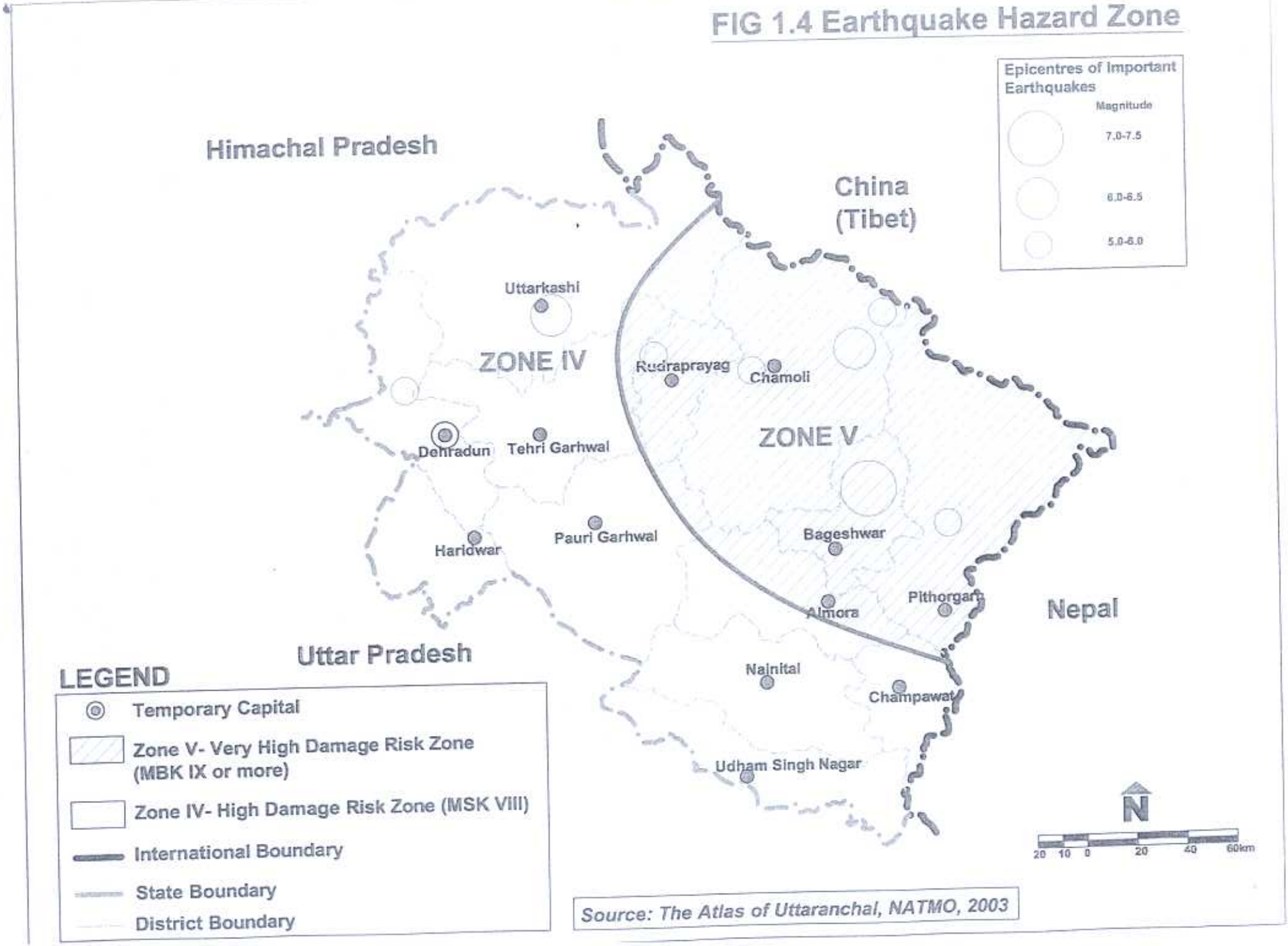
1.4.1 Seismic Zones

Uttrakhand being the hill state is mainly prone to two types of disasters i.e. earthquakes and landslides. These natural disasters could have catastrophic consequences for all settlements including the proposed state capital. Therefore, analysis is intended to show vulnerability of large areas to these disasters.

Earthquakes: The earthquake zonation map of India shows vulnerability of Uttrakhand in terms of earthquakes (Fig1.4). The whole state is vulnerable to earthquakes because it lies in seismic zone IV and V (Building Materials & Technology Promotion Council, BMTPC; 1997). But the districts and their parts lying in zone V are more prone to earthquakes. These districts are Pithoragarh, Chamoli, Rudra Prayag, Bageshwar and Almora (Fig1.4). These districts have seen some of the devastating earthquakes in the past at a frequency of once in 9 years of magnitude M6.0-7.5. Due to topography, even the northern parts of the zone IV in the state are vulnerable to earthquakes primarily including the district of Uttarkashi where earthquakes have disturbed the life in recent years. Therefore, the districts in zone V are not suitable for intense development activities and hence, not favorable for proposed Capital location (Fig1.4).

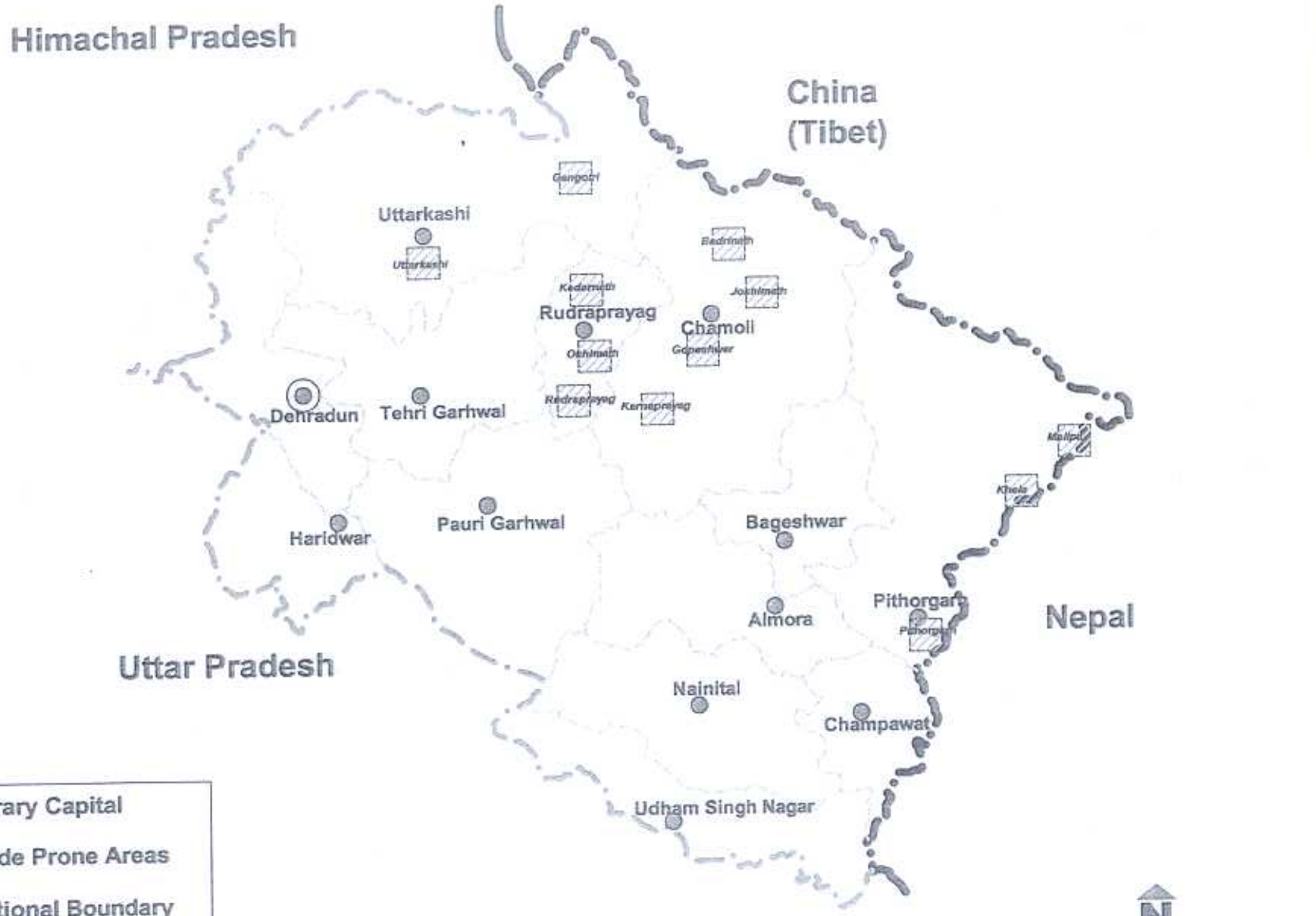
Landslides: Being a hilly state, the landslides become an important consideration in siting of the Capital location. These features are sometimes responsible for heavy loss of life and property, which may be a negative factor for locating the Capital. Looking at the landslide prone areas (Fig1.5), districts of Uttarkashi, Rudraprayag, Chamoli and Pithorgarh have significant landslide prone areas and therefore should be avoided.

FIG 1.4 Earthquake Hazard Zone



Source: The Atlas of Uttaranchal, NATMO, 2003

FIG 1.5 Landslides



Source: The Atlas of Uttaranchal, NATMO, 2003

Slopes: The Atlas of Uttaranchal (2003) shows the slopes in various parts of the state, ranging from flat (10-20 mt per Km) to very steep slope (more than 600 mt per Km). The area in and around the districts of Haridwar and Udham Singh Nagar are generally flat i.e. ranging up to 20 mt per Km. The area in and around the district Dehradun have a gentle slope of 20-80 mt per Km. The districts of Pauri Garhwal, Nainital and Almora have a steep slope of 150-300 mt per Km. The rest of the state generally comprising the districts of Tehri Garhwal, Uttarkashi, Rudraprayag, Chamoli, Bageshwar, Pithorgarh and Champawat have steep slopes to very steep slopes of 300 mt per Km and above. Keeping in the mind that steep and very steep slopes are not suitable for the high intensity urban activity, only the districts of Dehradun, Haridwar and Udham Singh Nagar are favorable for location of the capital.

1.4.2 Environmental Concerns

Reserved and protected forest areas are environmentally sensitive zones especially in case of hilly areas and hence, to be protected at all costs. These forest areas are to be kept untouched for proposed capital location. Even the areas adjacent to these forest areas are not suitable for the location of Capital due to the expansion possibilities and spillover of activities. Fig1.6 shows comparative percentage of reserved and protected forests in Uttrakhand. The districts with a cover of reserved and protected forests cannot be considered for Capital location to minimize disturbance in ecologically sensitive zones. Table1.3 shows the approximate percentage of area under reserved and protected forests in each district. The forest cover of the whole State is 63.96 percent. Therefore, the districts with percentage of reserved and protected forests below this value are more suitable for Capital location (Fig1.6). Districts Bageshwar, Chamoli, Dehradun, Haridwar, Pithorgarh and Udham Singh Nagar would be preferred from this. The districts with more forest covers are to be left undisturbed.

FIG 1.6 Environmental Concern

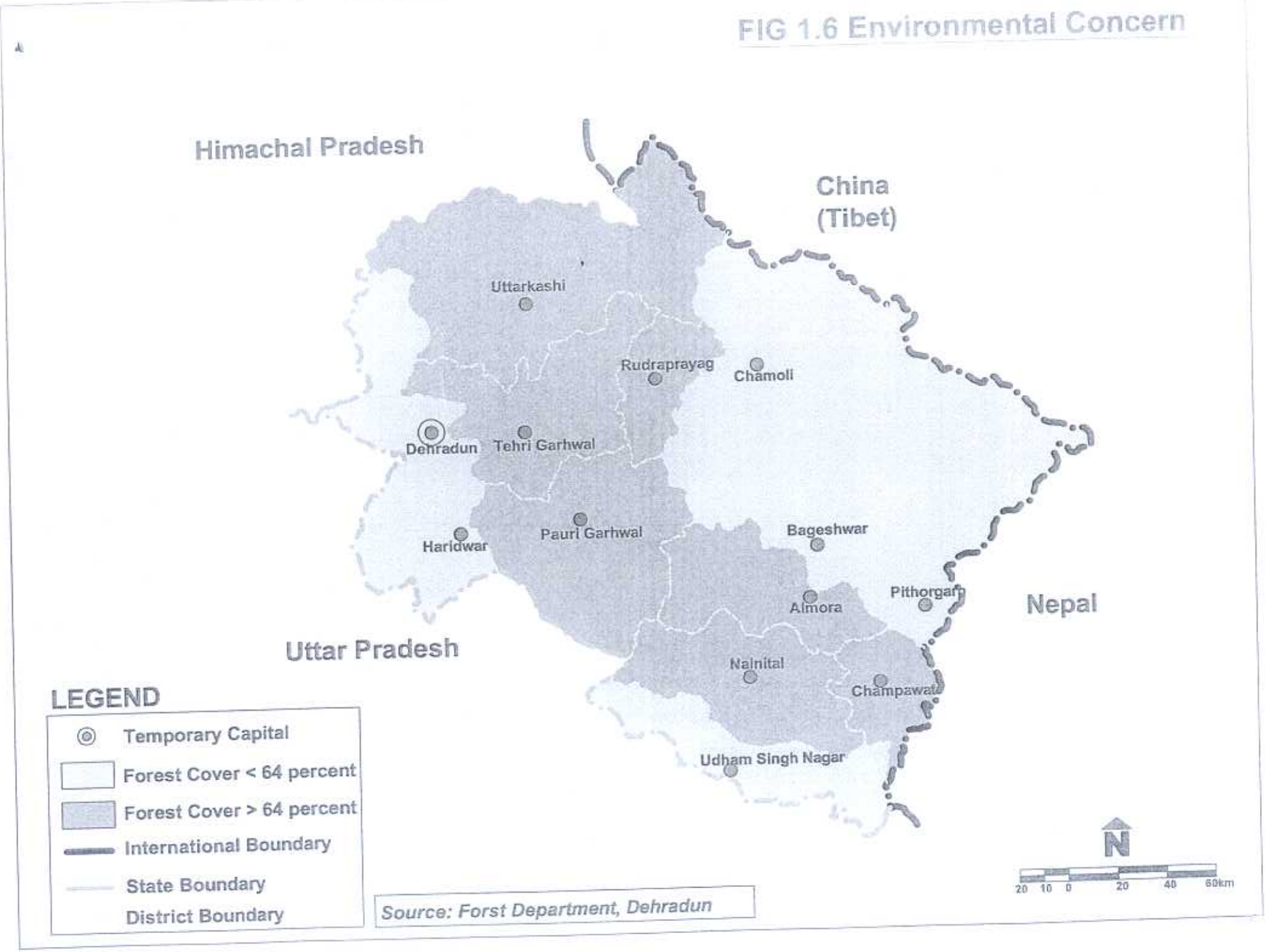


Table 1.3 PERCENTAGES OF RESERVED AND PROTECTED FORESTS IN DISTRICT OF UTTRAKHAND

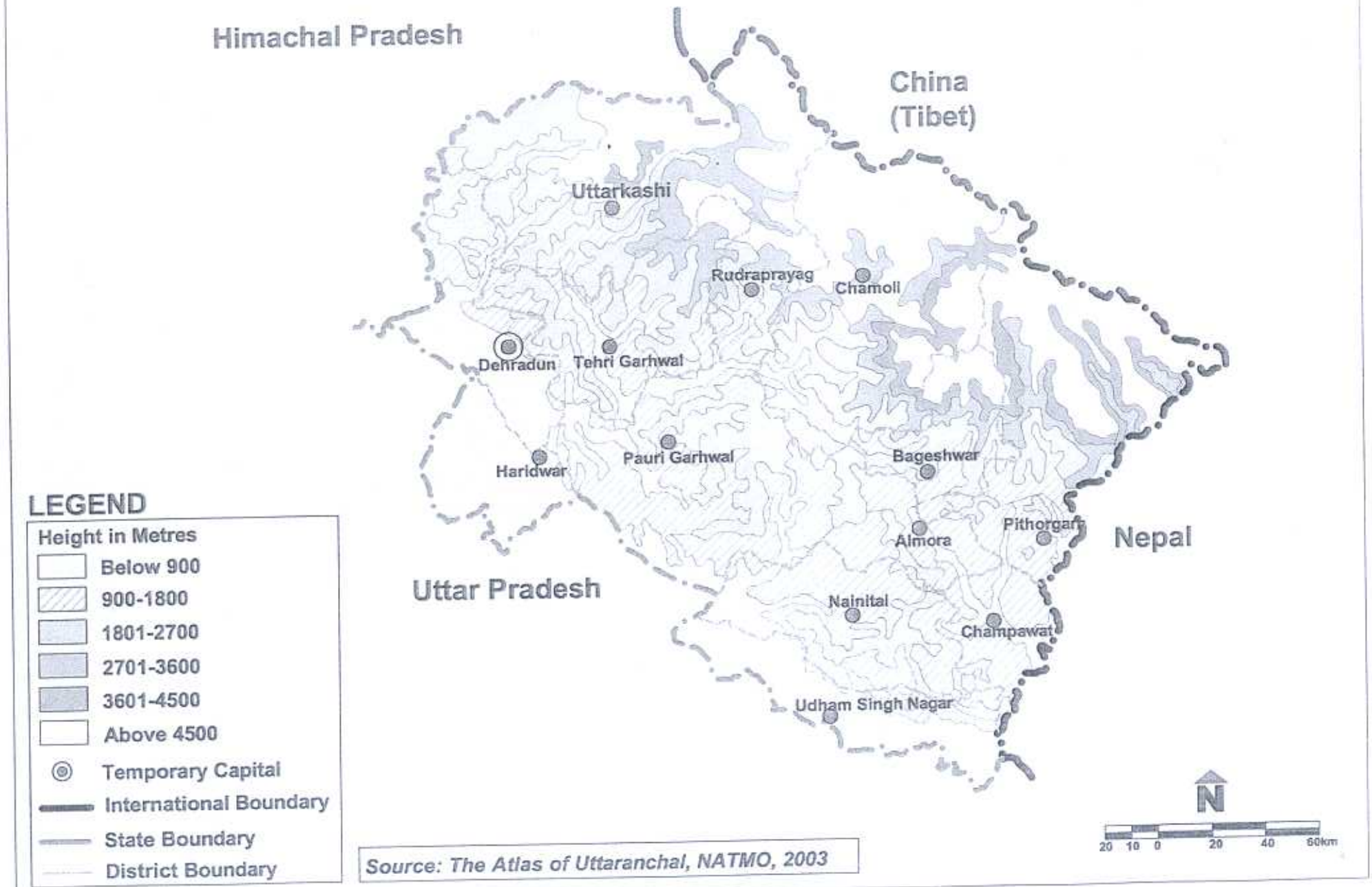
DISTRICTS	PERCENTAGE RF&PF
Almora	74.69
Bageshwar	49.02
Chamoli	62.90
Champawat	74.85
Dehradun	62.06
Haridwar	30.69
Nainital	70.17
Pauri Garhwal	72.03
Pithoragarh	28.76
Rudra Prayag	90.67
Tehri Garhwal	88.42
Udham Singh Nagar	36.49
Uttarkashi	90.00

Source: Forest Department, Uttrakhand, Dehradun

1.4.3 Topography and Climate

The geographical features of the state impose limitations on development in general and the location of Capital in particular. The region is mostly hilly (approx. 88 percent) and the remaining (12 percent) falls in the plains. All the thirteen districts in Uttrakhand can be grouped into three broad categories based on their physiographical characteristics:

FIG 1.7 Topography (Altitudes)



Source: The Atlas of Uttaranchal, NATMO, 2003

- The high mountain region (major portions of Bageshwar, Chamoli, Uttarkashi, Pithoragarh, Rudra Prayag districts).
- The mid-mountain region (major areas of Almora, Nainital, Pauri Garhwal, Tehri Garhwal Districts).
- The low mountain region (Dehradun, Haridwar, Champawat, Udham Singh Nagar Districts).

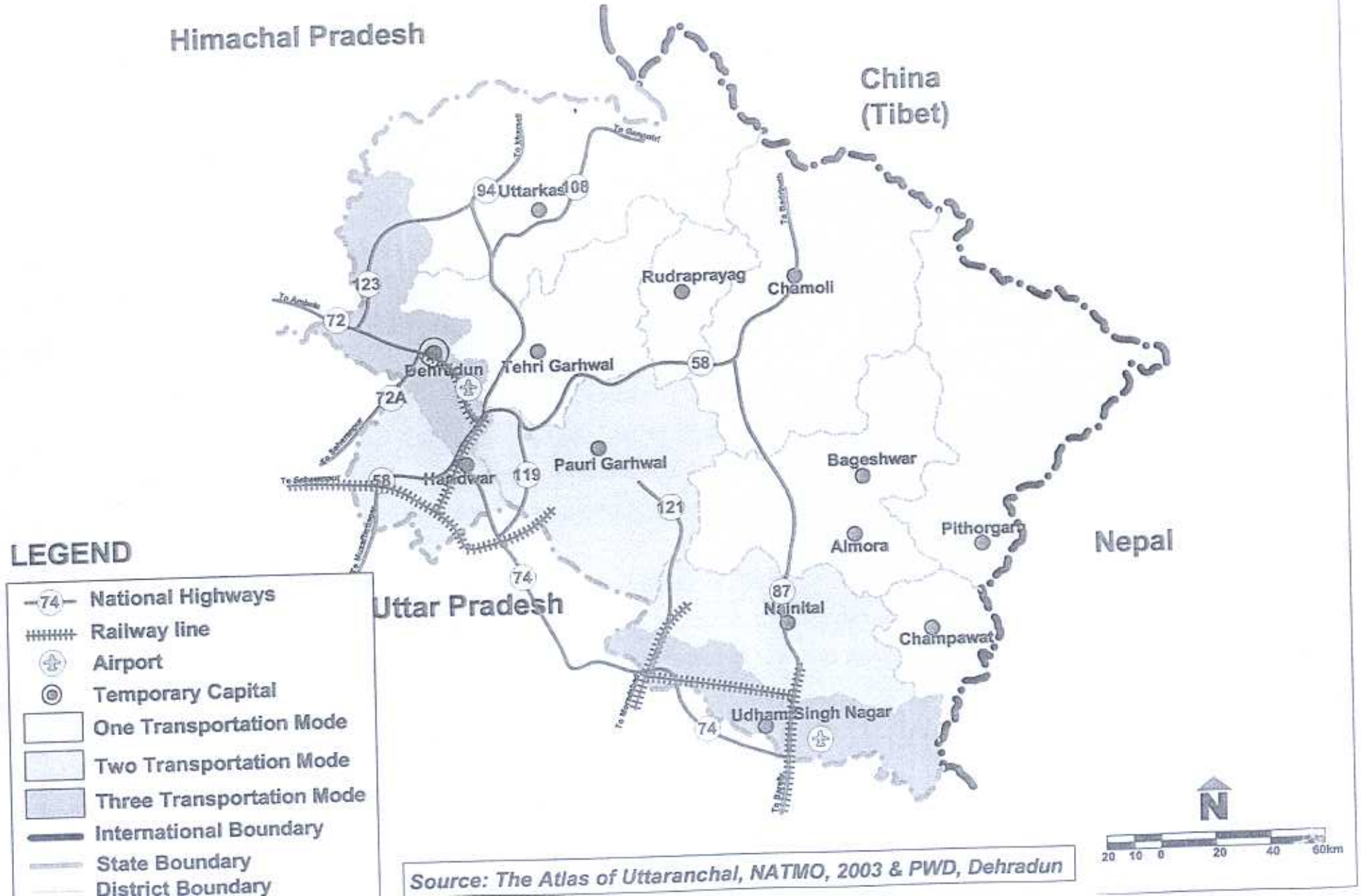
Most of the habitation in the State is below the fault line of Main Central Thrust i.e. in lesser Himalayas, Chivalries and Terai-Bhabar zones. Topographically, the altitude of these zones is suitable for development. Terai/ Bhabar and Shivaliks and the river valley areas of lesser Himalaya zone are relatively flat and hence suitable for development (Fig1.7). Northern parts of districts Uttarkashi, Chamoli, Pithoragarh and Bageshwar are unsuitable in respect of topography due to high altitudes.

The State has two distinct climatic regions, the predominant hilly terrain and the small plain region. Summers are unbearable with temperature going over 40°C and a lot of humidity. Winters can be chilly with temperatures going below 5°C at times. The Himalayan region has Alpine conditions characterized by cold winters with snowfall for quite a long time, good rainfall in the monsoon, and mild summers.

1.5 Transport Modes

The availability of the type of transport modes by road, rail and air affects the siting of the proposed Capital. The major National Highways passing through different districts are as follow:

FIG 1.8 Transportation Modes



Source: The Atlas of Uttaranchal, NATMO, 2003 & PWD, Dehradun

District	National Highways	State Highways
Dehradun	72, 72A, 123, 58	1, 8
Chamoli	58, 87	11, 12
Udham Singh Nagar	74, 121, 87	13
Nainital	121, 74	14, 13
Pauri Garhwal	119, 74, 121	

Rail links extend from the neighboring plain areas to the southern parts of the State. The overall rail transport is not well developed in the State. Topographical aspects of the State enhance these limitations. Among the districts, Haridwar and Udham Singh Nagar show developed rail connection. Some parts of the districts of Dehradun, Nainital and Pauri Garhwal are also connected by rail (Fig1.8). Rail transport in the State is mainly useful for the inter-state linkages but not developed for intra-state transport network. Existence of rail connections is desirable for the location of the proposed Capital.

Airport exists at two locations in the State (Fig1.8). One of them is situated between Dehradun and Rishikesh in Dehradun District and the other near Pantnagar in Udham Singh Nagar District. Location of Capital in proximity to airport sites or near sites having potential to develop new airports is advantageous.

Presence of various modes of transport affects the accessibility of the proposed capital location. Taking the national highways, rail and air linkages into account, the districts Dehradun and Udham Singh Nagar possess all the three modes of transport followed by Haridwar, Nainital and Pauri Garhwal with two types of modes-National Highway and

rail links. Chamoli with National Highway passing through and Nainital possessing rail links are the districts with at least one important transport mode (Fig1.8).

Delhi is located on the Southwest side of Uttrakhand. Dehradun, Haridwar, Pauri Garhwal and Udham Singh Nagar are the districts that are well connected to the National Capital, Haridwar being the nearest of them all.
Thus, the transport network is well developed in southern parts of the State, making it as a preferred area for locating the proposed Capital state.

1.6 Acceptability by the People

Several discussions have been made by various groups of people and several views have been published in magazines, newspapers, etc. The *Uttrakhand Rajdhani Sthal Chayan Ayog* has also sought and received opinions from 251 persons, out of which about 45 percent of the people were of the opinion that Gairsain should be considered for location of capital. Another 22 percent people felt that capital may be located at any other place (see Fig 1.9a for details).

Fig 1.9a: Survey Opinion Response by People

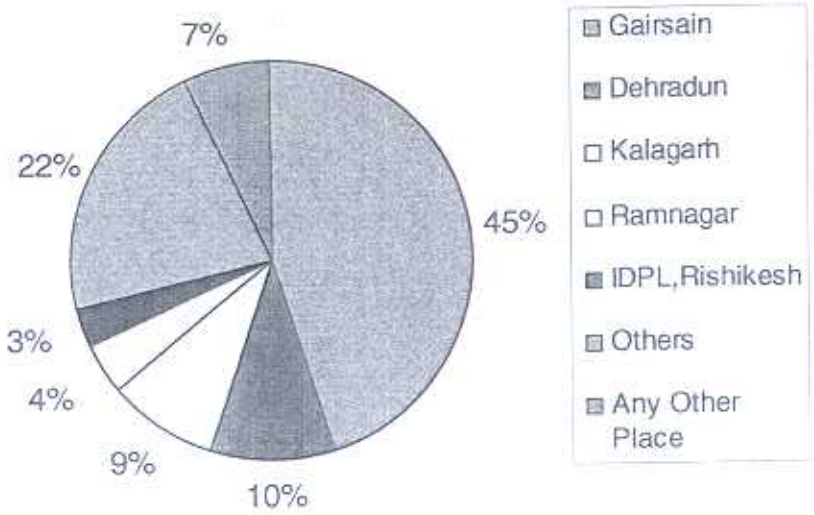


Table 1.4 People's Response on the Location of the State capital of Uttrakhand

Locations	Opinion percent	Reasons for selected locations	District	Opinion percent
Dehradun	40	Accessibility by road, air,rail,climate, security, facilities and infrastructure, land availability, institutions, safety from natural calamities in between hills and plains	Dehradun	46
Rishikesh	6	existing infrastructure, low investments, land availability, regeneration of sick industries		
Roorkee/Laksar	4	Land availability, good connectivity by NH and rail, good accessibility, existing facilities	Haridwar	4
Gairasain	10	For development of remote areas, identity of hill people, lies on border between Garhwal and Kumaon divisions, centrality	Chamoli	10
Kalagarh	10	Population distribution, land availability, accessibility, existing infrastructure, flat land	Pauri Garhwal	12
Kotdwar	2	Rail links, land availability, accessibility, central		
Ramnagar	6	Accessibility, rail links, existing facilities	Nainital	10
Haldwani	2	Accessibility, facilities, land availability		
Nainital	2	Kumaon identity, tourist place, existing high court, facilities		
Chaukhutiya	2	Land availability, hill identity	Almora	2
Any central location	16	Ease of access, smooth administration		16

Source: Bansal, Arjita (2002); Planning Approach for the Location of State Capital of Uttranchal, unpublished Thesis.

Several people have given various reasons for location of proposed Capital, viz. accessibility by road, rail, good connectivity by National Highway, existing infrastructure, land availability, vulnerability to natural calamities, etc. Stress has been placed on the importance of the availability of water at the site of the proposed Capital location followed by availability of land for future expansion. There are emotions attached, relating to the struggle for the formation of the state. Although it is difficult to quantify and rank emotional values, Gairsain, Dehradun and Kashipur-Ramnagar find significant mention as preferred locations in various documents.

1.7 Security

This aspect can be studied in two ways:

a. External Security
b. Internal Security

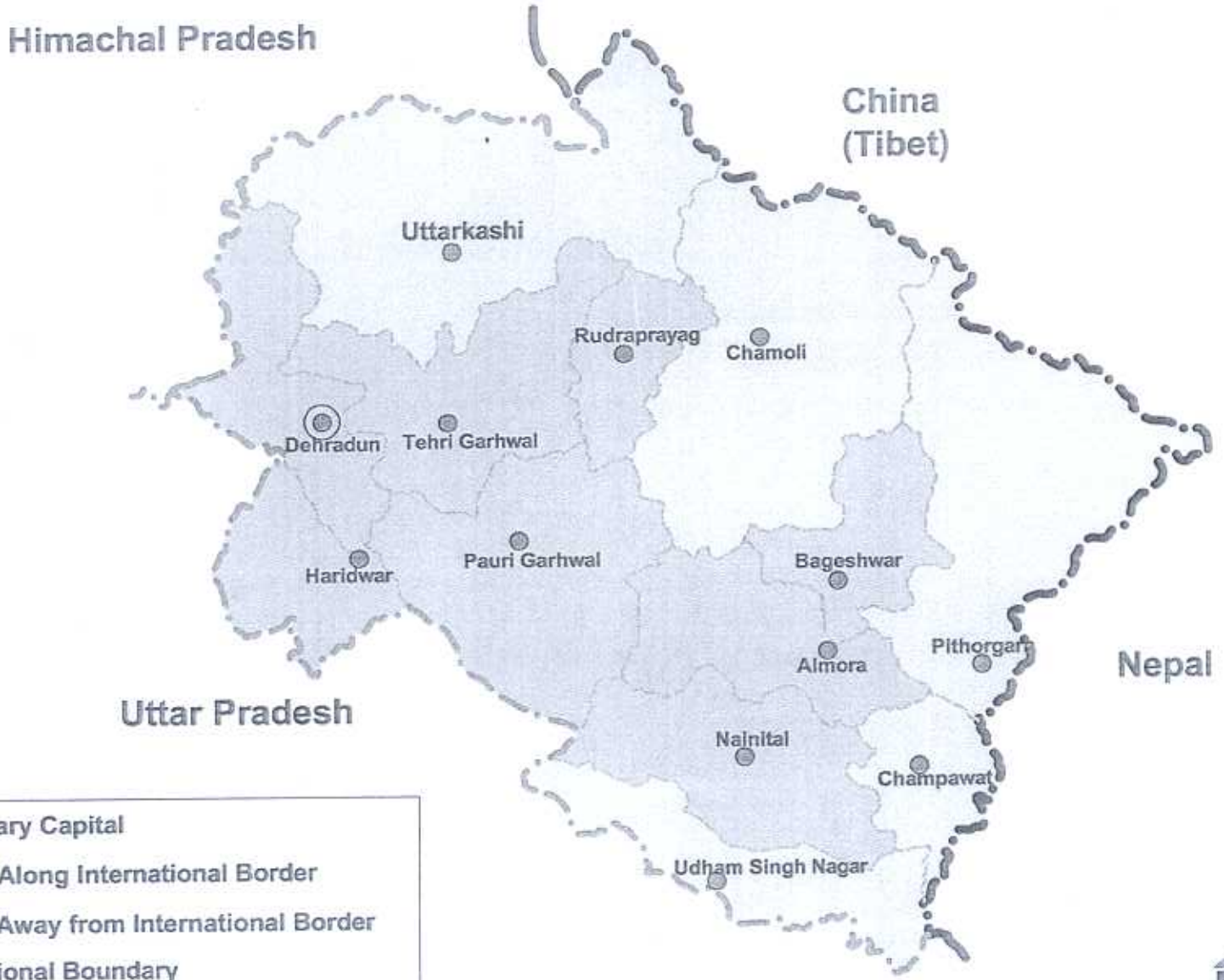
1.7.1 External Security

This factor is extremely important in case of Uttrakhand as the state shares a large part of its territorial boundary with other countries. In the north, the state has international boundary between India and China (Tibet) and whole of its eastern boundary is shared by Nepal (Fig1.9).

The districts with boundaries touching the international border are more prone to security problems, thereby not appropriate for the location of proposed Capital (Fig1.9). The location of proposed Capital should be well away from the international border. Clearances from the respective ministries of External Affairs, Defence and Home are not likely to come through for bordering districts. Proximity of Capital to cantonment areas is preferable, yet the location should be away to prevent the danger of attacks on cantonment areas.

The districts of Dehradun, Pauri Garhwal and Almora are away from international borders and possess cantonment areas, thus favourable for location of proposed Capital.

FIG 1.9 External Security



Source: The Atlas of Uttaranchal, NATMO, 2003

1.7.2 Internal Security

Internal security is essential in terms that the civil administration and maintenance of law and order should be efficient. The military and other officials from the Capital should be able to reach all parts of the state as quickly as possible during emergencies like riots or natural calamities. Generally, those districts, which possess good accessibility, have better internal security.

1.8 Settlement Pattern

Table1.5: DISTRICT WISE NUMBER OF TOWNS, UTTRAKHAND

Districts	No. of Towns
Almora	4
Bageshwar	1
Chamoli	4
Champawat	6
Dehradun	14
Haridwar	10
Nainital	8
Pauri Garhwal	6
Pithoragarh	4
Rudraprayag	2
Tehri Garhwal	7
Udham Singh Nagar	16
Uttarkashi	3

Source: Census of India, Provisional Population Tables, 2001

FIG 1.10 Settlement Pattern

Source: The Atlas of Uttaranchal, NATMO, 2003

Table No. 1.5 shows the number of towns in each District in Uttrakhand. Fig No1.11 shows the number of major cities in Uttrakhand. The Table and the figure together reveal that historically, there has been a concentration of urban settlements in the plain areas towards the S-W part of the State. However, it is to be noted that the concentration of urban settlements is more in the Southern part i.e. the Districts covering Almora, Nainital, Udham Singh Nagar and Champawat. This together makes 32 urban settlements. On the contrary, the concentration of urban settlements in the western part is relatively less with only 24 urban settlements in the districts of Haridwar and Dehradun together. The opportunity to locate the permanent Capital for Uttrakhand can be viewed as also an opportunity to correct this imbalance. Preference to locate the permanent Capital thus goes in favour of the Districts of Dehradun and Haridwar.

1.9 ZONE IDENTIFICATION

Ranking according to ordinal scale has been adopted based on the criteria discussed above. A matrix is prepared showing the applicability of each criterion for all the districts (Table1.6). For each criterion applied, weights are given to each district based on the extent to which criterion is satisfied. Maximum weight of 2 is given to the districts with full applicability of the criterion. If the district fulfills the criterion partially or a part of the district satisfies the criterion, an intermediate weight of 1 is given. No weight is given to the districts with no or marginal applicability of the criterion.

Putting together all criteria discussed below, this makes Dehradun and Haridwar as the most favourable districts for locating the proposed Capital. It may also be highlighted that out of the two favourable districts emerging above, only Dehradun has shown acceptability by the people.

TABLE: 1.6 CRITERIA WEIGHTING OF THE DISTRICTS IN UTTRAKHAND.

District / Criteria	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Geographic Centrality	1	1	2	0	1	1	1	2	0	2	2	0	1
Population Centrality	1	0	0	0	2	2	2	1	0	0	0	1	0
Accessibility by Road	1	0	0	1	2	2	1	0	0	1	1	2	1
Transport Modes	0	0	0	0	2	1	0	1	0	0	0	2	0
Forest Zones	0	1	1	0	1	2	0	0	2	0	0	2	0
Topography	1	0	0	1	2	2	1	2	0	1	1	1	0
Seismic zone*	1	0	0	1	2	2	1	1	0	0	1	2	0
Acceptability	0	0	2	0	2	0	1	1	0	0	0	0	0
Security	2	2	0	0	2	2	2	2	0	2	2	0	0
Settlement Pattern	1	0	0	1	2	2	1	0	0	0	0	1	0
TOTAL	8	4	5	4	18	16	10	10	2	6	7	11	2

I: Almora
II: Bageshwar
III: Chamoli
IV: Champawat
V: Dehradun
VI: Haridwar
VII: Nainital
VIII: Pauri Garhwal
IX: Pithoragarh
X: Rudraprayag
XI: Tehri Garhwal
XII: Udham Singh Nagar
XIII: Uttarkashi

* *Seismic Zones (Earthquakes, Landslides and Slopes).*

It may also be noted that the various sites under consideration as detailed in Chapter 2, lie in the Districts of Dehradun, Nainital, Udham Singh Nagar and Chamoli. Based on the table above, it is seen that Dehradun District emerges way ahead among the preferred locations. On the contrary, Chamoli, the District of other popular demand, i.e., Gairsain, emerges as the least suitable. However, the Chapter 2 in the following pages examines all the five sites, irrespective of the ranking of their respective Districts as emerged in Chapter 1.

CHAPTER - 2

SITE SPECIFIC CRITERIA

2.0 INTRODUCTION

Although there was no limitation to the number of locations under consideration, broadly, 5 locations were considered, based on the inputs from the Sthal Chayan Ayog and the Town Planning Department. These locations have been discussed here with respect to the location level criteria, applied later.

2.1 DEHRADUN

The total population of the District is about 10 lakhs. Dehradun urban area has a population of approximately 4.8 lakhs as per 2001 census. It is at an altitude of 640 mts. (2100 ft.) to 1,000mts. (3280ft.) above mean sea level. The district is situated in the north-western corner of the state. It is bounded on the north and to some distance in the north-west by the district of Uttarkashi, in the east by the districts Tehri Garhwal and Pauri-Garhwal, in the south by the district of Saharanpur (Uttar Pradesh), at its southern tip tou ching the boundary of district Haridwar. Its western boundary adjoins the Sirmur (Nahan) district of Himachal Pradesh with the river Tons and Yamuna separating the two. It lies between 29°58' and 31°2' 30" North latitudes and 77°34'45" and 78°18'30" East longitudes.

Dehradun is one of the most developed towns having all three types of transport modes. NH72 cuts across the large parts of district Dehradun. NH 72A passes through Chutmalpur area to district Dehradun. NH58 and NH 123 also pass through Dehradun district. Dehradun is well connected by road, rail as well as air transport. The Jolly Grant Airport is only 25 km away from the city. Dehradun is 250 km from Delhi by road and 320 km by rail. Area under forests

accounts for 2,018 sq.kms (including reserved, protected and private forest) of total area, giving a percentage of 65.3 of the total area of the district, which is 3,088 sq.km.

Dehradun is situated at the Himalayan foothills in the fertile Doon Valley. The Valley is well known because of its natural beauty. It is also an important educational centre of the country. Some of the best public schools and convents are housed here. The Indian Military Academy, Forest Research Institute, Oil and Natural Gas Commission, Indian Institute of Remote Sensing and many more offices of Central and State government are also situated here.

2.1.1 Sources of water: The amount of water supplied by sources in the urban area is as shown in Table 2.1.

Table: 2.1 Sources of Water Supply in Dehradun, 2001

Water Source	Water supplied (MLD)
47 Jal Sansthan tube wells	77.4
Mossy falls	14
Bindal River	4
Rispana Head works	1
9 Cantonment tube wells	6
25 private tube wells	17-40
Surface water in the Cantonment	6
Total Supplied	125.4-148.4
Per Capita Supply	251-297 lpcd

Source: Jal Sansthan, Jal Nigam, MES

Dehradun receives an average annual rainfall of about 200 cms. Water supply is from either Jal Sansthan or the Cantonment Board or private sources. About 80 percent of daily water supply comes from tube wells. About 42 tube wells are dug over 100 m deep, 31 of them have depths of more than 120m. Dehradun gets almost 90 percent of its rainfall during the summer monsoon. Groundwater levels drop from 70m to 110m during the summer.

2.1.2 **Land Availability:** Vacant land available in the Dehradun district is about 1062.2 sq. kms (34.8 percent of the total area). Land availability is towards the South-East direction of the city, along the major transportation corridors (Saharanpur Road and Chakrata Road). As a result, population pressure from the city core may be released. Further, due to lack of land availability in the city core, the future development activities can be diverted along these networks, where land values are relatively cheaper. This could further add to the potential for urban development.

2.1.3 **Topography and Climate:** Dehradun can be divided into two distinct tracts i.e. the mountain tract and the sub-mountain tract. The montain tract covers the whole Chakrata tahsil of the district and consists entirely of a succession of mountains and gorges. The mountains are very rough with steep slopes. The most important feature of this tract is the ridge which separates the drainage area of Tons on the west from that of Yamuna on the east. Below the mountain tract follows the sub-montane tract, which is the famous Doon Valley bounded by Shivalik Hills in the south and outer scarp of the Himalayas in the north. Topographically, Dehradun is relatively flat lying in the Doon Valley in the Shivalik ranges of Himalayas.

The climatic conditions of the city are similar to those in the plains. The heat is intense in summers. January is generally the coldest month with minimum temperature falling below the freezing point. Being near the

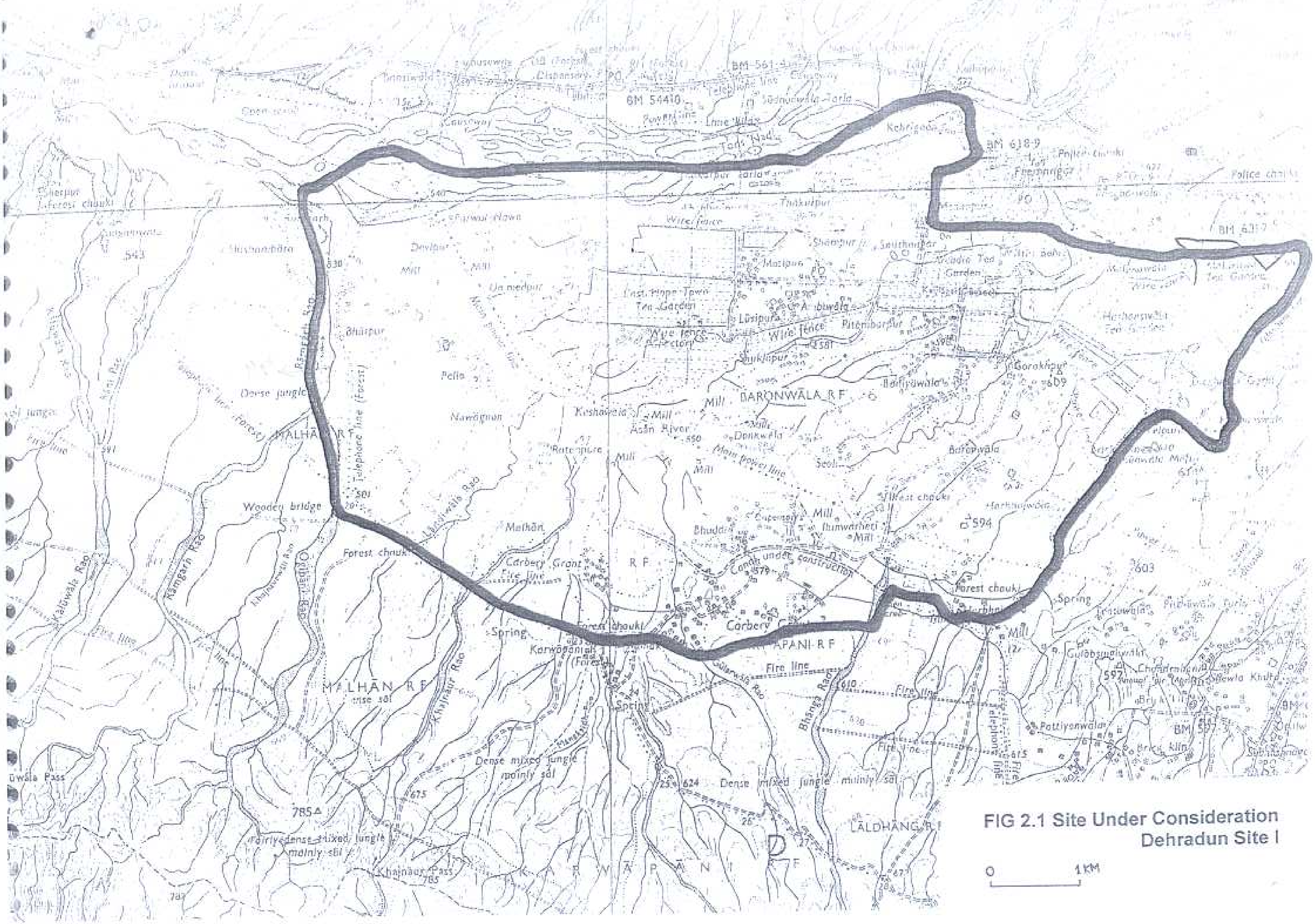


FIG 2.1 Site Under Consideration
Dehradun Site I

Himalayas, the city has maximum average temperature 36.6°C and minimum temperature of 5°C. About 90 percent of total rainfall occurs during monsoon, in the months of June to September.

2.1.4 **Natural Drainage:** Heavy rainfall leads to large amount of runoff from hills and rooftops. This discharge is taken into the valley through *nallah*, streams, to rivers flowing into the area. Special drains are provided on the uphill sides of the buildings to carry away the discharge through open drains, diverted away from the foundations and walls to avoid dampening. Additional damp roof course is provided to guard against heavy rains.

2.1.5 **Scope for Future Expansion:** Considering development potential and physical constraints for future growth, the physical growth has been envisaged on the Southern and South-Eastern side. The reasons attributed include adequate land availability and will have relatively better network with the new transportation corridor coming up in the area. The city has resource potential such as vast expanse of agricultural land.

2.1.6 **Investments:** Dehradun saves the cost of providing railway line and an airport to the state apart from the huge investments that would have gone in for providing these infrastructures.

Broadly, 3 specific sites are under consideration around the present city of Dehradun. The first site (Fig2.1) lies between 77°50'-78°0' E longitude and 30°15'-30°25' N latitude in the west of the present city, spread over 'East Hope Town Tea Gardens' and 'Harbanswala Tea Gardens' as shown in Fig 2.2. This site comprises of roughly 6,600 ha of area. This site is connected by Rishikesh-Haridwar-Muzaffarnagar road, which in the long run can serve as a major access to the Capital. However, this would be at a distance of about 12-15 km from the present railway station/ railway line. There are several old settlements and town extensions already putting pressure on the area. It is learnt that

several illegal transfers of lands have already taken place by the land grabbers and opportunists. The area has vast expanses of tea gardens, dotted with 'sheeshum' trees (Fig 2.2). The land is generally flat with few undulations.

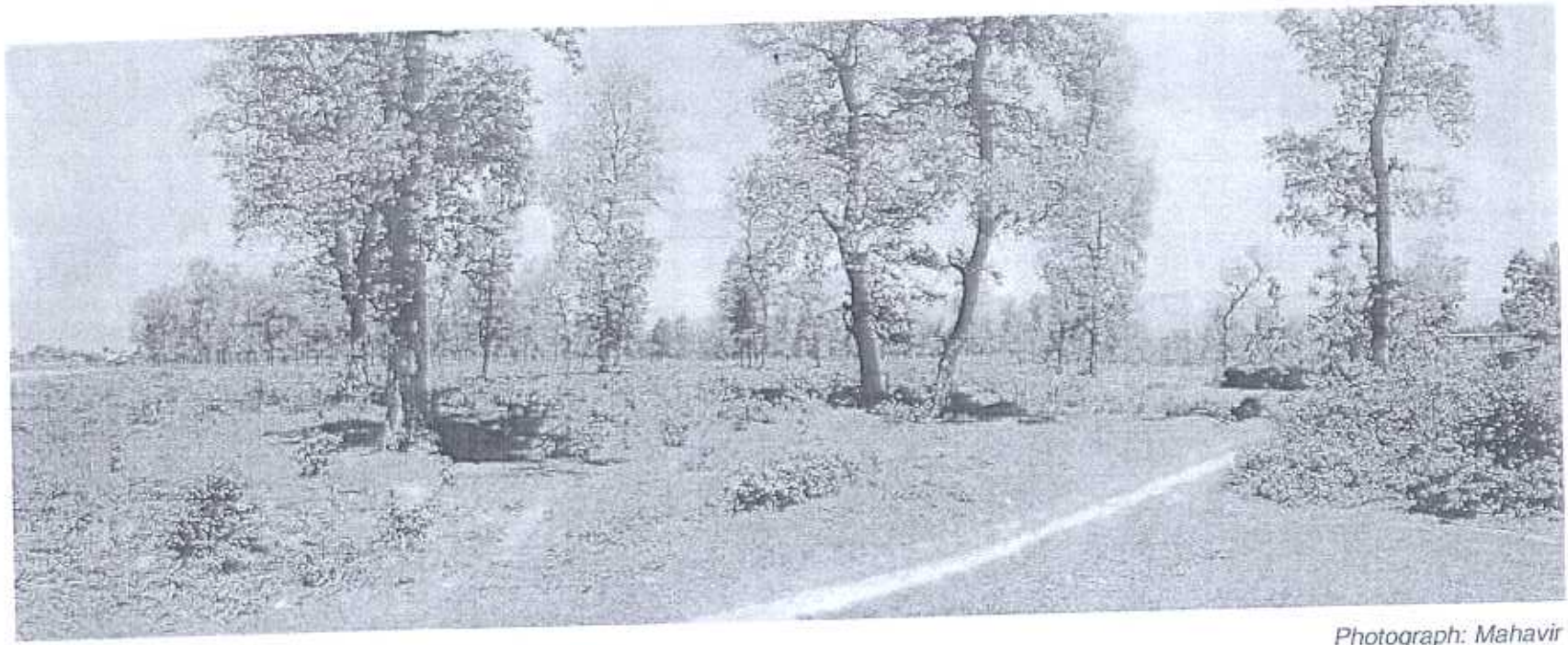


Fig 2.2: General Landscape at Tea Gardens, Dehradun *Photograph: Mahavir*

The second and the third sites (Fig 2.3) lie between co-ordinates 78°5'-78°10' E longitude and 30°10'-30°20' N latitude. These sites are spread along either side of Song River (Fig 2.4). The Jolly Grant airport is about 5 km away from the

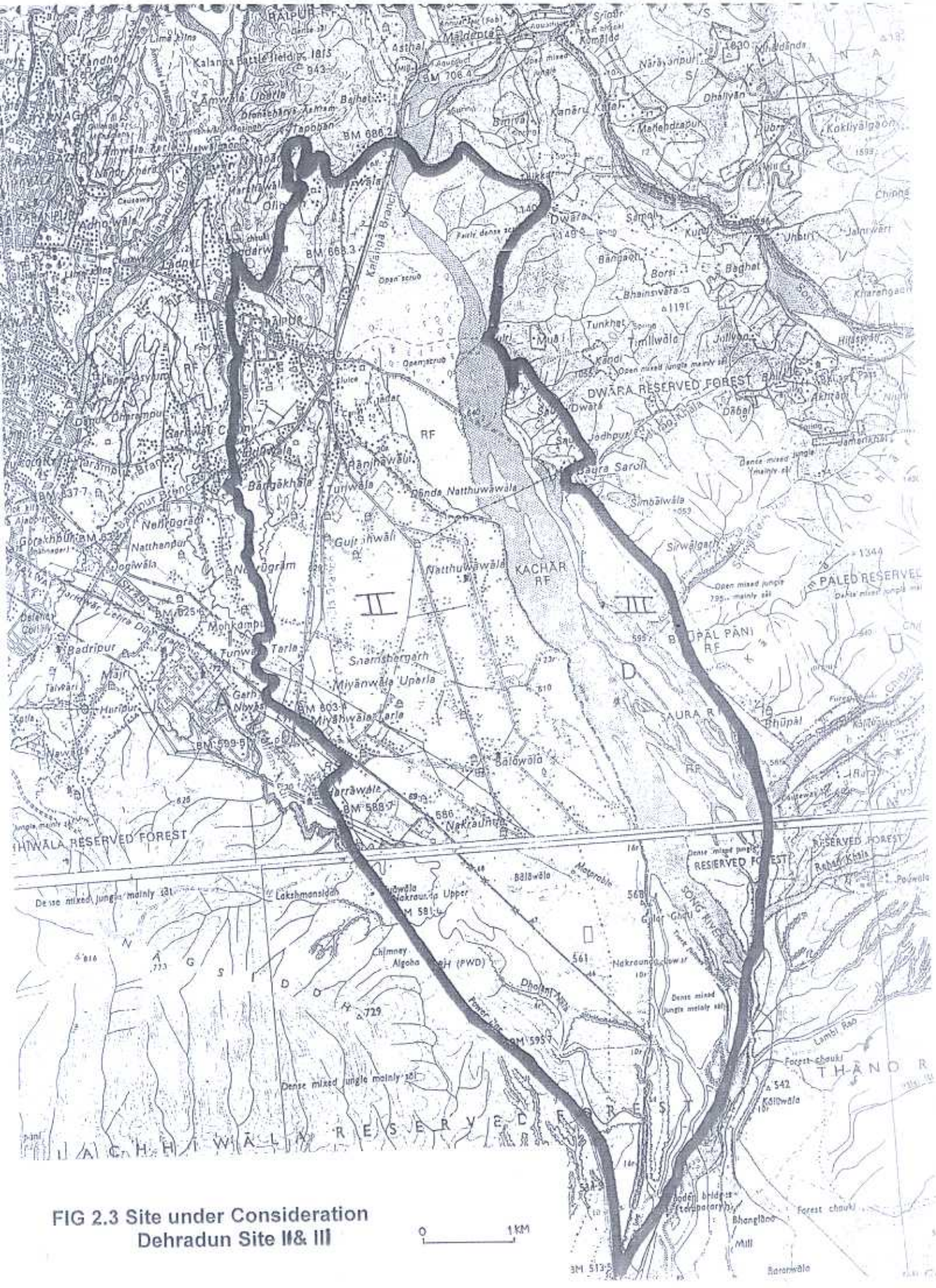


FIG 2.3 Site under Consideration
Dehradun Site II& III

site. The site comprises of about 2500 ha area. This site is connected through Haridwar railway line. The site on the east of existing city (and west of the river) is generally flat, with a gentle slope towards the river Song.

Fig 2.4: General Landscape at eastern side of River Song, Dehradun *Photograph: Mahavir*

The area is not fertile and thus no major agriculture activity takes place. The area is accessible through SH49 and Doiwala rail station. Being on the banks of river Song, both water supply and drainage facilities could be easily provided.

Fig 2.5 General view at the side of River Song, Dehradun *Photograph: Mahavir*

Being in contiguity of existing city, it enjoys the proximity to major city level functions, including the airport and other infrastructure developed for the temporary Capital. There is scanty residential development on the site, which can be easily absorbed for the development of the proposed state Capital.

The site on the east of River Song demonstrates a character similar to that in the west, except that the resident population is negligible. The area provides scenic views commensurate with the hill state of Uttrakhand. The site takes an elongated shape, bounded by the river in the east. Though the area is relatively near to the present airport, it is relatively away from the railway line. The present city level amenities are also away from the area, though well accessible through a bridge across the river, near Raipur.

General slope of the area is towards the river and in the direction of flow of river, thus favourable from the drainage point of view. The site has a potential to be developed for proposed Capital functions on a twin city approach, on the lines of Gandhinagar-Ahmedabad, Bonn-Frankfurt, the Hague-Amsterdam, etc.

2.2 GAIRSAIN

Gairsain village in Chamoli District is located in central Uttrakhand. It is approximately 200 km (about 8 hours drive) from Dehradun and about 45 km from Karnaprayag. It cuts across the area at Bhararisain (Fig 2.6) in approximately NS or N-NW-S-SE direction.

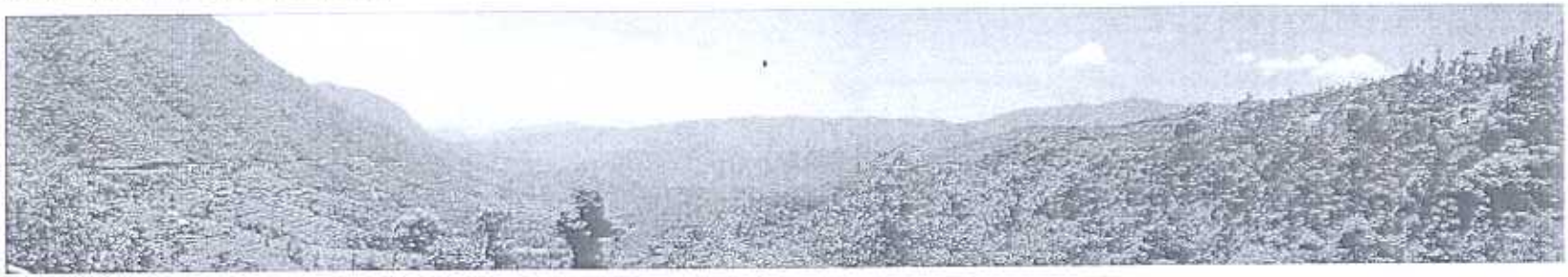


Fig 2.6: General view from Bhararisain towards Gairsain *Photograph: Mahavir*

Gairsain is well connected by an all weather road to Karnaprayag in the NW and Ranikhet and Ramnagar, located in the south. The area can be approached by rail upto Rishikesh and Kathgodam, and further from Rishikesh to Dugaddo by NH58, then by SH9 (Dugaddo to Dhumakot), NH121 (Dhumakot to Mohan) SH14 (Mohan to Ranikhet), NH87 (Ranikhet to Khatgodam) through national and state highways. The nearest Railhead for 'Gairsain' is 'Ramnagar' which is at a distance of 138 km. The approach from Ramnagar is by NH 121(Ramnagar to Mohan), then SH 14 (Mohan to Bhatronj Khan), then SH 12 (Bhatronj Khan to Chaukhutiya) and then finally by NH 87 (Chaukhutiya to Gairsain).

Apart from Terai region in the Shivalik foothills, the entire State of Uttrakhand is a part of the Himalayan ranges. At 7,817m above the mean sea level, Nanda Devi in the district of Chamoli is the highest point in the State.

2.2.1 Sources of Water: Gairsain area is located very close to the Ganga-Ramganga surface water divide, which in reality is a sub-surface divide and area close to sub surface divide are not suitable for groundwater development activities. Also this area are hydrologically known as recharge areas and do not act as promising groundwater repositories. Highly dissected hills occurring in Ramganga basin around Gairsain have very high hydraulic gradient and very low permeability, which do not support the groundwater transmission and storage. Such areas do not have aquifers with promising groundwater potential. Observed facts envisage that the aquifers existing in the Gairsain area can support the groundwater extraction structures like hand pumps and not the tube wells that can cater to the needs of local population and not additional inhabitants likely to migrate in the eve of formation of state Capital.

Moderately sloping terrain of this area is covered with a thin layer of weathered rocks. Rainwater infiltrates to the jointed rocks and weak planes through this weathered cover giving rise to local pockets of ground water with limited volume. Such pockets support hand pumps with low discharge and cannot sustain high yield tube wells.

There is no nearby source from where water can be supplied by gravity to the potential capital site at Gairsain. Nearby other sources do not have sufficient water to feed the population. There is insufficient discharge in Ramganga also. Hence Alaknanda River at Karnprayag is the only adequate source of water. There is no perennial source other than Alaknanda river, which can be tapped for water supply for the capital. Level difference between the river site and Gairsain site is around 1,600 m, which makes it an extremely costly proposition.

2.2.2 **Topography and Climate:** Gairsain is located at a height of 1,620 m above mean sea level in an open, old glaciated, intermontane valley, in the lesser Himalayan mountain ranges. The whole district exhibits a gentle to moderately steep, undulating topography. On the basis of preliminary geotechnical studies, hill slopes of this area appear to be suitable for development. Moderately steep slopes, flanking the *nalas* are prone to landslides and hence, not suitable for development activities.

The area being located in the lesser Himalayan zone is characterized by wide variations in climatic conditions due to complex relief and elevation difference. As the elevation of the District ranges from 8,00m to 80,00 m above the mean sea level, the climate of the district very largely depend on altitude. During winters, foggy conditions prevail in the valley. The winter season prevails from November to March and mean temperature varies from 6.1°C to 13.3°C. The area witnesses severe cold conditions coupled with snowfall. This area also experiences heavy rains from July to September, making it inaccessible from other parts of the State as well as within the District.

2.2.3 **Natural Drainage:** The existing drainage network developed on the slopes of the proposed area is properly lined along the check walls to avoid bank erosion. Two sites have been taken into consideration for the proposed Capital. Ramganga Nadi flows across both the sites.

The first site (Chaukhutiya) lies between 79°15'-79°25' E longitude and 29°50'-30°0' N latitude (Fig 2.8). It has Chhitaula reserved forest on east side of the site. The site comprises approx. 4,500 ha area.

The second site (primarily around Gairsain) lies between 79°15'-79°20' E longitudes and 30°0'-30°10' N latitudes (Fig 2.9). Nanda Devi is around 80-90 km away. The total area of the site is 2,500 ha approximately.

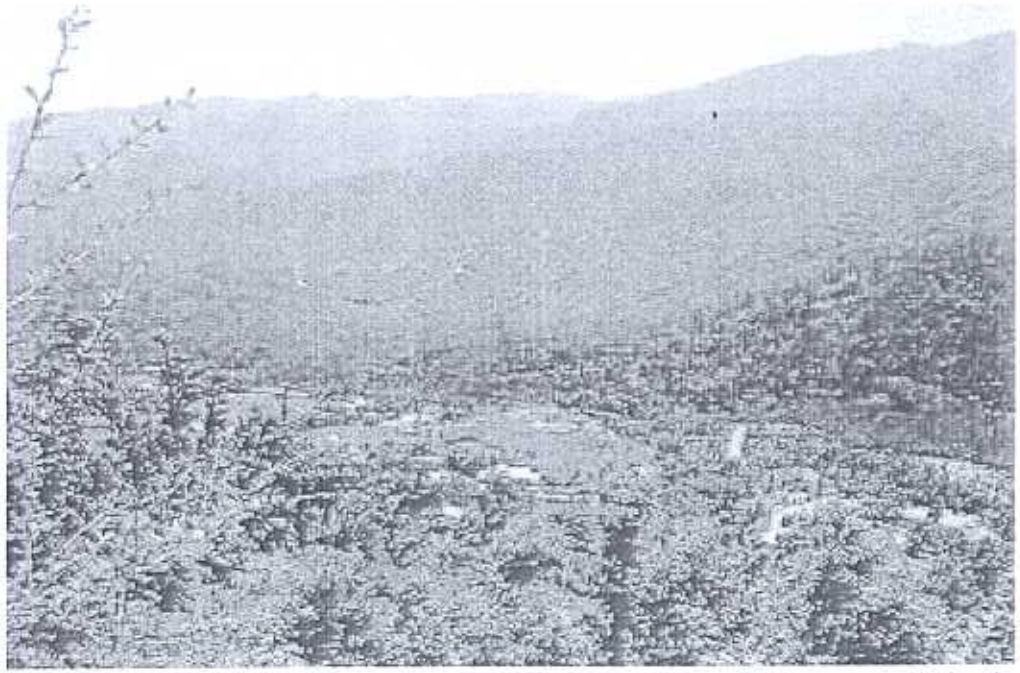


Fig 2.7: General view at Gairsain *Photograph: Mahavir*

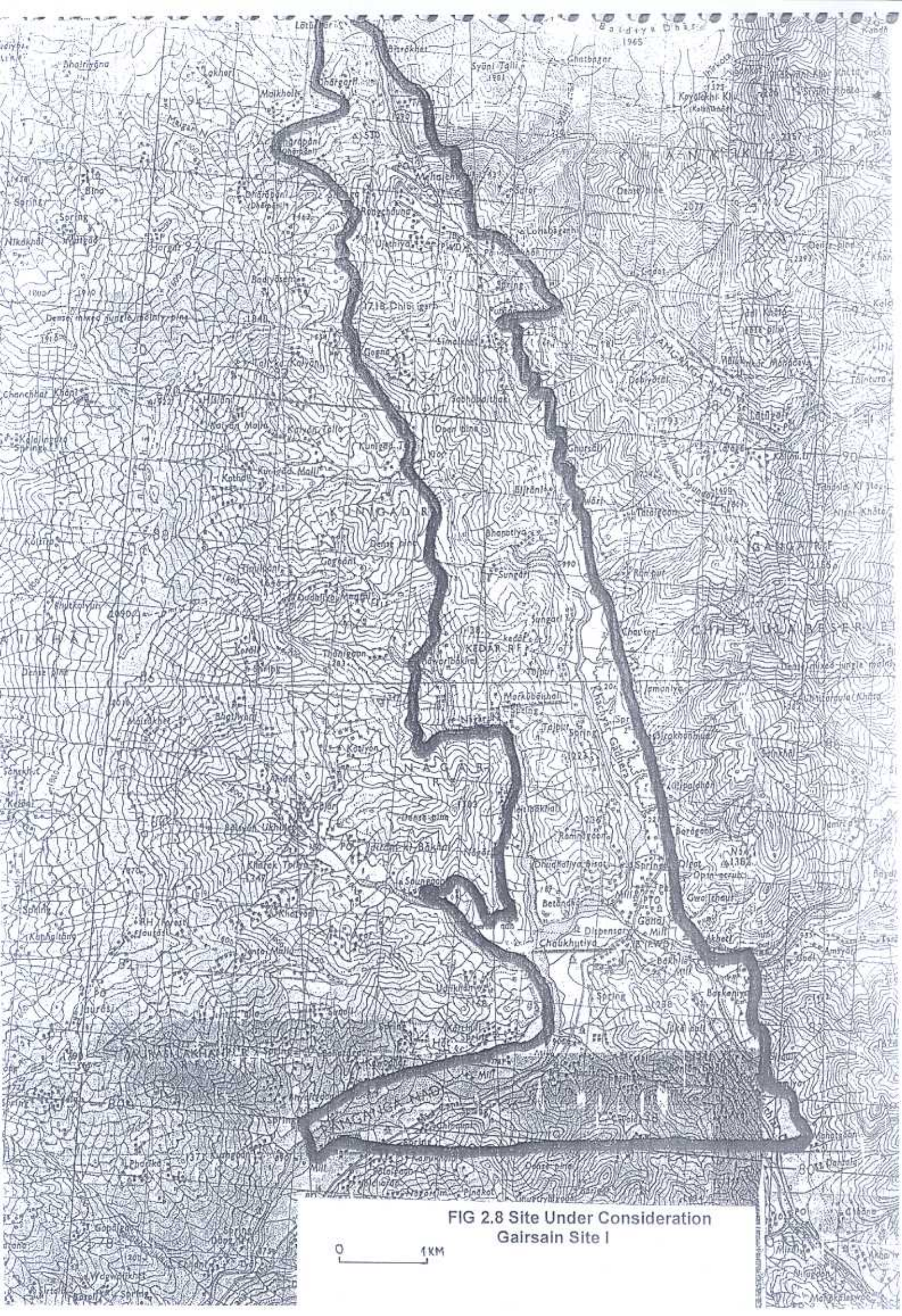


FIG 2.8 Site Under Consideration
Gairsain Site I

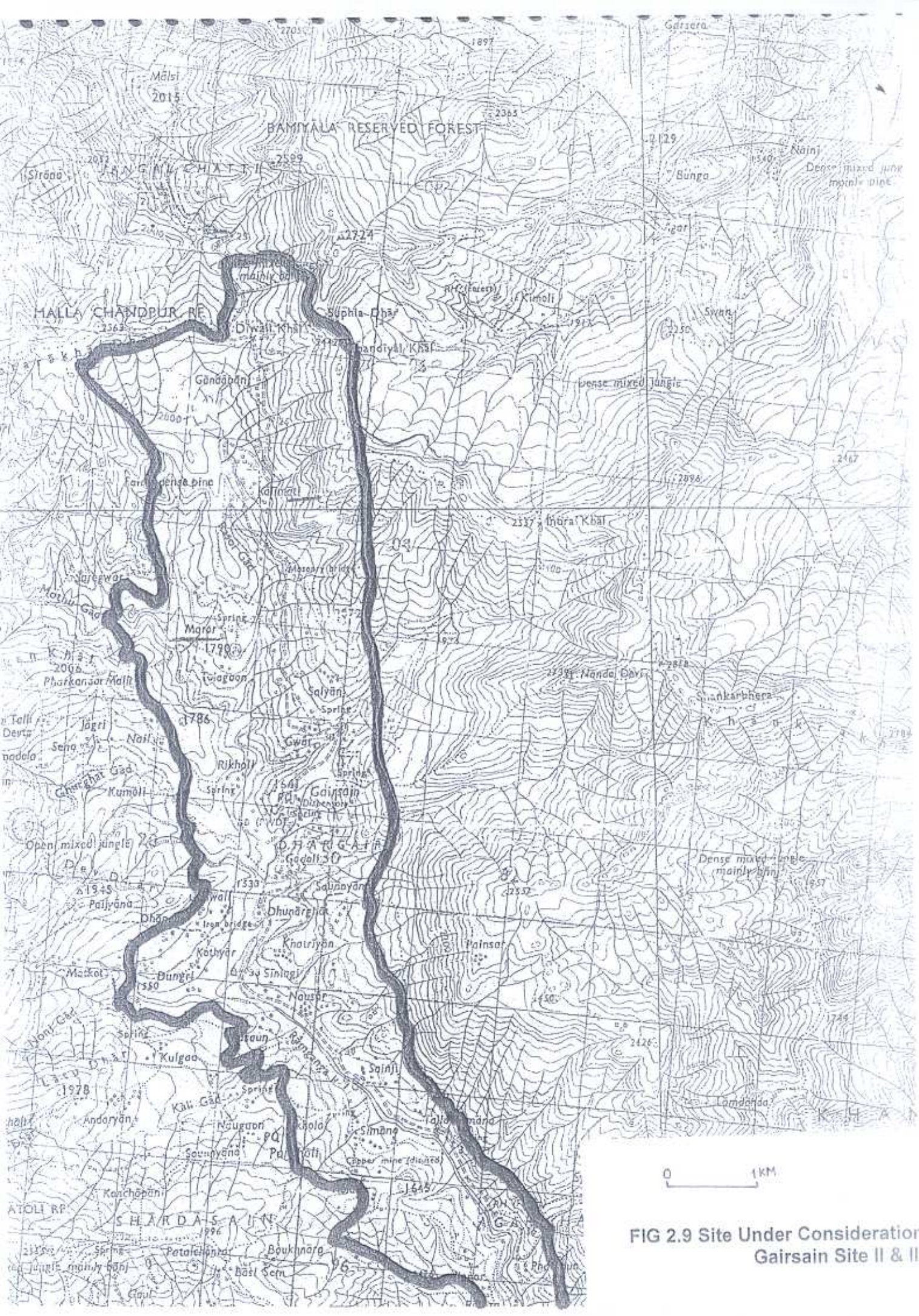


FIG 2.9 Site Under Consideration
Gairsain Site II & III

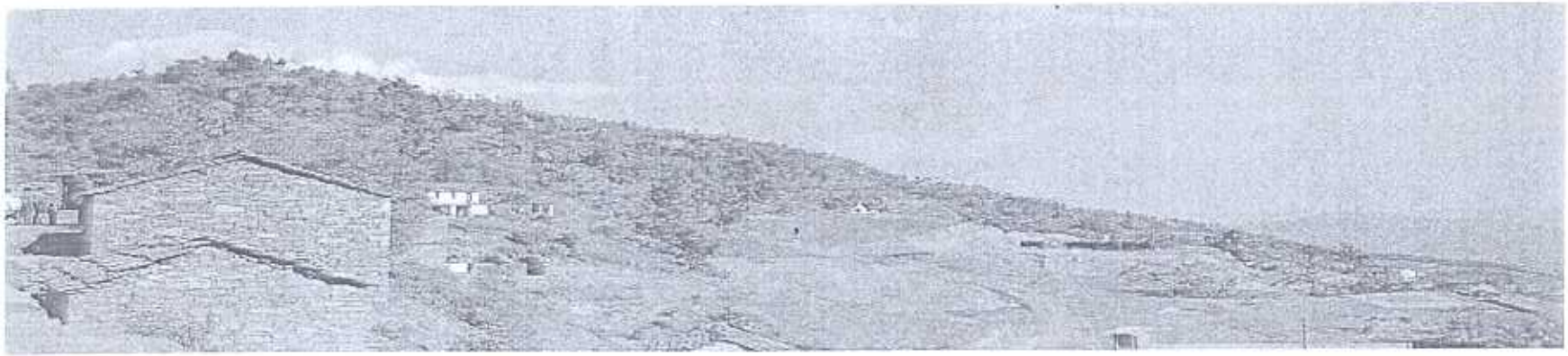


Fig 2.10: General view at Nagchulakhal, Gairsain *Photograph: Mahavir*

The sites in and around Gairsain include those at the present location of 'Videshi Pashu Palan (Fig 2.11), at Marora/ Kalimati (Fig 2.12) and Nagchulakhal (Fig 2.10) at Chaukhatiya.

Fig 2.11: General view at Videshi Pashu Palan Kendra, Gairsain *Photograph by: Mahavir*

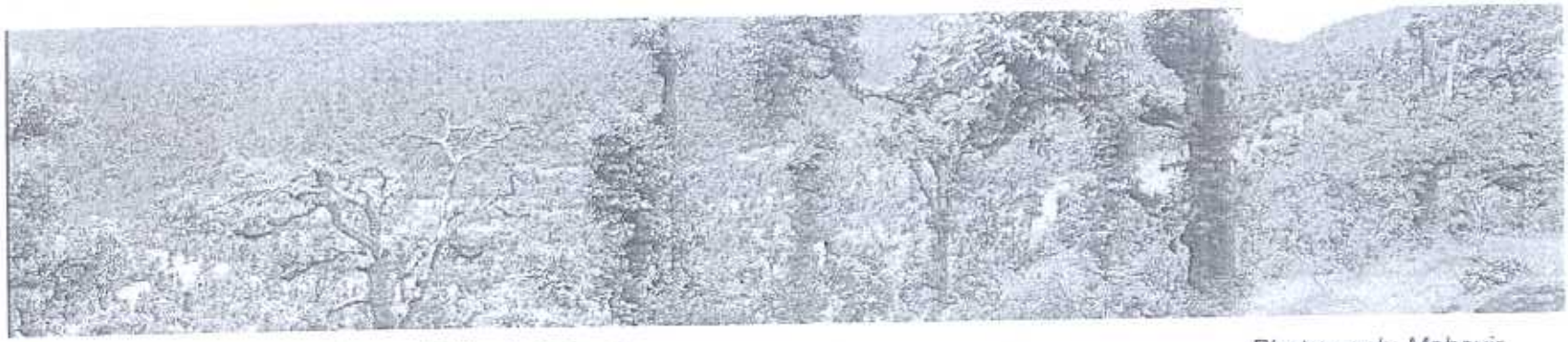


Fig 2.12: General view at Marora, Kalimati, Gairsain *Photograph: Mahavir*

The general area is dominated by excessive slopes on a loose soil, exotic flora and fauna and near absence of water resources, except at Chaukhatiya in the valley. In the event of Capital being located at Gairsain, there may be danger of vehicular pollution and plastic wastes spoiling the otherwise peaceful and natural surroundings and interfering with natural eco-systems. Heavy vehicles from all parts of the State reaching Gairsain first during the construction phase and later for daily supplies are likely to add to the pollution besides danger to and from excessive slopes and loose soils. Movements of construction machinery are also likely to cause damage to stability of soil in the area. Direct inflow of sewage and other solid wastes into the river is another cause for concern.

Fig 2.13: Condition of Local construction material at Nagchulakhal, Gairsain

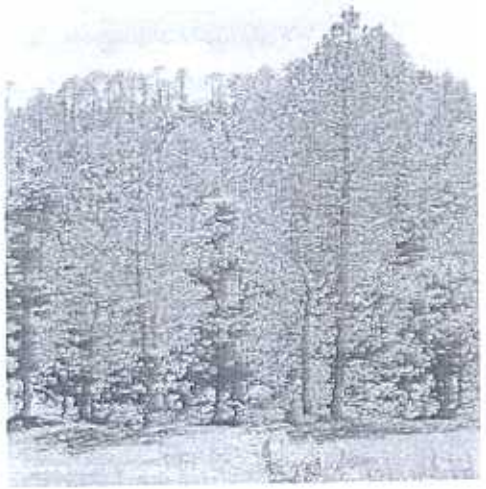


Fig 2.14: General Landscape at Marora, Gairsain

Photographs: Mahavir

At present, the population living in and around Gairsain is too meager to support a township with Capital functions. While the area is presently rich in flora and Fauna, it may get damaged from excessive human habitation in future. Similarly, humans would also be in danger from the wildlife, if their habitat were endangered. The area is cut-off from the rest of the state for a large part of the year due to rains, snow and related landslides. Non-availability of water is the biggest factor against consideration of a large human inhabitation in the area. There is lack of considerable water reservoirs, streams or ground water aquifers in the area. Water is a crucial factor for the location of proposed Capital of a State.

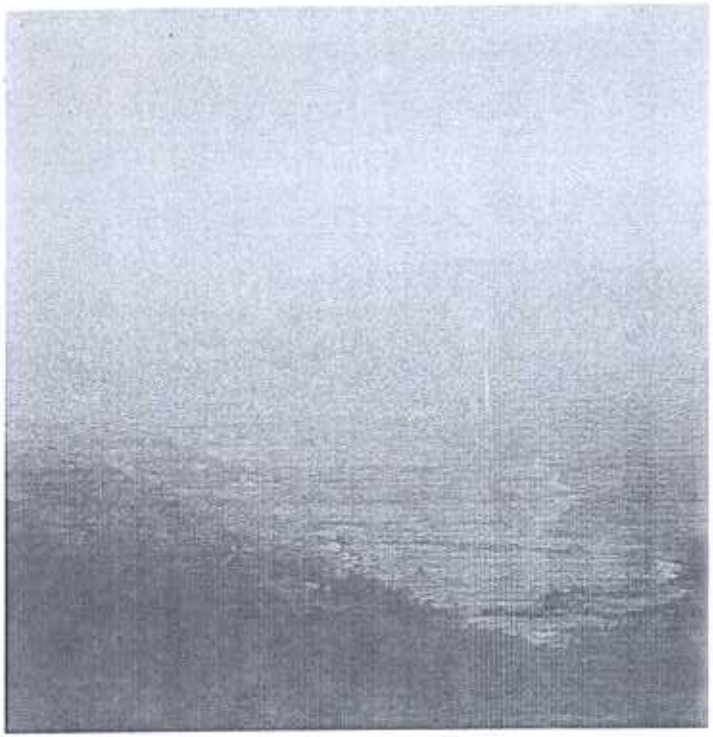


Fig 2.15: General view of valley at Chaukhatiya, Gairsain
Photograph: Mahavir

The river flowing in the valley along Chaukhatiya (Fig 2.15) is perennial and the possibilities of pumping the water up to any higher location are lean, due to heavy costs.

2.3 KASHIPUR

Kashipur lies in Udham Singh Nagar district in the south-western part of the State. It is located at a distance of 50 km from Rudrapur. It is located in the west of Haldwani at a distance of 65 kms and Southern side of Ramnagar at a distance of 30 kms.

Kashipur is well connected by rail and road. Airport is located at Pantnagar, which is very near to Rudrapur. Rail links are very well connected from Kashipur to other towns viz. Lalkuan, Bareili, Lucknow, Rampur, Ramnagar, Muradabad and Dehradun. Rail links are also well connected with the National Capital. NH 74 serves the whole district of Udham Singh Nagar running parallel to the district boundaries. The site is accessible by the road through national highway and by rail with a little extension of existing Delhi-Ramnagar line.

2.3.1 Sources of water: Tumaria Dam is a good source of water supply. Apart from the dam, Dhela river and ground water can be a perennial source of water.

2.3.2 **Topography and Climate:** The region being part of the Terai belt is similar to plains. Kashipur has a temperature of 29.4°C in summers and 4°C during winters. The average annual rainfall of this region is around 2583mm.

2.3.3 **Land availability:** Kashipur lies in a comparatively plain area. The vacant land available in Kashipur area is about 90 percent.

The site (Fig 2.16) under consideration is approximately 12000 ha. The site lies in Terai belt, which is mostly plain area. The Construction on this area would be easier due to the terrain than on a hilly area.

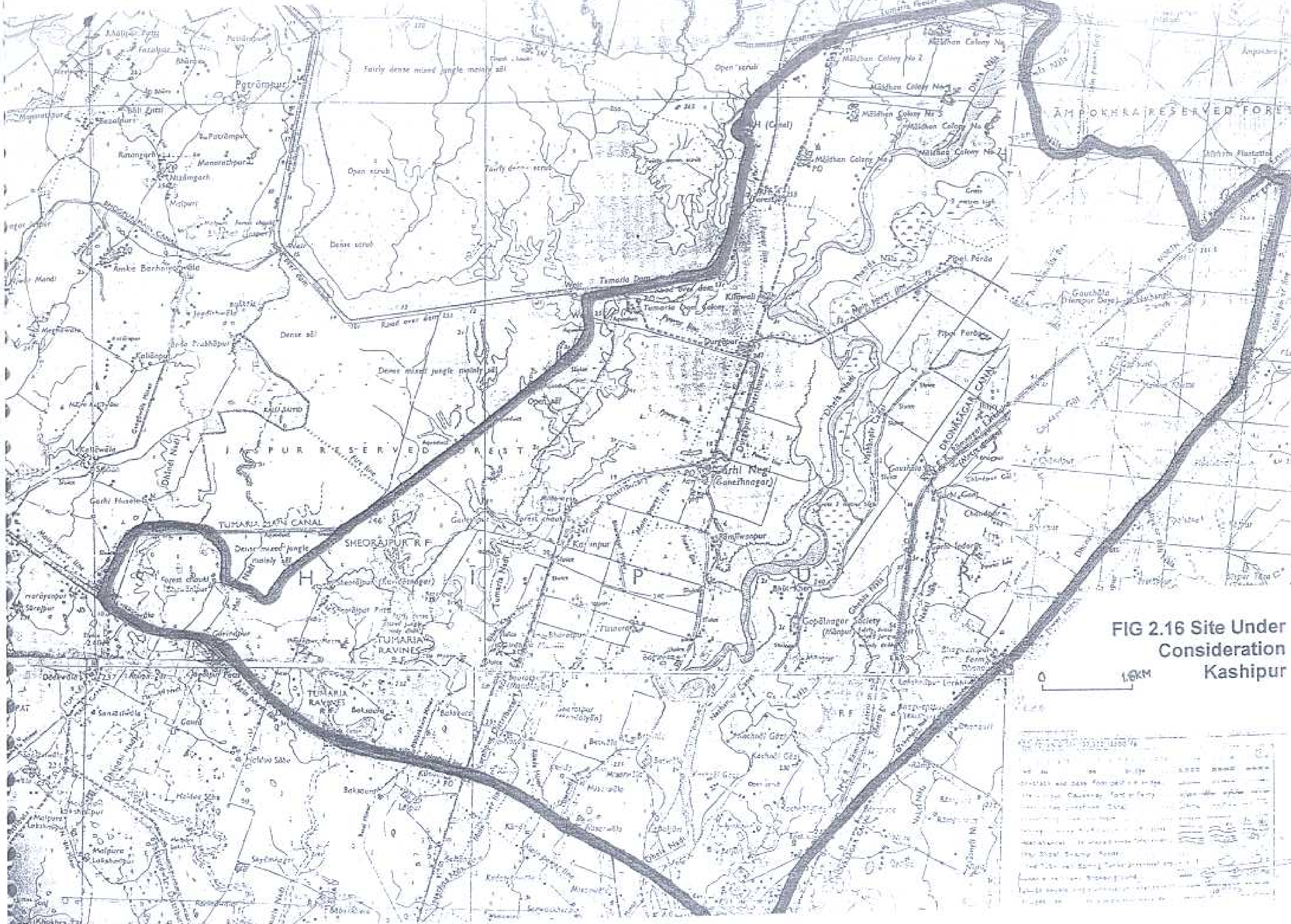


FIG 2.16 Site Under Consideration Kashipur

But this area demonstrates vasts of rich and fertile agricultural land with a generally flat character. The area is low lying and Dhela river is dividing the site in two parts. While the proximity to Tumaria Dam may ensure reasonably sufficient water supply, it may also be a cause of threat to a large part of the site in case of an accidental. Apart from Kashipur, there are isolated pockets of land available at NEPA, at Doi village, Escorts Farms, Kundeshwari Road (Fig 2.17) and the area around Gandhi Ashram. However, these isolated pockets are so small in size that they do not have any potential to be combined together to form a consolidated site for the proposed State Capital. Moreover, although the area is scantly inhabited, it is dominated by clusters of migrant Sikh population, who have shown reluctance to move away in favour of a Capital being located there. Locating the Capital on this site is likely to eat away the rich agricultural land in already agriculturally poor State.

Fig 2.17: General Landscape at Escorts Farms, Kundeshwari Road, Kashipur *Photograph: Mahavir*

2.4 RAMNAGAR

Fig 2.18: General view towards Malganj Chour- from Tumaria Dam, Ramnagar *Photograph: Mahavir*

Ramnagar is located in district Nainital in the southern part of the state. The site of Ramnagar is primarily low lying area traversed and bounded by canal systems. Kosi River flows about 2-3 km east. Kashipur is on the west of site, at a distance of about 5 km. The site under consideration is 500 ha approximately, which includes forests and water bodies etc.

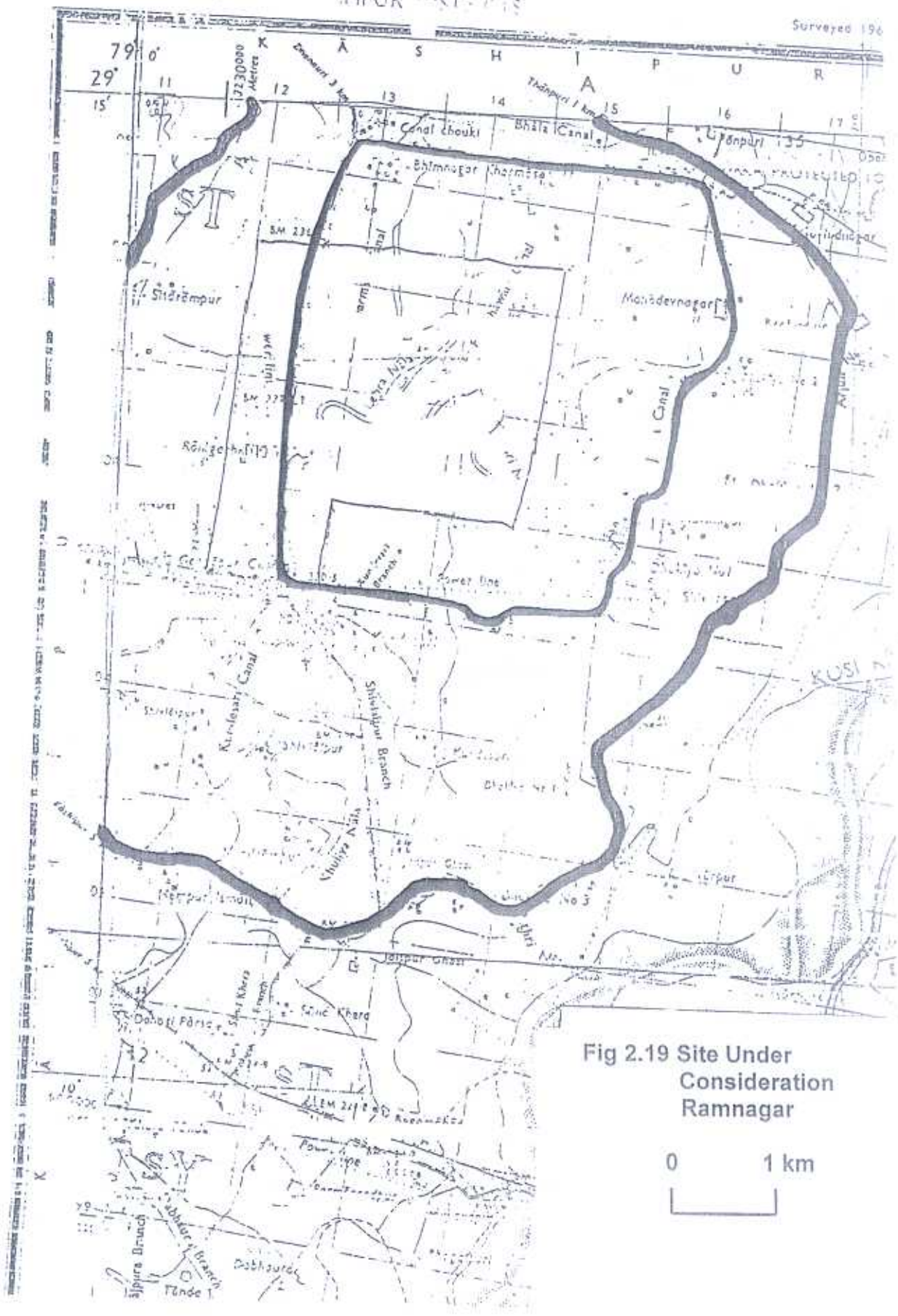


Fig 2.19 Site Under Consideration Ramnagar

Fig 2.20: General view towards Malganj Chour- from Tumaria Dam, Ramnagar *Photograph: Mahavir*

2.4.1 **Sources of water:** There is availability of water in Dhela and Kosi river. However, during summer season there is inadequacy and insufficiency of water which will not meet the demand of drinking water for the capital.

2.4.2 **Topography and Climate:** Ramnagar lies in Terai belt, therefore is easily accessible from hilly as well as other regions. This area has its own scenic beauty due to Dhela Barrage and is available for eco-tourism.

2.4.3 **Supply of Electricity:** Electricity supply is sufficient in the area, as it is in the State as a whole.

2.5 RISHIKESH

Rishikesh is located on the Haridwar-Rishikesh road. Rishikesh is located at a height of 1,360 feet above sea level. IDPL is constructed on the forest land (Fig 2.22). It is constructed on 0.2 ha area land. It has been developed as a town area with all facilities like electricity, water, housing facilities, bank, post office, school, college, guest house, nursing home, park, offices, and roads. The site in general is bound by the River Ganges in the east, Northern railway Rishikesh branch in the west with fairly dense Sheeshum further west to it. It almost touches the Rishikesh town in the north and Bangala Rao stream in the south.

Fig 2.21 Dilapidated Housing at IDPL, Rishikesh *Photograph by: Mahavir*

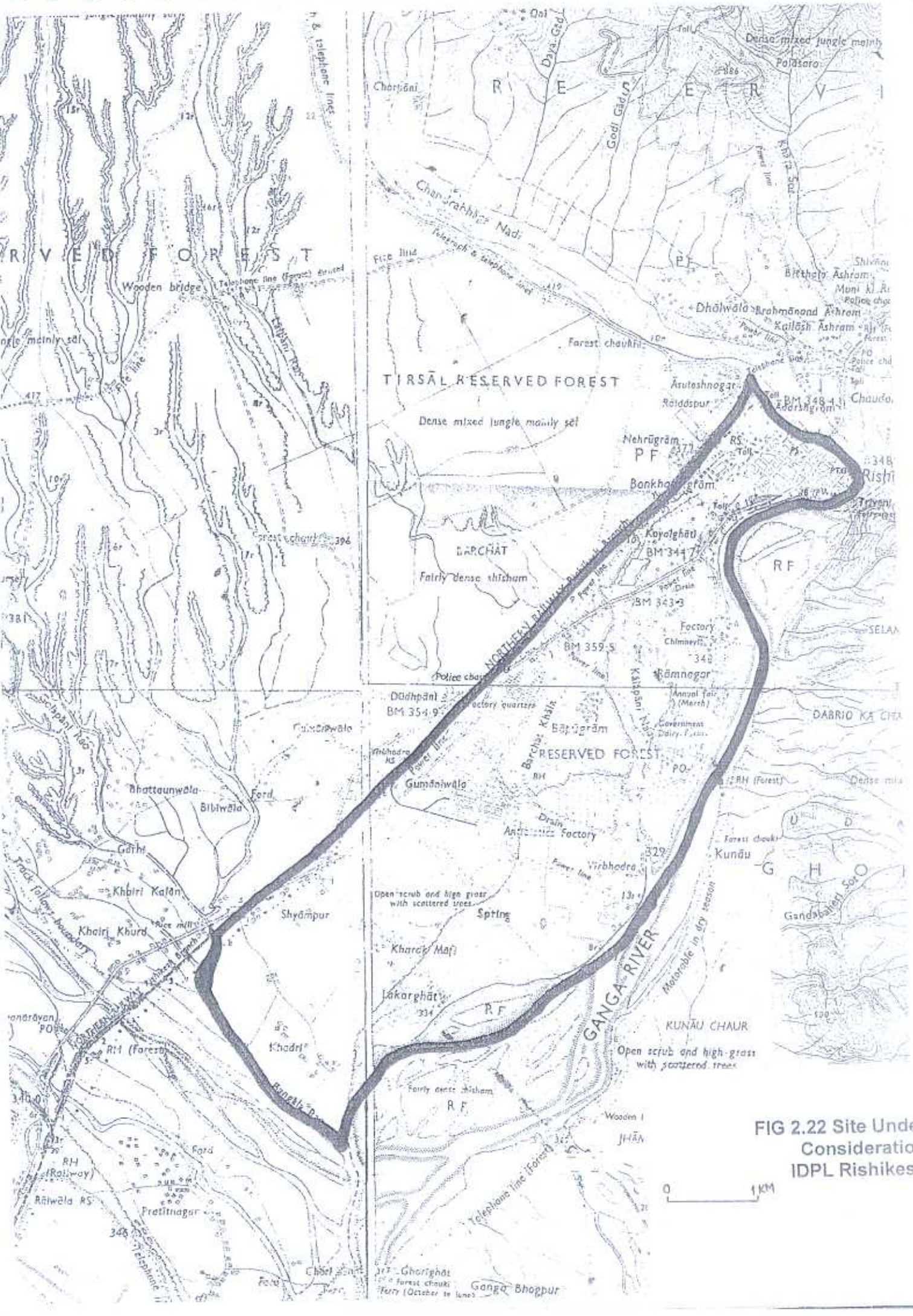


FIG 2.22 Site Under Consideration IDPL Rishikesh

Out of 0.2 ha area, 1/4th of the area has been kept as open ground. Forest land is about 0.005 ha. There is enough of vacant land also available, which can be utilized for any other purpose. However, the total land available is too small for Capital functions.

Fig 2.23: General view at the site of IDPL, Rishikesh *Photograph: Mahavir*

Earlier, IDPL factory used to make medicines, however, since been closed for a long time. Availability of water supply is through water tanks, water taps, water filter etc. Being in proximity to major religious activities like 'Yatra', 'Kumbh Mela' and movement of 'Kanwarias' attracting devotees from all over the country, the site is virtually inaccessible in some parts of the year. The town supports a population of only 1 lakh, which is too small to sustain a proposed State Capital. Proximity to River Ganga poses the risk of sewage and other wastes finding direct way to the holy river. However, as per the communication from the IDPL, they are actively considering revival of the factory and hence not available for consideration.

2.6 Comparative Analysis of Various Sites

Having discussed the brief salient features of the various sites under consideration, a comparative analysis is being provided (Table 2.2).

TABLE 2.2: COMPARATIVE ANALYSIS OF VARIOUS SITES

Site / Criteria	Dehradun	Gairsain	Kashipur	Ramnagar	IDPL Rishikesh
Topography and climate	Relatively flat area; moderate climate	Gentle to moderately steep, undulating topography; extreme climate.	Part of Terai belt and similar to plains; moderate climate	Lies in the Terai belt and is similar to plains; moderate climate	Relatively flat area; moderate climate
Sources of water	Available	Absence of water source. Water can be supplied from lifting which is costly proposition.	Available	Inadequacy and insufficiency in Surface water during summer season.	Available
Land availability	Available for Capital functioning only; not required for other functions	Desirable land is not available for Capital functions; not available for other functions.	Available for Capital functions, available for other functions.	Available for Capital functions, available for other functions.	Not sufficient for Capital functions; not required for other functions

Site / Criteria	Dehradun	Gairsain	Kashipur	Ramnagar	IDPL Rishikesh
Natural Drainage	Reasonably possible	Possible	Difficult	Difficult	Difficult
Scope for urban expansion	Possible	Not possible	Possible	Not possible	Not possible
Investment	Low, due to easy terrain, availability of rail, airlines, existing town level functions	Exorbitantly high due to excessive slopes, non-availability of water supply, linkages, town level functions	Low, due to easy terrain, availability of rail, airlines, existing town level functions	High due to non-availability of town level functions	High due to non-availability of town level functions
Remarks	Promise for development on a twin-city basis, no major environmental issues involved	Danger to fragile eco-system, Danger from natural disasters	Environmental issues related to Ganga catchment, Potential danger from Dam, Sacrifice of fertile agricultural land	Consolidated land not available, Environmental issues related to Ganga catchment	Environmental issues related to Ganga, inaccessibility due to religious activities

Although subject to further refinement with availability of further data, including satellite images, the above table brings out the sites at Dehradun as the most potential, without any major negativities. If the conclusions drawn in the end of Chapter 1 and 2 are clubbed, Dehradun alone emerges as the most preferred location, particularly the sites on either side of River Swong. Kashipur, with some reservations, emerges as a second preference when considered from the site specific angle. It is proposed that the two alternatives be studied in further detail for feasibility of locating the Capital, to be concluded in stage III of the study.

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