CHAPTER - 2

STUDY AREA

2.1 LOCATION AND EXTENT

The Singrauli coal fields is situated between 23°-55' to 24°-15' North latitude and 82°-30' to 83°-0' East longitude covering an area of 1880 sq km (Fig. 2.1) The area falls in Singrauli and Chitrangi tahsils of Sidhi district, Ramanujganj tahsil of Surguja district and Dudhi tahsil of Sonbhadra district located in Madhya Pradesh and Uttar Pradesh, respectively. The state boundary runs across the Baliya nala in the west and Baran river in the south. The area is well connected with Waidhan, Pipri, Renukoot, Sonbhadra and Varanasi by all weather road. The area is also connected by rail through Katni-Chopan line. A merry-go-round link also connect various mines as well as thermal power stations.

2.2 PHYSIOGRAPHY AND DRAINAGE

The area occupies the junctional region between the East-West trending Damodar-Koel-Tatapani-Grben and NW-SE trending rift 'Y' zone of the Son-Mahanadi valley. Depending upon elevation, slope and ruggedness of terrain, the area can be devided into two physiographic units (a) plateau region comprising mainly the area covered by mining blocks in the northern part and (b) the southern part is a plain formed by Rihand river and its tributaries. The elevation of

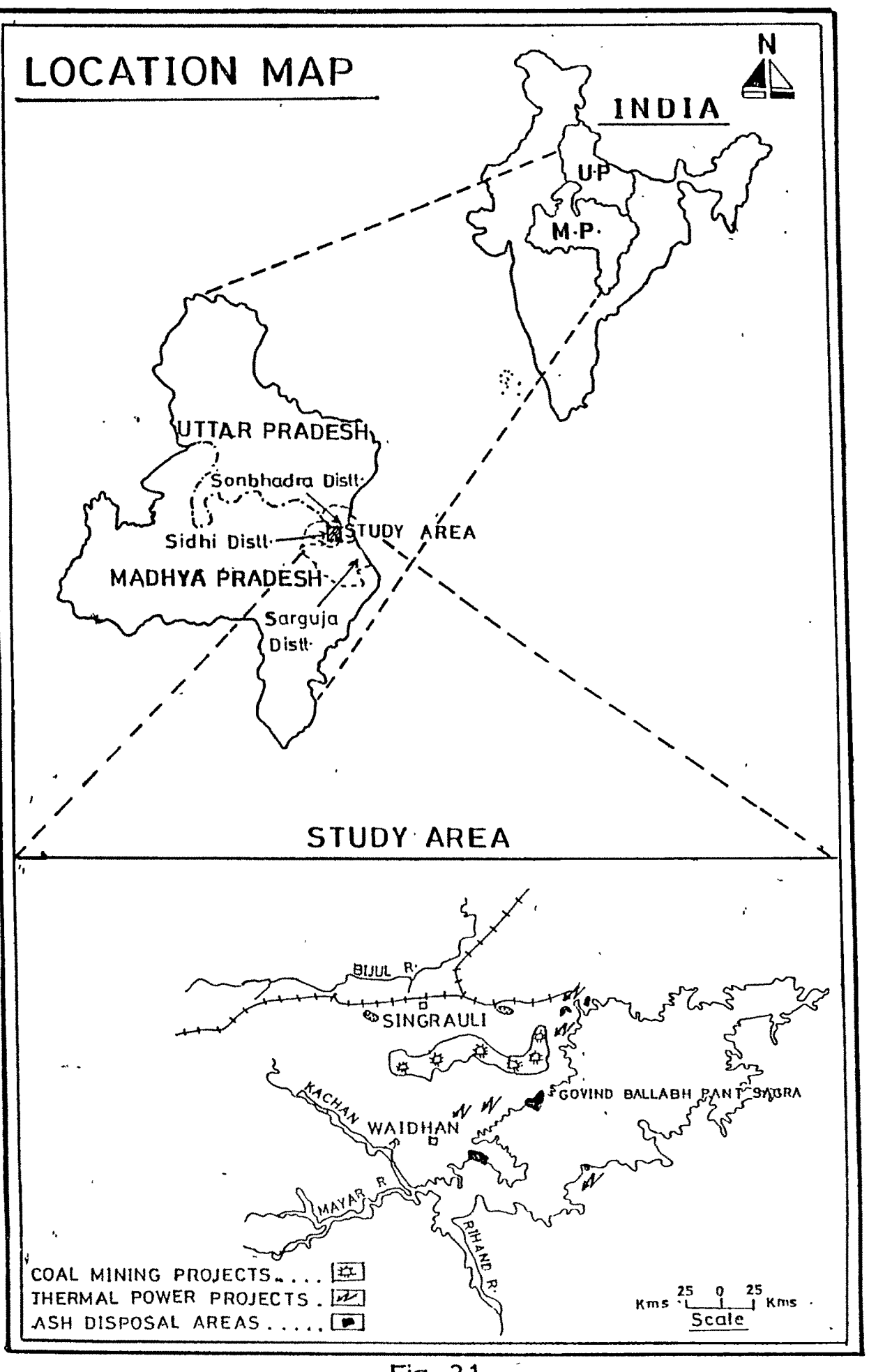
LOCATION MAP
N
INDIA
U·P
M·P·
UTTAR PRADESH
Sonbhadra Distt·
STUDY AREA
Sidhi Distt·
MADHYA PRADESH
Sarguja
Distt·
STUDY AREA
BIJUL R·
SINGRAULI
GOVIND BALLABH PANT SAGAR
KACHAN WAIDHAN
MAYAR R
RIHAND R·
COAL MINING PROJECTS . . . .
THERMAL POWER PROJECTS .
ASH DISPOSAL AREAS . . . . .
25 0 25
Kms
Kms
Scale

Fig-2·1

plateau is about 520 Metres, above Mean Sea Level and the plains of Waidhan and Renusagar, elevation is about 280 metres above mean sea level.

The eastern part of the area which falls in Uttar Pradesh is characterised by a cluster of hills and plateau to the north and undulating plain to the south. Towards north east several high peaks such as Aunri (571m) Durasin (444m), Jhandahwa (436m), Chitawar Panav (427m), Chirvair (426m) and in south east Tumba (451m), Nuckti Pahar (393m) are prominent topographic features.

The central part of the area has step like scarps faceing towards south. The step appears to represent stages of peneplation of gently inclined sendimentry strata of varying resistance. Consisting of anticlinal hills and synclinal valleys, carved out of sandstone and limestones.

The main rivers in the area are Rihand and Bijul. Bijul is the tributory of Son river flows almost parallel west to east and turn towards the north before it join the river Son. The north flowing river in the area joins Bijul. The southern half of the area is mainly drained by Rihand river and its tributary i.e. Kanchan, Mayar, Gabaia, Baran, Ajil, Bichhi, Laira, Bair and Baliya nala debouche directly into Govind Ballabh Pant Sagar. These nalas are seasonal except Baliya nala which is perennial in nature.

The extensive basin have carved out in the relatively soft rock formation, while where harder bedrocks are encountered, river is forced to escape through narrow gorge. This however, has facilitated the taming of Rihand river. These river basin with rich alluvial covers have ever since served as the cultural oases in the vast rugged stony and forest clad terrain of the region. The drainage pattern is dendritic while it is locally distributed by rectangular pattern.

2.3 CLIMATE

The climate of the area is dry with three distinct seasons. From March to mid June is summer followed by winter season. The post rainy season lasts from September to October followed by winter season from November to February. The minimum temperature recorded during winter (December-January) is about 4^{o}C and maximum temperature recorded during the same period is 21^{o}C. The temperature in summer goes up to 48^{o}C in May and June (Fig. 2.2). The average annual rainfall is about 900 mm. (Fig. 2.3). Maximum and minimum humidity varies between 86 to 45% and average wind velocity is about 7.8 km/hr. in the area. The wind velocity progressively increases from January to May, the highest being in June/July and gradually decreases from October onwards. The wind direction varies widely in different seasons, the predominantly direction being from NE and from SE.

YEARLY TEMPERATURE DISTRIBUTION IN SINGRAULI COALFIELD AND SURROUNDINGS

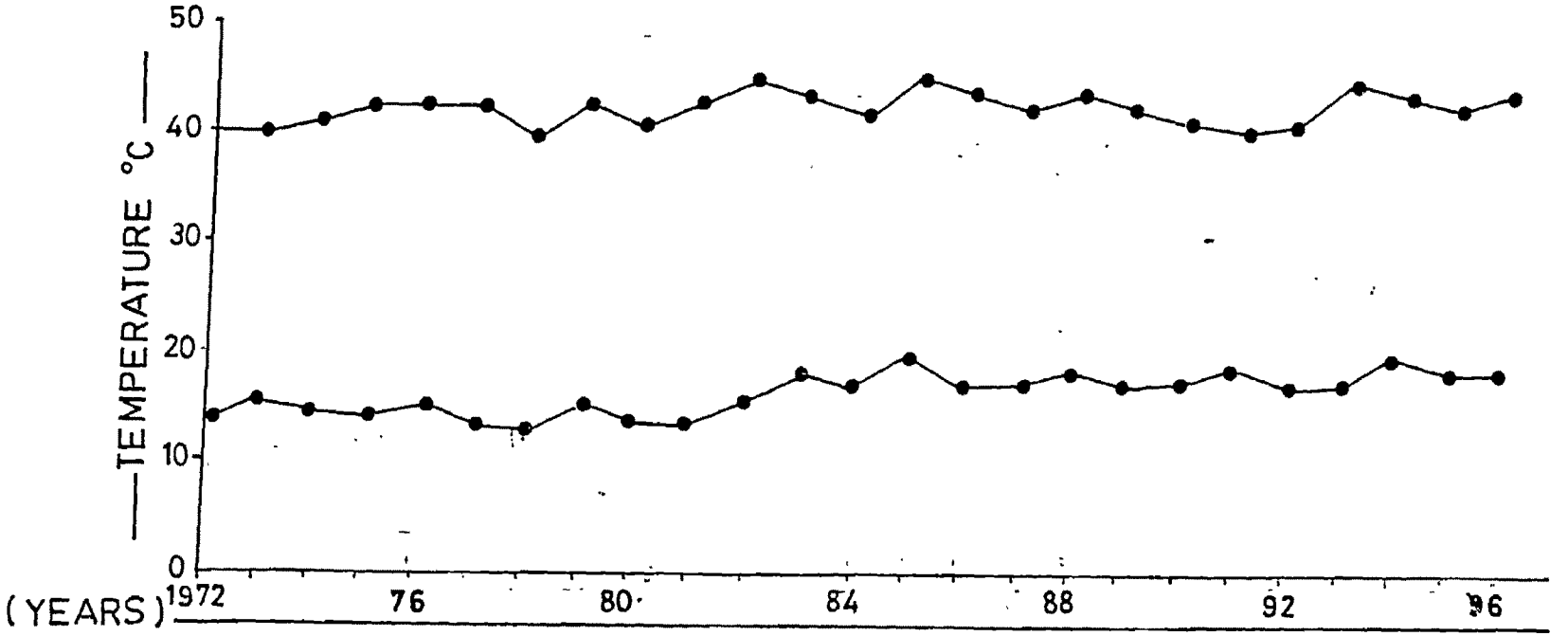

Fig. 2·2

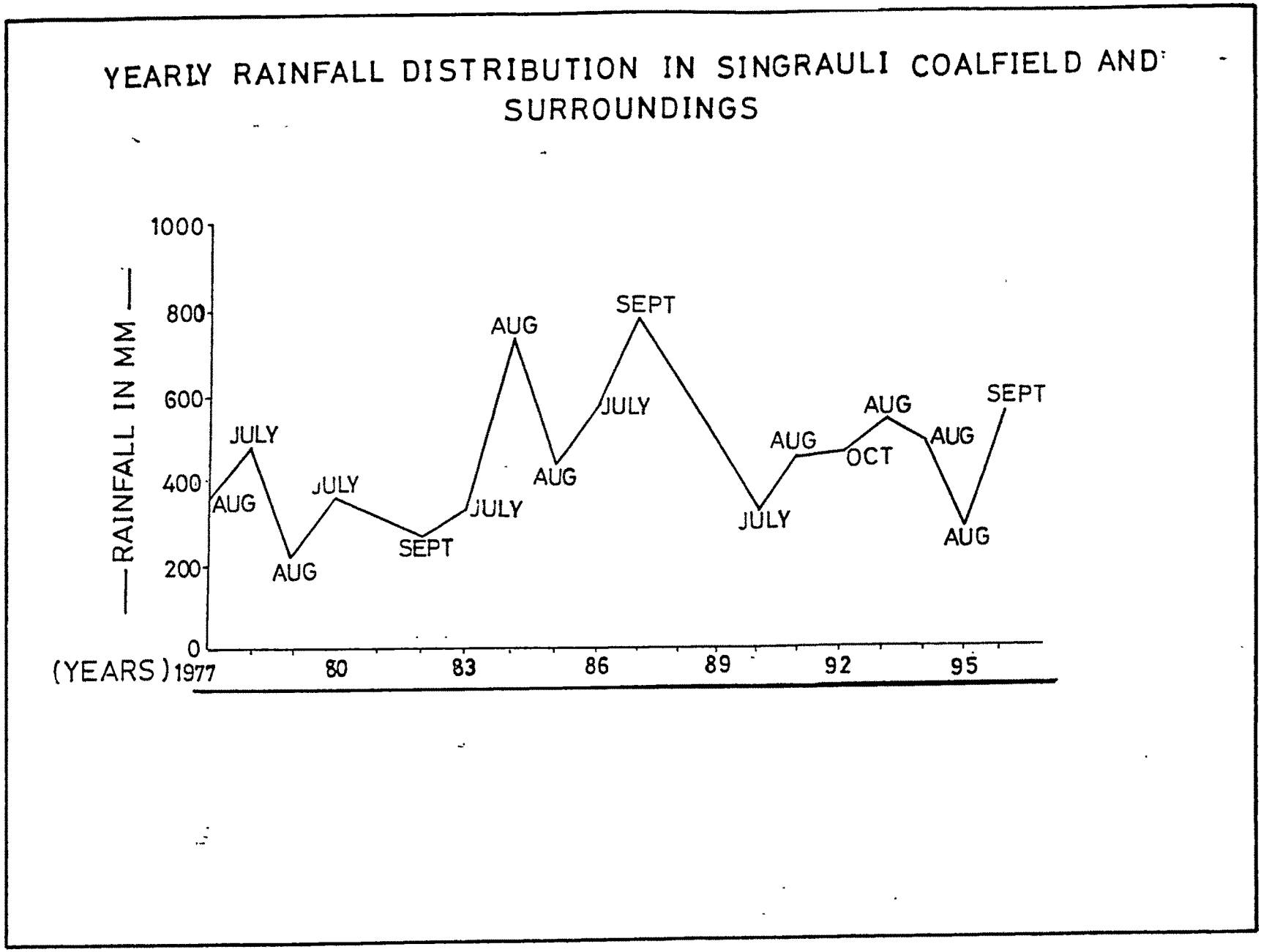
YEARLY RAINFALL DISTRIBUTION IN SINGRAULI COALFIELD AND SURROUNDINGS
—RAINFALL IN MM—
1000
800
600
400
200
0
(YEARS) 1977
80
83
86
89
92
95
JULY
AUG
AUG
JULY
SEPT
JULY
AUG
AUG
JULY
SEPT
JULY
AUG
OCT
AUG
AUG
SEPT

Fig. 23

Based on the variation in rainfall (P) and potential evapo-transpiration (PE) actual evapotranspiration (AE) and length of growing period (LPG) for normal cropping system, the area comes under Agro-ecological zone of Central highland having dry sub-humid climate.

2.4 GEOLOGY

Geological formation in the area is diverse in nature. It comprises the Archaean, Metamorphic to sub-recent and recent alluvium formation. The stratigraphic and tectonic frame work of the area shows character of both Son-Damodar valley (EW trending formation) and Son Valley Gondwana basin (NE, SE trending formation).

The Archaean rock formation occupies three separate area around Pipri, Makrohar and Rihand river, south-eastern part of Rihand valley is occupied by the crystalline rock of the Archaean age. Rocks in this area are prophyritic, granite and gneisses, mica, schist, quartzveins, pegmatites and basic dykes. The northward forming peaks of Kasav (20°-14': 82°-32') and Jhingurdah (24°-12' : 82°-42') which is about 12 km wide in eastward direction from Kasav is mainly composed of quartreef while west ward is mainly gneisses, granite and schist at places.

The quartzites amongst the Archaean formation stand high on the surface forming hillocks. The granite gneisses forms the hill with

rounded tops and gentle slopes. In low lying areas these give rise to rolling topography. The weathered zone extends fairly deep upto 20 to 30 metres and ground water level are much higher.

Rocks of transition series have occupied in the north-east near Churki (24°-15' : 82°13') and extend upto 3 km north-south upto river Gopad. The rock of transition series consists of quartzites, shales, phyllite, banded haematite, siliceous and green stone. These rocks are intruded by the basic rocks. The general trend of rocks in hill ranges, valley are ENW-WSW and having steep dips.

The rocks of red shale series are coarse grained sandstone and conglomerates of Panchet formation of lower triassic age can be seen around Gadsa (24°-8' : 82°-31'). Ground water condition of these rocks are similar to transition series.

The lower Gondwana sedimentry rocks are represented by Talchirs and Barakars in the area. The rocks of Talchirs formation are exposed over large area in eastern and south-eastern part of the area. The width of Talchir rock outcrop varies from 3 km to 8 km and shows a tendency to widen towards west. A large part of Talchir rocks exposures have been submerged in the water of Govind Ballabh Pant Sagar. Pant (1962) reported a 9 metres thick dia-micitite horizon at the base of the formation.

The Barakar rocks included white grained sandstone, shale and coal seams of lower permian age. The northern boundary of the barakar start from near Nigri (24°-9' 81°-55') on Gopad river in the west and it extend upto Singruali (24°-11' to 82°-40') in the east. Barakar rocks are prominent in the central part of the area. These rocks are hard and compact in nature. It consists mainly medium to coarse grained, light grey, pink and white rocks with interbands of shale and pink clay. Fine grained sandstone are also observed within the formation but their proportion to the coarse grained sandstone is rather low. Keolinised felsdpar is usually the cementing materials. The sandstone are usually cemented with high porosity and normaly acts as good aquifers, when they are sandwiched between intervious beds.

Ferruginous sandstones are also very common at places and red colouration is due to the deposition of iron along the bedding planes. These sandstone are invariably interbanded with coal and constitute most of the dirt bands within the seams. The shales are grey colour and generally sandy. The presence of some thick seams break the monotony of the dominance of sandstone. However, the total thickness of coal is much lower in comparison to non-coal bearing strata. In the western part, the average coal/non-coal ratio of the Barakar succession is 1:116, while towards east this ratio is around 1:125 (*Datta and Mukherjee*, 1979).

The characteristic feature of the area is that coal seams are defined by clay beds near the outcrop area. These clay show a wide spectrum of colour from light yellow to creamy white and pink. The clay beds are continuous along the incrop of coal seams. Pant and Shome, (1963), Pant and Basu, (1967) reported, these clay along with Paralava from a number of localities in these areas.

The Barakar formation in the area shows remarkable lateral variation in thickness. The maximum thickness is 585 metres to 500 metres in eastern part but attenuates to 325 metres to 400 metres in the Amilia area in western part.

The Raniganj formation of lower Gondwana group of upper Permian age includes fine grained sandstone and shales with coal seams including 134 metres thick Jhingurdah seams, cover large area in western part. In Jhingurdah this formation represents sandstone of various thickness and grain size, white and grey clays and carbonaceous shales. Jhingurdah seam is the thickest Gondwana coal seam so far known in the country.

Soil and alluvium are included in the recent deposit. Thick alluvium deposit is rare in the area. Marginal deposit are along Rihand, Kachan, Mayar and Bijul river.

2.5 Structure

Structurally the area is composed of two tectono-sedimentry domains, the Mohar sub-basin in the west and main sub-basin in the east. These two basins are seperated by a north-south trending elongated basement high, which is blanketed by a shallow superficial cover of basal Barakar strata. These two sub-basinal structure show distinct pattern of sedimentation and structural peculiarities. The Mohar sub-basin flanked by the Talchir sediments both on the east and west is delineated to the north by the prominent east west trending boundary fault. In Mohar sub-basin the beds have general NE-SE trend in the western part and this strike gradually swerves to nearly east-west along the Amlori-Nigahi-Jayant coal mine blocks. The dip direction in these places are northerly. In east of the Khadia-Bina coal mine blocks the strike shows frequent variation from NW-SE in the western extrimity to NE-SW in the eastern periphery. The strike takes a spectacular swing in the eastern part of Mohar basin, and almost north-south in Bina coal mine block, takes a swing towads Kakri block to the north and south-east in the Marrak coal mine block on the south. The dip direction in these areas are towards west. Mohar-sub-basin shows a broad basinal structure with uneven undulation on its limbs.

The northern part of the area presents a vast panorama of Gondwana country. Gondwana is dissected into flat topped plateaus formed by upper Gondwana rocks i.e. coarse grained ferruginous sandstone with

beds of shale, clay and conglomerates of Pre-Mahadev formation of upper Triassic age. The strike of these Pre-Mahadev beds in NS is the north to NE-SW in the south with a westerly dip of 3° to 5°.

The Raniganj strata are disposed with a anticlinal flexture. The beds of this formation are trending towards NW-SE with a dip of 10°-15° in North-East direction.

The Talchir metamorphic boundary trends NS and swings to ESE in the extreme south-eastern tip, where the coal measures pinch out. The beds of this formation are disposed as an anticlinal roll, the axis of which passes south-westward near village Nangwa and Khorahi.

The most prominent structure of the area is the northern boundary fault, which is a brecciated zone intruded by Pegmatite. In Mohar sub-basin faulting pattern is clearly available by observing the sub-surface strata (Bore lock). The first fault trending EW and swings at places to ENW-WSE direction. The other fault trends NW-SE and NNW-SSE. The throw of the fault in between are higher than 30 metres at places.

2.6 SOIL

Soil in the area is derived from sandstone granite, schist, gneisses, quartzite, phyllite and shales. Extremely shallow to shallow entisol developed on hill and ridges having steep slope. Undulating plateau

having deep inceptisol are well drained, fine loamy soil but these have severe erosion problem and very low water holding capacity. These soil are covered by sal and mixed forest of bamboo (*Dendrocalamus stricuts*) and Babul (*Acacia arabia*) Plain land are covered by well drained deep fine loamy to fine vertisol having medium to high water holding capacity, pH of these soil are between 7.0 to 7.4. Valleys are covered by deep to moderate, well drained alfisol. These soil are fine to fine loamy and having moderate erosion problem and mainly suitable for rice, wheat, gram, pulses etc.

Entisol and Inceptisol coverings the northern part of the area are derived from weathering of igneous and metamorphic rocks. These soil are shallow, poor and open in texture. These soils are light in colour on hills and rich, deep and dark colour in low lying areas. Entisol contains low percentage of clay and water holding capacity. Reaction of these soil is acidic, because of the open texture permeability is high resulting in free drainage of the soil.

Vertisol and alfisol are mostly derived from sandstone and they are mostly deep to very deep but shallow on hilly terrain. The texture of these soil vary from sandy-loam to sandy-clay loam. The clay content varies between 17 to 42% while sand varies between 43 to 76%. The pH of these soils varies between 6.0 to 7.5.

The deep soil have 30 to 50% water holding capacity while shallow soil varies between 30 to 50%. The percentage of calcium and magnesium varies from 2.0 to 19.6 and for sodium and potasium from 0.38 to 1.3 and 0.288 to 0.936 mg/100 gm of soil, respectively. The surface soil have more organic carbon than sub-surface soil.

2.7 FLORA

Vegetation in the area consists of dry deciduous forest. The density of the vegetation varies with the topography. The area falls under two forest range i.e. Waidhan and Mada range. Waidhan range consists of Gorbi, Mohar, Mahrauli, Chokra, Dudhichua, Charkardy forest area while the forest of Vihar, Nimna R.F comes under Mada range. Mirpur, Kaiabara R.F. area in the south east falls in Uttar Pradesh.

The main type of the forest encountered in the area are (i) sal forest (ii) mixed forest which represent stable climax. Distribution of forest is determined by the moisture availability. The area where moisture is relatively more favourable, sal grows more or less pure. In drier tracts mixed forest are found.

The main associates of Sal (*Shorea robusta*) are Dhawra (*Anogeissus latifolia*), Tendu (*Diospyros melanoxylon*) Saja (*Terminalia tomentosa*), Achar (*Buchanania lanzan*), Kari (*Saccopetalum tomentosum*). There are many blanks and patches of mixed forest in sal forest mostly due to

edaphic factor. The density is being below 0.4. Regeneration of sal is poor. Repeated fire and heavy grazing have deteriorated the condition of regeneration. In most of the area regeneration is almost absent.

Mixed forest occurs on all geological formation and almost all type of topography. The main species are Salai (*Boswalia serrata*), Tendu (*Diospyros melanoxylon*), Gunja (*Lannea grandis*), Anola (*Emblica officinalis*). Bamboo (*Dendrocalamus strictus*) type of mixed forest is more or less uniform in the area except in some compartment where it support Haldu (*Adina cordifolia*). All age classes of trees present but middle age tree are predominate. Most of the mixed forest are patchy, having density between 0.4 to 0.6.

Seharu (*Nyctanthes arbortristis*), Dhawai (*Woodfordia floribunda*), Kharhari (*Gardenia turgida*) Birhul (*Indigofera pulchera*) are the main shrub in the area. Lampa (*Heteropogan contortus*), Bhurbhusi (*Eragrostis tenella*) are major grass species found in the area.

The forest on the M.P side are Reserved and Protected Forests, whereas on U.P side these are "Vested" forests. These forest were later notified under section '4A' of Indian Forest Act. In "Vested Forest, the forest settlement was not done and rights were not settled with the result there are lot of encroachments in Uttar Pradesh side.

2.8 FAUNA

Earlier, the area was extremely rich in wildlife. Elephants, tiger, beer, bison etc., were quite common. Indiscriminate shooting and poaching have severely depleted the animals and today, there are no tigers and elephants in the area. Panther was found till 1965, cheetal, bear, wild boars can still be seen in Mohar and Mada Reserved Forest. The nearest National Park is "Sanjay National Park" in Sidhi and Surguja district of M.P. It is located at a distance of about 50 km in the south west direction from Singrauli.

A large number of birds come to this area in winter. They arrive in the month of October-November and depart in March-April. Ducks can be seen in Govind Ballabh Pant Reservoir. Wagtails, barheaded goose, surkhab which migrates in winter from Ladakh and Tibet are also seen.

2.9 POPULATION AND SOCIO-ECONOMIC STATUS

All the coal mining project and thermal power plants in Singrauli coalfield fall in the Singrauli tahsil of M.P. and Dudhi tahsil of U.P. The study area comprises of 251 villages as per 1991 census. The population of the study area is 322685 (District Census 1991). The percentage of Sheduled Caste (SC) and Sheduled Tribe (ST) population is 37.24% while the population of General caste is 62.76%. The area is less densely populated having an average density of 172

person per sq km. The area was also sparcely inhabited. Agriculture is the main occupation and Maize and Kodo form the staple food. Wheat and rice are also cultivated in certain parts.

2.10 SETTLEMENTS

The study area is predominantly rural in character with about 83.49% of its people living in 251 villages of different sizes. In general, the villages are small in size. The settlements are dispersed type with clusters of compact and semi-compact settlement in valleys and flat plateau land, both the type of settlement pattern exhibit the dominant control of terrain in consonance with soil, hydrography, vegetation cover and the nature of general development. The extent of compactness and size of settlements widely vary, where the cultivated land are patchy, the settlements are small and unevenly distributed, while small to medium size hamlets and semi-sprinkled villages have grown up in valley where the surface is studded with artificial tanks for irrigation. The rural settlement in most cases consists of a number of hamlets, each generally with dominance of one caste.

There are four urban centres in the study area i.e. Singrauli, Waidhan, Vindhyanagar, in Sindhi district and Ranusagar in Sonbhadra district, with a population of about 53290 (16.51%) of the total population. The urban centre in this region were came up because of mining and thermal power activities. The growth of these urban centres is

hampered because of their linkage with the rural population distributed over their natural umland. As such most of the villages in the study area are unadequately served and still unequipped in terms of basic amenities, and they are dependent upon the urban centres.