Chapter 2

GEOGRAPHICAL ACCOUNT OF THE BASIN AREA

The river Mayurakshi, is the western tributaries of Bhagirathi and her tributaries are Brahmani, Dwarka, Bakreswar and Kopai. Mayurakshi literally means the eye of a peacock (Mayur/Mor=peacock, Akshi=eye). Mayurakshi though named after its crystal clear water of the dry seasons, floods its valley during the monsoons. Even after the construction of the Massanjore dam, it wreaks havoc with its floods, washing away embankments. After coming down from the plateau fringe (Chhotonagpur) it ultimately joins the Bhagirathi river, one of the main channels of Ganga. The river with a length of about 380 km.’s, constitutes the transitional zone between the megaphysiographic province of the Chhotonagpur peninsular massif and the Bengal basin.

The combined streams of Matihari, Dhoobi and Pussaro, all originating from the uplands of Santal Parganas in Bihar (Jharkhand) form the origin of the river Mayurakshi or Mor. It then flows to Chhotonagpur plateau fringe zone. Before entering Birbhum district in West Bengal, it is fed by combined streams of Siddeswari and Noonbeal. After entering West Bengal, it is again joined by the river Khuskarni from the right and the rivulet Ghoshbera from the left, it leaves the boundary of the district and meets the river Dwarka at Telgram in Murshidabad district, the combined stream outfalls into river Bhagirathi.

Fig: 2.1 : Geographical Account of the Study area.
Below the plateau fringe, in the zone of old alluvium. This is followed by the alluvial recent alluvial zone at the confluence site. The latter tract is characterized by the presence of extensive waterbodies or ‘bils’ that require investigation. Moribund or ‘dead’ deltaic conditions are also manifest in this region. After coming down from the plateau fringe, they flow through banks of old alluvium, in which they are slightly incised. The Mayurakshi is obstructed for about 30 km. by the natural levees of the Bhagirathi, so that when only 5 km. away from the Bhagirathi, it turns at right angles to the south and runs parallel to the Bhagirathi, with natural levee between them. After flowing down 30 km. in this manner, it succeeds in finding a gap between the levee and joins the Bhagirathi about 20 km. north of Katwa.

2.1 Geology:

In the total catchment area of Mayurakshi, the portion above the Massanjore dam is flowing Northwest to South East in the Chhotanagpur plateau, composed of granite and gneiss. According to geologists, this portion of Chotonagpur plateau is a part of the Deccan Shield region. Here one can find, several remnants of this upland stands as erosional hillocks like Tinsuri (372mt), Madhuban (310mt), Diga (315m), Sitashal (232m), Nakti (276mt), Baska (492m) etc. All these peaks are extended mainly from north west to south east, parallel to the river course. Geologically the area has basaltic trap and sedimentary beds. Quartz and gneisses are found in some places.

At Massanjore of Jharkhand where the river flows in a narrow valley, Massanjore dam was constructed. The site of the dam and its vicinity are underlain by a coarse grained granulitic granite containing quartz, microline, oligoclase and certain ferromagnesium minerals such as — hypersthene, bilite and magnetite, garnet is also often present. The granite intruded into basic hypersthene – granulites, which consist of andesine, hornblende, augite, iron-ore and occasional garnet. The basic rocks occur as bands and lenses within the granites, the larger bands having the form of nearly vertical dykes. Both the granites and the basic granulites are intruded by veins and dykes of pegmatite and apelitite. The granite at the dam site is generally coarse grained. Joints are parmanent in both the acidic and basic rocks. They are mostly open, but sometimes filled with pegmatite.
The major part of the Mayurakshi river basin lies in West Bengal falls in the Mayurakshi canal command area which falls within Birbhum district, West Bengal and the rest of the area falls within Murshidabad & Bardhaman districts, West Bengal. Birbhum district shows the development of Archaean hard rocks, Gondwana sedimentaries with Rajmahal taps. Sub-recent laterites and recent to sub-recent alluvium, where as the parts of the command area, which are within Murshidabad & Bardhaman districts are covered by older alluvium. General geological succession of Birbhum district in as follows –

Recent : Alluvium – unconsolidated sand, silt clay etc.
Pleistocene : Laterites and lateritic gravels with fossil wood.
Tertiary : Clay heads, ferruginous and emphatic sanstones
Gondwana : Rajmahal Trap.
        Dubrajpur beds – Flaggy shales, clay & compact sandstones.
        Barakar – Sandstones, shales with coal seams.

Archeans : Granites, granite – gneisses, biotite – schists, cale – granulites, with quartz & pegmatite veins.

(Source: Roy Barman (1983)

Archeans are the oldest rock formation met with and represent the astern extension of peninsular Archean of the Chotanagpur Plateau. The formations comprise granites, granite-gneisses, biotite – schists & cale-granulites with quartz and pegmatite veins. They occur in the western and south-western parts of the district.

Lower Gondwana rocks (Barakar) overlie the Archeans with an unconformity. The rocks are mainly sandstones and carbonacens shales with minor coal seams, deposited under fluvial or lacustal conditions in isolated linear troughs resulted from block type of earth movements. These sedimentary rocks are developed in the south-western part of the district near Ajoy river, being an extension of the Raniganj coal field in Bardhaman district.

Rajmahal trap rocks (upper Gondwana) are well exposed along the western margin of the northern part of Birbhum district near Rampurhat, Nalhati etc. The traps are represented by basalts, which are vesicular and awygdaloidal in nature and often found to be altered to laterites.
The tertiaries comprise mostly felspathic & ferrogenous sandstones, grit & clay etc., and are exposed near Mohammad Bazar area. The rocks are associated with angiopernic fossil words at different places. China clay or Keolin pockets mainly occur in these formations which are quarried on commercial scale. Similarly, the trap rocks are extensively used as road material.

Laterites, mostly of vermicular type, occurs as a cap rock over the basalts & tertiary formations. The laterites are of diverse origin. The lateritics, which occur on high lands & can be traced back to the parent basaltic materials are reported to be primary in origin, whereas the low land lateritic gravels & clays are mainly detrital or secondary in origin.

Older alluvial deposits cover the major position of the area. They are coarse and generally reddishly coloured, lies in calcareous & limonitic concretions.

Newer alluvium is mostly confined along the present drainage channels & in poor in calcareous matter. It gradually merges in the east into the flood plain of Bhagirathi basin.

2.2 Physiography:

The western part of the area under study is quite rocky, undulating in topography being an extension of Chhoto Nagpur plateau and are made up of unconsolidated and semi-consolidated rock formation. Towards east, however, the spur become more undulating till the land becomes plain in Murshidabad and Bardhaman districts. These spurs sometimes take to formation of high cliffs, capped by laterites and separated by wide valleys. In the extreme north around Rampurhat the ridges amount almost to the dimensions of hills. These rocky formations have their extensions towards east and are concealed under a cover of unconsolidated sediments of variable thickness. The area has overall easterly to south-easterly slope. (Fig. 2.2)
In general, the surface of the Birbhum district is broken by a succession of undulation, the general trend of which is from North-west to South-east. Along the western boundary, high ridges of laterites are separated by valleys a mile or more in width. To the south-east these upland ridges are more pronounced, while the valleys become narrower and gradually merge into broad alluvial plains of the Gangetic delta. The western part of the Mayureswar and Siuri are covered with high ridges towards south-east. Whereas on the northern part of this area perfect level ground is found and on the south of the valley Mayurakhshi the surface area sinks into undulations and after nearly disappearing, rise again to the dimensions of low hills. The ridges on the south bank of the Mor pass into flat country east of Suri, but swell into well raised uplands near Sainthia. (O’malley, 1910). The relief of the area ranges from 400 mt towards West near Trikut Hill in Deoghar, Jharkhand to 15 mt towards the east in Hijal area in Murshidabad of West Bengal. (Fig. 2.3)
Brahmani-Mayurakshi Basin in Birbhum lies between the Brahmani river on the north and the Mayurakshi river on the south. It has been characterised by its uneven surface configuration. The region is sloping from west to east. But the Dwarka takes a north-easterly bend and the Mayurakshi southeasterly direction in the Muhammad Bazar and Mayureswar areas. The land sinks into undulations on the south of the Mayurakshi. However, some plain areas are found further eastward. The land between the Dwarka and the Mayurakshi and to the extreme south-east of the PS Mayureswar become flat and are found in large water bodies.

Mayurakshi-Dwarka Plain - In the south-western corner of the Murshidabad district the region lies and exhibits the Radh characteristic features of the Sub-Vindhyan region. Radh is substantially a continuation of sub-Vindhyan region of laterite clay. The land is high and slightly undulating, but is interspersed with numerous swamps and beds of old river.

The area is drained by a number of easterly flowing rivers and their tributaries. All these drainage channels belong to Ajoy and Mayurakshi river systems. Ajoy is the southernmost part of the area, Brahmani in the north and Mayurakshi in the central part of the area – are the main drainage channels of the area and flow from west to east, following the master slope of the land. The Bakreswar, Sal (or Kopai), Dwarka and Pagla rivers etc.
constitute the main drainage channels in the Mayurakshi channel near Sriniketan, Santiniketan, Surul etc., peculiarity of their gully erosion is that the bad land topography does not extend below 45 mts. Contour and the banks of Kopai itself are free from gully erosion.

The rivers present in the area flow with a tremendous velocity during the monsoon months, carrying substantial volume of sand and silt but become almost sluggish/dry during the rest of the year. During rainy seasons these rivers often overflow and thereby damage crops and cause heavy soil erosion. From O’Malley’s account, we came to know that “In the dry weather season their beds are broad expenses of sand with small streams trickling down the centre, but during the rainy season they grow much broader and deeper, and after a heavy downpour rise in a few hours, occasionally overtapping their banks and inundating the the surrounding country”.

There are several swamps in the northernmost part of Birbhum on the Dwaraka-Mayurakshi interfluve and extreme south-west of Mayurakshi interfluve and extreme south-west of Mayureswar PS, two large water bodies occupy a low lying depression. Several marshes are found on the right bank of the Mayurakshi. Many derelict channels forming linear or ox-bow lakes are found on the right bank of the Dwarka. The largest marsh, however, has been formed by a comparatively smaller stream, namely the Koiya on the Birbhum-Murshidabad border.

To check the overflow of the rivers and to ensure a steady supply of irrigational water, particularly in the dry seasons, the Mayurakshi Project was established in 50’s(51-55) by constructing a masonary dam on river Mayurakshi at Massanjore and other rivers like Kopai, Dwarka, Brahmani, Bakreswar etc. at different places. An area of 3174.40 sq.km. falling in the districts of Birbhum, Bardhaman and Murshidabad has been brought under irrigation by a network of canals(main, branches and distributaries under the Project).

2.3 Drainage :

The Mayurakshi-Babla system of rivers comprises a total catchment of 11,655 sq.km. upto its outfall into Bhagirathi. The distribution of the total catchment areas is as under:

a) Above Massanjore dam : 1860 sq.km.
b) Between Massanjore dam and Tilpara Barrage : 1349 sq.km.
c) Between Tilpara outfall at river Babla : 1900 sq.km.
d) Brahmani-Dwarka : 3446 sq.km.
e) Pagla Bajsloi : 2200 sq.km.

f) A small Bhagirathi Portion : 900 sq.km.

Total : 11655 sq.km. (Dasgupta, Sechpatra, 2001)

The Mayurakshi :

The combined streams of Matihari, Dhabbi, Pussaro, all originating from the uplands of Santal Parganas in Bihar (Jharkhand) form the origin of the river Mayurakshi or Mor. Before entering Birbhum district in West Bengal, it is fed by the combined streams of Siddheswari and Noonbeel. After entering West Bengal, it is again joined by the river Khuskarni from the right and the rivulet Ghoshbera from the left, it leaves the boundary of the district and meets the river Dwarka at Talgram in Murshidabad district, the combined stream outfalls into river Bhagirathi. Many “bils” and tanks are found in the Murshidabad district. In the north, an area of about 389 sq. kms. form a strip of low-lying country, which becomes a vast lake in the rains, village sites looking like islands. In the south, there is a plain of 129 sq. kms. at the confluence of the Mor and the Dwarka, known as “hijal”.

The Mayurakshi enters Birbhum from the Santhal Parganas (now in Jharkhand) and flows through the centre of the district from west to east, passing two miles north of Suri and forming the southern boundary of Rampurhat subdivision. It leaves the district and joins the Dwarka, which itself is a tributary of the Bhagirathi. All the distributaries of the Mayurakshi take off from the left bank. In the eastern portion of its course it gives off distributaries known As Kana and Manikarnika Nalas. The Hingla enters Birbhum district from the Santhal Parganas and gradually approaches the river Ajay. The river unites with the river Ajay at Chapla in Dubrajpur then. The Bakreswar rises at the hot springs of the same name west of Suri, and after following a zig zag course eastwards, and receiving one by one the waters of almost all the rivulets of South Birbhum, joins the Mayurakshi beyond the eastern boundary of the district.

The Brahmani a river enters the district at Narayanpur bisects the Rampuhat subdivision and passing under the railway two miles south of Nalhati falls into the Dwarka in the Murshidabad district. The tributaries of the Mayurakshi are Bakreswar, Kopai, Dwarka and Brahmani. Followings are their accounts:
The Kuiya :

The river Kuiya is formed by the union of two streams, viz. the Bakreswar and Kopai. River Bakreswar has its origin in the hills of Santal Parganas. After passing through the hot spring and following a zigzag eastwardly course, it receives water of almost all the rivers of South Birbhum namely the Chandrabhaga (O’Malley). The river Sal which originates from eastern hills of Santal Parganas in (Jharkhand) flows for a length of about 52 kms., then turns north with the name Kopai and outfalls into river Bakreswar near Kadipur. The combined stream, taking Kuiya by name, after receiving waters of some streams outfalls into river Mayurakshi in Birbhum district. (Dasgupta, Sechpatra,2001)

The Dwarka :

The Dwarka or Babla is a narrow non-perennial stream, originates in the Ramgarh hills of the Chotonagpur plateau, the river describes the district boundary of Birbhum flowing south-east. In its southeasterly course the Dwaraka receives numerous small tributaries of which mention might be made of Bamini Nala and Kuila Nala. In its northeasterly course the Dwaraka receives many tributaries on its right bank. After crossing a length of about 70 km in Birbhum district and receiving water of streams like Gambhira, gharmora etc it turns east, then the south and finally meets the combined flow of Mayurakshi and Kuiya at Hijol beel in Murshidabad district and outfalls into Bhagirathi. The Gharmora and the Chila nalas combine and the united stream falls into the Dwaraka. In its easterly course also the Dwaraka receives a few tributaries from the south. The Dwaraka unites with the Brahmani and goes into Murshidabad district.

The Brahmani :

The river river Brahmani originates from hills of Santal Pargana, enters Birbhum at Narayanpur and ultimately outfalls into river Dwarka at Sankoghat (Dasgupta, Sech Patra, 2001).

2.4 Climate :

The study area i.e Mayurakshi river basin is extended on two states namely Jharkhand and west Bengal. The upper basin (i.e upto Massanjore) I covers the Deoghar and Dumka District of Jharkhand .The middle basin (upto Sainthia) comprises of Birbhum district of West Bengal. Lower basin (i.e upto it’s outfall into Hijal Bill) extends to the murshidabad district of west Bengal. The western part of the area is an extension of Chotonagpur Plateau, towards east
it gradually becomes undulating finally into plain. Annual rainfall over the basin varies between 765 and 1607 mm with an average of 1200 mm of which 80% occurs during the monsoon season from June to September, July and August are the rainiest months. The annual temperature ranges between 25°C to 34°C. (Fig. 2.4)

The climatic characteristics are discussed as following -

**Upper Basin:**

In the upper part of the upper basin area, the region falls into hilly track of Deoghar district, the annual temperature is 25°C, in January at night the average minimum temperature drops down to around 9°C. Area adjoining Trikut hill, the source of Mayurakshi river, the annual rainfall is about 1300-1400 mm. The lower part of the upper basin, majority of the region falls into Dumka district where the relief is between 50 to 300 mt, the average annual temperature is 34°C. Owing to its position near West Bengal and hilly landscape of the
The climatic condition is slightly different from the rest of the state. The climate is sub-humid tropical type having three distinct seasons---mainly summer (average temp 36°C), monsoon (average temp is 32°C), and winter (avg. temp. is 27°C). The annual rainfall 1200-1300 mm. In this part the area adjoining the Massanjor Dam and also the transitional zone between the two states (Jharkhand and West Bengal) the average rainfall is between 1400 to 1500 mm.

**Middle Basin:**

The middle part of the basin mostly falls under Birbhum and partly in Murshidabad district of West Bengal with 25 to 50 mt elevation, the hottest month is May and the coldest month in January. The annual temperature ranges between 25 to 34°C. The area receives a mean annual rainfall varying from 1,300 and 1,500 mm which comes between 61 to 78 rainy days. The rainfall in the district in general decreases from the north-west towards the south-west. About 78 per cent of the annual rainfall come during the four monsoon months of June to September. Norwesters (locally known as *Kalbaisakhi*) mostly occur in the afternoon during the hot season.

**Lower Basin:**

The rainfall during the southwest monsoon season - June to September constitutes 74.0 per cent of the annual rainfall. July and August are the rainiest months. The average annual rainfall in this part is 1,361.5 mm. January is the coldest month with the mean daily maximum and minimum temperature at 25°C and 11.9°C. The area receives a mean annual rainfall varying from 1,300 and 1,500 mm.

**2.5 Soil:**

The area under the Mayurakshi basin area shows the development of varied types of soils. As the river touches Deoghar and Dumka district of Jharkhand, Birbhum and Murshidabad of West Bengal. The soils are characterized by different lithological units present in different parts of the area.

**Upper Basin:**

Topographically this part of the study area is the part of Santhal Paragana Commissionery, an upland tract with a hilly backbone between 400 to 50 metres. Geologically the area has basaltic trap and sedimentary beds. Quartz and gneisses are found in some places. The dominant types of soil found here are --- red gravelly soil and red and yellow soil in the
Deoghar district and loamy soil and clayey soil in the Dumka district part of study area. The soil pH ranges from 4.5 to 8.9.

**Middle Basin:**

Mayurakshi basin in Birbhum has red sandy and red loamy soils of the older alluvium. The soils are loose and friable. Loose sandy soil locally known as *Bindi* is friable, with very little water holding capacity. It can grow rice and is quite capable of growing rabi crops with irrigation. *Kankar* is friable loose reddish soil and considered as a very poor type of soil. However, it can grow crop like mahua, bajra, maize, etc. and with irrigation facilities can grow some rabi crops.

The western part of the area around Suri are covered by gneissic soil. This soil contains large amount of sand & gravel and shows low concentration of organic matter, available phosphate, bases and other nutrient and has a pH value of 6.5 to 7.2. Due to undulating topography & high porosity the land occupied by such soil is susceptible to gully erosion. Cultivation in different, except in low lying area and needs the application of manures and fertilizers.

The gneissic soil is followed in the east by laterite which covers a major part of the central position of the Birbhum district, south of Mayurakshi river in the Saithiya, Bolpur and eastern part of Siuri stocks. The lateritic soils are light textured, ferrous, acidic in nature (pH 4.8 – 6.5) and poor in organic matter, available phosphate & bases. Hard structures of iron and aluminium oxides are present in the sub-surface. Keoline is the principal clay mineral. Application of organic manure is needed for better agriculture.

The Sahibganj loop line more or less forms the boundary of the laterite soils with the Vindhya type of alluvium, occurring further east in parts of Saithiya and Bolpur, as well as in Nanur and Labhpur blocks. The Ahmadpur – Katwa branch railway line, forms a high land, compared to the areas in the north. The Vindhyan alluvium is formed from deposits brought down mainly by the Mayurakshi river system and in characterized by mildly acidic to neutral soil (pH 5.5 – 7.2), low to medium iron content & other bases, which increases with depth, mottling are present in the sub-surface. The soils are low in organic matter & have medium concentrations of available phosphate & potash.Worth of Mayurakshi river, the western part of Birbhum district, underlain by basaltic rocks in Md. Bazar, Rampurhat, Nalhati and Muraroi blocks shown the development of Gondwana type of alluvial soil. (*Guha. R.K 1989*)
Lower Basin :

Mayurakshi-Dwarka Plain lies in the south-western corner of the Murshidabad district, has loamy and clay loamy soil, exhibits the Radh characteristic features of the Sub-Vindhyan region. In this area, from the west red soil is followed by Vindhyan alluvium further east. Thus, the eastern parts of Birbhum district and parts of Murshidabad district falling in the lower Mayurakshi basin area are covered by Vindhyan alluvium. The red soils are mildly acidic in reaction (pH 5.4 – 6.6), low in organic content, bases & available phosphate. (Guha.R.K, 1989)

From the O’Malley’s account of Bengal District Gazeteers of Murshidabad (pp116-17:1914), we came to know that several types of soil are found here are in “Mathal” or “methal” or clayey soil, dark in colour, “Bagha Methal” is brown and “Ranga Methal” is reddish in colour. Loamy soils are known as “do-ansh” soil which are very much fertile and can produce good crops while sandy loam or “metebali” and higher sand contained “domabali” are not good for cultivation.

2.6 Vegetation :

Upper Basin :

Since the area consist of hilly landscape and receive more rainfall it has considerable vegetative cover. But due to ruthless exploitation of most of the forest have turned into bushes devoid of big trees. Sal is the most important tree, sacred to Santal tribes. Other trees include bamboo, khair, semal, kaha, ashar, mahua, jackfruit etc.In the upper basin of the study area, fairly dense protected forest lies in Trikut Pahar. Other than these, open mixed forest are found in Baska, near Nunihat along Bhurbhuri river, Masaliya, Massanjor and Ranibahal along the adjoining area Massanjor dam. Rich forest coverage of the area is much depleted due to indiscriminate felling of trees.

Middle Basin :

In the western part of the middle basin, comprises the undulated high lands and the vegetation of this region shows semi-arid nature. In the south and east of this area consists of almost flat alluvial plain. And the vegetation of this tract is characteristic of the alluvial rice plain of Gangetic West Bengal (West Bengal District Gazetteers, Birbhum,). Mango trees, palm, bamboo and other trees, among which species of the fig family, jackfruit and arjun are often present. On the borders of the Santhal Parganas the remains of forest are found
containing Sal, Pial, Shau, Kend and Mahua. Open and fairly dense forest are found to occur in Mahammad Bazar, Patharchapuri, Kalaipahari protected forest.

**Lower Basin:**

The vegetation this part of the study area resembles those of the deltaic districts of West Bengal. In the swampy area numerous marshy species are available. As this region has several bils and marshy lands, thus numerous submerged and floating water plants are found. Bamboos are scattered all over the area. Other trees include mango, jackfruit, Segun, Sisoo, along with Babla, Pitali, and Tentul etc. can also be found. “Bot”, “Aswattha”, “Sal”, “Mahua”, “Khend” and “Palas” are also found in some parts of basin. Near Gunutia open forest is found to occur.