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A PHYSIOGRAPHICAL STUDY OF PUNPUN BASIN IN MAGADH REGION OF BIHAR, INDIA

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ABSTRACT

This paper aims at physiographical study of Punpun basin in Magadh region of Bihar. Physiographically, the study region may be divided into two broad unequal units: the plateau surface of the south and the lowland of the north. The southern part is a plateau surface roughly contour line of 150 meters above the sea level. It is very much dissected by the stream flowing rapidly on it. The northern part of the area is a plain land and it forms a part of the Gangetic plain. It has largely been built by the alluvium brought from the southern hills.

Keywords: *Physiography, Plateau, Plains, Drainage*

INTRODUCTION

The river Punpun originates from Chotanagpur hills in Hariharganj Block of Palamu district in Jharkhand at an elevation of 442 m and at latitude $24^0$11' N and longitude 84°9'E. The river Punpun flows for most of its portion in a north, north-eastern direction and falls into the Ganga near Fatuha, about 25 km downstream of Patna. Its total length is about 235 km. The river receives a substantial portion of discharge from its right bank tributaries. Majority of the tributaries originate from the same range of hills in Palamu, Aurangabad and Gaya districts of Jharkhand and Bihar respectively.

Spanning over the parts of Palamu and Chatra districts of Jharkhand and Aurangabad, Gaya, Jehanabad, Arwal, Patna and Nalanda districts of Bihar it covers an area of nearly 9025.75 km which is nearly one per cent of the total area of the Ganga sub-basin in the country. The basin covers partially the areas of 8 districts viz. 32.51 per cent of the area of Patna district, 75.20 per cent of Jehanabad and Arwal districts, 52.60 per cent of Gaya district, 82.41 per cent of Aurangabad district, 0.88 per cent of Nalanda district, 6.26 per cent of Palamu district and 6.11 per cent of the area of the district of Hazaribagh (old).

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STUDY AREA

The study area is a drainage basin. This river basin consists of a number of small tributaries like the Morhar, the Dardha, the Batane, the Madar, the Ramrekha, the Bakri, the Adri, the Neera, the Senane, the Begi, the Khudwa, the Mavaria and the panchanva etc. which join the main river Punpun. The drainage basin is bounded by the Sone basin on the West, the Kiul-Harohar-Phalgu basin on the East, the Ganga basin on the North and the North Koel basin on the South. The Punpun basin is situated between latitudes 24°6'N and 25°37'N and longitudes 84°0'E and 85°19'F (Fig1).

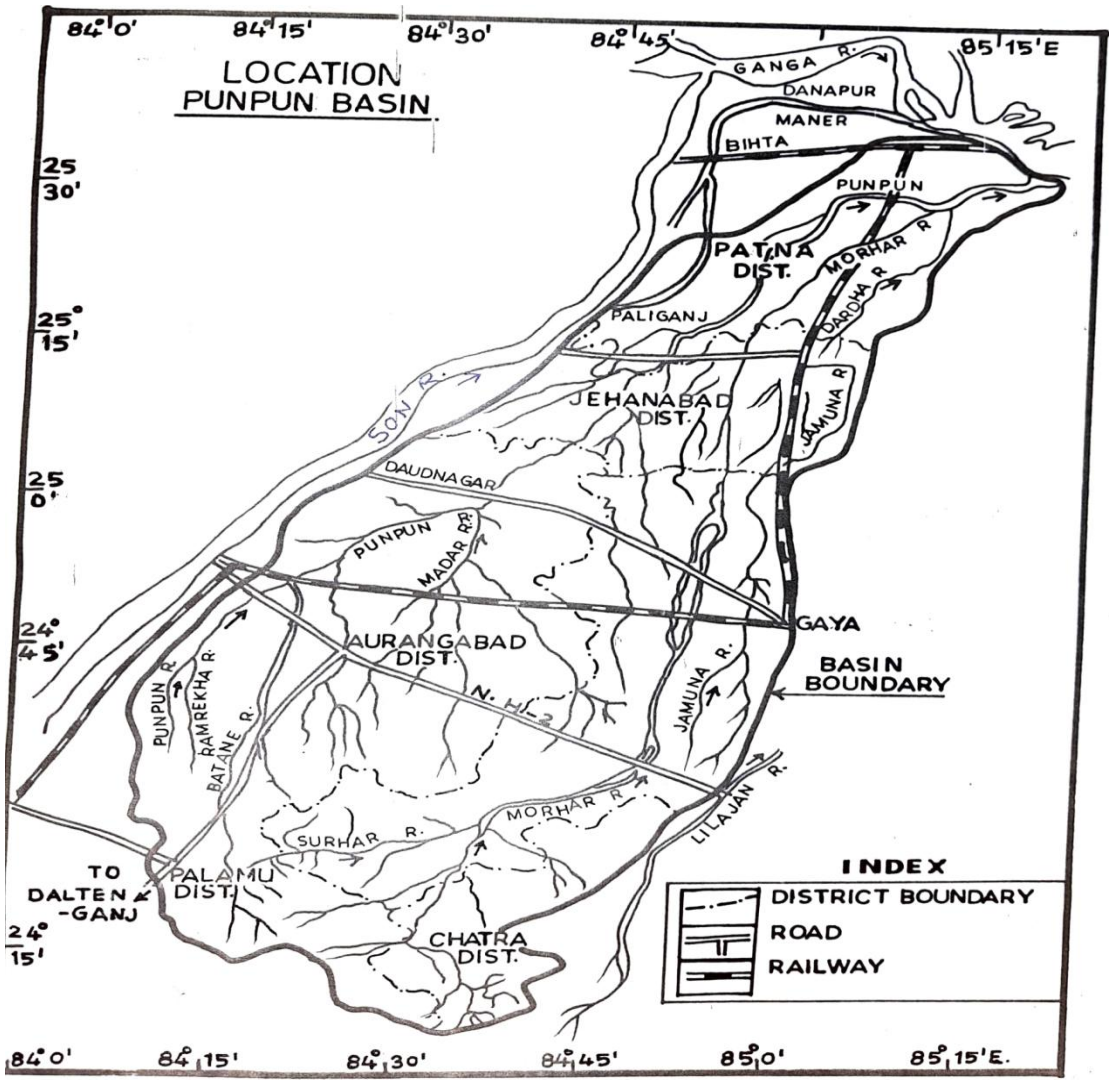

Figure – 01: Location of Punpun basin

The study area is characterised by hills, hillocks, escarpment, plateau surface, channels, channel bars, badlands, winding divides, flood plains, natural levees and slopes of various types. Tors on the hill tops and on the foothills present some other important geomorphic features. The Dome-shaped hills formed due to spheroidal weathering and exfoliation is also very common in the basin.

The Grand Trunk Road (NH-2) divides the catchment into two parts in such a way that almost all the hilly parts of the basin falls on its south and plain areas on its north. The upper catchment which lies in the districts of Palamu and Chatra is characterised by low hills mostly covered under forest and the slopes with depression and valleys. The lower part of the catchment area are in the districts of Aurangabad, Gaya, Walanda, Jahanabad, Arvai and Patna is mostly plain or having some uniform mild slope and are being used for cultivation. The elevation of the Punpun basin varies from 442 m above MSL near the origin of the river to about 50 metres above MSL near its outfall into the Ganga. But the highest point of the basin is represented by Bljai Glr (610.0 metres above MSL) which lies in the south-western part of the study area.

Geologically, the southern part of the basin mainly consists of the rocks of the Archaean Era. Granite, gneiss, porphyritic granite, biotite granite, augen gneiss and migmatites are the main rock types of the area. The rocks belonging to the Gondwana formations have also been observed in the south-eastern part in the Surhar basin in the bed of the river Surhar near Gangati 52 km south-west by west of Shergheti end 6.4 km west by south of Imamganj. This formation is Talchir shales and is entirely surrounded by alluvium. The northern part of the basin is overlain by alluvial deposits.

GENERAL PHYSIOGRAPHIC ELEMENTS

Physiography deals with relief and structure of any region. It also expresses the evolution, the causes and reflects the impact of geology and structure of landforms. Thus, it depicts the relief, structure and orography of an area.

The area under study is a drainage basin. Its southern part lies in Chotanagpur Plateau and the northern part is a plain land. The southern part is a plateau surface roughly delimited by the contour line of 150 metres above the sea level. It is very much dissected by the stream flowing rapidly on it. It represents a topographic complex including hills, hillocks, escarpments and plateau surface. Dome-shaped hills with tors represent beauty mingled features. The monsoon rain favours running water to be an important geomorphic process of land sculpturing. The general slope of the area is towards the north and north-east. The highest point of the region is represented by Bijay Gir (610 metres above MSL) in the extreme south-eastern part.

The northern part of the area is a plain land and it forms a part of the Gangetic plain. It has largely been built by the alluvium brought from the southern hills. The alluvium is coarse particularly in the south and the lakes and marshes universally present in North Bihar are relatively few. The area nearer to the Ganga is higher than the rest of the

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plain. The relatively higher land is the natural levee. As the high Ganga levee impedes the entry into the Ganga of the stream coming from the south, these streams (e.g. Punpun, Phalgu) flow parallel to the Ganga for several miles. As we move towards south outliers of ancient crystalline rocks appear as low hills.

The important rivers of the basin are the Punpun, the Batane, the Morhar, the Surhar, the Cholaki, the Labji, the Madawar, the Madar, the Adri, the Dardha and their tributaries. All these rivers have contributed much in the formation of landscape of the study region. Physio- graphically, the study region may be divided into two broad unequal units (Fig. 2).

(I) The Plateau surface of the south

(II) The lowland of the north

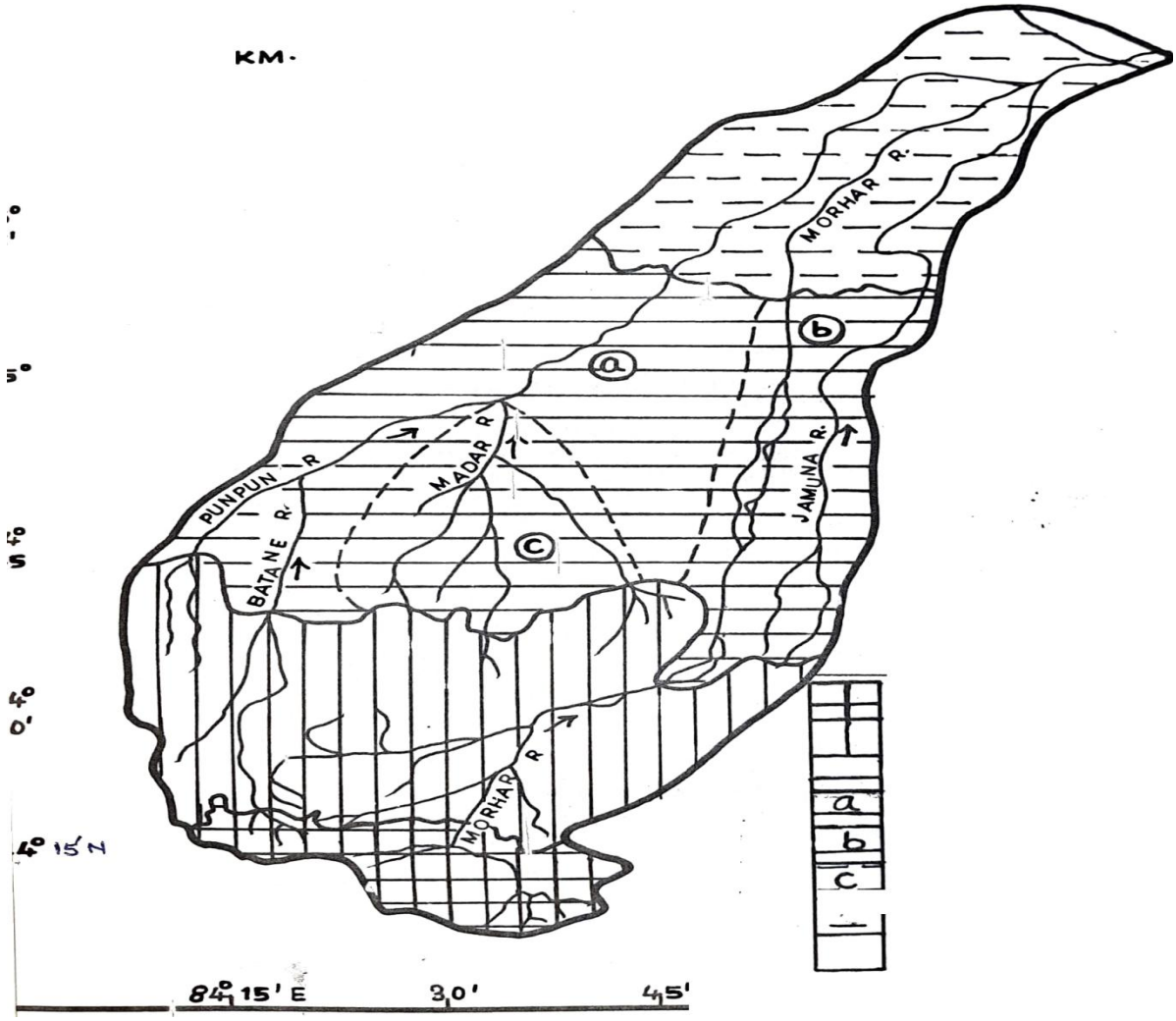

Figure 02: Physiographic division of Punpun basin

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THE PLATEAU SURFACE OF THE SOUTH

This plateau surface is limited by 150 m contour line in the north. It covers nearly 3372.02 or 37.36% of the study region. The plateau surface is flat, undulating and dissected. At places high hills composed of Archaean rocks can be observed. Hills composed of granite and granite-gneise has been weathered much and present picturesque landscape. This plateau surface may be divided into two parts:

(i) The Higher Plateau
(ii) The Lower Plateau

(i) THE HIGHER PLATEAU

It is the southernmost part of the basin. Its northern boundary is limited by 300 metres contour line. It covers nearly 303.26 km^2 or 3.36 per cent of the total and 8.99 per cent of the plateau surface. It is a part of lower Hazaribagh Plateau. The Chhotanagpur plateau consists of four main plateaus- the Pat region, the Ranchi Plateau, the upper Hazaribagh Plateau and the lower Hazaribagh Plateau. Each plateau is separated from each other by escarpments. The higher plateau of the study region is a part of lower Hazaribagh Plateau. It is composed of granite, granite- gneiss, schists, migmatites and other Dharwarian rocks. The important hills of this region which raise their heads on the plateau surface are Bijay Gir (610 m), Rajadera (574m), Gansa hill (540 m) and Teliadih hill(5O6 m). These hills are composed of granite and granite-gneiss. Nagad Pahar is composed of granite. Most of the hills are conical in shape with convex slope in the upper part and concave in the middle part. This form of the hills is due to move down cutting and erosion at the middle slope than the upper and lower slopes. Due to smaller catchment at the crest, quantity of water and sediment is less than that of middle slopes and at the lower surface, though the sediment increases has a choking effect which retards the erosion process.

These hills are covered with soft clothing of natural vegetation. Some parts of this area has dense mixed forest mainly bamboo but in many places it is devoid of vegetation. It is because either the vegetation has been cut down or lost due to the erosion of the soil and rock.

The surface is very much dissected by the streams. The Punpun, the Batane, the Morhar, the Urur take their origin on this plateau surface and flow towards north. The Urur originates on this surface and meets the Morhar flowing towards the east. The forested, dissected and hilly nature of the surface has not favored cultivation except in the narrow pockets where the soil has developed due to the denudation of the hills. The region is characterized by moderate to moderately high relative relief, moderate to high dissection index and high drainage density.

(ii) THE LOWER PLATEAU

North of the higher plateau lies the Lower Plateau. Its northern boundary is limited by the 150 metres contour line. It covers nearly 3068.76 km^2 or 34.00 per cent of the total basin area and 91.01 per cent of the plateau surface. This plateau surface is characterized by moderate relative relief, and moderate to moderately high drainage texture. It has moderate to moderately high dissection Index. The general slope is towards the north and north-east. The river Morhar flows roughly through the central part and it has formed lowland in its valley which is very fertile and important from the view-point of cultivation. A number of tributaries meet the Morhar coming from the west and south. The Surhar, the Urur and the Chotaki meet the master stream Morhar coming from the west. The Madawar meets coming from the north-west whereas Labji meets Morhar coming from the south. This plateau surface is the source region of the river Adri, the Madar and the Dardha.

Like the higher plateau, it is also flat. At places hills raise their heads from the flat surface. Hills composed of granite, phyllites, quartzites and migmatites are very common. Quartzite is a very hard rock. It is very much resistant to weathering and erosion. Hence, hills composed of quartzite are relatively high and are free from natural vegetation. The hills composed of phyllites are not so high and they are conical in shape which is evident from the contour pattern of the hills. Granitic hills are dome-shaped as they are very much affected by weathering. Granite has an important constituent-felspar. When it is heated due to hot climate of the basin and gets water by monsoon rain, it is converted into Kaoline. This Kaoline is transported to the lower slopes by the rainwater. Thus, granite rocks are disintegrated and features like tors on the top of the hills as well as on the ground have been formed.

The appearance of the different hills furnishes some striking contrasts. The hills on the southern edge of this physiographic unit are completely covered with a soft clothing of vegetation, chiefly of Sal, Kend and other trees. On the hills scattered over the northern parts of this division, the vegetation has gradually been cut down or lost due to the erosion of the clay and rocks and the boulders are in many cases left completely bare. The effect is almost equally picturesque as the hills stand out in rugged bareness. They are strangely different in colour and form.

The central northern part of this unit is a broken hilly region. The hills of this region are composed of biotite granite, quartzite, hornblende gneiss and mica schists. This area roughly coincides with the boundary of the Madawar basin, a tributary basin of the Morhar. The hills are covered with soft clothing of natural vegetation. The Adri, Madar, Kashmar and Dhawa rivers take their origin in this area and flow towards north roughly in parallel direction and finally meet the river Punpun in the north.

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THE LOWLAND OF THE NORTH

Nearly 62.63% or 5652.83 km^2 of the total basin area comes under this category. The southern boundary of this region roughly coincides with the contour line of 150 metres. This lowland is a part of South Ganga plain and comprises the parts of Nalanda, Patna, Jehanabad, Arwal and northern parts of Aurangabad and Gaya districts of Bihar. This alluvial plain of the north a form part of the Gangetic depression with alluvial deposits of immense depth and is broken here and there by groups and low ranges of hills or isolated peaks arising abruptly from the level 2 country at their feet. They gradually disappear in the further north.

Area lying in Patna and Jehanabad districts is almost entirely a level plain. The whole of this tract is drained by a number of streams which debouch from the southern hills and flow in more or less in parallel courses towards the Ganges. During the rains they are subject to violent floods and as the general slope of this area northwards is comparatively rapid, they flow swiftly when in floods, but in dry season they dwindle into trickling streams or lines of pool in the midst of long expanses of sand. The alluvial plain is protected from drought by a wonderful system of indigenous irrigation consisting of ahars and pains. It is therefore an area of great fertility when compared with the southern part of this unit and is comparatively densely populated. In this closely cultivated plain the natural vegetation consists largely of dry deciduous vegetation which occurs in village groves or along roads or riverine tracts or wastes.

The region largely consists of the Bangar soil or older alluvium which is found away from the main rivers outside the zone of valley flats. This lowland can be divided into three parts:

(i) THE UPPER LOWLAND
(ii) THE LOWER LOWLAND
(iii) LOW LYING COUNTRY PARALLEL TO THE GANGA LEVEE

(1) THE UPPER LOWLAND

On the basis of relief, slope and other morphometric parameters, this physiographic unit can be divided into the following subunits:

(a) The Middle Punpun Valley
(b) The Lower Morhar and the Dardha Valley
(c) The Madar Valley

(a) THE MIDDLE PUNPUN VALLEY

The valley is bounded by the 150 m contour line in the south, the Sone Valley in the west, the Madar Valley in the East and the Lower Lowland in the North. It covers an area of about 3566.97 km^2 or 39.52% of the

total study area and 63.09% of the total plain land. A number of tributaries originating on the higher and the lower plateau of the south meet the Punpun coming from the right. No stream meets the punpun from the west.

Though this area is plain land but some hills representing the outliers of Chotanagpur break its monotony. These hills are not very high. Most of the hills are below 305 metres above MSL. Pawai hill (226.5 m), Teona (221 m), Fesher hill (137 m), Raipura (157 m) etc. are important among them. There is an outcrop of the rock nearly 7 km west of Aurangabad near the village Pawai which is very famous because it repeats metallic sound.

The general slope of this area is towards the north. Rivers follow the sinuous path. Low drainage density, extremely low to low relative relief, low dissection index etc. confirm its senile stage of geomorphic development. This area is totally under plough. The highest point is represented by a hill having 226.5 metres height near the village pawai and the lowest point is 73 metres above MSL. The lowest point is a spot height representing the valley bottom.

Most of meandering channels are utilized as irrigation reservoirs and cultivable tracts by erasing their former crescent trends and meandering loops. Locally dug wells expose the sands of the former beds of the Sone. The country gradually rises to the south till outliers of Chotanagpur appear as hills.

(b) THE LOWER MORHAR AND THE DARDHA VALLEY

The Morhar rises on the Hazaribag Plateau and flows northward past the village of Raniganj and Imamganj after which it takes a north-easterly turn until it reaches the town of Sherghati where the Grand Trunk Road is carried over it on two fine bridges spanning the two arms into which it here divides. A little to the north of Sherghati the two arms of this river join into one for some distance when again it bifurcates. The main stream is known as the Morhar and the other is known as the Sorhar far commonly known as Burhi. A little south of Tekari, the two streams again join into one but after passing Tekari it is again divided into two branches, one the Morhar flowing in northerly direction to the district of Patna while the other, the Dardha flows by Jehanabad and during the rainly season floods a large tract of the country round that place. Some highland to the north forces the excess of water to disperse over this area and it only reaches the Punpun during the high floods. Another river of this unit is the Jamuna which flows from the south almost parallel to the Morhar between Gaya and Tekari, then turns east passing the Patna-Gaya road at Makhdumpur and flows on beyond Tehta when it twists back and joins the Dardha at Jehanabad.

This area is plain land but outliers of Chotanagpur Plateau raise their heads from the surrounding country and break the monotony of the plain land. The Panra hill (358 m) and the Cherki hill (194 m) are important among them. This sub-unit is limited in the west by the broad divide of the Madar and Morhar. The eastern boundary is limited by the Lilajan and Phalgu River. The river Morhar represents its old stage and fonts the braided drainage

pattern, low drainage density, low relative relief, lower gradient and gentle slope are the prominent characteristics of this physiographic unit.

(c) THE. MADAR VALLEY

Like the Morhar and the Dardha, this river has also got a big catchment area. But shape of the catchment is fan-shaped and not an elongated one like the Morhar and the Dardha. The rivers originates in the hills of Aurangabad district near village Barki and join the river Punpun near village Gagarh. Its catchment is nearly 1255 km^2. Its tributaries are the Tekari, Nalla, the Jharahi Nalla, the Keshar Nalla, the Satnadia Nalla and the Dhawa Nadi etc. There is one reservoir site namely Jagnath dam on this river.

The highest point is represented by Chalo Pokhar (437 m) and the lowest point is (76.8 m) near the confluence of the Madar with the punpun. The Chalo Pokhar hill area is heavily dissected and the hill is covered with forest. The hills have suffered much by weathering and erosion. Tors strewn in utter confusion make the beauty of the hill. This region is characterised by low relative relief, low intensity of relief and low drainage density. Except the hilly area, slope is very low. Gentle Slope and plain nature of the land has favoured cultivation very much.

(2) THE LOWER LOWLAND

The northern part of the Punpun basin comes under this category. It covers nearly 1860.76 km^2 or 20.61% of the total basin area and 32.91% of the plain land. The highest point is 112 m above MSL near Tehta and the lowest point is 57 m above MSL near Nura. The plain land and alluvial soil both have favoured agriculture in this area. One hill near Kharasi having 90 m height breaks the monotony of the plain land.

This area is characterised by extremely low relative relief, low intensity of relief and very low drainage density. The main streams which flow through this region are the Punpun, the Morhar, the Jamuna, the Nura and the Dardha. These rivers flow here from south-west to north-east. This plain land is bounded by 75m contour line in the south. The average slope of this part of plain land is 0°10'. The northern part is relatively high. It is because here lays the natural levee of the Ganga. The flat nature of the land indicates the old stage of this area in the present cycle of erosion.

(3) LOW LYING COUNTRY PARALLEL TO THE GANGA LEVEE

The Ganga Levee varies in width forms a significant flood plain which is breached by rivers of the south at convenient point, otherwise the rivers flow parallel to Ganga following the same direction.

The Tal land waxes and wanes following the rainfall regime. This low lying country behind the Ganga Levee has its own geographical personality. It forms a vast expanse of water in rainy season and spreads in Patna district but it shrinks in size and provides amazingly fertile land. The flood becomes acute in this area when the

Ganga is full to its brim coupled with the floods in rivers coming from the south. The spill waters of Ganga through the Punpun present a splendid expanse of water. The Ganga Levee appears an elongated land-surface between the Ganga and the Phalgu waters.

DRAINAGE

In geography drainage refers to the manner in which precipitation falling within an area or brought from outside is drained off. The study area is a drainage basin. It enjoys a humid tropical climate and chemical weathering is a dominant process of land sculpturing. Hence, drainage constitutes the most important element of surface geodynamics. In the absence of wind and frost actions, running water is the only agency of shaping the landform by sub aerial processes. Progressive dissection and degradation of the higher lands is caused by fluviatile action. Hence, the study of drainage in geomorphology is of vital importance.

The study region is a 5th order drainage basin. The Punpun is the master stream. It is served by a number of tributaries which contribute much in shaping the landscape. Four major tributaries namely, the Morhar having catchment area of 2585 km^2, the Dardha with 1001 km^2, the Madar with 1255 km^2 and the Batane with 634 km^2 join the Punpun on its right bank. The Khudawa, the Begi, the Serona, the Mawaria and the Panch- anwa rivers having length of 16.44 km, 10.12 km, 30.36 km, 24.08 km and 6.32 km respectively join the main river on its left bank. The Catchment areas of these left bank tributaries are too small and their contribution in shaping the landscape is relatively less.

THE MORHAR SYSTEM

The river Morhar originates in the hills of Palamu district of Jharkhand. At a place (Latitude 24°32'N and longitude 84°45'E) the river Morhar bifurcates in two channels. One of the channels is known as Budh River and the other Morhar. Further down, these two channels bifurcate and rejoin with each other a number of times to meet again near village Men (Latitude 25° 1' N and Longitude 84°54' E) and finally separate into two channels in the name of the Morhar and the Dardha till both of them join the Punpun near Ramganj and Jamalpur respectively. The Morhar has another channel known as the Ghaghar. Owing to steep gradient and shallow depth the river keeps on changing courses. According to recent developments, the main river flow is concentrated along the Ghaghar which falls into the Punpun upstream of the confluence of the Punpun with the Gangs.

It crosses the Patna-Gaya railway Line between Nadwan and Pothahi railway stations. The river Morhar, along with the Dardha cause flood in the lower reaches of the river system. The Chotaki, the Urur, the Surhar, the Labji etc. are its main tributaries.

THE DARDHA SYSTEM

The bifurcating channel of the Morhar is known as the Dardha. The Jamuna Nadi which originates from a place south of G.T. Road (N.H.2) near Sherghati, runs almost parallel to the Morhar and the Dardha and joins the Dardha near Jehanabad. Subsequently, river flows in the name of the Dardha and outfalls into the Punpun near village Jamalpur near the confluence of the Punpun with the Ganga.

THE BATANE SYSTEM

This river also originates from the hills of Palamu district near Dalpatpur village at an elevation of about 225 m. It joins the river Punpun at village Jamadra near crossing of the Punpun with Grand Chord Railway Line of Eastern Railway. Its catchment area is 654 km^2 and length is 78 km.

THE MADAR SYSTEM

Like the Morhar and the Dardha, this river has also got a big catchment. The fan-shaped basin of this river covers an area of 1255 km^2. The length of this river is about 56 km. The Tekari, the Jharahi, the Keshar, the Satnadia and the Dhawa Nadi are its main tributaries.

The Ramrekha, the Barki, the Bileri, the Nira, the Senane and the adri are the other important streams of the study region.

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