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Original Article

Phisiographic Analysis of Dalma Range, Jharkhand, India

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Abstract :

Dalma range occupies an south-western part of Chotanagpur highland between 25°45'N to 23°00'N and 86°00'E to 86°45'E. and its covers an area of about 2672.64km^2. This study region has various ranges such as Gurga-Baru, Urama, Chadari, Bhelxi, Khursi and Chekam. The relief various between 105m to 1,000m in this region. This paper studies the various relief features, physiographic division, altitudinal zones, climatic conditions, natural vegetations, drainage systems, soils etc. in details.

Keywords: *Relief, physiographic regions, altitudinal zones, drainage, soils, natural vegetation.*

Introduction-

The Dalma range occupies an south-western part of Chootanagpur Highland between 25°45'N to 23°00'N and 86°00'E to 86°45'E. (Fig. 1) Dalma range relief varies between 105m to 1,000m and it covers an area of about 2672.64km^2. The main ranges of this region are Gurga-Baru hill (739m), Urama (415m) Chadari (440m), Bhelxi (780m), Khursi (590m) and Chekam (570m). The Dalma range is lying between the Chhotanagpur highland in the north and Dalma ranges in the southeast. The rolling plain of Dalma runs from northwest to southeast. To the west, it narrows towards Ranchi and East Singhbhum. It forms the eastern most extension of the stable Indian Peninsular Block and is separated from Shillong plateau by the Malda gap. It lies between the water divide of Subarnarekha river in the southwest to southeast and Kumari rivers northwest to northeast direction (Fig. 1).

The Dalma range elevation varies from 105m to 1000m. The main ranges of the highland are Gurga-Buru hill complex (739m), Urama (415m), Chadari (440m), Kudali (241m), Lailam (336m), Bhelxi (780m), Amda (409m) pahars, Gurma hill-complex (449m), Khursi (590m), Lankaini (440m) and Chekam (570m) pahars. The topography of the area is diversified which provide a wide area for geomorphological study. It is an ancient landinmass which has been actively denuded since the Pre-Cambrian time. The roots of Archaean mountains have not only been exposed but have also reduced to an erosional plain. During different geological periods, it experienced several phases of denudation, weathering, erosion and deposition. The area acquires its greatest span over extensive Ranchi plateau and gradually descends to lower plateau in southeast .Its southern rim reveals many juvenile features like gorges, rapids, dissected hills, river piracy etc. Many geomorphalogical characteristics are visible in the complexity of this ancient landscape. The complex and polygenetic surfaces though accentuated lie at different levels. Each surface exhibits at its end landforms which necessitate morphological analysis.

Previous Studies: Dunn, J.A. (1942) was the first geologist to resent a systematic account of the physiography of Bihar. This lead was later carried on by geographers and geologists as like Chatterhjee, S.P. (1940) has explained the gneissic topography of Ranchi which was followed

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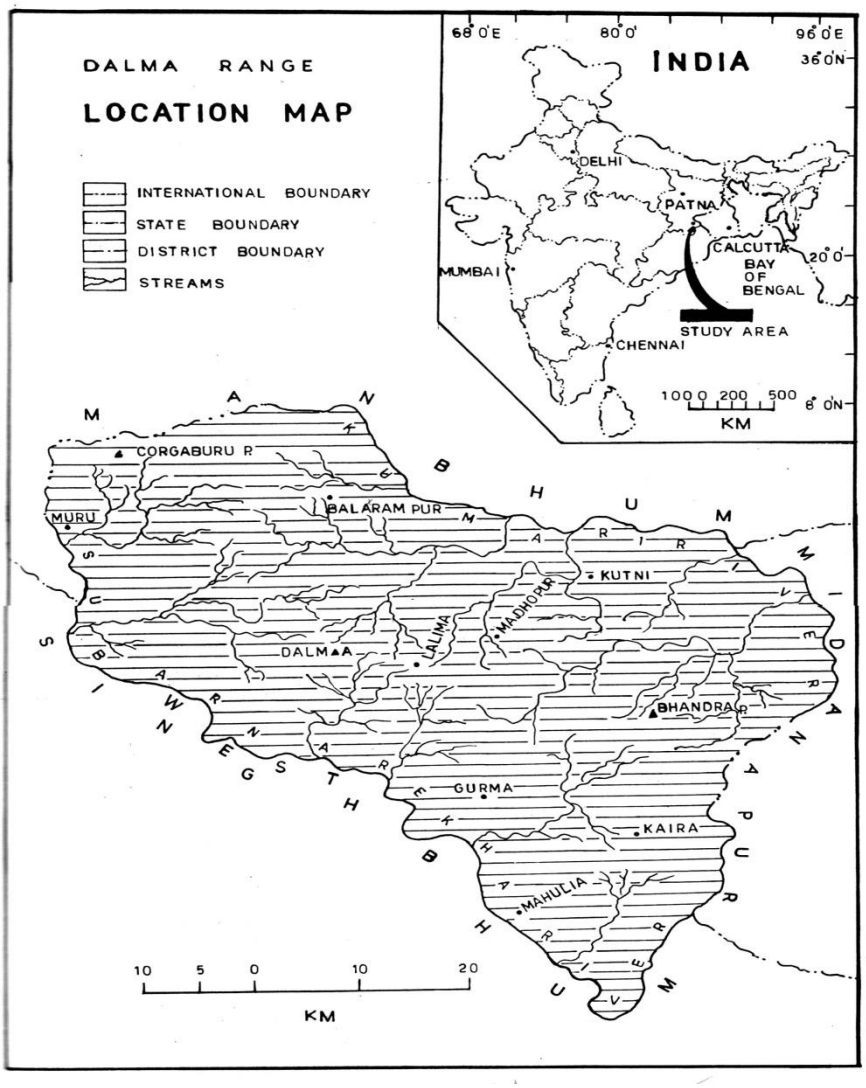
By Bose, N.K. (1940). Chatterjee, S.C. (1945) has made a valuable contribution to this field by analysing some aspect of geomorphology of Ranchi plateau. Later on, he presented a systematic account of the physiography of Chhotanagpur. In recent years, pioneer work in this field has been done by Sing, R.P. (1956). In his study of geomorphological evolution of Chhotanagpur highlands, he has covered almost every part of Chhotanagpur plateau. Ahmad, E. (1958) has presented an outline of geomorphology of Chhotanagpur. He had also contributed many articles on the various aspects of geomorphology of Chhotanagpur plateau. Verma, V. (1961) has discussed the diastrophic forces and their geomorphic expression in Ranchi plateau. Singh, R.L. (1971) stated that, "The Dalma range, the southeastern part of South Bihar is a geographical unit of Chhotanagpur highland, India. Thus, this region is bounded by the administrative unit of east Singhbhum district on the south; a parts of east Singhbhum and Manbhum anchals of Dalma range on the south, Manbhum district of Bihar on the west and parts of Manbhun anchal of Purulia district on the extreme north."



Major Relief Features:

The Dalma range is an upland tract with a hilly backbone running from northwest to southeast. To the northwest, it is flanked by a long but narrow strip of alluvial soil hemmed in between the river Subarnarekha and the Dalma range. Hills rise abruptly from the plains forming a wall of 150m to 1000m high jut-out into the Subarnarekha valley and force the Subarnarekha to bend before it takes its southerly course to the sea.

The Dalma range varies in physical characters because they correspond ranges and lower valleys in the northeast to southeast. Physical configuration of this area is thoroughly dissected consists of hills, spurs, plateau and poor soils. The Kumari and Subarnarekha, the main streams flowing from northwest to northeast and northwest to

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southeast divides the region into almost equal parts i.e. northern and southern. It is probably due to the differences in erosion and initiation of master Kumari and Subarnarekha streams. The other major ranges running northwest to southeast along the western boundary through which is Hanumata, Nangasai and Jam rivers forces, its way to enter into the area under study at the Bamani river (Fig. 2). These area have spurs, ridges and outlying peaks. The majority of spurs and ridges have been no definite names but the peaks are often called after the names of near by villages on the basis of peculiarities they posses.

The Dalma range can be divided in to two major and four sub physiographic regions as follows (Fig. 2B):

The Dalma Range

(a)The Upper Dalma Range

(b)The lower Dalma Range

The Valleys

(a)The Subarnarekha valley

(b)The Kumari Valley

The Dalma Range

The Upper Dalma Range

The upper Dalma range is spread over 85.0 km from northwest to southeast with an average height of 500m. Its northwest and southeast faces are mostly abrupted but to the north, it narrows and descends slowly in the neighborhood of Amda pahar (409m) and Bhelxi pahar (780m). Where it curves to the south and connects it with Ranchi plateau. On the western and southern edges, it is highly dissected by streams having an elevation viz, Dalma (1000m), Chadari (425m), Laidam (336m), Kadali (241m) pahars. Gorga-Buru (239m), Gurma hill-complex (449m) in northwest to southwest and Khursi (590m), Chekam (570m) pahars and Mahulia peneplain (175m) in the southeastern part of the study area. This descent is quite steep and is marked by winding gorges. The hills are open and cultivation is fairly extensive. The upper Dalma range is divided in to three sub region as follows :

Gurga-Buru hill-complex (739m) is situated 15.0 km north from the bus station of Balrampur. It is conical hill, Small streams radiate from here and join the upper Kumari river. Sobna river rise from the northern side of this hill. This hill is connected with Chadari (440m), Kadali (241m), Urma (415m) hills and its neighboring small hillocks but due to denudation some parts have been eroded away making it discontinuous and isolated hillocks having the height of 300m to 450m.

Bhelaxi hill (780) lying between the Gugai and Sona basins is accessible through a winding steep ghats of 31.0 km to the northwest and northeast of this range. There are a number of isolated peaks over 600m. Trap is seen under the laterite at various place on the slope of the range. Along the path leading down to the road, trap is seen high on the edge of the slope even at an elevation of 600m. It is great open range of laterite which forms imposing scarps along the banks of the Sona and Bandhu rivers.

Khursi hill (590m), the landscape of the higher southern basaltic upland stand out in great contrast to the neighbouring southeastern tract of the Chhotanagpur higlands. The higher range has been cut-up by the tributaries of the Subarnarekha to the southwest and by the Kharaoti to the southeast into many isolated masses locally known as 'Ranges.' These isolated hillocks have maintained their flat tops as reflected by the superimposed and projected profiles. These ranges from outliers of the Deccan lavas which flowed over the uneven gneissic terrain.

The Lower Dalma Range-

The lower Dalma range extends towards of East Singhbhum. The entire area is composed of schists fluctuated by epidiorites, quartzite hills. The area extends more towards its northeast section. This dissection has resulted into the formation of narrow hills and valleys. A narrow schist terrain has penetrated into Barabhum plain up to the confluence of the Nangasai and Sona rivers. The northeastern trend of drainage lines in the northwestern terrain marks the control of structure over drainage lines. The differential weathering of the ancient exposes surface during Tertiary periods under tropical condition has largely been responsible for producing surfaces at different levels. Many geomorphological problems appear, thus in the landscape study for interpretation. The terrain in the Nangasai basin slopes gently towards northeast flowing the course of the river but towards north, south and west, its rises slowly like a shallow saucer's rim. On the southeast, the horizon is shut in by the masses of the Lankaiani (440m), Urma (415m) bhills and Barbogala peneplain (220m) of the lower range.The western portion of the lower Dalma range forms a broad watershed between the Kumari drainage on the north and Jam rivers in the northeast. The highest hills of the watershed are named after the villages such as Balrampur (291m), Birbhum (275m) peneplains, Rangagera gorge (215m) in the northwest and Penchara (268m) and Kumari peneplains, Kunokia escarpment (275m) and Kesarpur gorge (326m) in the northeast and

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southeast above the general level of the range; Further east, along the southern margin of the range, spur projects right up to the Kumari river and ends in Rajauli dissected range.

Urma pahar (415m) is situated about 15.0 km of Balarmpur Bus station. The rising trend of this pahar turns northwest to south east. This is a flat-topped hill. On every side the gradient is rather steep. Many small streams take their rise from this pahar.

Lankaiani pahar (440m) is situated just by the side of near Bardih settlement. The rising trend of this pahar turns south to east. It is a round dissected range. Numerous streams take their rise from this range in radial manner.

Bhanda pahar (473m) is situated between the two river, namely Totko and Jamuna. There are numerous range near this pahar, i.e, Sangmaniya (360m) and Gusim (367m) pahars.

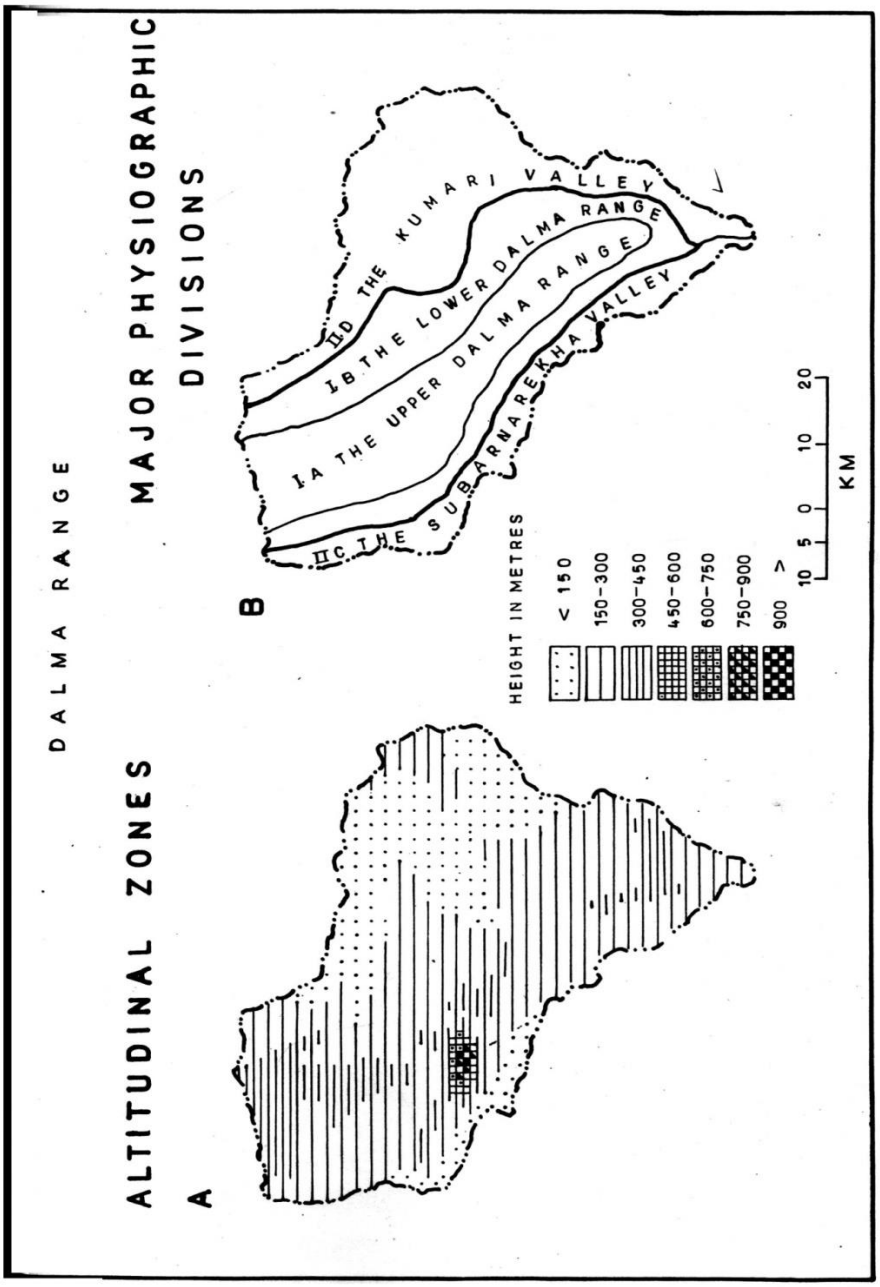

Fig. 2

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The Valleys:

The Subarnarekha Valley

This valley region extends from southwest to southeast direction of the study area. It is also known as the mica-schist plain. The valley has an average, length of about 85.0 km in the study area. There are several resdual hills spread all over the valley. The upper valley has good land of rice cultivation.

This valley region occurs between the Ranchi upland in the northwest and the Dalma range in the northeast. Its elevations is generally less than 350m. This region includes the thanas of Jamshedpur, Ghatsila, Mahulia and Khengar. It represents trough resulting from enormous fractures at their present edges, which caused the land to sink to great depths. This trough is not continuous. It is interrupted where the Sanka valley in the west is separated from the Subarnarekha valley in the west by a lofty spur from the higher highlands which is terminated in Dalma pahar (1000m). The northern boundary of the Subernarekha valley is steep as for as the southeastern edge of the middle higher range where the middle Subarnarekha river has modified its obruptness. The lower Kharaoti divide is characterized by steep slopes towards the valley and consequently this part of the valley is rough and largely uncultivated. The thalweg slope of the river in its lower part is gentle. The southwestern part of the Subarnarekha valley near Banjaria village is quite interesting. Its northern face is a forest covered broken ranges. It carries a scanty population of aboriginal until the level basin of the Sapaghara river.

The Kumari Valley:

The Kumari valley originates on the western toe of the Karmahills. To the western Barabhum plain overlooks the headwaters of Kumari. To the west of the valley, Mudali (725m) and Urma (415m) pahars marks the 12.5km continuation of along laterite capped ridge with narrow and breached in places. It collect waters on either side of the scarps that shut it from the neighboring areas. One of its tributaries, of Jam Nadi with its source in the southern rim of the Bhanda pahar (473m) runs from south to north over the range but turns to the east forming a deep gorge before it unites with the Kumari river.

From the southeastern part of Jorgra range, the Kumari meanders over its narrow basin bounded by steep scarp which rise to over 600m from its valley. The streams that flow over the flat-topped parts show a straight course until the scarps are reached below the scarps. Their courses are governed by gneissic terrain. The laterite capped plateaux have been detached from one another. The Kumari river receives these streams and several others whose sources are either engaged in notching the scarps or excavating their valley over that topped surfaces of the residue of the once continuous higher southern range. Its main affluent drainage, includes Sona, Nangasai, Totko, Jamuna, Jore and Jam rivers the area under study.

Climate:

The climatic conditions of the Dalma range preserves sub-tropical climate with a hot dry summer, a good rainy season and cool winter. The general temperature is modified by the elevation of the plateau. Summer is hot and dry. Dust storms and occasional hailstorms occur during this season. Maximum temperature in May goes as upto 46°C in May. Climate reflects the mean values of the weather elements, i.e., radiation, temperature, wind direction and velocity, pressure, precipitation, relative humidity, etc. Dalma range experiences the characteristics of monsoon climate having a seasonal rhythm, running through all the elements of weather. These elements Climate provides a platform for the cultural activities of the mankind.

Temperature:

For a proper discussion of the distribution of temperature in highly dissected ranges area of this region it is necessary to record temperature at different altitudes. This is possible only with a fairly close network of observatories in the area. But their absence does not permit a factual statement. Some general characteristics about the temperature have been given based on the data available from Jamshedpur of Dalma range, the only recording station in the region.

It is divided into the following four periods:

1. November to March, marked by low temperature,
2. April to May, with very high mean temperatures
3. July to September with the lowest range in daily maximum and minimum temperatures, and
4. September - October, characterized by equable conditions.

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Table-1: Mean Monthly Temperatures at Jamshedpur (2021)

Months	Maximum (°C)	Minimum (°C)	Mean (°C)
January	23.5	11.2	17.3
February	24.5	12.5	18.5
March	32.5	18.0	25.2
April	37.8	23.0	30.4
May	37.0	24.5	30.7
June	36.8	25.6	31.2
July	32.7	23.2	27.9
August	27.5	22.9	25.2
September	30.2	22.8	26.5
October	29.1	19.5	24.3
November	26.4	15.3	20.8
December	24.3	10.5	17.4

Source: Meteorological Department, Jamshedpur

Atmospheric Pressure and Wind Condition:

Generally pressure follow the temperature, then the temperature increases to a maximum of 37°C in the month of May, the pressure in June, decreases to a maximum of 973.0mbs at 17 hrs 1ST. (Table-2)

Table-2: Correlation between Pressure and Temperature Variations at Jamshedpur (2023)

Months	Pressure (mbs) at 8.0 hrs. 1ST	Pressure (mbs) at 17.0 hrs. 1ST	Mean Daily Min. Temp. (°C)	Mean Daily Max. Temp. (°C)
January	991.0	987.1	11.3	26.2
February	994.9	986.9	14.1	25.4
March	986.9	983.8	18.8	34.6
April	982.6	980.1	23.7	38.9
May	978.8	976.5	26.8	40.0
June	974.7	973.0	26.2	36.0
July	974.1	972.7	25.3	31.9
August	975.9	974.4	24.9	31.3
September	980.0	976.7	24.4	31.8
October	985.7	982.1	24.5	31.2
November	989.5	985.8	15.3	28.3
December	991.5	987.6	10.7	26.2
Annual	983.2	979.4	20.4	32.0

Source: Meteorological Department, Jamshedpur

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Both daily and yearly inequalities of pressure grow as we ascend to higher elevations. But since the barometric variations depend upon the range of temperature, which is less at altitudes of 450m-750m than in the plains. The decrease in pressure is not directly proportionate to increase in elevation. It has been observed on the slopes of Dalma range that winds blow up the valleys during the day and down during the night. The season for the above, mentioned diurnal variation in pressure is the formation of different pressure gradient during the night and in the day time between the plains and the hills.

Table 3 give the mean monthly wind velocity and wind direction at Dalma range. The speed of wind varies from 1.9 km/hour both in the months of October and. November to 4.2 km/hour and 4.3 km/hour in the months of May and June respectively. This shows that the wind blows with greater velocity in summer than in the winter. The direction of wind is also variable. It blows from the northwest in all the months, except during July and August when it blows from the southeast.

Table-3: Mean Wind Velocity and Direction (2023)

Months	Mean Wind Velocity (km/hrs)	Mean Wind Direction at 8.0 hrs/IST	Mean Wind Direction at 17.0 hrs/IST
January	2.0	S 68 W	N 67 W
February	2.6	S 86 W	N 86 W
March	3.3	S 69 W	N 74 W
April	4.0	S 62 W	N 75 W
May	4.2	S 58 W	N47 W
June	4.3	S 52 W	N63 W
July	4.0	S 66 W	N40 W
August	3.4	S 54 W	N43 W
September	2.6	S 53 W	N 50 W
October	1.9	S 63 W	N 40 W
November	1.9	S 77 W	N 35 W
December	1.8	S 68 W	N 34 W
Annual	1.6	S 66 W	N 54 W

Source: Meteorological Department, Jamshedpur.

The wind velocity is the highest during April to July. This is due to great difference in temperature and pressure conditions obtaining in the lowland plains on the one hand and the highly dissected hills of the upland on the other.

Relative Humidity-

The relative humidity, expressed as percentage of the total possible amount of vapour present in the air.

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Table-4: Mean Relative Humidity and Maximum and Minimum Temperatures

Months	Maximum Temp. (°C)	Minimum Temp. (°C)	Rel. Hum. at 8.0 hrs. 1ST	Rel. Hum. at 17.0 hrs. 1ST
January	33.3	4.4	79	52
February	37.2	6.7	74	31
March	35.6	11.7	61	45
April	43.9	16.7	56	24
May	46.1	18.3	62	38
June	46.1	20.0	72	68
July	35.6	22.2	84	81
August	36.7	21.1	86	82
September	35.0	21.7	84	78
October	36.1	13.0	79	69
November	33.9	7.8	77	57
December	30.6	5.0	79	56
Annual	46.1	4.4	74	58

Source: Meteorological Department, Jamshedpur.

It is generally high during the rainy season (June-October) but it is reduced to 2%-4% only during the winter season. The area enjoys monsoon type of climate with rainfall mostly concentrated in the months of July, August and September.

Rainfall:

The area enjoys monsoon type of climate with rainfall mostly concentrated in the month of July, August and September. Rainfall which does November to February, increases to about 18.50 cm in March, owing to the influence of occasional cyclonic storms in that months.

Table-5: Monthly and Monsoon- wise Rainfall (cm) at Jamshedur (2023)

Months	Rainfall (cm)	Months	Rainfall (cm)
January	2.50	July	28.25
February	1.25	August	33.75
March	8.50	September	24.50
April	7.50	October	14.00
May	5.75	November	1.75
June	22.75	December	2.00

Source: Meteorological Department, Jamshedpur.

In July, the rainfall is 28.25cm and August the heaviest rain fall of 33.75cm occurs. September and October are also rainy months with a rainfall of 24.50 cm and 14.00 cm respectively . The rainfall decreases with the onset of the retreating monsoon in the middle of October.

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The nature of rainfall and other special weather phenomena on Dalma ranges are as follows:

1. Heavy rainfall over the area is associated mainly with the passage of depressions and storms from the Bay of Bengal and depressions formed over the land.
2. About 82.0% of the total annual rainfall occurs during the monsoon period, (June to September) while as much as 8 8.0% is during June to October.
3. The highest intensity of rainfall per hour has been noted between 76.8mm and 102.4 mm.
4. The mean daily evaporation is maximum in April (1.0cm to 1.5cm)
5. Hailstorm occur mainly during the period of April-June.
6. Ground frost occurs generally during the period of December-February.
7. Dust raising wind is a common feature which takes place just before the advent of the mansoon, i.e., during April and May. Besides, thunder-storms, fog and squall are also regular feature at Dalma range.

Drainage:

Drainage, the channel arrangements to remove the surplus waters of an area, provides the main string to trace certain morphological character of the area. Its distribution is adjusted according to a bunch of complex variables such as morphology, mainly relief, slope, rock structure, climatic and vegetal characters. They do provide clue to the general and specific directions of the slope of an area and constitute a component of the surface hydrology. Thus, in area of complex natural environments, one is sure to come across a complex drainage alignment in respect of its orientation and distributional pattern (Fig. 3).

The pattern of divides portrays drainage pattern. Thus, the pattern of divides has equal significance to the pattern of drainage. The Dalma range streams comprising rocks of varying hardness. Streams of this region have curved out erosinal plains where they pass through softer rocks.

The area under study can be grouped in to two main drainage systems

The Subarnarekha Drainage System

The Kumari Drainage System

The Subarnarekha Drainage System:

The Suparnarekha and its tributaries constitute the most important drainage system of Dalma ranges with a drainage area of about 1382.40 km^2 or 51.79% of the study area . The most notable affluents of the Subarnarekha river are the Bamni, Kapila, Sanka, Sobna, Gurma, Sapaghora, Damna rivers and their shares of the Subarnarekha river are 25.73%, 17.86%, 23.82%, 7.44%, 25.98%, 13.27% and 16.22% respectively.

It is also significant that the Subarnarekha form the southwestern and southeastern boundaries of the study area respectively.

The Subarnarekha is a capracious stream, rising at an elevation of about 750m. The Subarnarekha rises from the eastern face of the elevated Ranchi plateau 3.5km north of Balrampur village. Its other stream rises from the southern face of the elevated Dalma range, south of Mahulia village.

The eastern part of the central gneissic is highly diversified by the Subarnarekha and its tributaries which follow the major joints of the rejuvenated gneissic terrain. The major joints run from west to east while minor joints run from northwest to southeast.

Subarnarekha has a rapid flow and brings down large quantities of silt. The bed of the river has an elevation of 105m at the confluence of the Kumari stream. It has a total stream length of 85.5 km in the area which gives an average thalweg slope of 0.5m/km.

Though small in size, the river is a gaint in destruction. Its upper valley receives, an average 150cm of rainfall annually and most of it are torrential downpours during the monsoon month when water gushes down the hills and into the river with great velocity. The unchecked flow of the river has resulted in a continuous stripping of the soil mantle and the weathered rock mass from Dalma ranges.

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Table-6 : Draiange Systems of Dalma Range (Area and Attributes)

Master Streams	Secondary Tributaries	Tertiary Tributaries	Total Area (km^2)	% of Total Area	% of Master Stream System	Upper Height (m)	Lower Height (m)	Total Fall (m)	Total Length in Dalma Range
(01)	(02)	(03)	(04)	(05)	(06)	(07)	(08)	(09)	(10)
Subarnarekha	-	-	1382.40	51.73	-	300	105	195	85.5
	Banini	-	687.92	25.73	-	333	187	146	22.4
		Kapila	122.88	-	17,86	675	450	225	19.0
		Sonka	163.84	-	23.82	540	260	280	19.2
		Sobna	51.20	-	7.44	263	190	73	12.8
		Others	350.00	-	50.88	-	-	-	-
	Gurma	-	694.48	25.98	-	300	150	150	25.6
		Sapaghara	92.16	-	13.27	575	250	325	16.0
		Damina	112.64	-	16.22	590	325	265	17.6
		Others	489.68	-	70.51	-	-	-	-
Kumari	-	-	1290.24	48.27	-	678	166	512	58.6
	Jam	-	714.01	26.71	-	260	180	80	32.2
		Jamuna	71.68	-	10.04	180	150	30	12.3
		Totko	430.08	-	60.23	360	250	110	20.5
		Others	212.25	-	29.73	-	-	-	-
	Nangasi	-	432.87	16.19	-	258	200	58	17.2
		Sona	174.08		40.22	242	150	92	7.2
		Sopa	133.12	-	30.75	299	225	74	8.9
		Others	125.67	-	29.03	-	-	-	-
	Hanumata	-	81.92	3.06	-	250	200	50	10.4
	Kharaoti	-	61.44	2.29	-	232	141	91	10.5

In the dry season, from October to May, the volume of water in the river dwinders to almost a trickle, so that irrigation is not possible. The Subarnarekha river is sacred to the primitive tribes as the Ganga to the Hindus. The tributary streams of the Subarnarekha river are as follows:-

The Bamni River:

The Bamni river is a tributary of the Subarnarekha river. This river originate from the Amdha pahar (409m) in the northwestern part of the study area. This river flows in western direction for a distance of about 4.6 km and then takes a northwesterly turn, crossing the Kapila village. Further down stream flows in westerly and northwesterly directions forming the western and northwestern boundaries of the study area. The river Bamni appears to be fault-quided river. It has a drainage area of about 687.92 km^2 or 25.73% of the master stream. Its total length is about 22.4 km. It gives an overage thalweg slope 1.0 m/km. The important tributary of the Bamni river are, Kapila, Sonka. Sobna

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rivers and their shares to the Bamni river are 17.86%, 23.82% and 7.44% respectively. These streams generally follow northwesterly until they join the Bamni river. Their lower courses are generally entrenched in their flood plains.

The Bamni river flows in a narrow channel with steep valley slopes in its upper parts. Its course is often traversed by water-falls, rapids and narrow gorges.

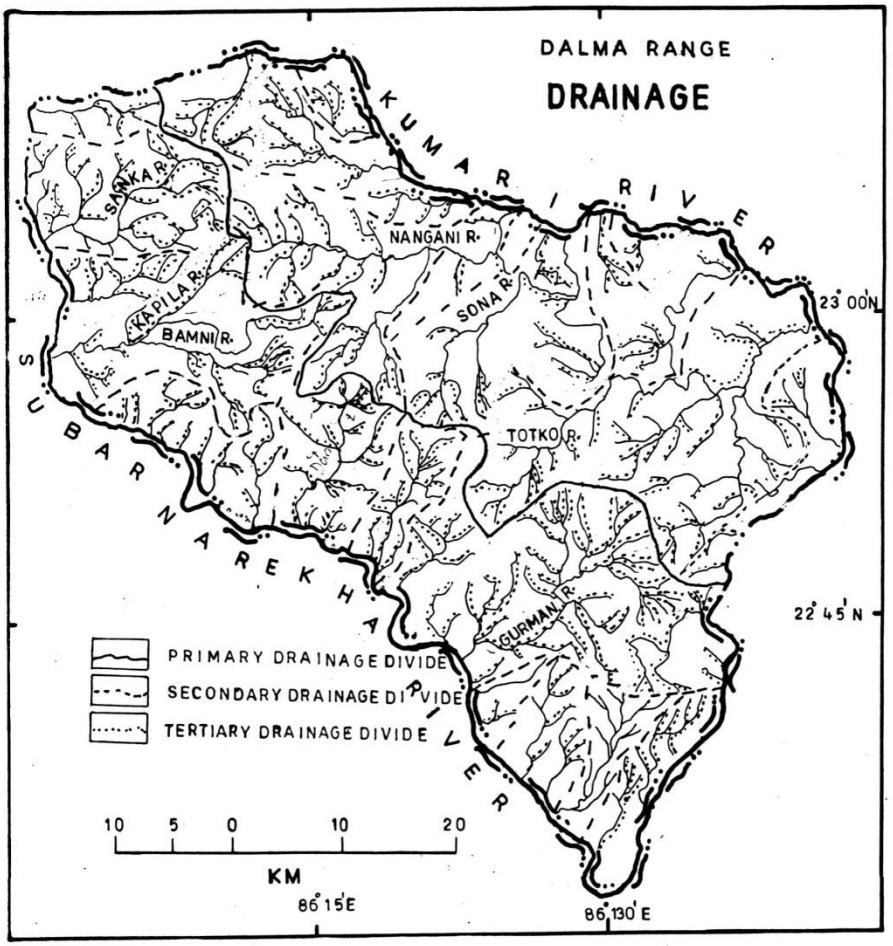

Fig. 3

The Gurma River:

This river is the largest tributary of the Subarnarekha river of the study area. It originate from the higher range about 4.3 km southeast of Chekam hill, at a height of about 570m. It has a drainage area of about 694.48 km^2 or 25.98% of the master stream and mostly covers the southeastern part of the study area. It has a southerly course in the upper part where it receives several small affluents. This stream takes a southeasterly turn and flows in that direction unit it joints the Subarnorekha at the southeastern margin of the study area. Between the Dalma range and the isolated range of the Ledasai pahar, small affluents of this streams have produced a dissected topographic characteristic of badlands.

The Kumari Drainage System:

The Kumari drainage system covers an area of about 1290.24 km^2 or 48.27% of the study area. Its arises from the western slope of Karma hill at an altitude of 750m flowing to northeast and it follows the northwestern projection of Mudali pahar to bend sharply southeastward along its eastern scarp forming Bumani falls (116m). In the upper part, it has rapid flow and brings down large quantities of silt. The bed of the river has an elevation of 450m at the confluence of the two streams. But 25.6 km down near its confluence with Barabhum, its bed elevation is about 250m. It has total streams length of about 25.6 km in the area which gives an average thalweg slope of 0.9m/km.

Through small in size, the river is gaint in destruction. Its upper valley receives, approximately 125cm of rainfall annually and most of its as torrential downpours during the monsoon months. When water gushes down the hills into the river with great velocity of the Kumari meanders is frequently being admirably controlled by the joints

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over the granite-gneiss rocks. Joint direction guides the course of the Kumari and its tributaries. Its granite landscape reveals some of weathered and erosinal marks. This river length is about 58.6 kms.

The Jam Valley:

The Jam river is the largest tributary stream of the Kumari river in the study area. It has its source in the higher Dalma range about 22.0 km north from Jorgara pahar with a height of 473m. The river flows in the northeast direction for a distance of about 22.0 km. Further downstream, its flow northerly and northeasterly directions forming the southern and southeastern boundaries of the study area. The streams like the Jamuna is fault-guided river. It has a drainage area of about 714.01 km^2 or 26.71 percent of the Kumari basin area. Its total length is 32.2 km. It gives an average thalweg of slope about 1.1m/km. This important tributary streams of the Jam river are the Jamuna and Totko etc. and it shares about 10.04% and 60.23% of the Jam river respectively. Their lower courses are generally entrenched in their former flood plains.

It course is often traversed by waterfalls and rapids which some times lead to narrow and beautiful gorges near Dulukdih (300m). From this placed, the river flows more or less in easterly direction. It forms a beautiful steep-sided valley when it passes through the gap between the imposing hills of the Kumari peneplain (262m), Bhanda pahar (473m) and Gurima pahar (367m).

The Nangasai River:

The most of its feeders have their sources at an altitude of 258m over the granite rocks of Biramdih. The Nangasai and its tributaries fallow the joints so long as they flow over the granite bed. The Nangasai changes its general course from northwest to northeast. It has drainage areas of about 432.87km^2 or 16.19% of the Kumari river. The central highland range tract acts as a drainage axis to the streams but the Nangai cuts across numerous narrow schist hills of Dalma range. Sona and Sopa rivers are the tributary of the Nangasai river and its shares about 42.22%) and 30.75% of the main streams respectively.

The Hanumata River:

The Hanumata river has its source in the isolated range of Hayam pahar (680m) on the upper Dalma range about 15.0 km northwest of the Barabhum village. Its drainage area is about 81.92 km^2. Their course on the upper Dalma range runs from northwest to northeast beyond Balrampur, this is due to the hard and resistant nature of rocks in this area.

The Kharaoti River:

The source of the Kharaoti river is at an elevation of about 570m. One of its tributary rises from the adjoining Chekam pahar, southeast of Ghatsila. It meanders through the granite-gneiss surface almost from north to south till it sharply bends to southeast near Ghatsila. It has a drainage area of about 61.44 Km^2 or 2.29% of the study area. The nickpoint though sufedued appears over the granite-gneissic surface.

Soils:

Soil is the friable end product of the interaction of series of natural forces as climatic, biotic, etc., itself repeats its histogenesis. It bears much deformed condition, the marks which tell the story of its parent materials and the processes responsible for its present form. The climatic and biotic agencies decompose the exposed rock mantle according to their capacities. The decomposed materials are sometimes left to rest over the spots. The decomposed materials often are transported to different places by the agents of erosion. Its utility and capacity do depend on the parent materials and processes involved.

Soil is the mineral constituents of soils developed in situ, due to the decomposition of the parent rocks material, vary directly according to the character of the underlying rocks. Hence, it has been considered necessary that the preparation of a soil map should be based on the geological map of the area (Fig. 6). But recently, it has been recognized that climate plays no less significant role than geologic structure in determining the character of the surface soil. In several tropical countries, it is almost impossible to distinguish laterite on lateritic soil which has been formed from underlying granite and the laterite that has developed on shales. On the other hand moisture, which is a factor is climate plays a cordinal role in bringing out soil differentiation both laterally and vertically under the influence of run-off flow and percolating rain-water.

Study of soils not only incudes consideration of the character of the surface layers but also of the lower horizons. Broadly speaking, the soils of Dalma range can be classified in to three broad groups (Fig. 4):

(a) Lalerite Soil,
(b) Red Soil, and
(c) Sandy Soil

Laterite Soil:

This soils are argillaceous material impregnated with iron peroxide and are mottled with various tints of brown, red and yellow while a considerable proportion sometimes simply consists of white clay. Laterites also occurs

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in a large number of forms containing a considerable quantity of hydrates of alumina. The term 'Laterite' should be used to denote a soil formed in situ by the leaching of the bases and much of silica from the original rock leaving a residue having certain amounts of alumina uncombined with silica. Laterirte soil are formed under conditions of high seasonal rainfall which help to form the hydro oxides of alumina Chemically it is very difficult to indicate the common traits of leterite soils.

The laterite soils are observed on the range of middle Kumari (225m), lower Kumari (185m), Kulandani (292m) valleys, Penchara (268m), Kumari (262m) peneplains, Dulukdih gorge (300m), Kunokia escarpment (275m) in the northeast; Lankaiani (440m), Ledasai (275m), Chekam (570m) and Khursi (590m) pahars, Kesarpur gorge (386m) in the southeast and middle Subornarekha valley (250m) in the southwestern part of the study area..

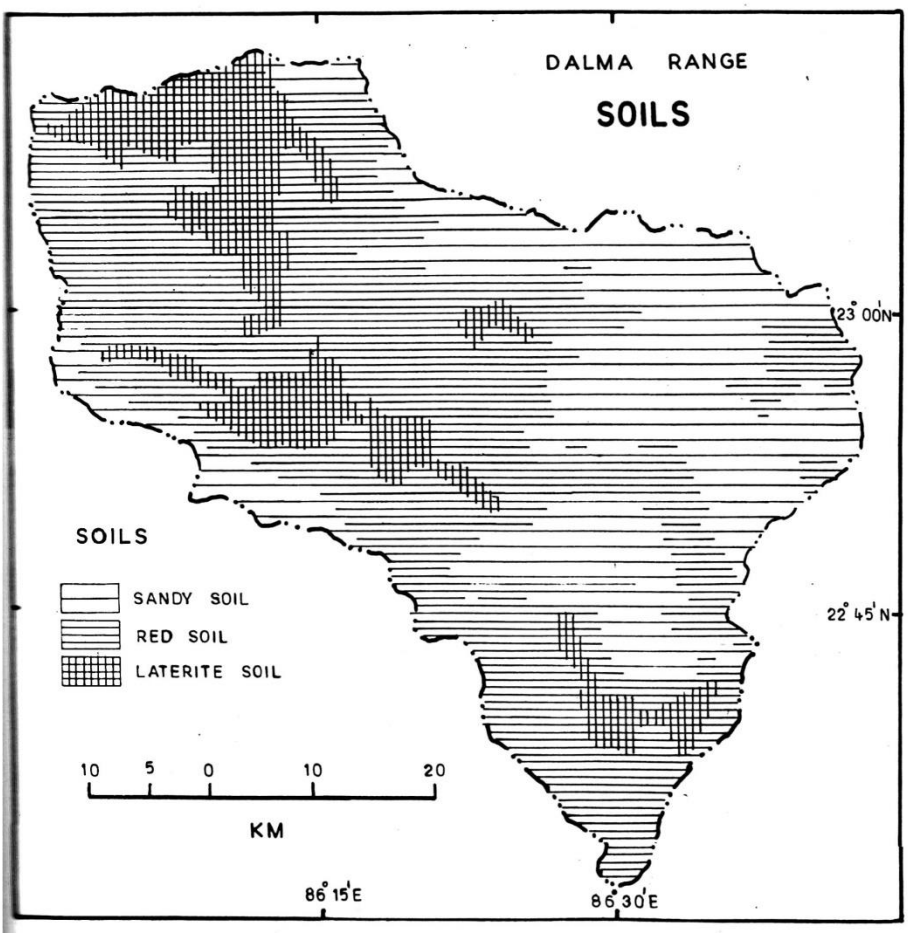

Fig. 4

Red Soil:

The red soil is derived from the ancient crystalline and metamorphic rocks namely the granites, gneisses and schists, with subordinate rocks rich in ferromagnesian minerals. In comparison to the black cotton soil, it is poorer in lime, potash and ferric oxide and is also low in phosphorus content.

The red soil varies not only in colour but also in depth. It exhibits a very fine texture in places where its thickness is more but become coarser with shallower depth. Also where granite is the parent rock, it become a coarse dry soil with reddish colour. At some places, the soil merges into the laterite soils of higher levels. The commonest form of the red soil is a sandy clay varying from the poor, thin gravelly and sandy soils of the Dalma range to the rich, deep and fertile loams of lower levels which under irrigation produce good crops. The soil has low organic content.

The red soil covers an area of the most of the intermediate slopes of the Barbogala pahar (220m), Sukiara gorge (290m), Gurma (300m), Jam (299m) and Nangasai (299m) valleys in the northeast; upper Kumari (300m) upper Subarnarekha (285m) and Sanka (425m) valleys, Balrampurl peneplain (275m), Rangara gorge (215m), Amda (409m), Lailam (336m), Chadri (440m), Chakotia (275m), Dalma (1000m) pahars in the northwest; upper Kharaoti (300m),

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lower Kharaoti (125m), lower Subarnarekha (105m) valleys, Mahulia (175m), Khengar peneplain (141m) in the southeast and Saopghara (575m) valley in the southwestern part of the study area.

Sandy Soil:

Sandy soil is the most inferior kind of soil which can not be improved by aeration. It is poor in nitrogen, phosphorous and humus but has moderate amounts of potash and lime. This soil varies from reddish yellow to greyish yellow in colour and is often moderately deep. Its fertility status and croping patterns are similar to those of the red soil. This soil is mostly found in areas lying close to stream channels in the valleys of the Jumuna and Kharaoti in the northeast; upper Kharaati and Bandhu valleys in the southeast and lower Subarnarekha, Gurma, Spaghara valleys in the southwestern part of the studyarea.

Natural Vegetation:

Natural vegetation of the entire study area has a diversified and rich natural vegetal corer which is influenced by climatic, biotic and edaphic conditions. Climatic factors are directly affecting the growth of vegetations while edaphic conditions are related with altitude, latitude and direction of slope etc. The altitudinal variations have produced various types of vegetation in the study area which are symmetrically distributed.

The various forest tracts are named after mountains ranges, peaks and important places of the region. Continuous belts of forests are observed along main ridges and hills. It is noted that atmospheric and biotic conditions govern the broad features of vegetation of an area. The atmospheric conditions depend upon the latitudinal and meridional position of the area, its elevation above sea level and include factors like temperature, rainfall, cloudiness, sunshine and humidity conditions. Impact of altitudinal variation on vegetations has been testified by various workers including Strahler, A.N. (1951) and Pearson, G.A. (1931). The edophic factors include the direction and amount of slope, depth and other characteristics of the rock debris. The more important among the biotic factors are the shade and organic content of the vegetation itself besides the activities of organisms including man and animals.

The vegation of Dalma range is primarily of the mansoon sub-humid of tropical moist deciduous type. It is more luxuriant than the vegetation of the adjoining Kumari plain in the north because the higher elevations of the range result is increased precipitation on the one hand and decreased evapotranspiration on the other. Champion, H.G. (1936) describes the vegetation of Chhotanagpur region (including the study area) as tropical moist deciduous in contrast to the vegetation of the Kumari plain which he calls tropical dry deciduous (Fig 5).

The Tropical Dry Deciduous Vegetation:

This type of vegetation is a combination of two distinct types. The first is the semi-xerophytic type corresponding to drier area. It includes tree and scrubs vary often stunted and mostly depleted. The second type is the damp tropical natural vegetation confined to the water tracts. Forests are mostly confined to the undulating areas drained by the middle Kumari (225m), lower Kumari (185m), Nangasai (299m), Jam (299m), Gurma (300m), and Kulandari (292m) valleys, Kunokia escarpment, Dulukdih gorge in the northeast; upper Subarnarekha, Kumari. Sona. Sanka valleys, Urma, Raoacha, Lailam, Amda, Chadri, Chakotia pahars, Balrampur, Birbhum peneplain and Rangagara gorge in the south west; Lankaiani, Khursi, Lodasai, Chekam pahars, Kharaoti valley, Kesharpur gorge, Mahulia, Khengar peneplains in the southeast and middle Subarnarekha valley in the southwestern part of the study area.

The thorny scrub jungle, covering large area of the Dalma range and rapidly taking the place of the true forest is an example of the first semi-xerophytic type. A large numbers of dry thorny plants namely 'Khair' (*Acacia ketchu*) 'Babul' (Acacias), Berberi' (*Zezphus Jujuba*) and 'Menphal' (*Ramdoas dumetroum*) compose this scrub jungle.

Common plants growing in cracks of the driest rocks are Papra' (*Gardenia latifolia*) and 'Thanella' (*Gerdenia turgida*), 'Govi' (*Fias tomentosa*), 'Kudia' (*Hamiltonia Suavealens*), the lost one often adopting itself to dry habitats by developing a fleshy pyramidal cactus-like stem. A considerable number of larger trees, occupying drier habitats on the hills and scarps of the ranges are deciduous during least a part of the long dry season and are a characteristic feature of Dalma range. Some have very thick corky twinges *Tomentosa* leaves which help them to resist the desiccating influence of climate.

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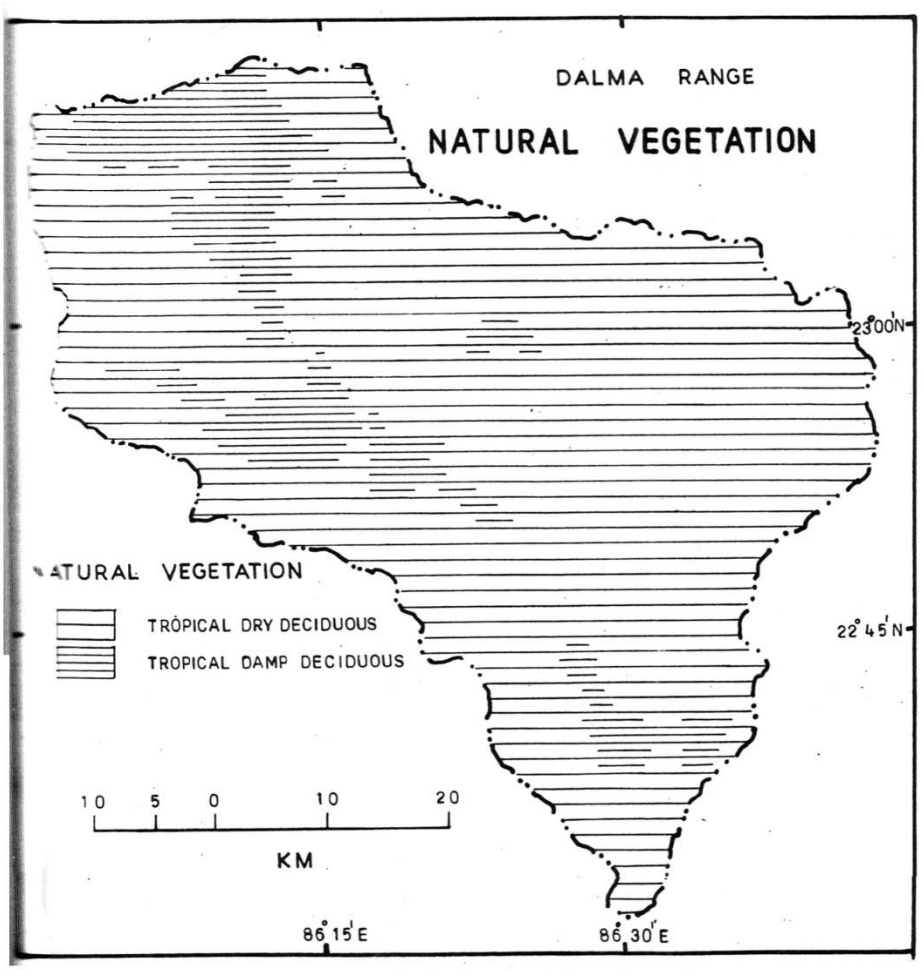

Fig. 5

The Tropical Damp Deciduous Vegetation:

The tropical damp type is represented by number of Sarpa Gandha' (*Rauwolfia serpentina*) and 'Madar' (*Calotropis procera*). Several short lived plants, namely, 'Kal Megh' (*Andrographic paniculata*). Tulasi' (*Ocimum sanctum*) also grow under the jungle tree.

In the rainy season, great variety of beautiful and interesting plants growing in the paddy fields and damp places. The parasitic and epiphytic plants in Dalma range form an interesting part of the vegetation. With a considerable number of climbers and scandent herbs and shrubs. The jungle in damp condition has all the appearance of a wet tropical forest.

The Damp tropical deciduous forests are confined to higher elevation of the Gorga-Buru hill-complex, Sobna valley, Bara-Banki gorge, Dimna Jhar Gorge in the northeast and Kadali, Bhelxi, Dalma pahar in the northwest; Gurma hill-complex in the south east and Gurma hill-complex in the southwestern part of the study area.

'Mahua' (*Bassilatifolia*) is commonly met near settlements. Other species comprise 'Bergad' (*Ficus bengalensis*), 'Neem' (Melia indica) and 'Sema' (*Bonbax malabaricum*) in this area.

The beneficial effects of forests in Dalma range can be enumerated as reduce the temperature of the air and soil, increase the precipitation of moisture, preventing soil erosion etc. It reduces the velocity of air protect adjoining fields against cold or dry winds and offered shelter to cattles and useful birds.

Summary and Conclusion:

The study area varies in elevation from 150m to 750m. It has been divided into two major physiographic regions, namely: (i). The Dalma range: (a) The upper Dalma range, (b) The lower Dalma range, (ii). The valleys: (c) The Subarnarekha valley and (d) The Kuamri valley: The Dalma range has an average height of 450m and it accounts for about 30.1% of the study area only. In contrast, the elevation of valley region varies from less than 150m in the southeast to about 750m in the southwest.

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The Dalma range has largely a tropical location. The highest temperatures at Jamshedher are recorded in months of May and June. These months have mean temperature of 31.0°C and 28.1°C respectively. The relative humidity is generally high during the rainy seasons. August in the rainiest month with an average rainfall of 33.75cm. Like most parts of India, the Dalma range experiences 4 season, namely (i) The cold weather seasons (November-February), (ii) The hot weather season (March-mid June), (iii) The rainy season (mid June to mid. September) and (iv) The season of restreating monsoon (mid September-October).

Two main drainage systems have been noted in the area. These are: the Subarnareka drainage system which includes important streams like % foe Bamani and Gurma rivers and its tributaries. The Kumari drainage system, which include important streams, like Jam, Sona, Nangasai, Hanumata, Jamuna and Totko.

Three main groups of soils, namely sandy, red and laterite soils, Occurs in the area. The sandy soil zone, associaled with reverine plain and valleys, accounts for half of the population of the area. This zone is characterized by compact settlements. Laterite soil has been noted a part of the higher range and on summits of ranges, etc. but typical soil of the area is the red soil which occurs quite extensively.

The vegetation is primarily of the mansoon sub-humid of tropical moist dciduous type with 'Sal' (*Shorea robastd*) as the most important tree species. In true tropical moist deciduous forests, thorny scrub jungle covers large areas of the Dalma range. The damp tropical deciduous vegetations are confined to the higher elevation of the study area.

The physiographic characteristics have plays a vital role of the distribution of soil, forests 16 climate, environment settlement and society. The geological structures also played their great impact on the various characteristics of this region. The physiographic characteristics have played a vital role in the distribution of soil, forests, climate, environment, settlement and society. The geological structures have also played their great impact on the various characteristics of this region.

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