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Rapti Basin, India: A Hydrogeomorphic Analysis

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Abstract:

Rapti River is the most important left bank tributary of the Ghaghra River. The Rapti rises south of a prominent E-W ridgeline midway between the western Dhaulagiri Himalaya and the Mahabharat Range in Nepal at an elevation of about 3048 m. The Dundwa range subrange of Shiwaliks in Western Nepal divert the Rapti to some 100 km west before the river resumes its southward course towards the Ganga. After flowing through Nepal, it enters Eastern Uttar Pradesh in Chanda Pargana, east of the Kundwa village of Bahraich district. The flood water of river Rapti is being controlled by Rapti Barrage. This is situated at the up-stream of Bhinga site in district Shravasti and maintained by State government. Rapti River Basin is the part of the middle Ganga plain. It is fed by numerous tributaries and affluents drop vertically down in Rapti from Shiwalik and its foot hills. The basin is homogenous aggradational plain of older and newer alluvial deposits. Like other tropical monsoon areas, seasonal rainfall causes inundation, flood, water logging and severe erosion as well as large scale over bank deposition in Rapti River basin as well.

Key words: Rapti River, Mahabharat Range, Rapti Basin, Bahraich, Ganga Plain.

Introduction

The Rapti Basin in Uttar Pradesh is located between East longitudes 81°35' and 83°49' and North latitudes 26°18' and 27°59' (**Figure 1**), covering an area of 14,658.20 square kilometres. Historically, the Rapti River was known as Iravati. The Rapti River originates in Nepal near Rukumkot in the Mahabharat range of the lesser Himalayas. The river begins in Nepal's Mahabharat range at an elevation of 3,050 metres. The Rapti River basin has a diverse physiography. The entire basin's topography is made up of lofty mountains, inner and outer Tarai, and undulating plain regions. Rapti River begins as a small river draining Nepal's Chitwan (Inner Terai) valley and flows west to join the Narayani (Gandaki) river a short distance to the north. The Rapti zone is located in Nepal's Middle Hills, between the Karnali and Gandaki Basins and flows west through the Mahabharat range, then southeast down the Indo-Gangetic plains to join the Sharda (Ghaghara) River. Rapti River is a significant tributary of Ghaghara River. The Rapti River has two distinct climatic regions due to altitude differences: the mountainous region has a temperate climate, while the plain region has a subtropical climate. The climate in the Himalayas is temperate. Summers are hot, while winters are cold. The subtropical climate plain region has a typical monsoon climate with a dry winter season. The summers are extremely hot. The daily maximum temperature reaches 46.5°C. The western region is hotter than the eastern region. Rapti Basin, like most of northern India, has an extreme Humid Subtropical with Dry Winter. Summers are hot, with temperatures reaching 40 degrees Celsius. Temperatures range between 20 and 30 degrees Celsius from mid-October to mid-March. The predominant winds are westerly.

From mid-April to the end of May, the hot wind Loo blows strongly. The monsoon season, which begins in mid-June and lasts until September, accounts for 90% of the 150 cm of rain. Temperatures range from a low of 9°C in the winter to a high of 45°C in the summer.

Geomorphology:

The Rapti River basin may be divided into three zones:

- 1- The northern mountain zone or Shiwalik Himalaya
- 2- The tarai zone
- 3- The plain zone.

The Northern Mountain Zone, also known as the Shiwalik Himalaya, is the foothills of the Himalayan Range and is primarily composed of Miocene to Pleistocene molassic sediments derived from Himalayan erosion. The Muree and Siwaliks Formations are internally folded and imbricated molasses deposits. The Sub Himalaya is thrust along the Main Frontal Thrust over Quaternary alluvium deposited by Himalayan rivers (Ganga, Indus, Brahmaputra, and others), demonstrating that the Himalaya is still a very active orogen.

The Tarai Zone is traversed by the large perennial Himalayan rivers Yamuna, Ganga, Sharda, Karnali, Narayani, and Kosi, each of which has created alluvial fans covering thousands of square kilometres below their exits from the hills. The Mahabharat Range is the source of medium rivers like the Rapti. The geological structure of the region is made up of both old and new alluvium, both of which are alluvial deposits primarily composed of sand, clay, silt, gravels, and coarse fragments. Every year, fresh deposits brought down by active streams that engage in fluvial action replenish the new alluvium. Old alluvium is found away from river courses, particularly on plains uplands where silting is uncommon.

The Plain Zone: As rivers exit the hills and transition from the sloping Bhabhar to the nearly level Tarai, the current slows and the heavy sediment load falls out of suspension. As monsoon-swollen rivers overflow their low banks and shift channels, this deposition process creates multiple channels with shallow beds, allowing for massive floods. Many places have erosion, such as gullies. This region is rich in fertile and arable land.

Rivers in Rapti River Basin:

The Rapti River:

The Rapti River (**Figure 2**), formerly known as Iravati, rises in Nepal's Mahabharat range of the Lesser Himalaya near Rukumkot at an elevation of 3,050 metres. The river continues south-eastward after the hairpin bend just above the Indo-Nepal border, passing through a number of lakes and swamps as well as some abandoned water courses. It enters Eastern Uttar Pradesh in Chanda Pargana, east of the Kundwa village of Bahraich district, after passing through Nepal, it flows in a very sinuous and shallow course, causing heavy flooding in the districts of Eastern Uttar Pradesh. The river then flows through the districts of Bahraich, Shrawasti, Balrampur, Siddhartha Nagar, Sant Kabir Nagar and Gorakhpur before joining the Ghaghara on its left bank near the town of Barhaj in the Deoria district. However the Rapti Basin covers 10 districts viz. Bahraich, Shrawasti, Balrampur, Siddhartha Nagar, Sant Kabir Nagar, Basti, Mahrajganj, Gorakhpur, Deoria and Kushinagar. The Rapti River runs approximately 560 kilometres from its headwaters in India to its confluence with the Ghaghra at Barhaj in Deoria. The Rapti River in India basin has a catchment area of approximately 14,658.20 square kilometres. Burhi Rapti and Rohini are the major left bank tributaries. Those on the right bank, on the other hand, are minor Rapti River bends. The Ami is prominent among them.

Major Tributaries of Rapti River in India:

Burhi Rapti: Burhi Rapti (**Figure 3**) emerges near Mathura in Balrampur district and flow across it in a direction roughly parallel to that of the Rapti as far as the Siddhartha Nagar border. This intercepts the water of large number of tributary streams, which bring down the drainage from the hills in the north and consequently attains at times large proportions. Arrah Nala first joins Chharihwa Nala which then joins Burhi Rapti and at this junction with Chharihwa Nala, Burhi Rapti then leaves the District. The Burhi Rapti is the most important tributary of the river Rapti. It rises in the Dundwa range at an elevation of about 914.4 m. and has a steep drop of about 609 m. in about 16.1 km. of its flow. It flows roughly parallel to Rapti and in high floods it inundates a large area. It joins the river Rapti near the Tal Natawa village, located in Naugarh tehsil of Siddharthnagar district. The tributaries of Burhi Rapti are mostly non-perennial streams except the Banganga. The BurhiRapti drains a catchments area of 4,701 Sq. km. and has a length of 198.3 km.

Banganga: The Nepalese Terai is where the Banganga, a river of remarkable size, rises. It moves into the neighbourhood close to Jharua and divides Bansi East from Bansi West for a while. It enters the old pargana (Bansi east) in Antu and continues on via Pirpi and Kakrahi before joining the Burhi Rapti in a southerly direction. The channel of the river is apt to frequent changes as a result of heavy flood brought down by it.

Suwawan Nala: This Nala originates in the western portion of the Balrampur district, flows through Balrampur and Bhagwatiganj, and then meets Rapti at the border of Siddhartha Nagar, close to the village of Rasulabad. Near Balrampur city look like narrow lakes. Afterward, it resembles Nala, and before joining Rapti, it resembles a deep river during rainy seasons.

Ami: It has its source in Rasulpur Tehsil of Sant Kabirnagar district and meets Rapti River near Sohgaura village, Tehsil Bansaon.



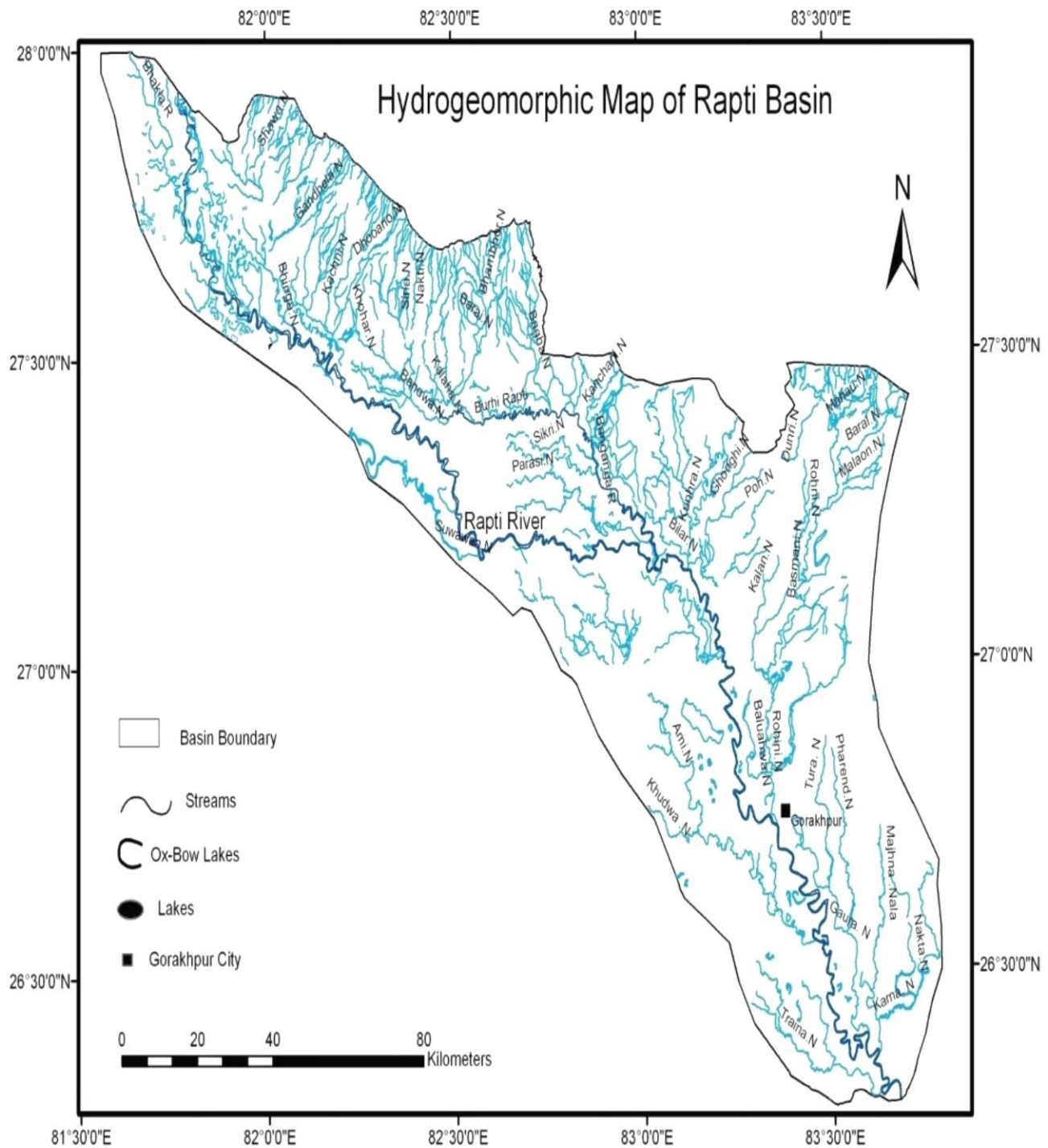


Figure 1

Hydrogeomorphic map of Rapti Basin

Rohini: Has its source in Nepal near Chaurangi Khola. It enters the district near Campeerganj Tehsil and meets Rapti near Domingarh. During floods it affects the villages of Kauria block.

Taraina: Originates in the south of Unaula pargana and flowing in south-easterly direction through Dhuriapur reaches the Bhenri Tal. Emerging from eastern extremity of this lake it finds it way into Rapti by an almost

direct route due east. During the dry weather it is an insignificant stream but during wet season it assumes considerable dimensions.

Tura and Gaura: The Tura is a small stream which rises in Tappa of Haveli pargana and flows southward through the Ramgarh forest to the east of Gorakhpur city till it joins the Gaura at the village of Jhangaha. The latter carries off the overflows from the Ramgarh and Narhari Tals and the combined stream continue for a considerable distance parallel to Rapti.

Pharend: Rising in the north of Pipraich flows southwards almost parallel to the River Tura and finally joins Gaura in the south of Rajdhani. The name Pharend is derived from the thick growth of 'Pharend' or wild 'Jamun' trees along its course.

Bhakla: It is the Rapti River's main affluent. Its source is in Nepal's tarai, and it travels a good deal through the Shrawasti district before exiting along the eastern edge of the central plateau, on average 6 km to the west of the Rapti. Prior to flowing through the entirety of Pargana Charda, which it exits in the south towards Mahdewa, it first approaches the eastern edge of the Charda forest. Then, after briefly forming the western boundary of Bhinga, it bends east into the pargana before turning south once more to form the western boundary of Ikauna, joining the latter just south of Naubasta. After that, the river travels northeast of Ikauna and merges with the Rapti in Piprahwa close to Bhagwanpur.

Kain: The Kain is another affluent of the Rapti. It comes from Tulsipur tarai and is led by the Hathikund and numerous others streams. It joins the Rapti below Bhinga at Lachhmanpur Gurpurwa.

Parasi: It begins in Tilakpur and flows through Bansi West's southern border before entering some low ground close to Chaur Tal. One branch leaves from here and empties into the Rapti to the south, close to Narkatha, while the other branches into the Burhi Rapti to the east. The Sakrahwa nulla, which removed drainage from the Leond Tal, is the first tiny affluent of the Parasi. The second is a short channel that runs south from Intwa, and the third is known as the Akrari. The final begins in the Akrari Tal, just to the north of Domariaganj, and after passing Chaukhara, bends to the east before emptying into the Parasi not far from Khaira.

Sikri: The second and very similar tributary on the same bank is the Sikri, which rises near Budhi in the extreme west of Bansi and flows through the middle of that pargana as far as Kathela; it then turns to the south for some kilometres and again to the east, joining the Burhi Rapti at Misraulia.

Rapti River : Left and Right Bank Tributaries

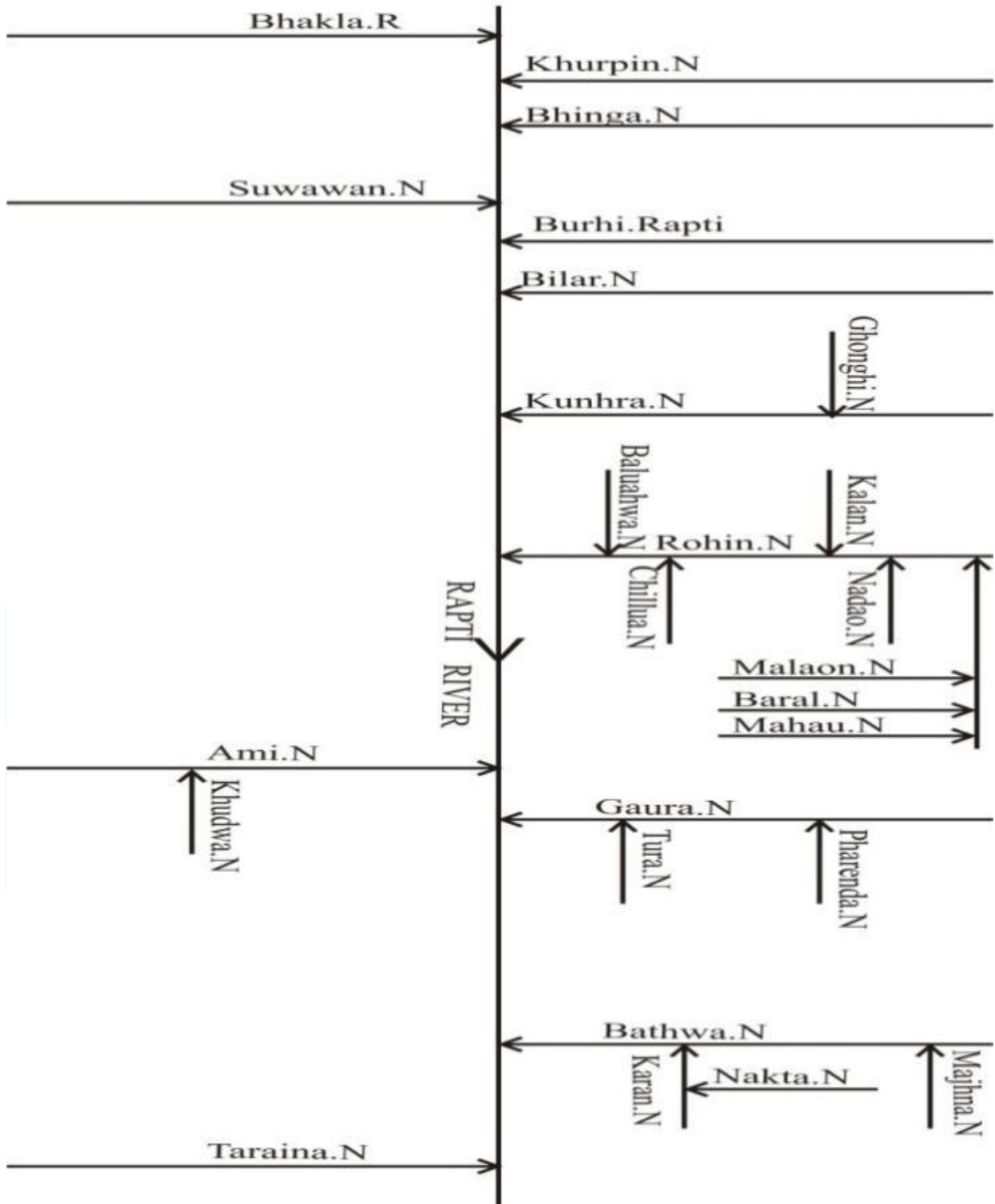


Figure 2

Burhi Rapti : Left and Right Bank Tributaries

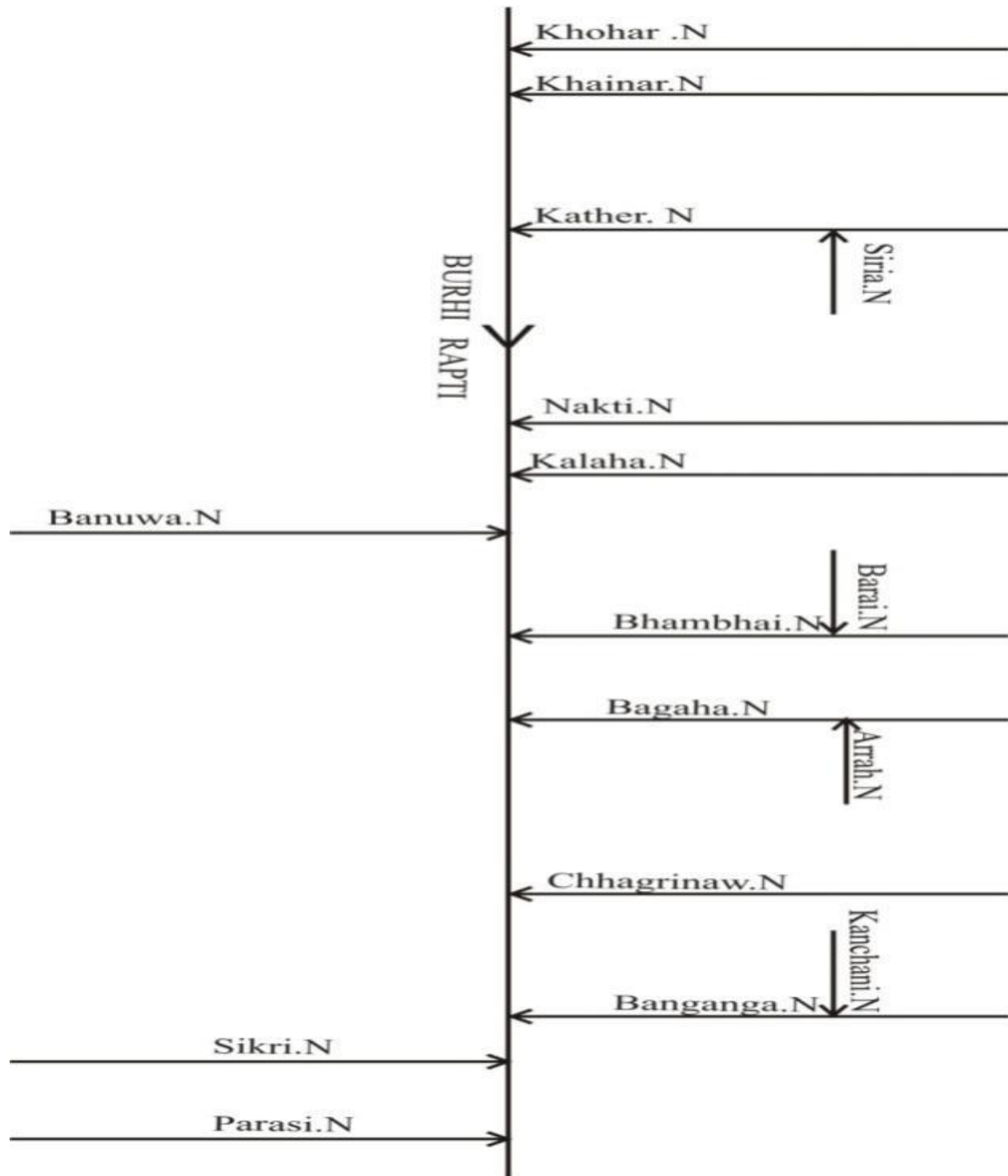


Figure 3

Arrah: Of the northern streams, the first is the Arrah which, after issuing from the hills, divides the Nepales terai from that of the Avadh and forms for about 12 km, the boundary between this district and Gonda, joining the Burhi Rapti to the east of Khankot. To the east of Arrah are the Chhagrihwa, Ghurahi, Awinda or Aundahi, the Surhi and its tributaries the Karma, Sotwa or Satohi and the Kanchani. These and several others flow through the paddy belt of tappa Dhebarua and Khajahni, their channels being seldom well defined, particularly near the point of confluence.

Jamwar: The portion to the east of the Banganga is drained by another series of hill streams which are no less perplexing in their ramification and constant liability to change. The first of any importance the Jamuwar, which shortly after its entry into the district is fed by small tributaries known as the Musai, Mahsai or Masdi and the Doi, which falls into the river near Alidapur. Further south, at Naugarh the Jamwar receives on its left bank the Budhia, the name given to the combined water of the Mokhra and Ghaghwa, which drains the villages of Birdpur. About 8 km south at Karchulia, the Jamwar falls into the Kunhra, shortly after its junction with the Dubai, a small stream rising to the west of Naugarh.

Kunhra: The Kunhra is a deeper and more clearly defined stream, which flows through the Dundwa range, past the Nepalese town of Butwal and enters Pargana Binayakpur near the village of Khairanti flowing through the pargana to its western boundary, it is there joined by the Tilar, which again is reinforced by the Siswa and Marti, small terai streams of a similar nature. From the junction the Kunhra forms the boundary between Bansi West and Binayakpur, receiving the Hagni and other minor affluents on its west bank. Continuing southwards passes Sohas and after uniting with the Jamwar flows through the town of Uska to join the Rapti.

Ghonghi: Mention may also be made of another tributary of the Kunhra. The Ghonghi, rises in the lower range of hills above the Nepal terai. The united stream of the Ghonghi and Kunhra generally goes by the name of Dhamela and this appellation is commonly given to the Rapti itself in that portion of its course in which it follows the channel formerly taken by the Burhi Rapti as far as the point where the river resumes its old bed at Karmaini.

Hill Torrents: Hill torrents in dry season either disappear or else carry down an insignificant amount of water but in the rains they are immediately transformed into rushing rivers. The important ones are, Kachni, Dhooano, Khainar, Kather, Sina, Nakti, Banua, Kalaha, Bhambhor, Bahga, Arrah and Chhagrinaw Nala.

Lakes: The basin contains several lakes many of which are of considerable size and form a valuable source of water-supply. The character of these jhils varies according to the locality. In the terai and the tarhar they are generally formed by the action of the rivers in changing their beds. Their shape is that of a horse-shoe, and the convex side the bank is usually high and sandy. Such jhils were once merely bends of streams, which have become silted up at either side. In the terai there are innumerable swamps along both sides of the Rapti and throughout the lowlying rice tract.

Conclusion:

The current study aids in locating and determining the Rapti river basin's mainly untapped water resource potential. The area's population is primarily agrarian, and the basin includes some of Uttar Pradesh's most underdeveloped districts, including Bahraich, Balrampur, Basti, Siddhartha Nagar, Sant Kabir Nagar, Maharajganj, Kushinagar, Deoria, and Gorakhpur. The study may aid in maximising the region's irrigation potential. Additionally, because the area is vulnerable to flooding, it may help to identify and demarcate the outlets of various tributaries in order to construct small check dams in various subbasin areas, which will lessen the flooding issue.

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