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Subarnarekha: The Scenario of Lower Course & Lower Catchment Area of the Gold Streak River Basin in West Bengal & Orissa, India

Biswajit Shyamal

Assistant Professor, Department of Geography, Santal Bidroha Sardha Satabarshiki Mahavidyalaya, Goaltore-721128, Paschim Medinipur, West Bengal, India

Abstract: ***The Subarnarekha River is commonly known as the "Gold Streak of India" in the public domain. The river originated from Piska village near the Ranchi district of Jharkhand & joining the Bay of Bengal near the Balasore district of Orissa. This study is based on the Lower Course of the river which is extended from Ghatshila to Kirtaniaport. The total length of the river's lower course is about 126 km, 64 km in West Bengal & 62 km in Orissa. This river is a lifeline for the tribal communities inhabiting the Chotonagpur region of Jharkhand, West Bengal & the people of north Orissa. The LCA of the Subarnarekha River Basin is (about 6,103 km^2) full of fertile alluvial soils (11% of the total basin area) due to the floodplain area. It's a rain feed Non-perennial River. In the lower course, the quantity of water flows fluctuates from monsoon to post-monsoon season. Flood & Bank Erosion is major issues in the lower course of the Subarnarekha River. Sand, Silt & Gravel mining on the river bed is a regular activity in the lower course. In the LCA the river water is used for regular agricultural practices but as a part-time occupation, people are involved in fishing for freshwater fish from the lower course of the Subarnarekha River.***

Keywords: Gold Streak River, Lower Catchment Area, Lower Course, Sand Mining, Bank Erosion, River Ecosystem

1. Introduction

The word "Subarnarekha" literally means "streak of gold." It is a combination of two words; "Subarna" meaning gold and "Rekha" meaning line or streak in Indian languages. Traditionally, it is believed that gold was mined at a village named Piska near the origin of the river. This was the reason for the river being named as Subarnarekha (Singh & Giri 2018).

The river flows a distance of about 395 km from its origin before falling into the Bay of Bengal. Out of the total travel distance of 395 km, the river flows 269 km in Jharkhand, 64 km in West Bengal, and 62 km in Orissa (CBPCWP 1986; Giri and Singh 2014).

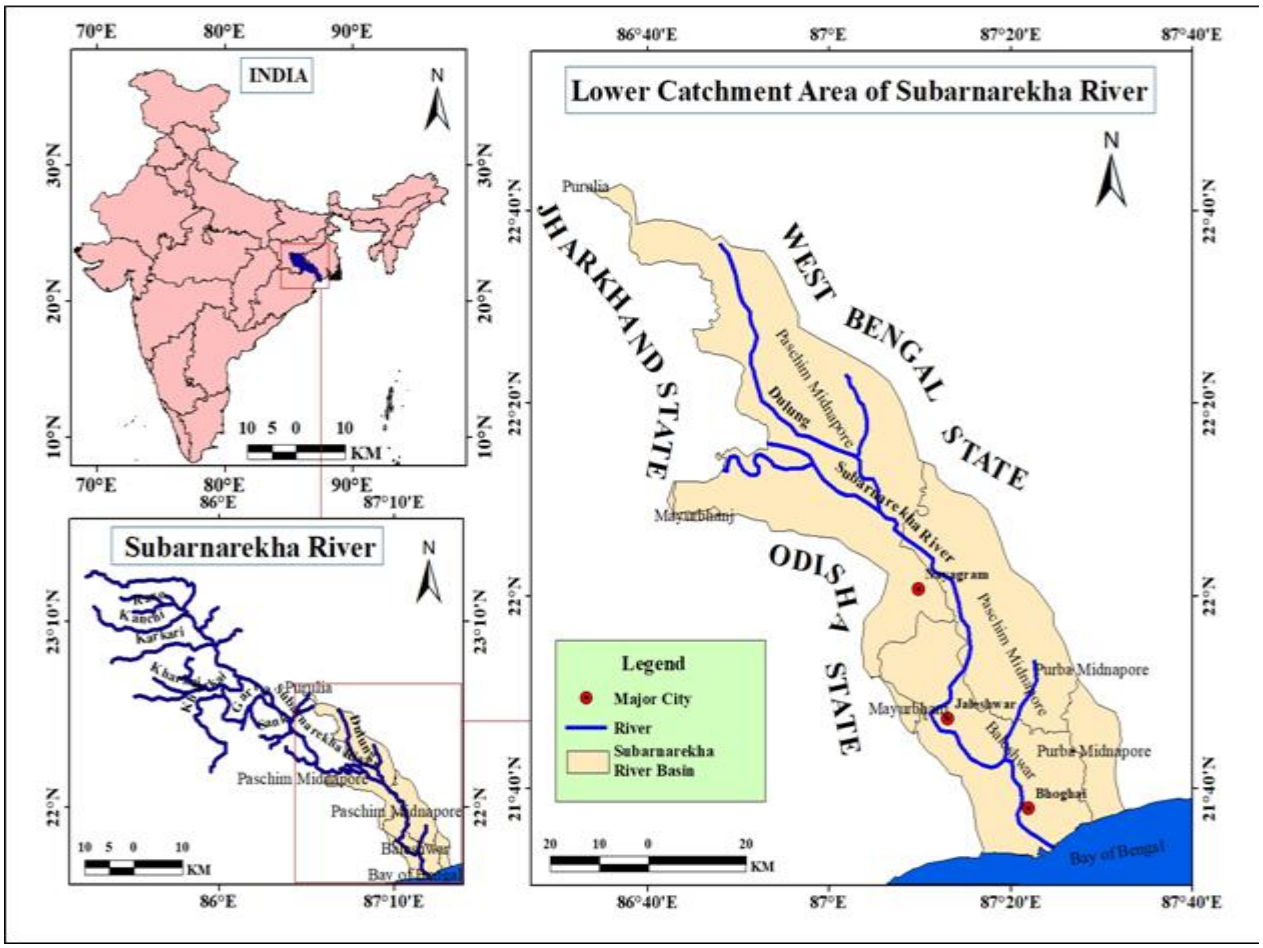
The Subarnarekha is one of the major rain-feed in India. As per ranks, it's the smallest river basin among fourteen major river basins in India. This is a superimposed river. The Subarnarekha River courses have been divided into three prominent reaches. The upper course is from the source of the river at Piska village near Ranchi district to Jamshedpur. The middle course is from Jamshedpur to Ghatshila in Jharkhand state and the lower course is from Ghatshila to the mouth of the river submersed to the Bay of Bengal at Kirtania port in Orissa state.

In the lower course of the Subarnarekha River near Gopiballavpur CDB of West Bengal, the downstream valley is wider & meandered than the upstream valley of the middle & upper courses. This section of the river is under the sand, silt & gravel mining activities during the pre-monsoon & post-monsoon periods. Besides, fishing (by local fishermen) is one of the dominant activities in the lower course of the Subarnarekha River.

2. Study Area

The Subarnarekha River originates near Nagri village (23° 18′ 02″N and 85° 11′ 04″E) in the Ranchi district and runs through some major cities and towns, i.e., Jamshedpur, Chaibasa, Ranchi, Bhadrak before joining to the Bay of Bengal near Kirtania port (21° 33′ 18″N and 87° 23′ 31″E) in Orissa (Singh & Giri 2018).

The lower catchment area of the Subarnarekha River basin extends over 6,103 km^2 and accounts for 0.2% of the geographical area of India (Roy et al. 2013).



The lower catchment area of the Subarnarekha River basin is bounded by north latitudes of 21° 33′ to 22°42′ and east longitudes of 86° 33′ to 87°32′. The lower catchment area of the Subarnarekha River basin is restricted by the Brahmani & Burhabalang River basin in the southwest, the Kansai River basin in the southeast, and the Bay of Bengal in the south side. The study area is under Jhargram, Paschim Medinipur districts of West Bengal & Balasore district of Orissa.

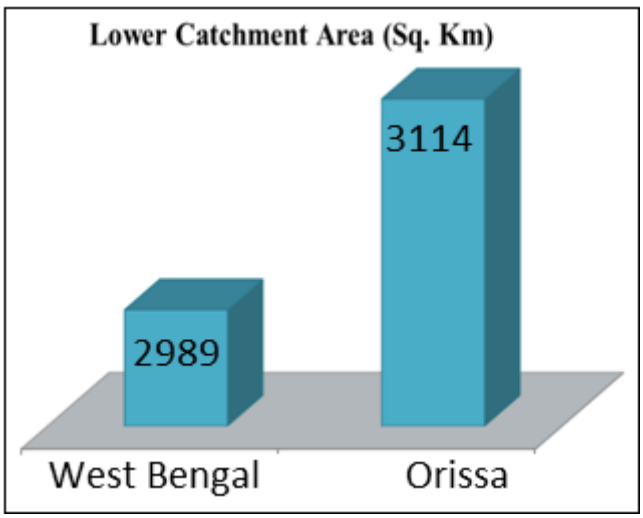


Figure 1: State-wise Distribution of LCA in the Subarnarekha River Basin
Data Source: SOI (1923-1979), Rao (1975)

3. Major Tributary in the Lower Course of the Subarnarekha River

The Dulung is one of the main tributaries of the Subarnarekha River. It originated near Dulungdiha (22°9'34"N 87°4'41" E) in the Jhargram district of West Bengal. It terminates with its confluence with the Subarnarekha River near Rohini. It is one of the left side important tributaries in the lower course of the Subarnarekha River. The total length of the Dulung River is about 84km. The Dulung River catchment area is 1200 km^2. This tributary flows from a North-West direction to a South-East direction. Rainfall is the main source of water for this tributary during pre-monsoon, monsoon & spring seasons also. This tributary carries a huge amount of water during the monsoon season but in the dry season, it carries a very less amount of water. Besides, this tributary received water from so many sub-tributaries which are small in size called Nala.

Table 1: Tributary in the Lower Course

Sl No	Name of the Tributary	Bank	Length (km)	Catchment Area (km^2)
1.	Dulung	Left	84	1,200

Source: https://indiawris.gov.in

4. Topography & Soils of the LCA

The lower stretches comprising of the gently undulating alluvial plains of Tertiary deposits that are overlain by unconsolidated Quaternary sediments (Guha & Patel 2017).

All the Prominent developments of terraces have been described in the lower Subarnarekha valley by (Niyogi 1968). It has been recorded 3-level terraces in the areas close to Baharagora (CD Block in the Ghatshila Subdivision of the East Singhbhum District in Jharkhand.) –Jamsola (Village/hamlet in Suliapada Tehsil in Mayurbhanj District of Odisha) on the northern bank of Subarnarekha. These are at elevations of 74, 61, and 49 m above mean sea level (AMSL). The most prominent of these is the highest terrace, traceable from SW of Baharagora to near Jamsola. The terrace has a maximum width of some 2.5 km, and a prominent natural levee (2–3 m high and about 500 m wide). The other terraces are much smaller in their dimensions. All the terraces comprise thin alluvial cover over the lateritic basement of the country rocks (Niyogi 1968).

The younger geological formation namely, Tertiary gravels, Pleistocene alluvium, and recent alluvium are exposed only in the lower reaches of the basin southeast of the Ghatsila (Singh & Giri 2018).

The LCA of the Subarnarekha River basin is mainly an alluvial floodplain area. The range of elevation of LCA is about 103m (Ghatshila) to 0-4m (Kirtania Port) From MSL. The slope is moderate to gentle from Ghatshila to Kirtania.

The soils in the Subarnarekha basin are derived from diverse parent materials and can be divided into three groups: (i) Alluvial Soils, (ii) Red Soils, and (iii) Latosols. The red soils cover more than 83% of the basin area mainly in the upper reaches of the basin. The river-borne alluvial soils cover is 11% of the basin area and mostly confined in the lower valleys and coastal plains. The remaining 4% of the basin area is covered by the infertile latosol mainly laterites (Singh & Giri 2018).

So, the soils of the lower catchment area of the Subarnarekha River basin are full of alluvium with sand, silt & clay content. Some of the portions are under fertile loamy soil. It's part of a flood-prone area.

Mostly every year due to floods in the monsoon season the lower catchment area of the Subarnarekha River basin has evidence of silt & clay deposits.

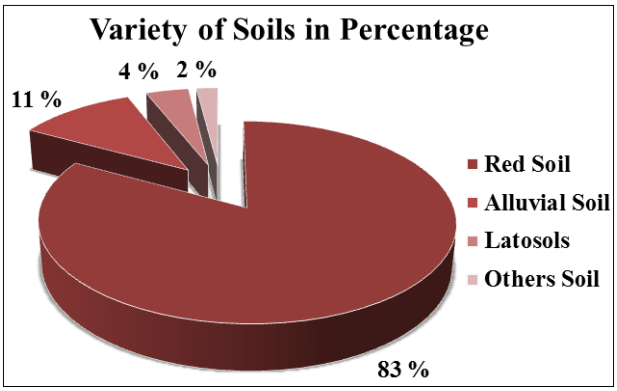


Figure 2: Soil Types in the Subarnarekha River Basin
Data Source: Singh & Giri (2018)

5. Socio-Economic Significance

5.1 Utilization of Water Resources in the LCA

The LCA of the Subarnarekha River basin is generally influenced by the South-West monsoon, which onsets in the month of June and extends up to October. The average annual rainfall for the basin is around 1800 mm. The climate in the sub-basin is tropical with hot summers and mild winters. The mean monthly temperature varies from 40.5° C (May) to 9.00 ° C (December). The highest temperature recorded is 47.2° C and the lowest is 2.8° C. Annual average maximum and minimum temperatures vary from 32.4° C to 18.0°C.

Since the sub-basin is located in the heavy rainfall area of Peninsular India, especially along the belt of storm tracks originating in the Bay of Bengal, it receives a substantial quantity of rainwater every year. About 82% of the total annual flow actually occurs over only four wet months (June–September), while in the remaining part of the year, the lower course of the Subarnarekha River and its tributary run almost dry or very less amount of water.

The lower course of the Subarnarekha River and its tributary are sustaining a large population of West Bengal and Orissa and forming the main sources of irrigation water supply. The land use pattern of the LCA of the Subarnarekha River basin area is under mostly agriculture practices & natural forest. Besides, some portion of the land is under uncultivated barren & orchards.

A number of irrigation and multipurpose projects were initiated to fulfil the water and energy demand of the eastern region. This includes Subarnarekha Multipurpose Project, an inter-state project in Jharkhand, West Bengal, and Orissa. The main objectives of the Subarnarekha Multipurpose Project (SMP) are to provide reliable water supply to agricultural lands in Jharkhand, Orissa, and West Bengal, to reduce flood damage in Orissa and West Bengal by constructing 463 million m3 flood-storage capacity dam at Chandil, to construct embankments by Orissa and West Bengal governments in their respective territories along the flooding reaches of the river, and to generate 30 MW of hydroelectric power through the medium, mini, and micro-hydroelectric projects located at various points of the canal system.

Table 2: AIBT Project

State	River	Project Type	Date of Monitoring	Remarks
Orissa	Subarnarekha	Major	10 & 11/02/2022	Ongoing

Source: Annual Report (2021-2022), CWC

5.2 Sand, Silt & Gravel Mining:

Although the upper part of the Subarnarekha River basin is full of mineral deposits and a sufficient number of industries have been developed along both sides of the river bank mainly in Jharkhand.

The mineral resources of the Subarnarekha basin are mainly comprising of ores of Cu, Fe, U, Cr, Au, and V, industrial minerals including kyanite, asbestos, barytes, apatite, china

clay, talc, limestone, dolomite, and building stones (Giri et al. 2013).

But the lower course of the Subarnarekha River basin is full of sand, silt & medium to small size rounded shaped gravels. Sand mining is a prominent mining activity in the lower course of the Subarnarekha River valley. Due to the growth of urbanization in the adjoining area of West Bengal & Orissa, the demand for river sand as a constructive building material has increased. From the river floodplain area, a huge amount of silt & clay is collected by a large number of brick production units. Besides, gravel is collected for the construction of roads and associated concrete materials. As a supporting document, some pictures of the Subarnarekha River valley at the Gopiballabpur section are given below.

Picture 3

Picture 4

All the pictures (1 to 4) are live evidence of sand mining on the river bed in the lower course of the Subarnarekha River at Gopiballabpur in West Bengal.

5.3 Natural & Anthropogenic Impact:

5.3.1 Flood

The river "Subarnarekha" is considered a lifeline for tribal communities inhabiting the Chota Nagpur region of Jharkhand & West Bengal as well as for the people of north Orissa. So, it's not only a river it represents a lot more than that for this region.

However, it has also become the death line when it submerges major areas of Balasore such as Bhogarai, Baliapal, Basta, Jaleswar blocks, and some parts of Rasgovindpur block of Mayurbhanj every year during the rainy season, causing large-scale devastation in the villages situated on both sides of the river. Every year, people suffer from the same problem but the only change is in the intensity of the flood (Singh & Giri 2018).

Annual average rainfall in the basin is in the order of 1250 mm with the maximum and minimum rainfall recorded as 1420 and 1150 mm, respectively. Out of this, about 90% of this rainfall is recorded during the southwest monsoon season, i.e., June–October (Jain et al. 2007).

The water level of the Subarnarekha rose beyond its danger line due to heavy rain in July 2007, and it crossed the previous highest flood level (HFL) of 12.2 m recorded in 1997. Flash floods due to heavy rainfall in the upper catchment areas were also recorded in the Subarnarekha River in the years 1973, 1974, 1977, 1978, and 2009 (Maiti et al. 2009).

Mostly every year all the floods in the LCA of the Subarnarekha River sub-basin are devastating in nature. Due to the floods so many lives were destroyed &thousands of households have been submerged under the flood water. As per records, it has been destroyed thousands of hectares of agricultural fields in the LCA.

Uncontrolled deforestation, continuous urbanization, unplanned industrialization in the upper catchment, illegal mining, severe soil degradation, and coastal cyclone, were the main causes of such ecological disaster in the LCA of the Subarnarekha River basin.

Table 3: Severe Flood Situation in 2021

State	District	Name of the River	Affected Area
Orissa	Balasore	Subarnarekha	Rajghat

Source: Annual Report (2021-2022), CWC

5.3.2 Bank Erosion

Bank erosion is a common phenomenon in the lower course of the Subarnarekha River Basin. Both sides of the river bank in the lower course are mainly affected by the rills & gully erosions. If the total annual flow is taken into account there is a huge deviation between the flow of wet season & dry season. The actual fact is that due to peak rainfall in the monsoon season, the maximum amount of cannel flow occurred in the four wet months (June-September). During the flood due to high turbulence, the river carries a large number of sediments from the upper course to the lower course and as a result of high turbidity the colour of the river water turns muddy or yellowish. The width of the river has been increased near Gopiballabpur due to bank erosion.

So, the high stream power is a responsible factor for bank erosion in the lower course of the Subarnarekha River.

Picture 5

Picture 6

These two pictures (Pic-5 Rill Erosion & Pic-6 Gully Erosion) are proof of bank erosion in the lower course of the Subarnarekha River at Gopiballabpur in West Bengal.

5.3.3 River Ecosystem

The Subarnarekha River is a rain feed & non-perennial river. The lower course of the Subarnarekha River has two kinds of ecosystem lotic & lentic due to the availability of water in the monsoon season & unavailability of water in post monsoon season respectively.

5.3.3.1 Lotic Ecosystem

The term lotic (from the Latin lotus, meaning washing), refers to running water (fluvial or fluviatile) habitats such as rivers and streams. Every year the lower course of the Subarnarekha River contains a huge amount of water flow in the monsoon season (June- September) due to heavy rainfall & floods. The Subarnarekha River has a wide variety of freshwater fish. The river is very much rich in food fishes than ornamental fishes. About 50 types of fish species have been found in the Subarnarekha River in Paschim Medinipur (Bera 2022).

Picture 7

So, in the rainy season, the lower course of the Subarnarekha River (Pic-7) becomes a highly diversified lotic ecosystem with the presence of aquatic plants & animals.

5.3.3.2 Lentic Ecosystem

The term lentic (from the Latin lentus, meaning slow or motionless), refers to standing waters such as lakes and ponds (lacustrine), or swamps and marshes (paludal). Every year the lower course of the Subarnarekha River remains dry or contains very less amount of water flow in the post-monsoon period (October- May) due to scarcity of rainfall & construction of Dams, Reservoirs in the upper catchment area of the mainstream & its tributaries.

Picture 8

Picture 9

So, in the post-monsoon period, the lower course of the Subarnarekha River turns into a stagnant water body (Pic-8 &Pic-9) due to shortage & discontinuous flow of water.

6. Conclusion

The Subarnarekha is an important inter-state river. The dwelling peoples on both sides of the river bank in the lower course in West Bengal & Orissa are surviving depending on this river. This river water is used for agricultural purposes. This is a cheap source of freshwater fish for fishermen.

But, day by day the environmental condition of this river is deteriorating due to un-control mining and industrial activities in the upper catchment. The water quality of the river is reducing due to garbage dumping & releasing pollutant materials. Due to regular deforestation river bank erosion is a common problem in the lower course and also stimulates the flood impact in the LCA.

So, an integrated plan is required to mitigate all the problems in the lower course of the Subarnarekha River Basin for the reduction of the ecological imbalance & to promote ecological development.

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List of Abbreviations

LCA	Lower Catchment Area
LC	Lower Course
CDB	Community Development Block
MSL	Mean Sea Level
CBPCWP	Central Board for the Prevention and Control of Water Pollution
CWC	Central Water Commission

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