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# Impact of Sand Mining on Geo-Environmental Milieu: A Case Study of Subarnarekha River Basin of Jharkhand

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**Abstract:**

The rivers are natural streams of flowing waters with a significant volume of freshwater. Subarnarekha river is primarily a plateau river and a lifeline of the southeastern part of Jharkhand which extends over the state of Jharkhand, Odisha, and a comparatively smaller part in West Bengal. Has a total area of 29196 sq. km with a maximum length and width of about 297 km and 119 km. It lies between 21º58´ N to 25º18´ N latitude and 83º´19´ E to 87º57´ E longitude.

**Salient features of Subarnarekha River**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| Basin extent | Length of the river (km) | Catchment area | Av. Water resource potential (MCM) | Utilizable surface water resource (MCM) | Live storage capacity of completed projects (MCM) | Total live storage capacity of projects (MCM) | No. of hydrological observation station (CWC) | No of flood forecasting stations (CWC) |
| 85º8´ to 87º 32´E 21º15´ to 23º34´N | 395 | 29196 | 12370 | 6800 | 3288 | 3152 | 12 | 02 |

Table 1: salient features of Subarnarekha basin

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Excessive anthropogenic interference as sand mining from the river bed has created several direct and inadvertent modifications. Excess sand mining has changed and disrupted the geomorphic scenario of the river. It has changed the erosional and depositional features producing a variety of geomorphic and ecological impacts. It may be observed as lengthening of channels, shortening of channels, the intersection of meandering rocks, drainage integration, changes in courses, changes in channel geometry, and channel dynamics, and increased rate of erosion. The regularization of the river to halt riparian erosion decreases the supply of sediment downstream which results in downstream scouring. Excess sand mining had adversely affected the accelerated rate of erosion, increased rate of channel water flow, suspended load of the channel, and aquatic life.

The present investigation is an attempt to analyze the extent of changes produced by excess sand mining endangering the geomorphic and ecological conditions in the Subarnarekha River basin.

**Keywords**: Mining, Riparian, Plateau River, Geomorphic, Ecology.

## INTRODUCTION:

The river is a most significant and morphological agent. It has tremendous creativity for natural and also human society. Most of the ancient civilizations constructed a river bank side. From ancient times to the present-day scenario rivers had been played a major role socially, economically, and also economically. Of the diverse potentiality and tremendous source of resources river are great. India is a motherland of river. All of Indian territories lots of river have fed and contributing our generation to generation by their activities. But present-day time, our modern society, our creativity, technical advancement, our need dependent on the river, that's for most of the river are extracted from different aspects.

Subarnarekha river is flowing west Bengal, Orissa and Jharkhand. We are study only Jharkhand part of the Subarnarekha River.

## OBJECTIVES:

The present paper aims to examine the change of Subarnarekha River basin for sand mining. The three-fold objectives of the present study are as follows:

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i. To analyze the impact of mining on the morphology of the streams and river.
ii. To find out the main problem for mining in the river bed.
iii. To analyze the anthropogenic impact on the river mechanism and natural flow of the river.

**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. The catchment area of the Subarnarekha River basin extends over 19,296 km2 and accounts for 0.6% of the geographical area of India (Roy et al. 2013). The total annual yield of water flowing within the basins is in the order of 7940 million m3. The Subarnarekha River basin is bounded by north latitudes of 21° 33′ to 23°32′ and east longitudes of 85° 09′ to 87° 27′ and flows in the north-east corner of the Peninsular India (Fig. 1). Chhota

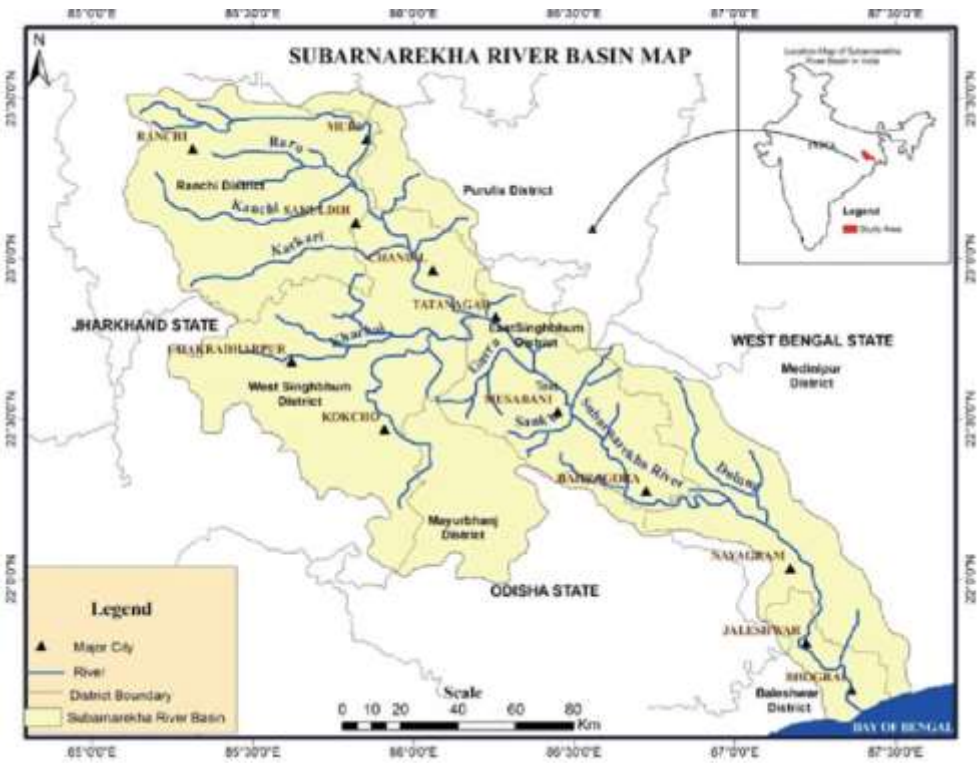


Figure 1: location map of the study area

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Nagpur plateau bounded the Subarnarekha River basin from the north-west side, while it is restricted by the Brahmani River basin in the south-west, Burhabalang River basin in the south, and by the Bay of Bengal in the south-east side. The Subarnarekha flows through the Ranchi, Saraikela, and east Singhbhum districts of Jharkhand, the west Mednipur district of West Bengal, and the Balasore district of Orissa. It 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 2014a). Subarnarekha is a very important river to satisfy the irrigation, industrial and municipal water pg. 24 demands of these three states. The state-wise distribution of the catchment area and its percentage with respect to the total river basin drainage area are given in Table 1.

**State Wise Distribution of Catchment Area**

| Sl. No. | Name of the State | Catchment Area (sq km) | Percentage |
|---|---|---|---|
| 1 | Jharkhand | 13193 | 68.4 |
| 2 | Orissa | 3114 | 16.1 |
| 3 | West Bengal | 2989 | 15.5 |
| | Total | 19296 | 100 |

Table 2: state wise distribution of catchment area

**DATABASEBASE / METHODOLOGY:**

After an in-depth review of the existing literature related to the study, necessary information and data have been collected from various sources like India census data, many journal paper, NGT report, district gazetteers, gram panchayat etc. to fulfill the objectives of the study. The primary data have been generated by using selective questionnaire schedules by local villages and track drivers on the mining field. The data have been analyzed using suitable/ quantitative method.

**ANALYSIS & DISCUSSION:**

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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 Subarnarekha. It has been known that gold particles were found in the Subarnarekha River bed sediments in ancient times. In some places, even today people are searching for the gold particles in the sandy beds of the river. As the tributaries of Subarnarekha flow over gold-bearing rocks of the Panch Pargana plain, they pick up particles of gold from the auriferous rocks for deposition in the bed of Subarnarekha. Still, it carries grains of glittering metal which are often panned from its sandy bed by the local residents along the middle reaches of the river. The Subarnarekha is a rain-fed river and is ranked as the smallest river basin among the fourteen major river basins of India.

**River Course and Major Tributaries**

The river Subarnarekha originated near the Nagri village, at a distance of about 15 km south-west of Ranchi, the capital of Jharkhand (Fig. 2a). On the Ranchi plateau, the river lazily winds its way for 60 km till its water plunge down a 74-m-high cliff, creating a scenic waterfall known as Hundru Fall (Fig. 2b). The river thereafter flows through a 25-km-long deep gorge till it emerges out of the Ranchi plateau and debouches on the flatter piedmont pg. 26 plain of Panch Pargana. By now, the river swells fairly big, some 500 m wide. After having traveled through a course of 145 km over the Panch Pargana plain, the river cuts through a narrow defile across the volcanic lavas of the Dalma range. After emerging from the range, the river sweeps through a fairly wide floor of the Dhalbhum valley for another 150 km till it finally leaves the rocky granitic terrain of Jharkhand and takes to a more meandering course on the unconsolidated alluvial material in the Medinipur district of West Bengal and Balasore district of Orissa (CBPCWP 1986; Jain et al. 2007). After several turns, the river eventually empties its enormous volume of water along with its rather heavy silt load into the shallow shelf of the Bay of Bengal at Kirtania near Talsari (Fig. 2). Fig. (2) a- The origin place of the Subarnarekha River at Nagri village, b- Subarnarekha plunge down a 74 m high cliff at Hundru (Hundru Fall), c- the river near the mouth at Kirtania, d- the confluence of Subarnarekha and Kharkai rivers at Sonari near Jamshedpur pg. 27 Table V: - Major Tributaries

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of Subarnrekha River The Subarnarekha has an asymmetrical catchment basin; the right-bank tributaries draining more than three-fourths of the total basin area, whereas the left-bank tributaries drain hardly one-fourth of the basin. On the right bank, there are four major tributaries, the Raru, the Kanchi, the Karkari, and the Kharkai, draining between them nearly half of the Subarnarekha basin, covering around 9050 km2 area, while on the left side there is only one sizable stream, namely the Dulung, which drains an area of some 1173 km2 (Table 2). The Kharkai is the largest tributary of the Subarnarekha originated on the slopes of the Simlipal massif in the Mayurbhanj district and contributes nearly 45% of the total annual flow of the Subarnarekha River. It drains a catchment area of 5825 km2 and flows through a course of 145 km before joining Subarnarekha at Sonari near Jamshedpur town (Fig. 2d). The Kharkai is also a gold-bearing river, and some of its tributaries like the Sanjai, Sona Sanhua, and the Bonai are known to have placer gold in their beds.

**Major tributaries of Subarnarekha River**

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**Table 3: Geographical features of major tributaries in the Subarnarekha River basin**

*Source: Survey of India (1923-1979). Rao (1975)*

| Sl. No. | Name of the tributary | Bank | Length(km) | Catchment Area ($Km^2$) | % Of total basin area | Annual yield (MCM) |
|---|---|---|---|---|---|---|
| 1 | Raru | Right | 50 | 622 | 3.22 | 250 |
| 2 | Kanchi | Right | 80 | 1036 | 5.37 | 750 |
| 3 | Karkhari | Right | 120 | 1575 | 8.17 | 950 |
| 4 | Kharkai | Right | 145 | 5825 | 30.19 | 3300 |
| 5 | Garra | Right | 55 | 483 | 2.50 | 200 |
| 6 | Sankh | Right | 30 | 196 | 1.02 | 80 |
| 7 | Other streams of the right bank | Right | - | 4812 | 24.94 | 970 |
| 8 | jumar | Left | 35 | 182 | 0.94 | 70 |
| 9 | Dulung | Left | 75 | 1173 | 6.08 | 500 |
| 10 | Other streams of the left bank | left | | 4760 | 17.64 | 870 |
| | total | | | 19296 | 100 | 7940 |

**Effect of sand mining in Subarnarekha River Basin:**

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Sand mining particularly from 15th October to 15th June as per NGT regulation has led to lakhs of matric tones sand of different categories lifted up from the beds of tributaries streams of Subarnarekha River, particularly tajna, karkhari, poto, jumar, Sanjay and kharkai etc.

Sand mining has disturbed the bed morphology, rate of stream flow, sand drift, erodibility of a stream, bank erosion, natural laby formation, and rejuvenation of erosional landforms. It is observable that excavation by sand mining from the river bed has accelerated the headward stream erosion.

Severe stream bank erosion is seen in the upper catchment area of poto, jumar, doranda nala, harmu Nala, and the upper catchment area of Subarnarekha River.

Access sand mining from the bed has worn on the bedrock. This has led to reverse bed erosion. Rapids and holes formed on the beds of the stream on the granitic rocks have been accelerated. Almost all the stream on the upper catchment area of Swarna Rekha river has been observed to access headward erosion that's why the interfluvial track is also shrinking. The rate of deepening of the river bed and transverse cutting has been accelerated in the streams. The Shape form of the stream has disturbed it is due to a natural increase in erosional activity and due to anthropogenic effect. Thousands of tractors, small track and JCB are involved in mining process and accelerating the rate of bank erosion and also loosening the bed rock. Access erosion from the catchment area wearing the upper soil layer from the agricultural field has increased alkalinity in the soil, which has decreased agricultural productivity. Wearing of the access upper soil layer has exposed the hard bedrock on the surface.

**Figure 2: Sand lifting in the Subarnarekha River basin**

It is observable that access sand mining has led to shifting of the course in most cases sand mining is done from one part of the river another side remains comparatively un-disturbed this is the reason

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the side of the access mining is the done undergoes quick shifting of the course. in total the natural morphology and gradient of the river bed have been disturbed, which has led to changes in micromorphological shape of the stream.

The sand mining from different tributaries of Subarnarekha River has been shown in following table.

**Sand mining different streams of Subarnarekha River**

| Sl. no. | Name of the stream | Sand mining in different financial year<br>Sand mining in thousand metric tones | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 |
| 1 | Raru | 200 | 230 | 250 | 310 | 400 | 450 |
| 2 | Kanchi | 555 | 623 | 700 | 800 | 850 | 1000 |
| 3 | Karkhari | 150 | 170 | 200 | 230 | 280 | 300 |
| 4 | Kharkai | 120 | 153 | 178 | 190 | 201 | 230 |
| 5 | Garra | 140 | 180 | 200 | 260 | 302 | 324 |
| 6 | Sankh | 250 | 324 | 361 | 389 | 398 | 520 |
| 7 | Other streams of the right bank | 758 | 825 | 932 | 963 | 1056 | 1235 |
| 8 | jumar | 361 | 384 | 397 | 425 | 498 | 568 |
| 9 | Dulung | 154 | 147 | 265 | 362 | 389 | 456 |
| 10 | Other streams of the left bank | 456 | 564 | 654 | 789 | 879 | 987 |

**Table 4: Sand extraction report**

**Sources: Govt. of Jharkhand, mines and minerals department**

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## CONCLUSION:

Excessive sand mining from the Subarnarekha River basin is one of the most vital environmental and geomorphological threats. A huge quantity of sand is from the different tributaries of the Subarnarekha River, particularly the tributaries streams flowing nearby the big cities like Ranchi and Jamshedpur. Minning is not only deteriorating the general configuration, morphology, and aqua life but also danger agriculture in general and human and animal life in particular. The impact of mining may be concluded as below

1. Sand mining is endangering bio-diversity in general.
2. There is a severe impact of mining on erosional and depositional landforms, and there are an accelerating rate of human impact on the natural process of river mechanism.
3. Agriculture and aqua-culture are catchment areas in threat.
4. In sand mining accelerating rate of bank erosion, sheet erosion, and gully erosion.
5. Excess sand mining has increased river valley deepening and different safe for the river.

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