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An Assessment of Water Quality and Physicochemical Evaluation of Chhoti Gandak River: A Case Study of Sonepur

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Abstract – Chhoti Gandak is a meandering river which originates in the terai area of the Ganga Plain and serves as a lifeline for the people of Deoria district, Uttar Pradesh. It travels a distance of about 250 km and drains into Ghaghara near Gothani, Siwan district of Bihar. It has been observed that people of this region suffer from water-borne health problems; therefore water samples were collected to analyse its quality along the entire length of Chhoti Gandak River.

The principal components of water quality are controlled by lithology, gentle slope gradient, poor drainage, long residence of water, ion exchange, weathering of minerals, heavy use of fertilizers, and domestic wastes. At some stations water is hard with an excess alkalinity and is not suitable for drinking and irrigation purposes. The variation in the local and regional hydrogeochemical processes distinguished the geogenic sources from the anthropogenic one.

Chhoti Gandak is a 250 km long ground water fed meandering river. It originates in the terai area of Maharajganj district of Uttar Pradesh and drains into Ghaghara River near Gothani in Siwan district of Bihar state. The drainage basin, water discharge, sediment load, and slope gradient determining its energy are controlled by climate and tectonics which evolve and decide the type of fluvial landforms. The role of tectonics is determined by morphometric parameters such as hypsometric integral (HI), drainage basin asymmetry factor (AF), stream length - gradient index (SL), and transverse topographic symmetry factor (T). These geomorphic indices indicate active tectonics in this basin and tilting towards west. Narrow channel confined between wide valley, nature of cliffs, and discharge of river exhibit role of climate in this region. In the present paper geomorphological and morphometric analysis have been carried out to interpret control of tectonics, and climate in the Chhoti Gandak River basin.

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INTRODUCTION

Chhoti Gandak basin is located between 24°-27° N latitude and 83°-85° E longitude and covers an area of about 3565.00 km2 between Rapti and Great Gandak River basin. It is characterized by the presence of ox-bow lakes, meander scars, palaeo-channels, natural levees, point-bar deposits and terrace surfaces. Upland terrace surface, located 10-20 m above river level is flat to gently sloping, slightly undulating surface. It is made up of older alluvium and formed by extensive deposition of alluvium. River valley terrace is extensive low lying flat area adjacent to river. It lies at an elevation of 5-10 m above the river level and consist of newer alluvium. Present day flood plains are narrow areas adjacent to the channel at an elevation of 0-5 m from the river level.

The Gandaki River, also called the Narayani in Gandak in India, originates in the Himalayas near the Nepal-Tibet border and drains the central mountains of Nepal. After crossing the Nepalese border near Tribeni Bazar, it enters India, where after running a course of about 250 km; it joins the Ganges River near Patna, in the State of Bihar (Salman and Uprety, 2002). The Gandak Treaty was signed between Government of Nepal (GON) and Government of India (GOI) on 4 December, 1959 with the purpose of using the waters of Gandak River and its tributaries, primarily for irrigation and also hydropower for India and Nepal. As per the treaty, Gandak barrage was constructed on the border at Bhaiselotan to regulate the flow of water for irrigation.

The Gandak fluvial regime is generally characterised by light to dark-grey soils in the uplands and olive-grey to olive-green soils in the low lying areas. They have medium to heavy texture, low permeability, moderate to strong alkaline reactivity (pH - 6.8-8.4, rising to > 10% in places) and low to high free CaCO3 (to 15%). Free P2O5 Content is variable (14-396 kg/ha), variable organic carbon (0.17-0.81%) and generally high free K2O (14-396 kg/ha). Potash content in the Paharpur-Harsih area of East

Champaran is as high as 1320 kg/ha. CaCO3 content in these soils is also high (10.1-58-6%). In several areas, as for example in the Barharia-Panchrukhi-Manjhi area of Siwan and Gopalganj districts, salt affected soils cover large areas.

The Gandak river project irrigates mainly the parts of Purbi and Paschim Champaran, Muzaffarpur, Gopalganj, Siwan, Saran districts. The Gandak has migrated over a distance of 105 km. from west to east. The Sone river has shifted westward since the Epic period, through Budha, Gupta and medieval time. These shifting is concomittent with flood disaster and deluge.

The role of neotectonic changes (Seismic behaviour) has been attributed as the cause for tilting of megafans towards east, leading to shifting of Gandak. The gradual shifting of Kosi towards west may be correlated with the influence of Patna – Muzaffarpur crustal fracture. Though there is no positive correlation with many severe earthquake and floods.

The shifting of Sone river is assumed to be an outcome of superimposition of Patna – Muzaffarpur fault over the pre-existent Sone-Narmada basement fracture system. The Quaternary of North Bihar Plains, between the tortuous course of Ganga and Himalayan foothills, are represented by Older Alluvium Group (OAG) (Bhangar) and

Newer Alluvium Group (NAG) (Khader). The OAG is represented by Mirganj Formation, Khajauli Formation and Madhubani Formation in Gandak basin, Gandak-

Kosi interfluve and Kosi basin, respectively. The NAG includes the Vaishali Formation, the Jainagar Formation and Purnea Formation in Gandak basin, Gandak-Kosi interfluve and Ganga-Kosi-Mahananda interfluve. In the whole region the uppermost formation is the Present Flood Plains, Diara formation, Channel Bars and Sand Dunnes.

ABOUT SONEPUR

Sonepur is a town in the Indian state of Bihar, situated on the banks of the River Gandak in Saran district in theIndian state of Bihar. It hosts one of the world's largest Animal Fair which starts on Kartik Poornima. The town is located at 25.7°N 85.1832°E at an altitude of 42 metres (137 ft).

The river Gandak must have been the route of the movement of Buddha and his followers from Nepal Tarai to Magadh that is why many of the stupas and similar structures, including Ashoka pillars, are found on the banks of the river. The location of Pathar ki Maszid just opposite the meeting point of the gandak, that is southern bank of the Ganges, shows the Muslim influence of trade and commerce in medieval times. The current township Patna is just the modern version of the makeshift headquarters of military establishments of old Patna city which in turn was later version of Patliputra, the capital of Maurya Empire.

Of the ten railway stations in the world having the longest railway platforms, Sonepur being on the 8th (and 2nd longest at the time of construction) longest platform in the world at 2,415 ft (736 m). It is connected by two rivers, the Ganges and the Gandak.

LITERATURE REVIEW

Vikram Bharadawaj, Dhruv Sen Singh and A.K Singh (2009) conducted a study for the assessment of water quality of the Chhoti Gandak River using principle components analysis, Ganga Plain, India. Water samples have been collected from a part of Chotti Gandak River along different points and analysed for various water quality parameter during dry and monsoon periods. Effects of individual waste, municipal sewage and agricultural runoff on Sunamganj portion of Chotti Gandak River, which is significant due to the presence of two major industries - a paper mill and a cement factory. The river was found to be turbid in the monsoon season.

METHODOLOGY

Water samples were collected in two sets from different stations at regular intervals along the entire length of Chhoti Gandak River during summer (June), 2006. The collected samples were stored in acid-cleaned, high-density polyethylene (HDPE) bottles (1000ml), which were carefully rinsed three times before use. The use of HDPE bottles minimizes container pollution and promotes the sample preservation (Hall 1998). Analyses of water samples were carried out immediately after collection. Samples were stored in a refrigerator at 4◦C prior to analysis. Temperature, pH, conductivity, total dissolved solids were determined in the field by Cyber Scan 510. Potassium and sodium by Systronics Flame photometer 128, nitrate by Perkin Elmer, UV/VIS spectrometer, Lambda 40.

Other parameters were measured using standard water quality procedures (American Public Health Association 1992, 1998). The reproducibility of the analytical procedures was checked by carrying out duplicate analysis. The variation in result was less than 5% of the mean. Ability to replicate samples was determined by collecting two samples at every station.

Chemical data were analyzed by the principal component analysis, which quantifies relationship between the variables by computing the matrix of correlations for the entire dataset. In the present study results of the first three principal components were selected following Kaiser (1958) to explain the hydro-geochemical processes that control the ion

concentrations of water, which account for most of the total variance in the dataset.

CONCLUSION

Water of the Chhoti Gandak River is hard at most places. The concentrations of TH, Mg2+ exceed the safety limit prescribed for drinking at some of the stations and may cause physical disorders. At most of the stations however, water is of good quality for irrigation, and can be used for agricultural production. The scatter diagrams, ionic signatures, and mechanisms controlling the water chemistry diagrams indicate that the first principal components are controlled by gentle slope gradient, poor drainage conditions, long residence of water, high rate of weathering, ion exchange, heavy use of fertilizers, and domestic wastes. Variables in groups A, B, and C have high variability in the dataset, in groups D, and E variables have the second most influential function, and in groups F, G, and H variables have some influence on the variability in the dataset. The groups broadly distinguished geogenic sources from the anthropogenic ones.

The present study suggests that the principal component analysis determines the assemblages of water quality, which are an indication of genetic processes and the origin of pollutants with respect to domestic and agricultural sectors.

REFERENCES

- Abbas, N. and subramaniyan, V., 1964, Erosion and sediment transport in the Ganga River Basin. Indian Jour. Hydrology, 69.
- Edokpayi, C.A. and J.A. Nkwoji, 2007. Annual changes in the physico-chemical and macrobenthic invertebrate characteristics of the Lagos Lagoon sewage dump site at Iddo, Southern Nigeria. Ecol. Env. Cons., 13(1): 13-18.
- H.B.Mahananda, M.R. Mahananda, and B.P. Mohanty, “Studies on the Physico-chemical and Biological Parameters of a Fresh Water Pond Ecosystem as an Indicator of Water Pollution”. Ecol. Env & Cons.11(3-4), 2005, pp 537-541.
- Mishra, V.S. and Mishra, D.N. 2008. Report on West Gandak Inundation Problem. Department of Irrigation (DOI), Government of Nepal.
- Mohindra, R., Parkash, B. 1994. Geomorphology and neotectonic activity of the Gandak Megafan and adjoining areas, middle Gangetic plains. Journal of Geological Society of India, **43,** 149-157.
- Pun, S.B. 2007. Whither Indo-Nepal Water Resources? Part III- Issues and Episodes to Reflect on Gandak River: Indo-Nepal Gandak Treaty, Amendment and Gandak Master Plan Study. Vidyut Year18, No.1: pp. 1-11.
- R.K. Trivedy, “Physico-Chemical Characteristics and Phytoplankton of the River Panchganga Near Kolhapur, Maharastra”. River Pollution in India (Ed. R.K. Trivedy) Ashish Publishing House, New Delhi, 1990,pp.159-178.
- Singh D S, Awasthi A and Bhardwaj V 2009 Control of Tectonics and Climate on Chhoti Gandak River Basin, East Ganga Plain, India; Himalyan Geology **30(2)** 147–154.
- Vikram Bhardwaj, Dhruv Sen Singh and A K Singh(2009), "assessment of water quality of the Chotti Gandak River using principal component analysis, Ganga plain, India".