Library Progress International *Print version ISSN 0970 1052*
Vol.44, No.4, Jul-Dec 2024: P. 1423-1430 *Online version ISSN 2320 317X*

Original Article *Available online at www.bpasjournals.com*

Exploring the Spatio Temporal Analysis of Channel Characteristics in the Santijan Stream, Nagaon District, Assam (India)

Arup Jyoti Bora[1*] and Ashok Kumar Bora[2]

[1]Research Scholar, Department of Geography, Gauhati University, Guwahati, 781014, Assam, India
[2]Professor, Department of Geography, Gauhati University, Guwahati, 781014, Assam, India
[*]**Corresponding author: e-mail:** arupjyotibora@gauhati.ac.in

How to Cite this Article*:* Arup Jyoti Bora1 and Ashok Kumar Bora (2024). Exploring the Spatio Temporal Analysis of Channel Characteristics in the Santijan Stream, Nagaon District, Assam (India).*Library Progress International*, 44(4), 1423-1430

Abstract

Streams are the natural sources of fresh water for living organisms over the earth surface. There are seen many aquatic floral and faunal species who develop their communities, habitation in the aquatic environment. In the early decades people are also depend on rivers and streams for their livelihood purposes. Unfortunately, the living status of these small streams may fall under the threatened condition due to the advancement in the technological development of human society. Many other anthropogenetic factors which lead to create degradation in a natural stream character. This study makes a good opportunity for environmentalists to look at a closer view to the changes occur in the Santijan stream from past to the present due to human interference. This study also enlightens the preventive measures of mitigation and conservation strategies in a proper way which are taken immediately before further degradation of the stream.

Keywords: *stream; channel changes; human intervention; degradation; Santijan*

1. Introduction

In the fluvial processes, surface runoff and stream flow both are included (Richards, 1988). The prime source of a stream water is the surface runoff (Lintern, 2018). Running water is the most powerful agent of erosion, deposition and sedimentation in a stream or a river channel (Newson, 2002). Streams are generally divided into four broad categories. These are perennial streams, seasonal streams, intermittent streams and ephemeral streams (Singh, 1998). The course of a stream or the path totally depends upon the slope of the land, geological structures like fractures, faults, joints, cracks and the rock hardness (Hack, 1973). Generally, it is seen that a stream may originate from the feederchannels, tributaries and empty into the wetlands, lakes, ponds, swamps and marshy areas (Ward, 2017).

The materials which are locally found in the bed and banks of a stream directly influence the morphology of a river or stream channel (Best, 1986). It is also said that movement of water and sediment from one place to the other are also dependent on the morphological characteristics of a river or stream (Brookes 1994). Channel morphology or river channel morphology includes i) channel geometry or channel cross-sectional characteristics e.g., channel length, channel width, channel depth, wetted perimeter, channel slope, channel bends etc., ii) channel flow dynamics (e.g., discharge, velocity), iii) hydraulic geometry, iv) channel patterns etc. (Singh,1998). On the other

way, the channel morphology is also impacted by the channel processes which develop in a river basin (Iware Matsuda, 1992). According to Iware Matsuda these channel processes are - erosion, transportation and sedimentation. According to Erskine (2011) channel morphology refers to the cross-sectional, planimetric, longitudinal and drainage network geometry of a river channel. Channel morphology is the physical and often the most significant component of aquatic habitatalso.

Assam has a unique character in geological formation and set-up (Goswami, *et al.,* 1999). The state has basically two major river basins and many tributaries and sub-tributaries as well (Bhuyan, and Deka, 2024). Due to some natural and human interference in present times some of the rivers and their tributaries, sub-tributaries, streams and other water bodies are dying in conditions dayby day (Bhuyan, 2022). Among the rivers and streams under severe human impacts, a stream in Nagaon District of Assam is a notable one, which is known as Santijan. This dying and degraded stream is a historically important stream. Santijan is a small stream. It is connected with many small and medium feeder channels, and other wetlands and waterlogged areas which are getting degraded in recent times mainly due to human impacts and interferences.

1.1 Study area

The study area falls under the Dhing Revenue Circle in the district of Nagaon, Assam at a distance of 20 km from the Nagaon main city. The study area covers an area of 81.96 sq km with latitudinal extension of 26°21'12" North to 26°28'33" North and the longitudinal extension of 92°28'59" East to 92°35'10" East. The study area surrounded by villages like Meleka Dhing, Sonaibera Gaon, Sola Pathar, Rampur Satra and Kadamani Gaon in the North, Haidubi Pathar, Keri-Meri, and Batamari village in the North-East, Bhumura Guri in the East, Dhania Bheti Pathar, Dhania Bheti Gaon and Kuji Satra in the South and Dhupa Guri Gaon and Batadraba in the West. Its location with reference to Nagaon District, Assam and India is presented in figure 1. The entire Santijan has a total length of 13.3 km.

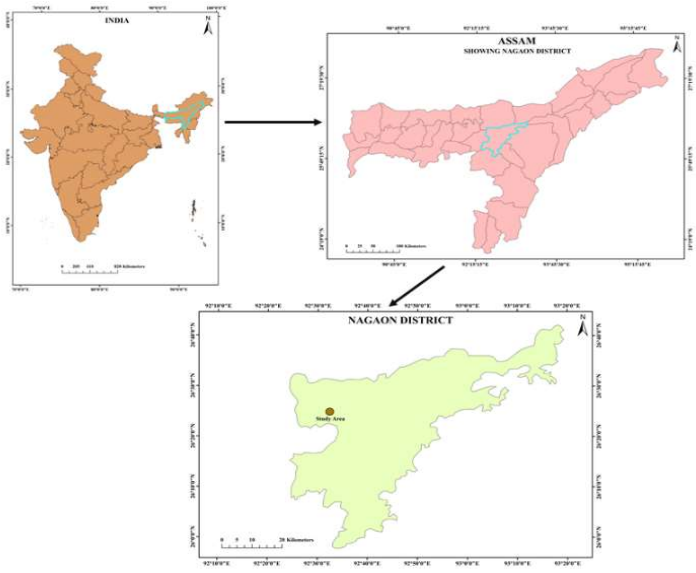


Fig. 1: Location map of the Study Area.

2. Methodology

The stream named 'Santijan stream' has been chosen for study as because it is historically known and presently the stream is getting gradually degraded due to various types of human interference. The study area is taken around one and half kms on both sides of the stream from its source to mouth for understanding its origin, shape, size, changes with time and human impacts

since 1955 to the present-day context. With the help of primary data obtained from field observations and surveys the ground reality of the stream has been examined. The relevant secondary data are also collected from various secondary sources like- cadastral maps obtained from the D.C. Office, RKG Branch of Nagaon District to find out the course of Santijan. A village dag map has been obtained which was prepared in 1925 and toposheets from the University of Texas Libraries, Series U502, U.S. Army Map Service, 1955 and Survey of India toposheet 2005. With the help of cadastral maps, toposheets and Google Earth images, the proper picture of the present and past channels and courses in terms of connectivity, inflow and outflow of Santijan. The feeder tributaries and other neighboring wetlands, swamps and marshy areas have also been noticed and known. With the help of GIS software the final output of the course maps and their changes from 1955 and 2005 have been organized.

3. Results and Discussion

3.1 Channel characteristics in 1955

The figure 2 showing the status of Santijan in 1955 indicates that there were only its channel having connectivity with other streams and rivers in the area. In that period, the human activities and interferences were very negligible. There were only 5 villages along which the stream passed through. The human settlements were sparse. In the toposheets there were no patches of built-up areas sown in that portion. There were seen the tropicalgrass lands and woods and other natural vegetation in the study area. No any human effects on the stream were found. In that period, the stream did not lose its natural identity and entity.

During 1955, Santijan received water mainly from the precipitation and surface runoff and small amount of water from the dead channel 'Rasuti Jan'. The term 'Rasuti Jan' comes from the term 'Erasuti' which means abandoned channel or the dead channel. As observed from the toposheets it is found that Rasuti Jan was formerly connected to the stream namely 'Leteri Nodi'. But due to the human interference and also natural impact Rasuti Jan has turned into a dead channel. Earlier Santijan was also connected with the Rasuti Jan. The source region of Santijan was Rasuti Jan by a small connecting channel.

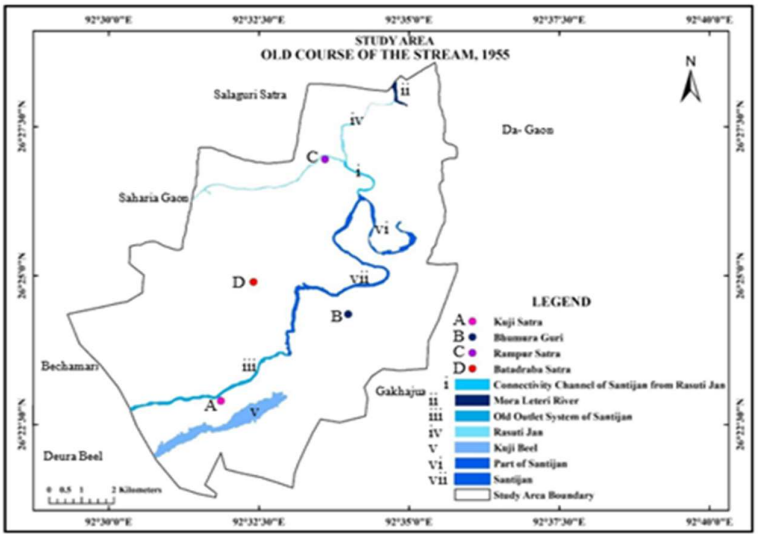


Fig. 2: Old course of Santijan during 1955.

3.2 Channel characteristics in 2005

The channel length of Santijan from its source Mora Leteri stream to the confluence point of Santijan with Mora Leteri stream is nearly 4.79 km. From this confluence point to the mouth i.e., Dhania Bheti Pathar the channel is connected with swampy and marshy lands which is about 8.51

km long. The total channel length of the stream from its source to mouth is nearly about 13.30 km. The average width of Santijan is about 67.43 m, and average depth is nearly 3.71 m. The present scenario is that Santijan connects the feeder channel of 'Mora Leteri Nodi' by a small stream which was formerly known as 'Sonai Bera river' flowing by the side of the revenue village 'Sonai Bera' under the Dhing Revenue Circle (Fig. 3). Thereafter, it enters the villages such as Haidubi Pathar, Batamari, Bhumura Guri and lastly Batadraba. The Mora Leteri river also receives water and gets joined with Brahmaputra river in the north-eastern side of the study area. After taking the name 'Santijan' the stream joins the Doloni Pothar (marshy fields), swampy areas, ponds and fallow lands.

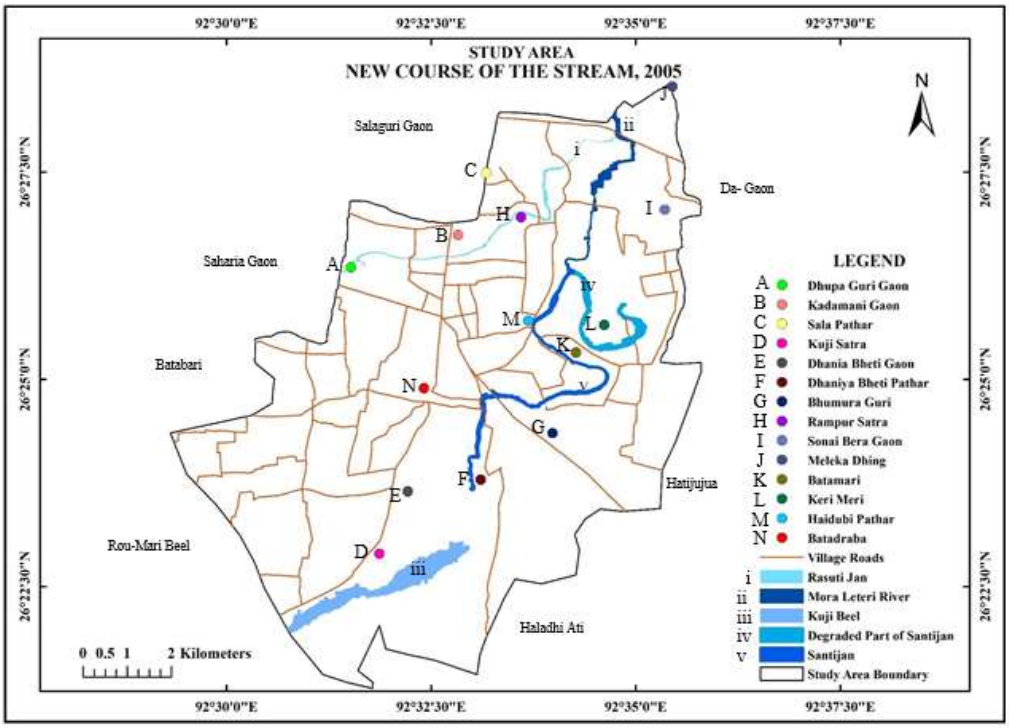


Fig. 3: New course of Santijan during 2005 to till present.

3.3 Channel changes in time and over space

The channel of a river is a dynamic entity. From a small stream to a large streamcontext channel changes play a vital role (Chakraborty and Datta, 2013). In the present-day times, the rivers have loosed their own identity and entity due to someenvironmental conditions and others by human activities and exploitations upon natural resources (Sachs, and Warner, 2001). During channel narrowing, establishment occurs on portions of the channel bed from future disturbance because of the inability of a stream to rework its entire bed (Johnson, 1994). Naturally, it is seen that channel change may take place by the processes like erosion and deposition of the river or stream (Brooks, 1994). A river or a stream may have more than one channel which are dynamic in nature under the control ofbasin variables like geology, geomorphology, physiography, vegetation cover,climate and land use.

The study area Santijan is a small stream. It has not much water velocity, water discharge, sediment discharge as well. Now, in present day situation, it is almost dying in certain areas. Here, the channel changes in time and over space are discussed.

The figures 4 and 5 indicate that the old course of Santijan in 1955 was changed to a new course in 2005. The old course which was connected with the Rasuti Jan was later on changed to the newer course linking the Mora Leteri stream.Due to human interferences and also the natural processes, channel changes in Santijan took place in due course of time.

In the old course, the Rasuti Jan had connection with Mora Leteri stream and received the water from it. Then it flowed from the northern direction to the western direction near Saharia Gaon. In 1955, Santijan was connected with the Rasuti Jan and received water from it.

But during 2005, increasing the amount of human interference and also the natural factor the channel route is changed from Rasuti Jan to Mora Leteri river. The scenario in 2005 has changed a lot when drastic changes in the study area created by the growing inhabitants have been observed. People encroached upon the stream and its bed for agricultural activities and construction of commercial and living house. As of 2005 many built-up areas, village roads, agricultural lands, ponds and fisheries all overthe study area especially on both banks of the stream have grown up. The confluence point of Santijan which was seen in 1955 on the south near Kuji Satra has also been degraded and turned into marshy and swampy areas.

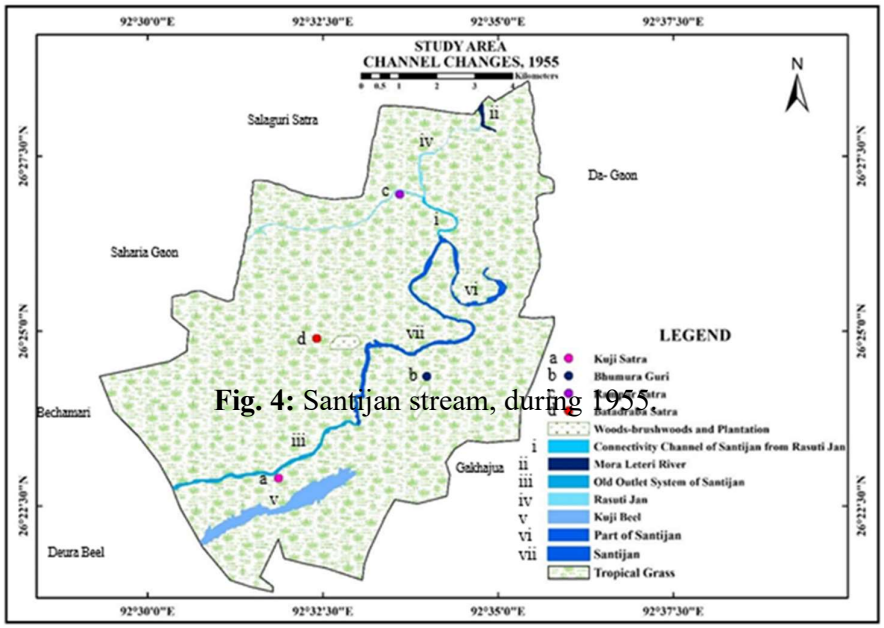


Fig. 4: Santijan stream, during 1955

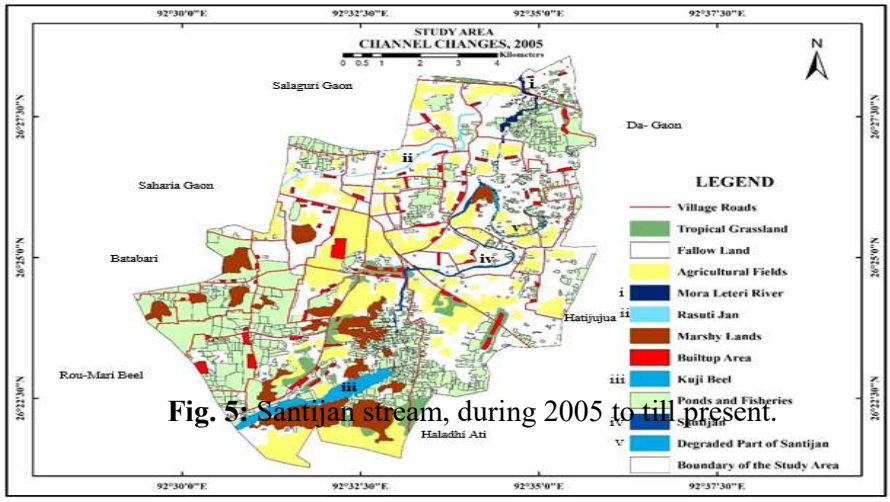


Fig. 5: Santijan stream, during 2005 to till present.

Fig. 6: Channel size and shape changes of Santijan near Keri Meri, Batamari and Haidubi Pathar.

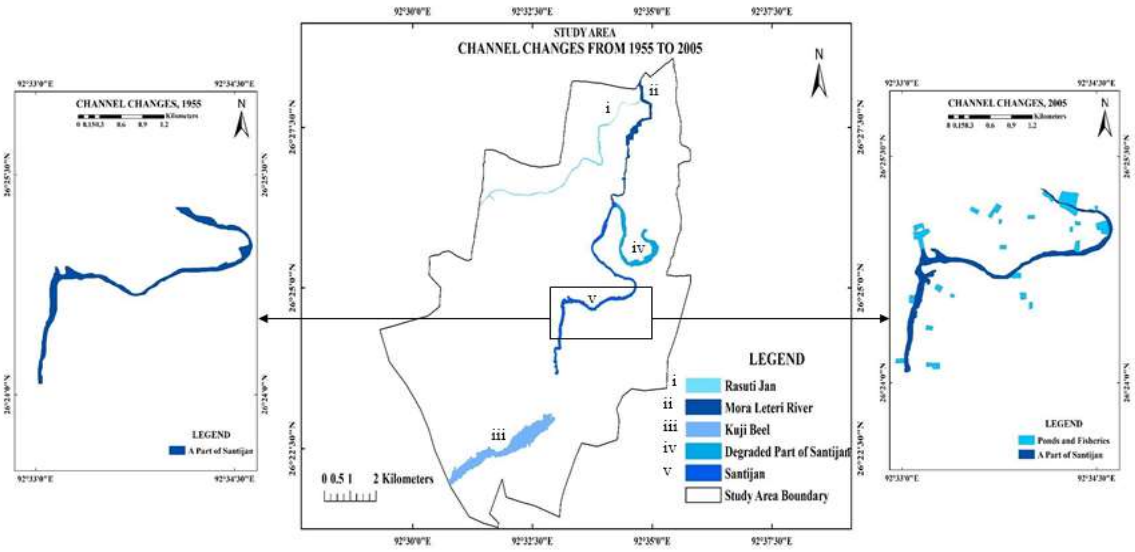
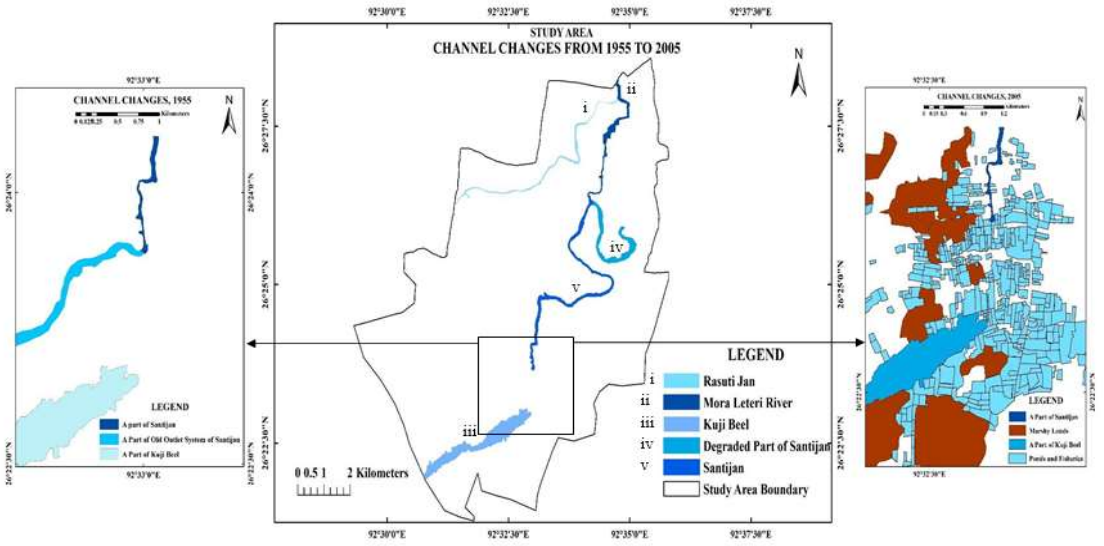


Fig. 7: Channel size and shape changes of Santijan near Batadraba village from 1955 to 2005.



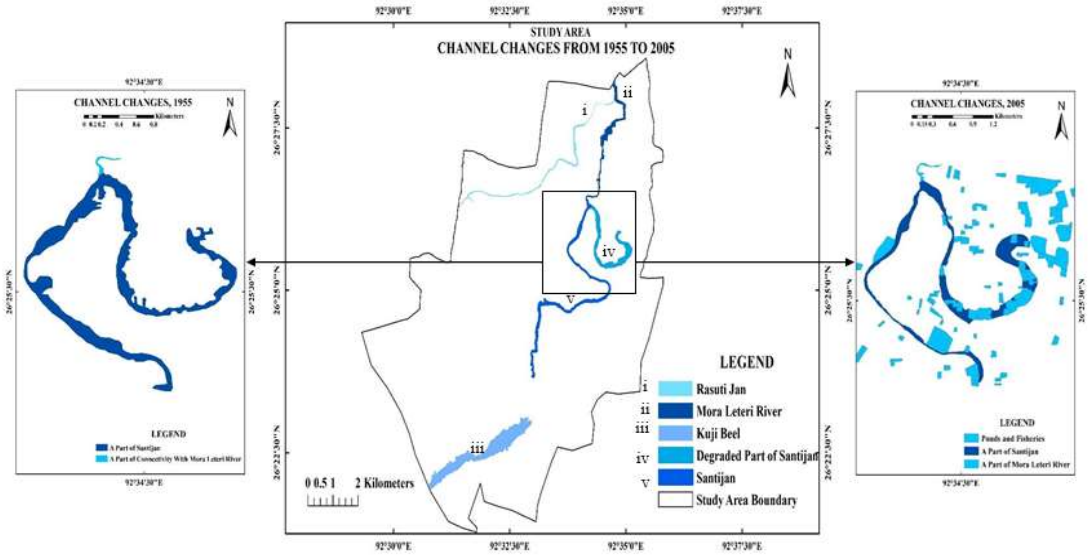


Fig. 8: Channel size and shape changes of Santijan near Dhaniya Bheti Gaon and Dhaniya Bheti Pathar from 1955 to 2005.

In the figures 6, 7 and 8 denote that the both sides of the bank are changed in size and shape due to some human activities and also natural processes. Human activities are most responsible for these changes. In the portions which are described in the map are captured by human and making ponds and fisheries for the business purposes. That is why, the bank sides are totally different from 1955 to 2005. People are creating such types of fisheries at the course of the stream and encroached the channel at a high rate. In the figure 8, it is clear that the mouth of the stream is inter-connected with the marshy and swampy areas. These swampy areasare also connected with the Kuji *Beel* in the year 2005 which is situates south side of the village Batadraba and the stream. But in 1955 Santijan had the own course and flowed to the mouth onthe other course.

4. Conclusion

The human being plays an important role to change the characteristics of river channels from more than 4000 years ago to achieve their own benefits. But from 1950s, there have been seen only a few of scientific investigations and research are done about this matter. Due to unwise human encroachment with the growth and expansion of settlements, may affect upon any natural phenomenon over the earth surface. Rives, its tributaries, streams and others related to river landscape are totally affected and loose their won characteristics and nature. The present study has also confined the story of the natural stream Santijan and try to describe the problems facing by the stream when it is flowing from its source to mouth region. The study has also enlightened us about the spatio temporal changes occur in and around the study area from 1955 to till present.

Funding: None

CONFLICT OF INTEREST: None

References

1. Best, J.L., 1986. The morphology of river channel confluences. *Progress in Physical Geography*, *10*(2), pp.157-174.
2. Bhuyan, M.J. and Deka, N., 2024. Investigating the geographies of water use and water cover in the rural areas of Nagaon District, Assam (India): Unraveling the micro-ecological implications. *Journal of Hydrology*, *637*, p.131328.
3. Bhuyan, M.J., 2022. Rural Hydrological Environment of a Floodplain Village in the Brahmaputra Valley, Assam: Status, Changes and Livelihood Issues.
4. Brookes, A., 1994. River channel change. The river handbook: hydrological and ecological principles, 2.

5. Chakraborty, S. and Datta, K., 2013. Causes and consequences of channel changes–a spatio-temporal analysis using remote sensing and GIS—Jaldhaka-Diana River System (Lower Course), Jalpaiguri (Duars), West Bengal, India. J Geogr Nat Disasters, 3(107), pp.2167-587.

6. Erskine, W.D., 2011. Geomorphic controls on historical channel planform changes on the lower Pages River, Hunter Valley, Australia. Australian Geographer, 42(3), pp.289-307.

7. Goswami, U., Sarma, J.N. and Patgiri, A.D., 1999. River channel changes of the Subansiri in Assam, India. *Geomorphology*, *30*(3), pp.227-244.

8. Gregory, K.J., 2006. The human role in changing river channels. Geomorphology, 79(3-4), pp.172-191.

9. Hack, J.T., 1973. Stream-profile analysis and stream-gradient index. Journal of Research of the us Geological Survey, 1(4), pp.421-429.

10. Kale, V.S., Baker, V.R. and Mishra, S., 1996. Multi-channel patterns of bedrock rivers: an example from the central Narmada basin, India. Catena, 26(1-2), pp.85-98

11. Lintern, A., Webb, J.A., Ryu, D., Liu, S., Bende-Michl, U., Waters, D., Leahy, P., Wilson, P. and Western, A.W., 2018. Key factors influencing differences in stream water quality across space. Wiley Interdisciplinary Reviews: Water, 5(1), p.e1260.

12. Matsuda, I., 2004. River morphology and channel processes. Fresh surface water, pp.299-309.

13. Montgomery, D.R. and Buffington, J.M., 1993. Channel classification, prediction of channel response, and assessment of channel condition (p. 84). Seattle: University of Washington.

14. Newson, M.D., Pitlick, J. and Sear, D.A., 2002. Running water: fluvial geomorphology and river restoration. Handbook of ecological restoration, 1, pp.133-152.

15. Richards, K., 1988. Fluvial geomorphology. Progress in Physical Geography, 12(3), pp.435-456.

16. Sachs, J.D. and Warner, A.M., 2001. The curse of natural resources. European economic review, 45(4-6), pp.827-838.

17. Singh, I.B., Bajpai, V.N., Kumar, A. and Singh, M., 1990. Changes in the channel characteristics of Ganga River during Late-Pleistocene-Holocene. *Geological Society of India*, *36*(1), pp.67-73.

18. Singh, S., 1998. *Geomorphology*. Prayag pustak bhawan.

19. Ward, A.S., Schmadel, N.M., Wondzell, S.M., Gooseff, M.N. and Singha, K., 2017. Dynamic hyporheic and riparian flow path geometry through base flow recession in two headwater mountain stream corridors. *Water Resources Research*, *53*(5), pp.3988-4003.