

TEMPORAL MAPPING AND MONITORING DYNAMICS OF PANDU RIVER UTTAR PRADESH USING REMOTE SENSING AND GIS TECHNIQUES

Garima Singh¹, Ram Chandra², Sudhakar Shukla³

¹M. Tech Student, Remote Sensing Applications Centre, Uttar Pradesh, India

² Scientist-SE & Head, Geospatial Data Division, Remote Sensing Applications Centre, Uttar Pradesh, India

³ Scientist-SE & Head, School of Geoinformatics, Remote Sensing Applications Centre, Uttar Pradesh, India

ABSTRACT

Dynamics of river channel are natural autogenic occurrences for fluvial system with influences from modification of some climatic and geological factors. Remote Sensing and GIS tools and techniques have been used to analyze epochal channel dynamics of river. There are six reaches with in a 242 km Pandu river stretch were studied and analyzed by comparing sequential migratory changes of the river channel during 1975-2000, 2000-2013, 2013-2015, 2015-2020 and 1975-2020 epochs. Manual and automatic digital processing procedures and Geographical Information System were implemented to visualize and quantify the reach-wise spatial and temporal morphological changes. The present study concluded that some major changes in migration in Pandu river. With the help of temporal monitoring some of the places have been identified at which were river highly migrated. There were six migratory points observed. At point C shows multi-direction migration in river channel. This point C is situated in Mavaiya village, which is affected by migration at four different channels and it is migrated in multi-direction. C1 -64.65m in SW, C2- 84 m in SE direction from 1975-2020, C3- 73.61m in upward NE direction from 1975-2013 and C4 65.47m in downward South direction from 1975 to 2020. These are drastic changes in Pandu river at Mavaiya village. The study period were observed and quantified at all reaches. Meandering and the switching off the main active channel were also illustrated. The information is important and necessary for understanding river modification characteristics and aid in planning and management at the lower reaches which has remained poorly understood. Use of remote sensing data in conjunction with GIS provides efficient and economical quantitative spatial and temporal analysis of river channel behavior in Pandu river.

Key words- Remote Sensing and Geographical information System, epochal changes, Morphological changes, Switching off, Meandering.

1. INTRODUCTION

The Pandu river also known as tributary of Ganga river. This tributary of Ganga river flows through five districts of Uttar Pradesh before its confluence with Ganga river. Approx. 2000 villages are situated on its bank. Villages are so populated and all villagers are dependent on the Pandu river for irrigation and drinking purposes. The Pandu river is very helpful in providing irrigation facilities to thousand acres of land villages. These villagers of the Auraiya, Kannauj, Kanpur Dehat, Kanpur Nagar and Fatehpur five districts of Uttar Pradesh.

1.1. OBJECTIVES

The main and broad objectives of the present investigation are as follows:

- Mapping and Monitoring of Pandu river migratory trend using of multi-date satellite data.
- Specio-temporal assessment of migration of Pandu river.

2. STUDY AREA

During the monsoon season, the water level of the Pandu River rises. The Pandu River originates 120 kilometers from a lake in Purwa Umed Village and flows through five districts. The Pandu river flows over 242 kilometers. The Pandu river watershed

has a total area of 1721.3 hectares. At Gunir village in Fatehpur district, the Pandu river merges with the Ganga to form the Ganga. In the Uttar Pradesh district of Fatehpur, the Kanauj, Auraiya, Kanpur dehat, Kanpur Nagar, and eventually the Ganga merge. The Pandu river stretch, which runs between latitudes $26^{\circ}52'38.77''\text{N}$ and $26^{\circ}9'50.08''\text{N}$ and longitudes $79^{\circ}32'31.68''\text{E}$ to $80^{\circ}35'49.03''\text{E}$ and covers five districts in the research, is the interest of the area (IOA) under investigation.

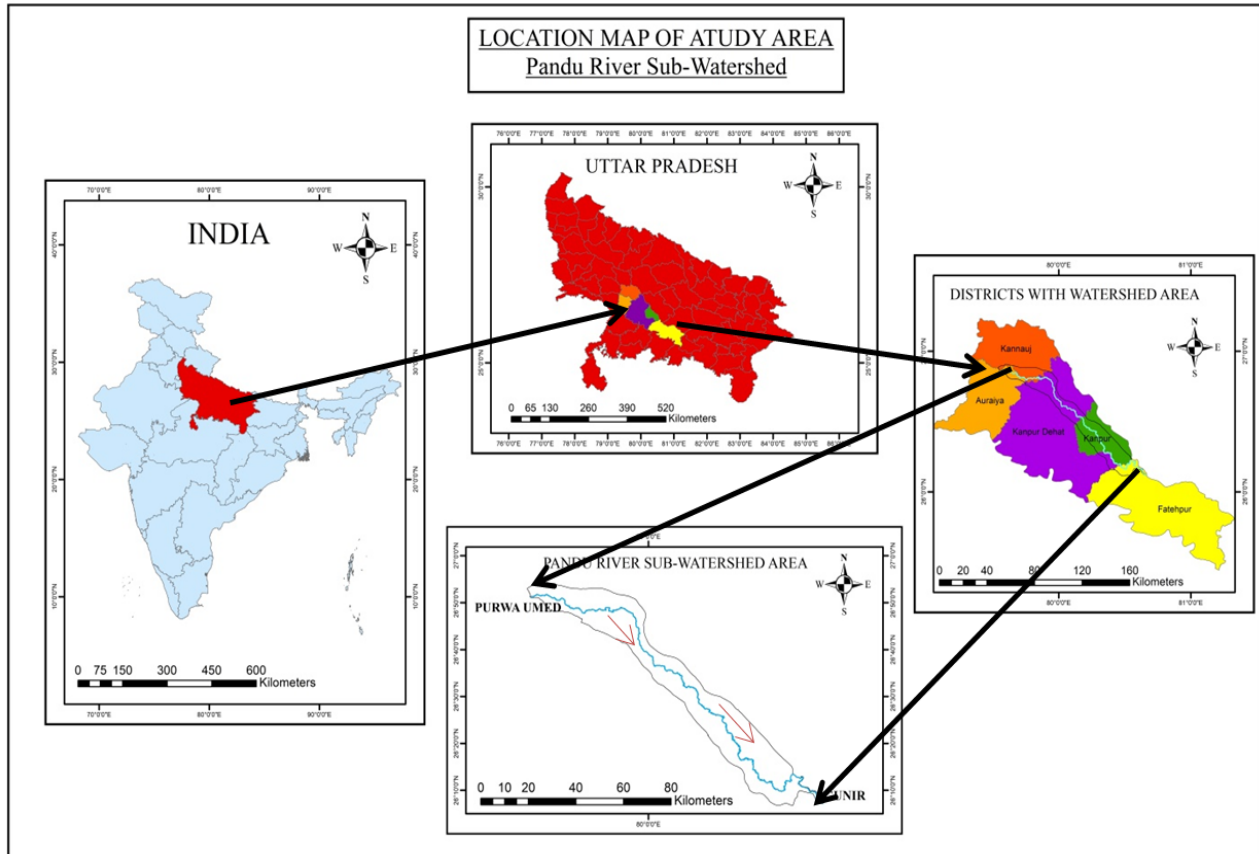


Fig -1: Location Map

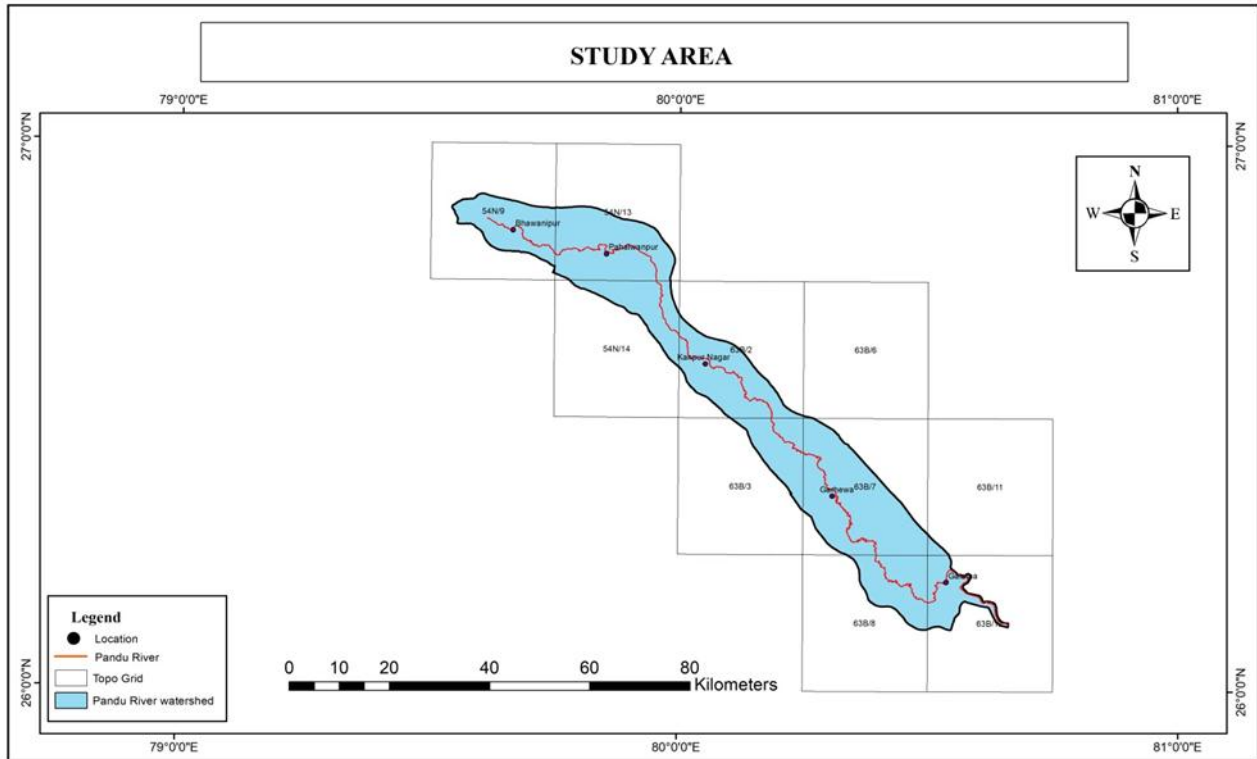


Fig -2: Study Area

3. MATERIAL AND DATA USED

3.1. DATA USED

The following data and materials were used for achieving the objectives of the study:-

- SURVEY OF INDIA – TOPOGRAPHICAL SHEETS
SOI Topographical sheets corresponding to - 54N/9, 54N/13, 54N/14, 63B/2, 63B/3, 63B/6, 63B/7, 63B/8, 63B/11, and 63B/12 for the year 1975.

SATELLITE DATA-

Table-1. Image acquisition details

S.No.	LANDSAT Mission	Sensor Type	Acquisition
1	5	TM	30,Oct 2010
2	8	OLI	22,Oct 2013
3	8	OLI	12,Oct 2015
4	8	OLI	09,Oct 2020

3.2. SOFTWARE USED

- Arc GIS
- Google earth pro

4. METHODOLOGY

The information regarding the study area for the year 1975 was extracted by using SOI-toposheets acquired from the Nakshe portal, which are published by the Survey of India at a scale of 1:50,000. The Universal Transverse Mercator projection system in the world Georeference System (WGS84) data was used to georeference the toposheets. The Earth Explorer (<https://earthexplorer.usgs.gov/>) was used to download Landsat-8 (TM/OLI) satellite data for 2010, 2013, 2015, and 2020. We were able to identify the changes in the course of the river channel from 1975 to 2020 by overlaying different layers of river channel from various years, and we were able to pinpoint the locations where the river channel migrated drastically. In this river channel search, a total of 6 locations demonstrate significant migration in the study area.

Different ways for mapping and monitoring of river migrations have been included in the present study. Figure 3 depicts the methodology-workflow used in this research.

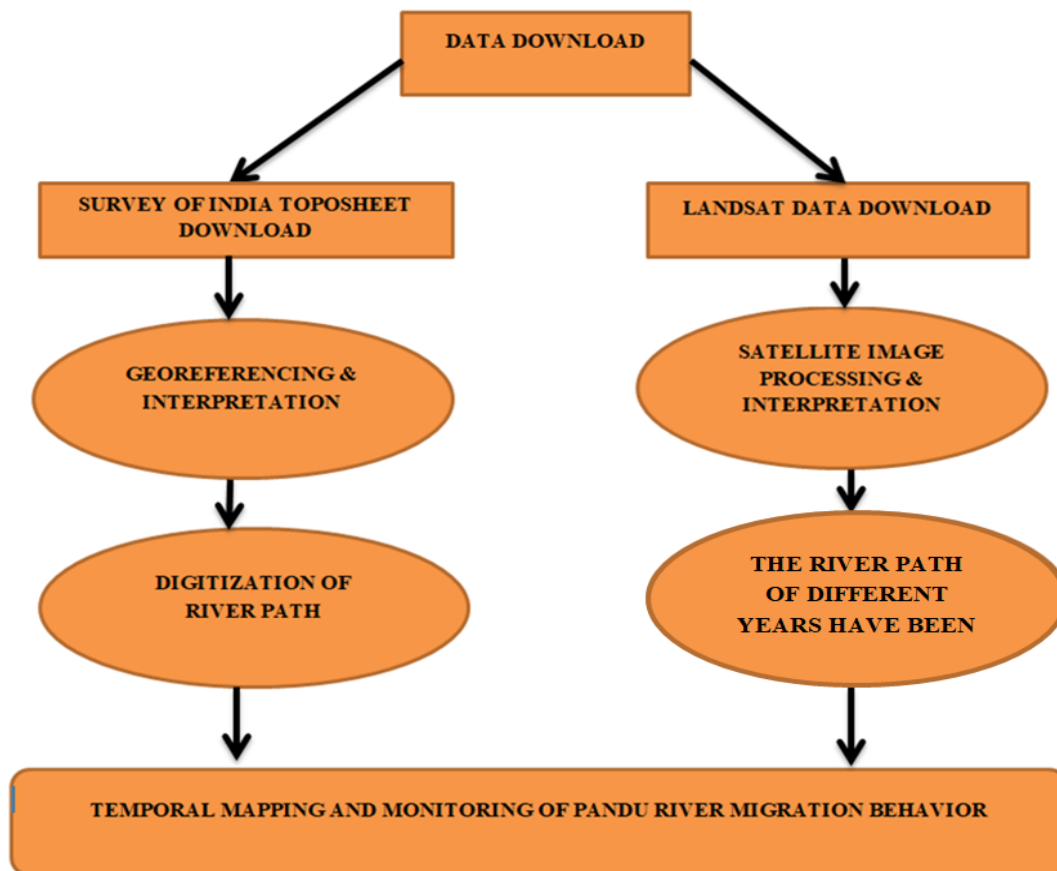


Fig -3: Flow diagram of methodology

4. RESULT AND DISSCUSSION

The map depicts the evolution of river configuration from 1975 to 2020. Several times during these years, the river channel has changed. According to the findings of this study, there have been significant changes in migration patterns in the Pandu River. Some of the sites where river migration was extremely migratory were found using temporal monitoring. Six migratory points were identified – A, B, C, D, E and F. River migration can wreak havoc on livelihoods along its path.

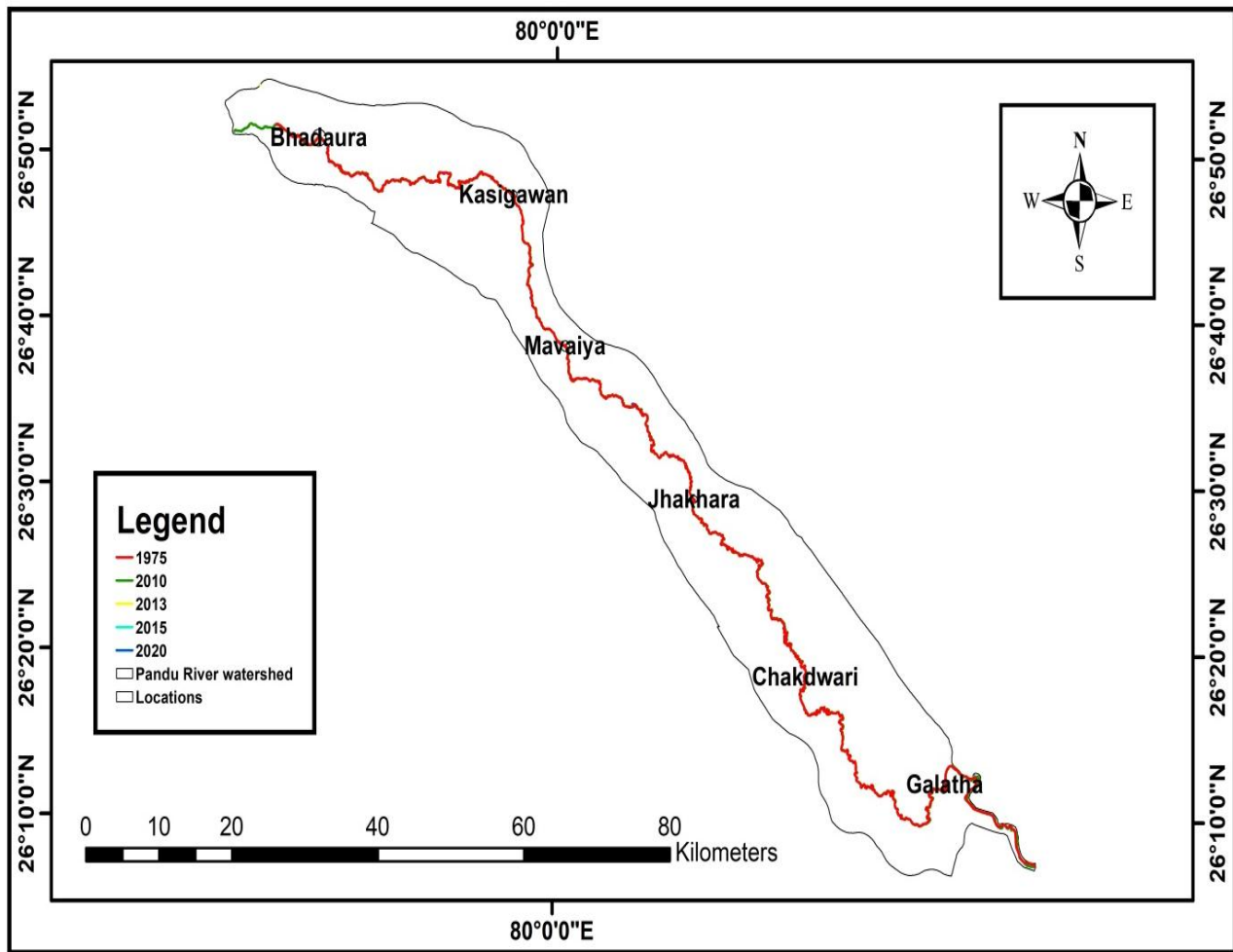


Fig -4: Pandu River configuration in different years

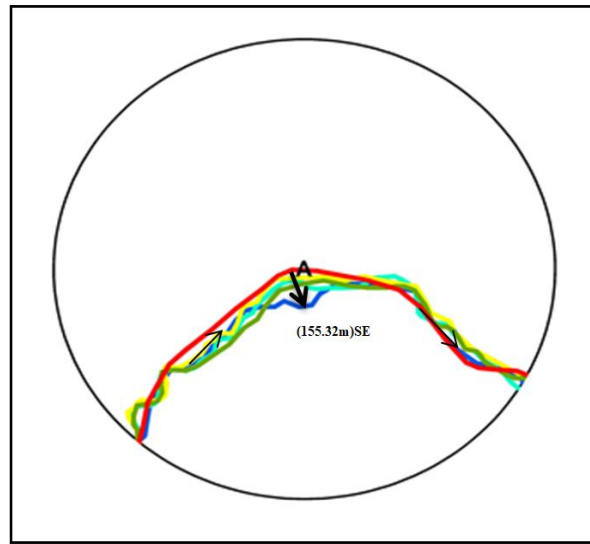


Fig -5: Pandu river channel at Point A

At point-A, the river path shifted around 155.38 meters in a south-east direction from 1975 to 2020. Point A is located near Bhadaura village in Auraiya district. There are many agricultural fields present at A-point and these agriculture fields will be affected in the near future if the migratory trend continues.

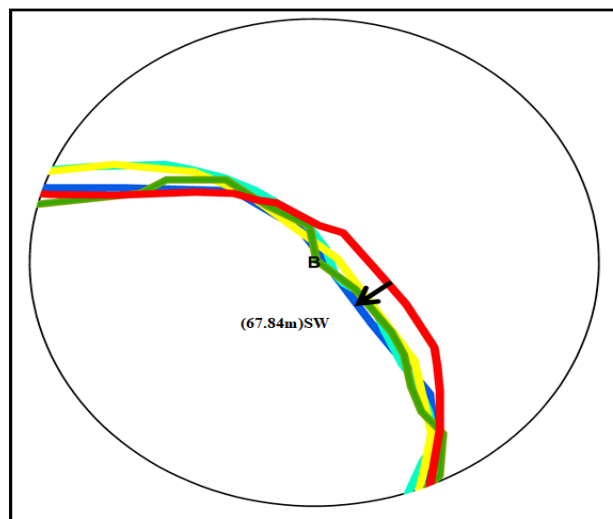


Fig -6: Pandu river channel at Point B

At Point-B, the river path shifted around 67.84 meters. From 1975 to 2020, the migratory trend at point-B was toward the Southeast. Point-B is located between Kherwa and Kasigawan villages near the boarder of Kanpur dehat and Kanpur Nagar districts. At this point of the Pandu river, there is a lot of agriculture fertile land present. If the Pandu river channel migrates in the future, there will be chances of soil erosion and damage of agriculture land.

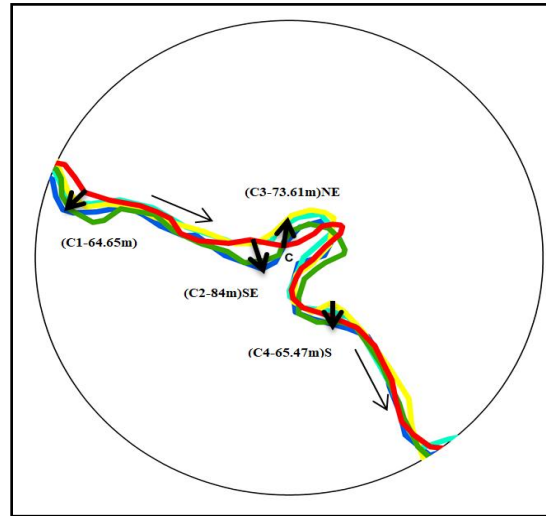


Fig -7: Pandu river channel at Point C

At point-C, the river channel shows migration in multi-direction. This point C is located in Mavaiya village near the boarder of Kanpur nagar, which is impacted by four separate migration pathways and is migrated in many directions. From 1975 to 2020, C1 was 64.65m in the Southwest, C2 was 84 m in the Southeast, C3 was 73.6m in the upward Northeast direction from 1975 to 2013, and C4 was 65.47m in the downward South direction from 1975 to 2020. At Mavaiya village, the Pandu River has undergone significant alterations. If the channel continues to migrate in the same direction, it will have an impact on agricultural areas.

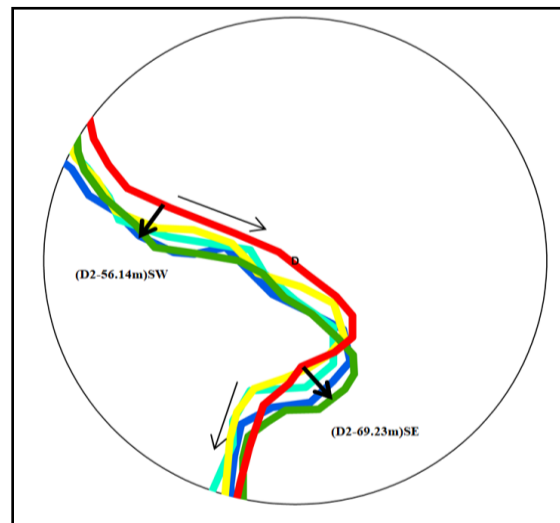


Fig -8: Pandu river channel at Point D

At point D, D1 and D2, the river channel moved in two sub-points. river channel altered around 69.23 meters to the southwest at sub-point-D1 during 1975 to 2010, then migrated back to the southeast at sub-point-D2. The river channel shifted 56.14 meters to the southeast at sub-point-D2 from 1975 to 2020. This point is adjacent to the settlement of Jhakhara in Kanpur nagar district. If the river channel continues to migrate in a southeasterly direction at sub-point-D2, it will have an impact on the settlements and certain agricultural areas on either side of the Pandu River's channel.

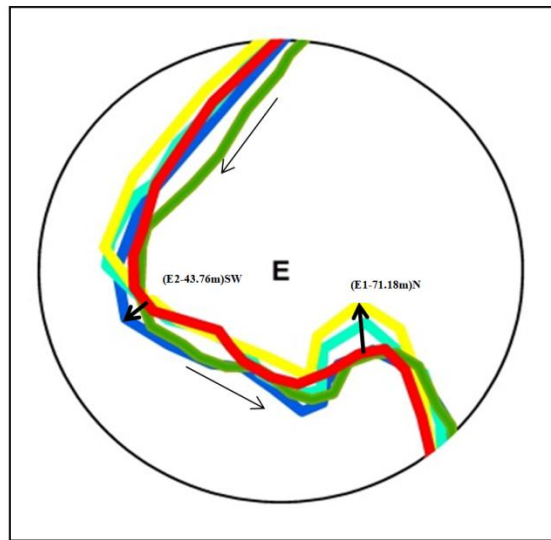


Fig -9: Pandu river channel at Point E

At point E, the Pandu river channel has migrated into two sub-points, E1 and E2. From 1975 to 2013, the river channel migrated at Sub-point-E1 71.18 meters towards the north direction, and afterward, it migrated at Sub-point-E2 about 43.76 meters towards the south-west direction from 1975 to 2020. Point E is situated near Chakdwari village in Kanpur district. There is an agricultural area present on both sides of the river bank. If migration is not under control, then there will be more chances of soil erosion. And soil erosion will affect all agricultural land that is situated on the river bank

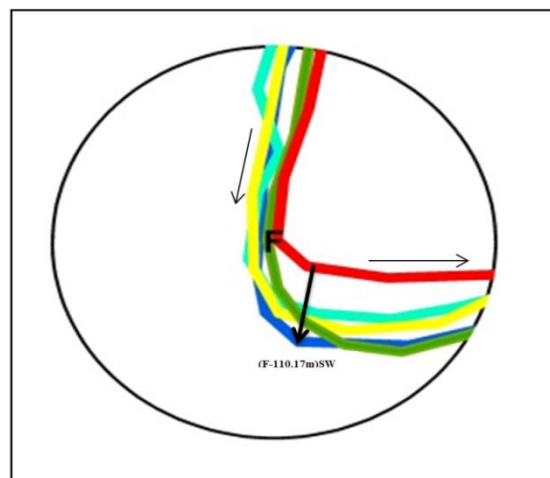


Fig -10: Pandu river channel at Point F

At point-F, the river path shifted around 110.17 meters in a south-west direction from 1975 to 2020. Poin-F is located near Galatha village in Fatehpur district. There are some agricultural fields present at F-point and these agricultural fields will be affected in the near future if the migratory trend continues.

5. CONCLUSION

The present investigation concluded that if the river channel migrates drastically, bank erosion will increase which affecting settlements and fertile agricultural land. Between 1975 and 2020, it was effectively observed as a meandering shape near Mavaiya, Jhakhara, Chakdwari, and Galatha villages, resulting in the loss of agricultural land and habitation life and property space.

Furthermore, geomorphic features such as ox-bow lakes, cutoff meanders, paleochannels, and abandoned river channels might alter the landscape in the future.

Most of the migration of the river channels has been observed near Mavaiya about at C2-84 meters towards the south-west direction, Chakdwari at E1-71.18 meters in the north direction, and Galatha at point-F 110.17 meters in the south-east direction in respectively villages, and during the last 38 to 45 years, according to this study based on river channel migration.

6. REFERENCES

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