MONITORING OF WETLANDS IN PANDU RIVER SUBWATERSHED UTTAR PRADESH USING REMOTE SENSING AND GIS TECHNIQUES

Garima Singh[1], Ram Chandra[2], Sudhakar Shukla[3]

[1]M.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: *Wetland is one of the most important ecosystems in the world. A healthy wetland ecosystem is important for development of a regional and even global economy, which is also beneficial to the human being of country. In the present investigation, remote sensing and Geographical Information System technology have been used for monitoring and assessment of temporal changes in wetland conditions. Survey of India Topographical maps have been used for the year 1975 and Landsat-8 satellite data has been used for the year 2020 in order to analyse the temporal variations in the study area. The Study demonstrate that 1258 wetlands have been mapped covering the area of 1345.72 ha in 1975. Whereas 589 wetlands have been mapped covering the area of 1127.83 ha in the year 2020. Thus decreases in the areal extent of wetlands have been observed with a time span of 45 years. The created data base will helpful to decision maker for various purposes like water conservation, land development etc.*

Key words-Monitoring, Temporal changes, Remote Sensing and Geographical information System, Topographical maps.

1. INTRODUCTION

The Pandu river is a tributary of the Ganga flows through five districts of Uttar Pradesh before its confluence with Ganga river near Gunir village in Fatehpur district. The river has more than 1,990 villages situated on its bank, which is populated and dependent on the Pandu river as a water resource for domestic, agricultural purpose. The Pandu river has proved to be helpful in providing irrigation facilities to thousand acres of land villages of Auraiya, Kannauj, Kanpur Dehat, Kanpur Nagar and Fatehpur districts of Uttar Pradesh.

1.1. OBJECTIVES

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

- Monitoring the changes of wetlands using of multidate satellite data.
- Analyzing the causative factors of changes in wetlands.

2. STUDY AREA

The velocity of Pandu river is increasing during the monsoon season .The pandu river starts its journey 120 km from a lake in Purwa Umed Village and passes through the five districts. The length of Pandu river is 242 km. The Total area of Pandu river watershed covers 1721.3 ha. Pandu river end its existence by merging with the Ganga at Gunir village in Fatehpur district. River flows through the Kannauj, Auraiya, Kanpur dehat, Kanpur Nagar and finally merging with river Ganga in district fatehpur, Uttar Pradesh. The area under the study is Pandu river stretch lies between the latitude 26°52'38.77"N to 26°9'50.08"N and Longitude 79°32'31.68"E to 80°35'49.03"E in covering five districts of Uttar Pradesh.

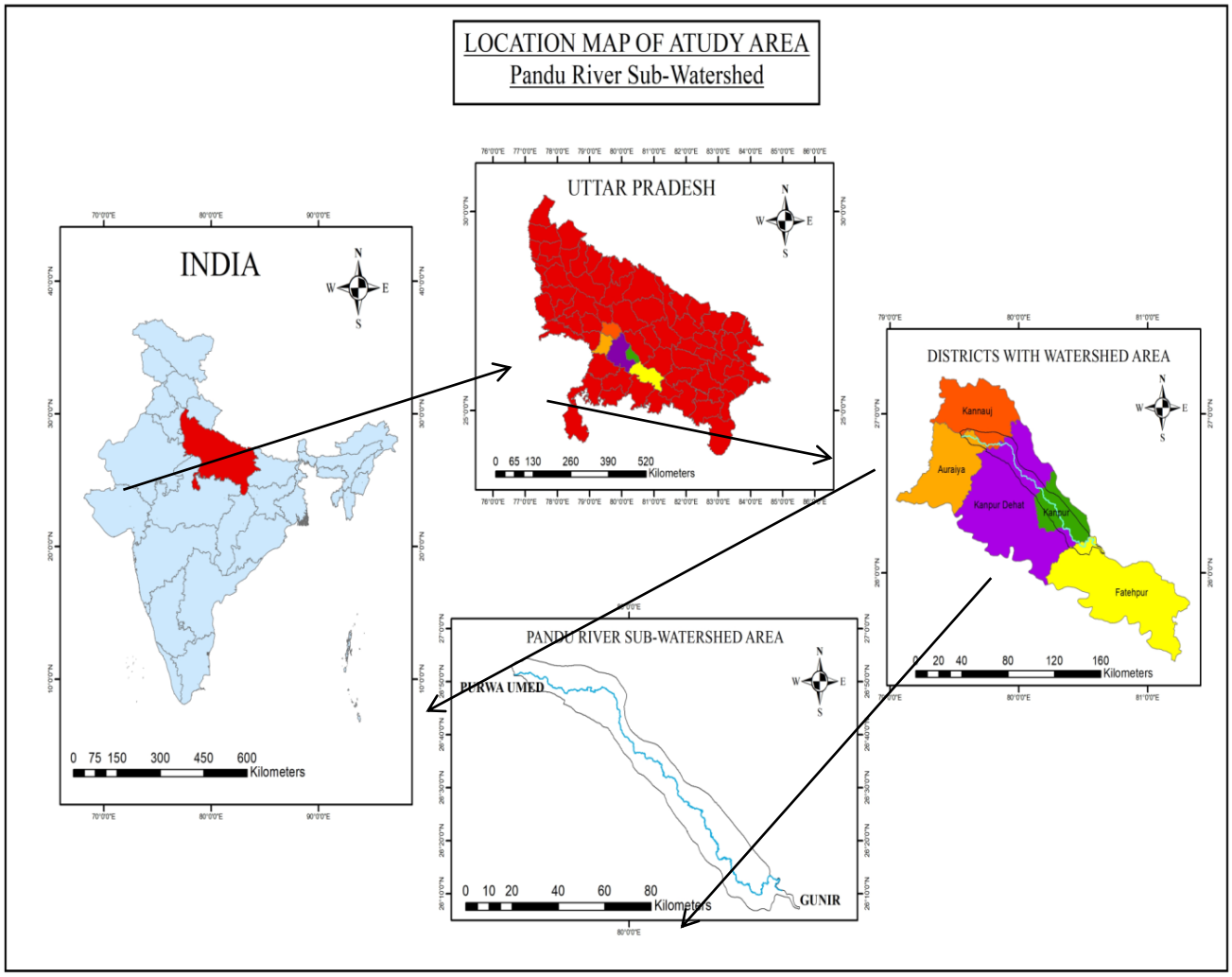

Fig -1: Location Map

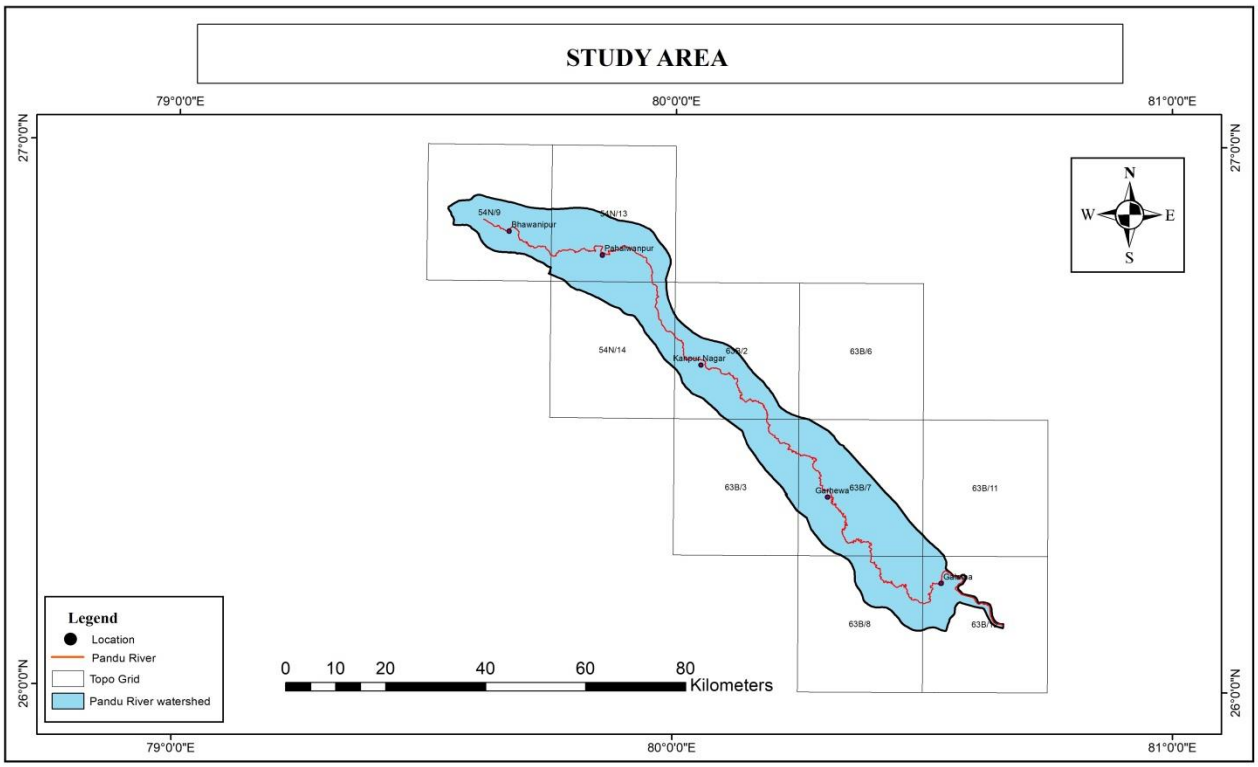

Fig -2: Study Area

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

4. METHODOLOGY

Toposheets was downloaded from Nakshe portal which are provided from Survey of India at a scale of 1:50,000 has been used to extract the information about the study area for the year 1975.The corresponding toposheets were georeferenced using the Universal Transverse Mercator projection system in the world reference system (WGS84) datum. Landsat-8 (TM/OLI) satellite data for the years 2010, 2013, 2015 and 2020 were downloaded from (https://earthexplorer. usgs.gov/).

The methodology in this study contains different approaches for mapping and monitoring of wetlands. The workflow applied in this study is shown in **Fig-3**

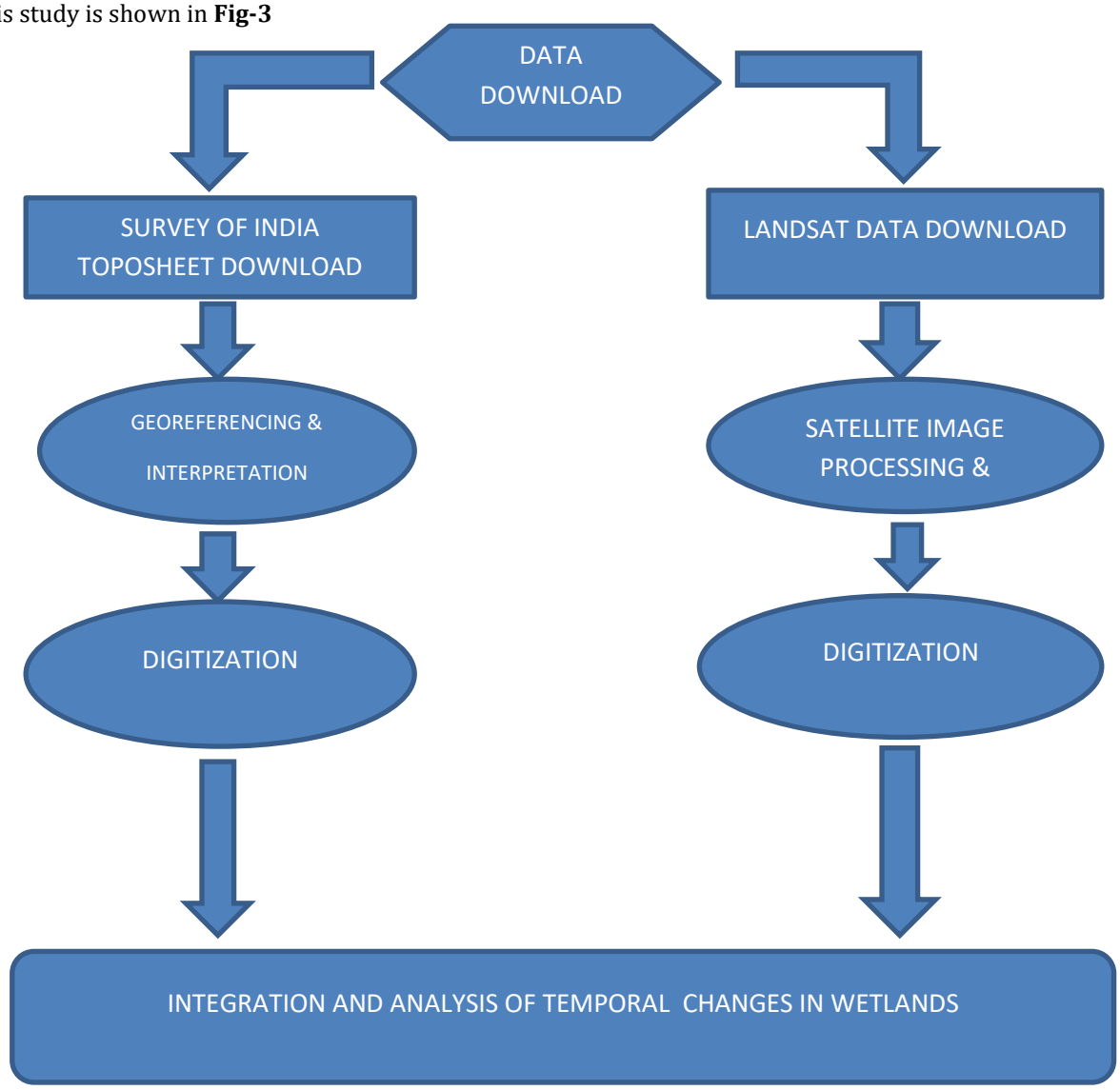

Fig -3: Flow diagram of methodology

5. RESULTS AND DISCUSSIONS

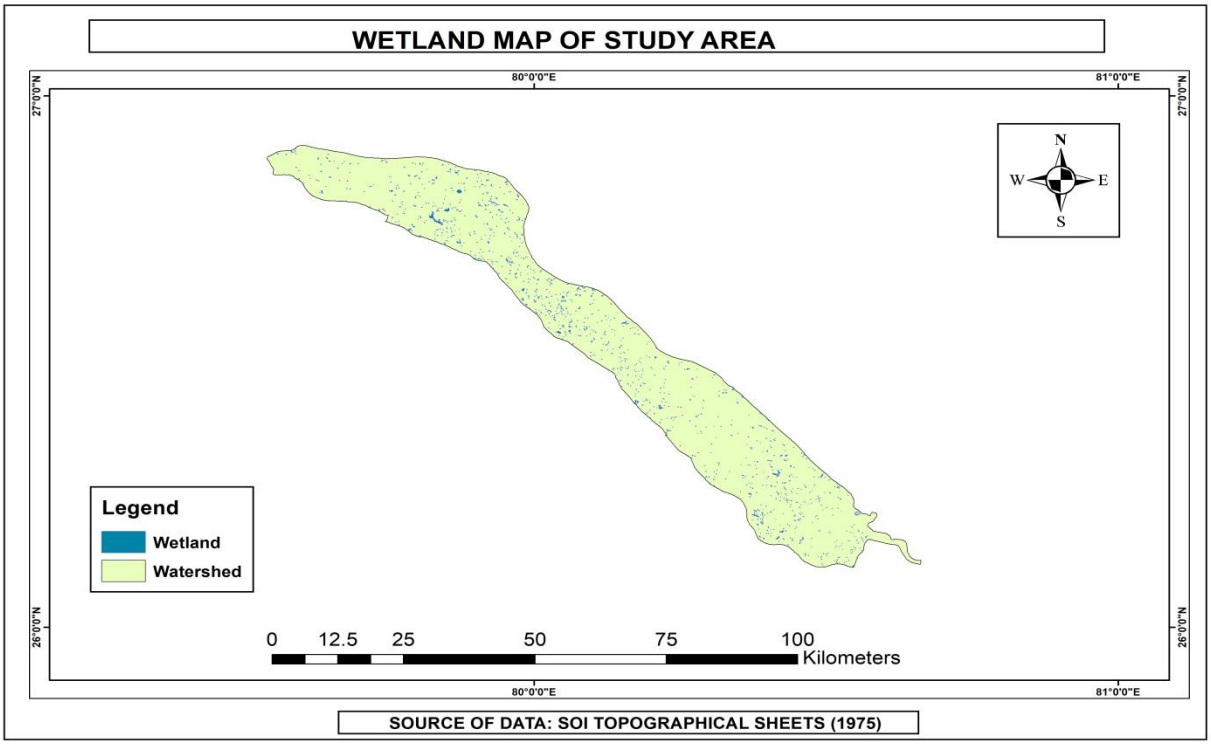

Fig-4: Wetlands generated from SOI

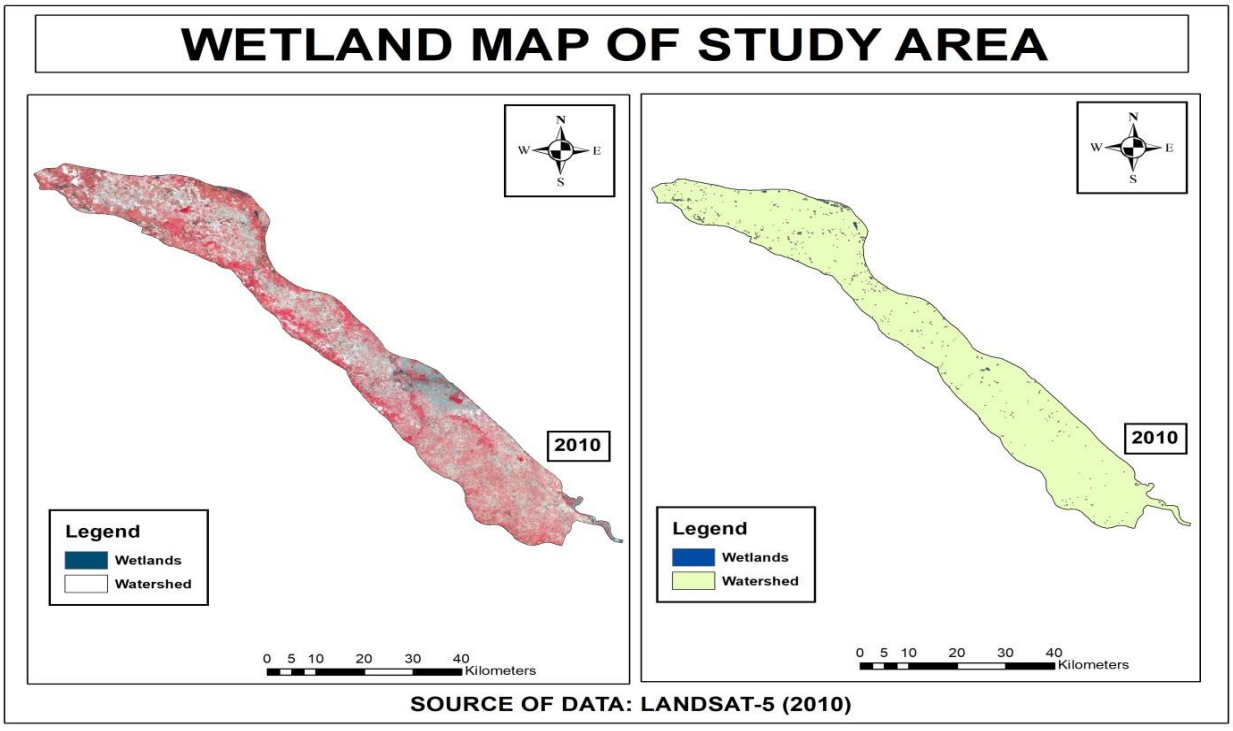

Fig-5: Wetland generated from LANDSAT-5 satellite Image

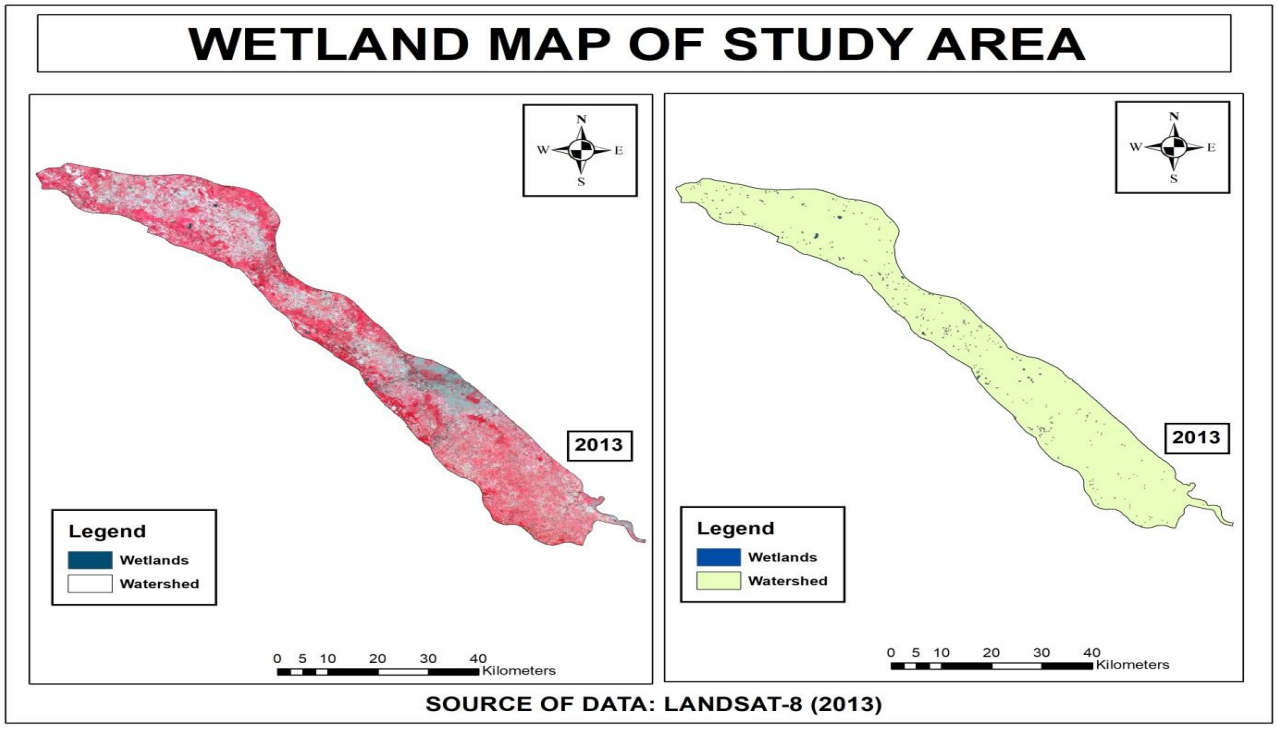

Fig-6: Wetland generated from LANDSAT-8 satellite image

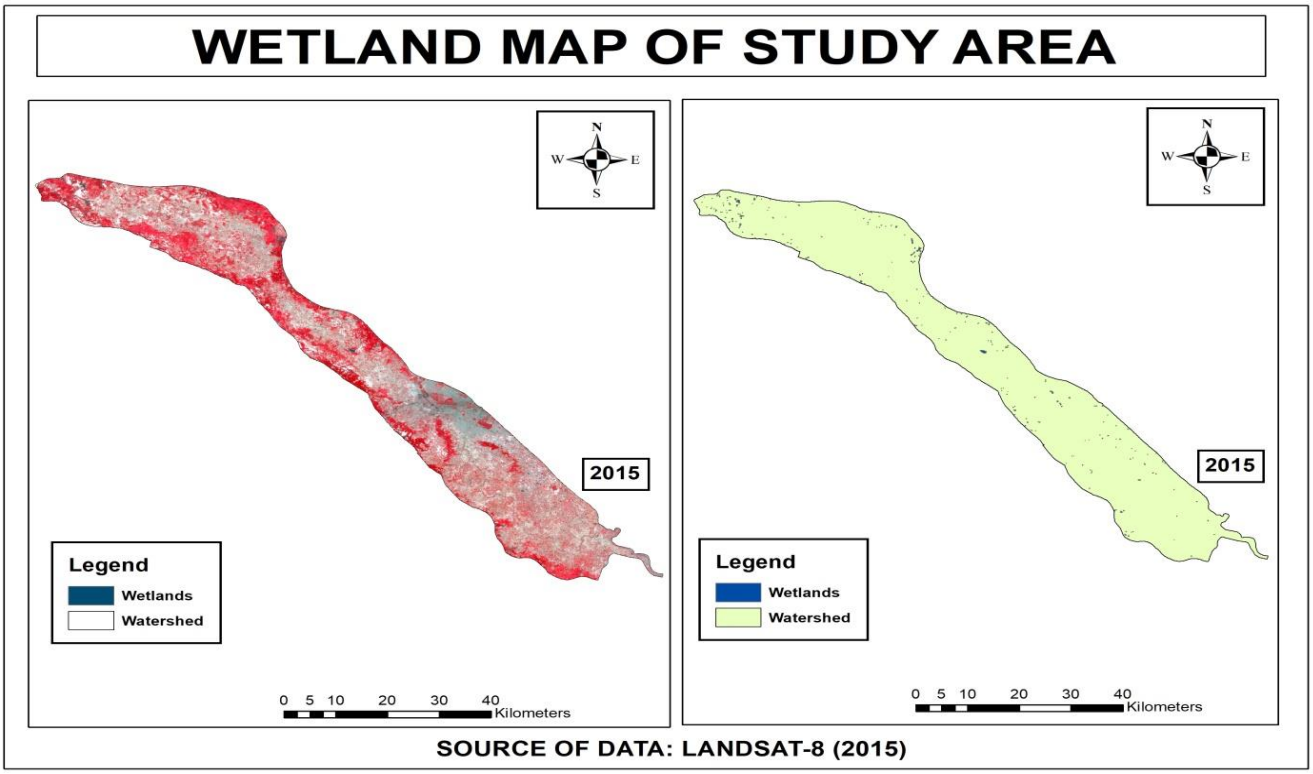

Fig-7: Wetland generated from LANDSAT-8 satellite image

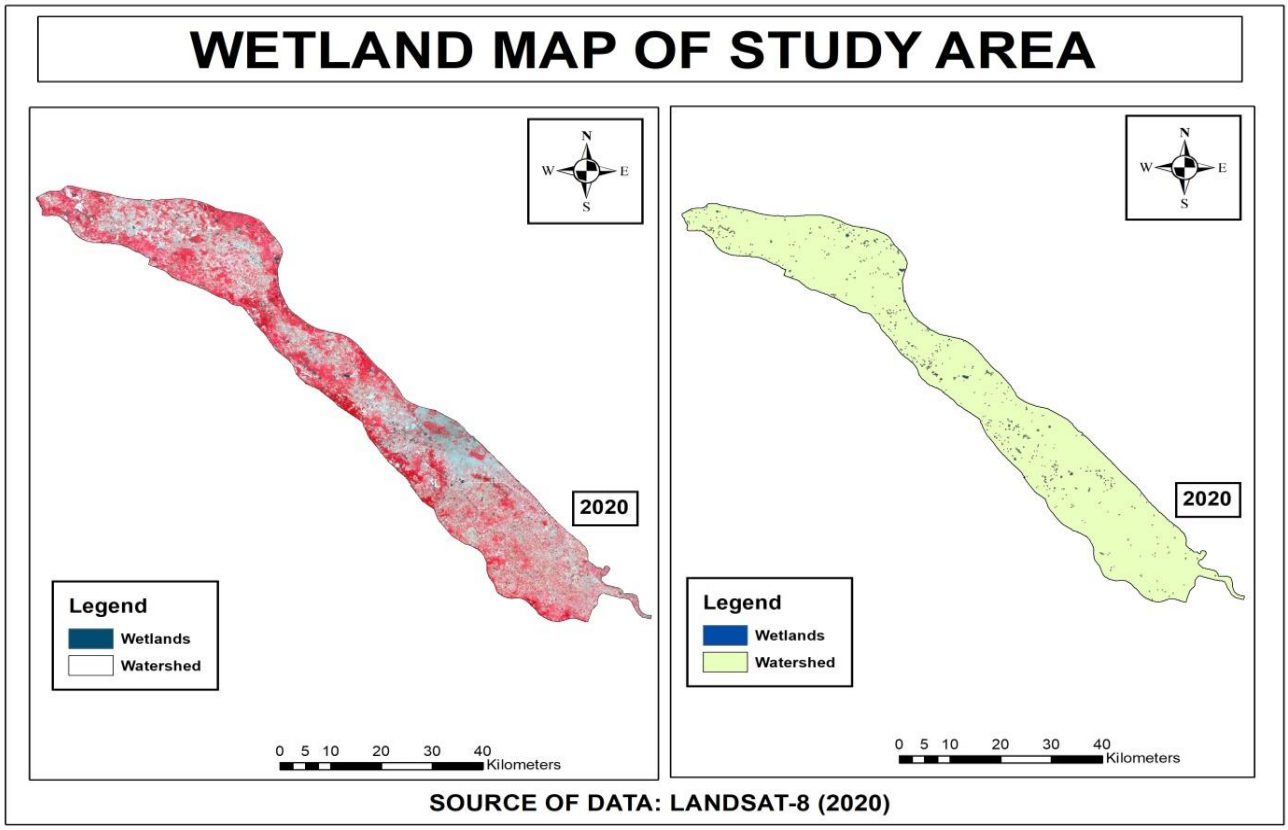

Fig-8: Wetland generated from LANDSAT-8 satellite image

TABLE-2: TEMPORAL CHANGES IN WETLANDS IN DIFFERENT YEARS

Year	Number of Wetlands	Area of Wetlands (in ha)
SOI (1975)	1258	1345.72
2010	524	1200.21
2013	365	756.62
2015	238	563.21
2020	589	1127.2

These figures shows the extracted wetlands for the years 1975, 2010, 2013, 2015 and 2020 respectively and changes in the wetlands were observed. The Northeast average rainfall for our study area was 191.75 mm in the year 1975 and number of wetlands were 1258 have been depicted with the area of 1345.72 ha. However in the year 2010 the average rainfall for our study area was 55.75 mm and number of wetlands were 524 have been depicted with the area 1200.20 ha. Which demonstrate decreases in the areal extent of wetlands between the years 1975 and 2010 due to decreasement of rainfall. Similarly in the years 2013 and 2015 the average rainfall for our study area respectively 76.64 mm and 29.94 mm but rainfalls were increased in the year 2013 are compared to 2010. The numbers of wetlands were for the year 2013 and 2015 respectively corresponding to 365 and 238 with the area of respectively 756.62 ha and 563.21ha. Thus the area of wetlands was decreased in the year 2015 due to less rainfall in comparison of the year 2013.The average rainfall for the year 2020 was higher in the comparison of the year 2015 due to high rainfall with 46.38 mm rainfall. Thus an increase in the in the areal extent of wetlands

with the numbers 589 have been depicted with an area 1127.2 ha in the year 2020 which was greater than numbers of wetlands in the year 2015. Therefore, the decreases in the areal extent of wetlands have been observed from the year 1975 to 2020.

6. CONCLUSION

In the present study land use land cover mapping as well as temporal wetland changes were analyzed using multi-date LANDSAT satellite data. Which demonstrate decrease in areal extent of wetlands due to decline in annual rainfall and encroachment within the wetland area. This decline in wetlands leads to depletion of ground water level in the study area. Thus conservation and monitoring of wetlands are highly essential to provide balance to the ecosystem.

7. REFERENCES

- Baker, C., Lawrence, R., Montagne, C., & Patten, D., "Mapping wetlands and riparian areas using Landsat ETM+ imagery and decision-tree-based models" Wetlands, Volume 26, No.2, 2006,pp. 465–474.
- Baker, Corey, Rick L. Lawrence, Clifford Montagne, and Duncan Patten, "Change detection of wetland ecosystems using Landsat imagery and change vector analysis",wetlands, Volume 27, No. 3, 2007, pp. 610–619
- Butera, M. K. (1983). Remote sensing of wetlands. IEEE Transactions on Geoscience and Remote Sensing(3), 383-392.
- Civco, D., Hurd, J., Prisloe, S., & Gilmore, M. (2006). Characterization of coastal wetland systems using multiple remote sensing data types and analytical techniques. Paper presented at the IEEE Int. Conf. Geosci. Remote Sens. Symp. 2006 (IGARSS 2006).
- Czajkowski, K., Torbick, N., & Lawrence, P. (2007). Application And Assessment Of A Giscience Model For Jurisdictional Wetlands Identification In Northwestern Ohio Wetland and Water Resource Modeling and Assessment: A Watershed Perspective (pp. 2-12): CRC Press.
- MacAlister Charlotte and Mahaxay Manithaphone, "Mapping wetlands in the Lower Mekong Basin for wetland resource and conservation management using Landsat ETM images and field survey data", Journal of Environmental Management, Volume 90, No. 7, 2009, pp. 2130–2137
- Ramachandra, T.V. (2002). Restoration and management strategies of wetlands in developing countries. Electronic Green Journal, 15. Retrieved November 24, 2007
- Ramachandra, T.V., Kiran, R., & Ahalya, N. (2002). Status, conservation and management of wetlands. New Delhi: Allied Publishers.
- Rani, M., Kumar, P., Yadav, M., &Hooda, R. S., "Wetland Assessment and Monitoring Using Image Processing Techniques: A Case Study of Ranchi, India", Journal of Geographic Information System, Volume 3, No.4, 2011, pp. 345-350