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WATERSHED DELINEATION OF BANAS RIVER USING GEOGRAPHICAL INFORMATION SYSTEM (GIS)

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Abstract: Delineated watersheds are required for Rainfall-runoff modelling, and to prepare a drainage map of a river basin. Watershed delineation helps in characterization and investigating the watershed. DEM based Arc-hydro model is used for delineating the Banas watershed¹. Several intermediate results were generated while running the model and several parameters of Banas River and its catchment is defined at the end of model.

Keywords Watershed Delineation, GIS, Arc-Hydro tool, DEM



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INTRODUCTION

Watershed Delineation means creating a boundary that represents the contributing area for a particular river outlet.[1]. Banas River Basin is located in eastern part of Rajasthan and occupies significant area in the east of Aravali mountain range. It stretches between 24° 17' 14.22" to 27° 18' 15.24" North latitude and 73° 20' 54.84" to 77° 00' 36.49" East longitudes. Watershed can be delineated by two methods: first is a traditional methods using toposheets and second is using GIS. However now a days DEM based extraction is widely used for the watershed delineation. The purpose of this study is to define the basic parameter of the Banas river basin and which can further used in Rainfall-runoff modelling of that region.

STUDY AREA

The Banas drains an area of 8674 sq km, out of which nearly 37.69% lies in Rajasthan state and remaining 62.31% falls in Gujarat state. Banas river originates from Aravalli hills and descends in a South-western direction through Rajasthan state and travels through Banaskantha and Mehsana district of Gujarat before it drains into little Rann of Kutch. Sipu is the only right Bank tributary of Banas, which drains into the main channel. There are 6 tributaries on the left bank of Banas River namely the Batria, the Sukli, the Sewaran, the Suket, the Balaram and the Khari which drain into the main channel. The Sipu and the Khari are the two important right and left bank tributaries, which together drain nearly 37% of the total catchment area of Banas.

Sr.No.	Name of State	Name of District	Length of river (km)	of Drainage area (sq km)	% of Total CA
1	Rajasthan	Sirohi	78	3269	37.69
2	Gujarat	Banaskantha	119	4638	53.47
3	Gujarat	Mehasana	69	767	8.84
		Total	266	8674	100.00

Table 1: state wise distribution of drainage area

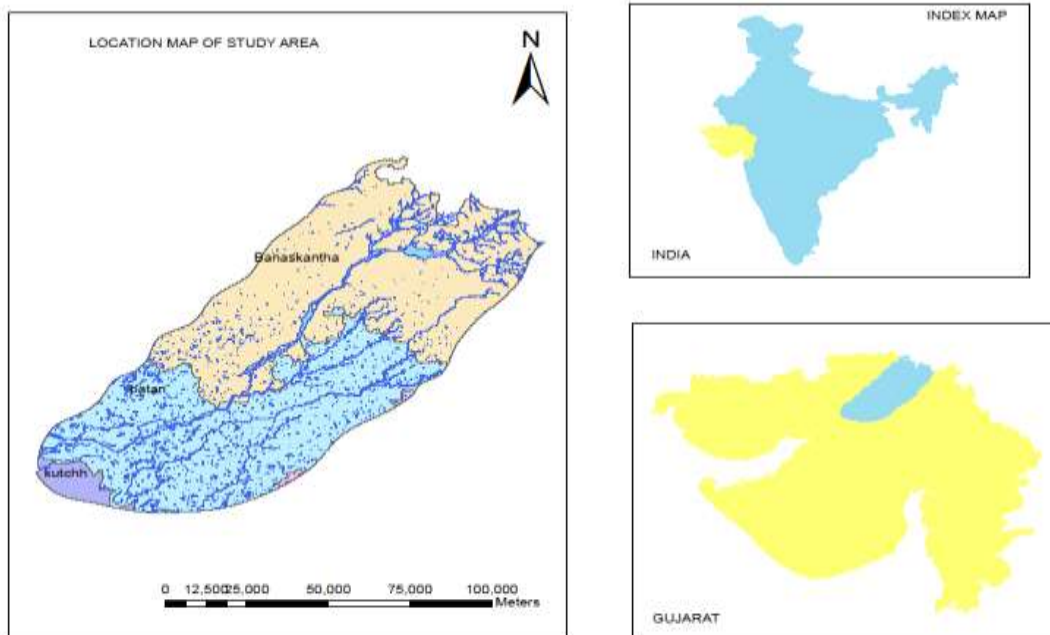


Fig 1: study area

MODELLING AND METHODS

Primary data for watershed delineation in GIS is Digital Elevation Model. Here the DEM used for model is ASTER Global Digital Elevation Model. Arc-Hydro tool is used in GIS for Banas watershed delineation and with addition several intermediate maps like Flow direction map, catchment map, Drainage map etc. has been generated. The methodology is described in flowchart Fig 2.

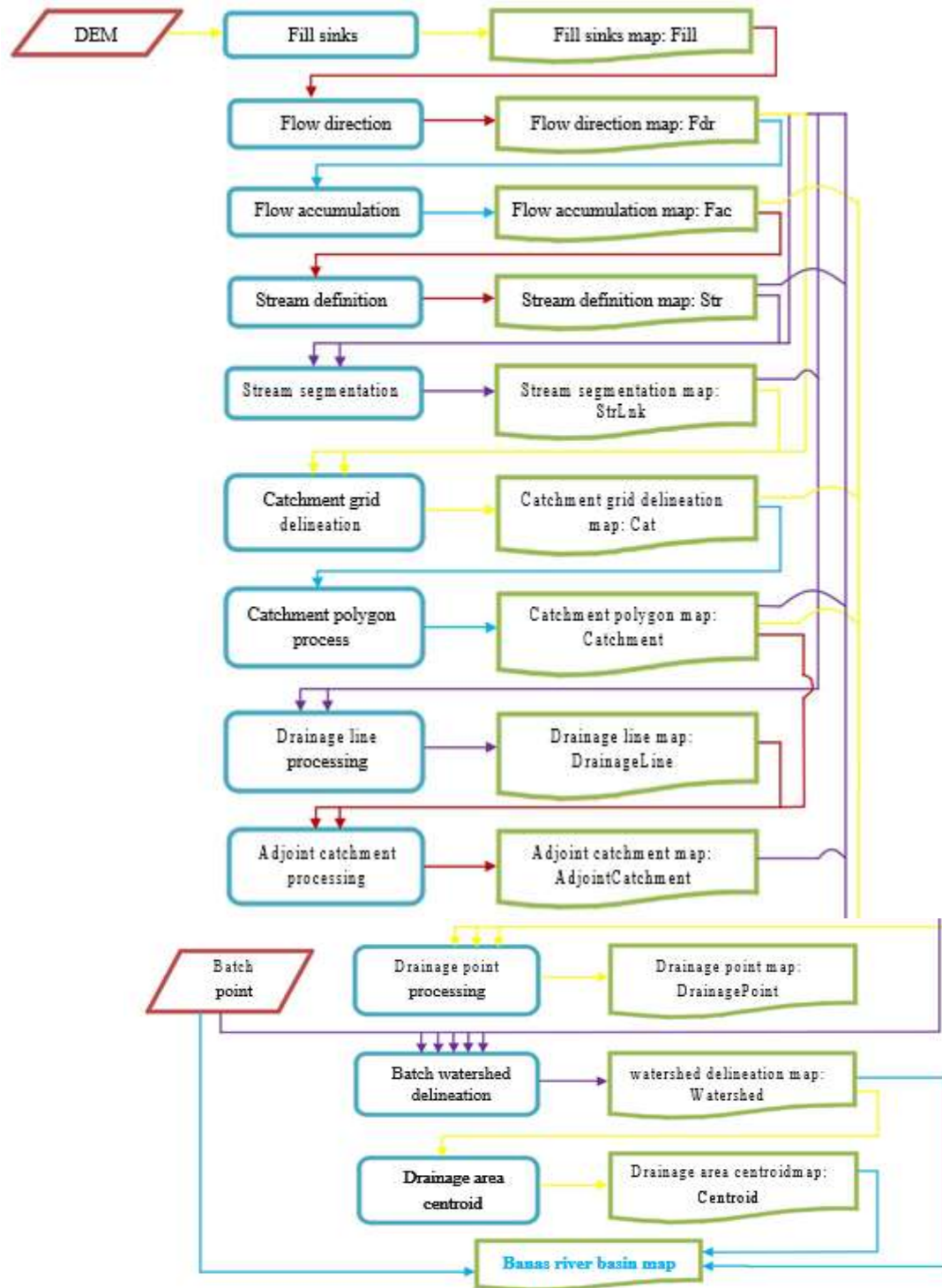


Fig 2 Methodology Flowchart for Arc-hydro tool

RESULT AND ANALYSIS

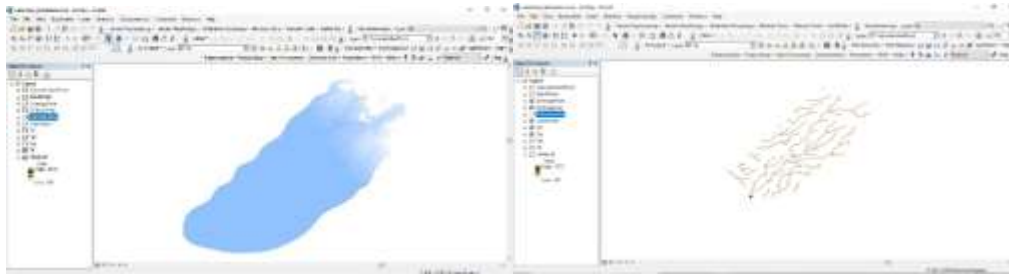


Fig 3 Fill Map

Fig 4 Flow Direction Map

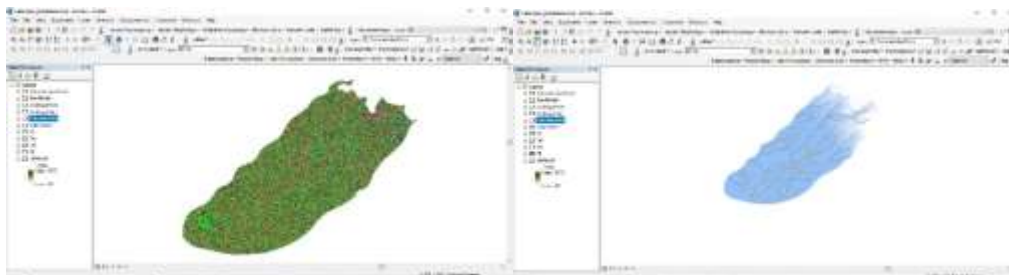


Fig 5 Flow Accumulation Map

Fig 6 Catchment area

CONCLUSION

The calculated Banas river basin is 45.844km². this result may vary depending upon the spatial resolution of Digital Elevation Model. The results can be further used to identify the sub basins and calculate the topographical features.

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