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## An overview of Urban Flooding in Dibrugarh Town, Assam

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### ABSTRACT

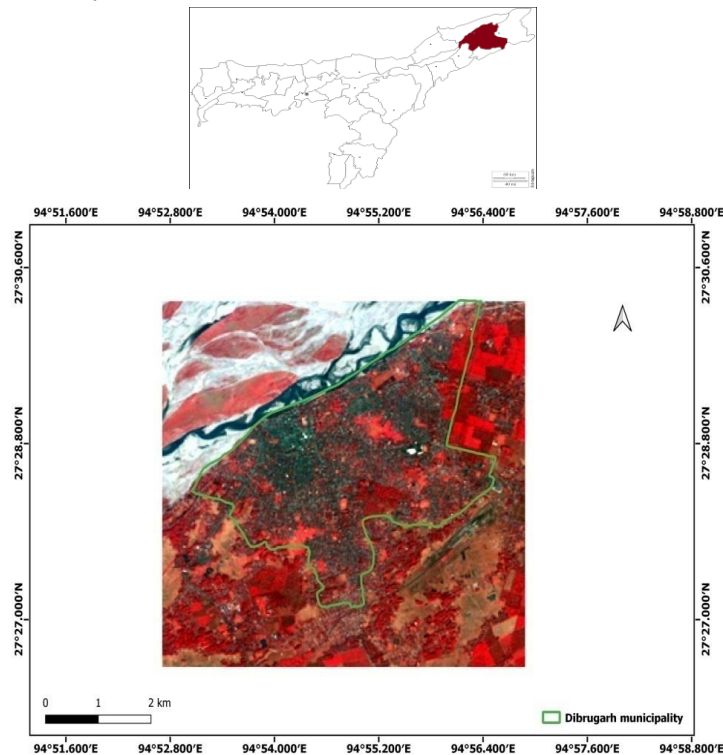
Urban flood is very common in most of the Indian cities. Unplanned urbanization is primarily responsible for urban flood in India. The rate of urbanization in India has been increasing rapidly. According to 1901 census, 11.4% of the total population was residing in urban areas. This count has been increased by 28.53% in 2001 and 31.16% in 2011. This rapid urbanization leads to many problems in urban areas because it is happening without any proper planning. One of such problem is causing urban flood. Unplanned urbanization comes up with an improper urban drainage system, illegal construction of buildings in low lying areas, construction of buildings without acknowledging the natural topography and hydro-geomorphology etc. All these factors combined with excessive rainfall causing urban flood within a very short period of time. Dibrugarh is one of the largest and important cities of upper Assam where urban flood also occurs mainly during the summer season (Jun-Sept). It creates havoc among the city dwellers. Through this paper, the author simply highlights the urban flood events in Dibrugarh, their occurrences and consequences.

### 1. INTRODUCTION

The According to MSN Encarta Dictionary, "A flood is an overflow of water that submerges land which is usually dry" (2009). Urban flooding occurs because of excessive rainfall along with poor urban drainage network and

without proper urban drainage management it will increase in near future [1]. Land use change and urban development related activities causes' urban flood by removing the vegetation and soil [2]. Urbanization leads to city congestion, growth of urban impervious surface and because of this rainwater infiltration decreases and surface runoff increases, which will result in the occurrence of urban flooding[3]. Urban flooding is very common in most of the Indian cities (Mumbai flood of July 2005, Chennai Urban Flood of Nov-Dec 2015, Delhi Urban Flood Events, Noida Urban Flood Event of Sept 2010, Kolkata Urban Flood of June 2007 etc.). It is because of poor urban drainage management, unplanned construction etc[4].Urban flooding is also very often in Dibrugarh during the summer months of the season (Jun-Sept).Although there has been several land use changes and urban studies already discussed about Dibrugarh, none of them discusses the urban flooding. For example studies such as Mili, Acharjee investigated urbanization in Dibrugarh District: an important driver of environmental degradation. Saharia, Shingh investigated Short term Land use/ Land cover change Analysis: A case study with Geomatic Approach. Acharjee, Goswami, Saikia studied visual change detection study of some areas of Assam, India using Remote Sensing. Neog, Gogoi investigated A GIS based analysis of urbanization and its impact on arable land: A study on selected municipalities of upper Assam, India. These studies are based on land use change and urbanization, but they are not discussing on urban flooding. Therefore this study is going to highlight the overview of urban flooding in Dibrugarh town.

**2. STUDY AREA:**



**Fig1. Location of the study area on Assam and IRS P6 LISS III image of Dibrugarh city of 11 January 2016**

Dibrugarh is an administrative district of Assam, situated in the north eastern part of India. The total geographic area is 3381sq km with a population of 1327748 <sup>[5, 6]</sup>. It extends from 27°0' N to 27°45'N latitude and 94°30' E to 95°30' E longitudes. The heart of the Dibrugarh district is Dibrugarh city, which comprises of 22 wards. The city is located at the intersection of 27°28' N latitude and 94°35' E longitudes and at 104.24 meters above mean sea level. Total area of the city is 15.45 sq km and the total population is 154019 <sup>[7]</sup>. The city of Dibrugarh receives its maximum rainfall during the summer (June-September) whereas in winter lowest amount of rainfall is recorded <sup>[8]</sup>.

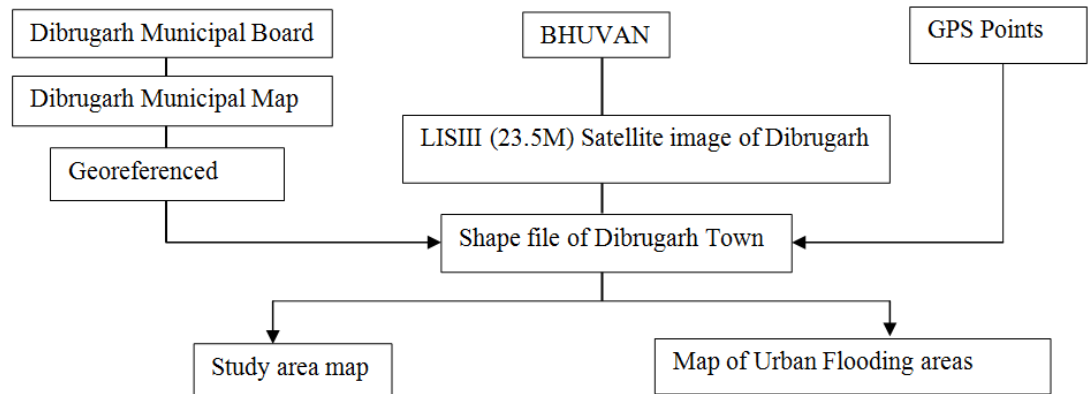
**3. OBJECTIVES:** The Objectives of this study are to highlight the recent urban flood events in Dibrugarh town and to identify the urban flood prone areas in Dibrugarh town.

**4. DATABASE AND METHODOLOGY:** This paper is based on both primary and secondary data.

Table1. Data sources

Primary	Secondary
Observation, GPS Points	Internet, Newspapers, Books, Government Organization.

Dibrugarh municipal map was collected from Dibrugarh Municipality Board, Dibrugarh. Data were also collected from library work, newspapers as well as internet sources regarding the urban flood events in Dibrugarh.



**Fig.2 Methodology flowchart**

The collected municipality map was georeferenced using QGIS3.8 through image to image rectification where Google Earth Pro was used as a reference. The boundary of the Dibrugarh municipality is digitized and the shape file has been created. IRS LISSIII (23.5) satellite image of Dibrugarh has been downloaded from [https://bhuvan.nrsc.gov.in/bhuvan\\_links.php](https://bhuvan.nrsc.gov.in/bhuvan_links.php) and pre-processed. The shapefile of Dibrugarh was put on the LISSIII imagery and exported as a map unit and the study area map was created. GPS points of the different flood affected areas have been collected through field visits. These

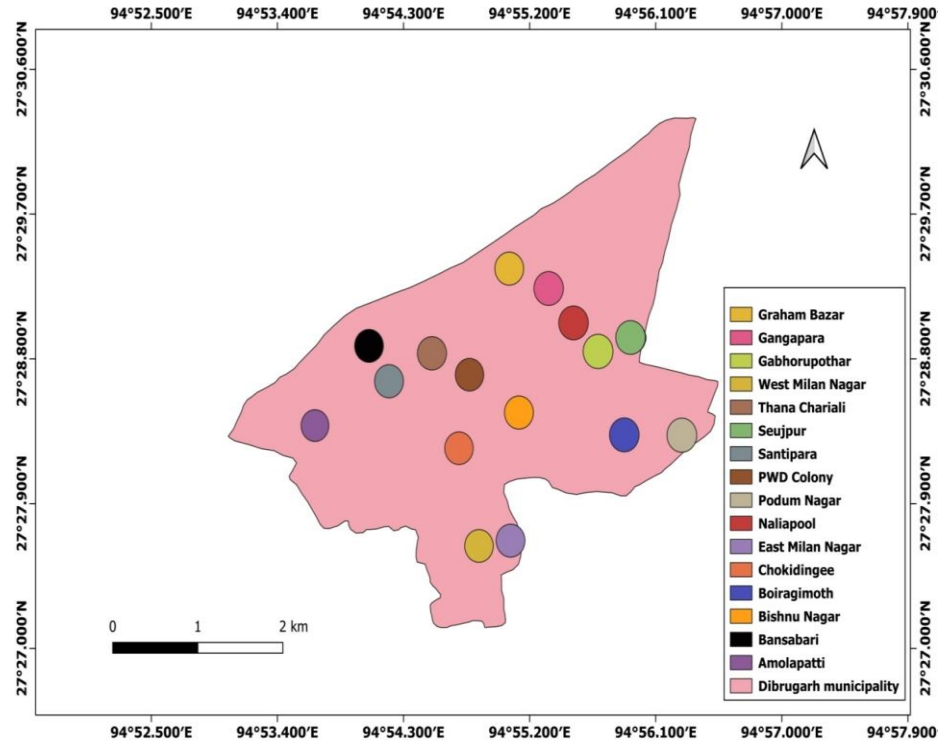
GPS points are uploaded on the shapefile of Dibrugarh and the map of urban flooding areas of Dibrugarh has been created.

**5. URBAN FLOOD EVENTS IN DIBRUGARH:** The table 2 shows the list of urban flood events recorded in the recent years in Dibrugarh city.

Table2: Urban flooding in Dibrugarh in recent years.

Date	Affected areas	Consequences
Jun 10, 2015	The affected areas include Dibrujan, Durgabari, PWD Colony, Kalibari, Vishnu Nagar, Bagchipara, West Chowkidinghee, Bansbari, Amolapatty, Guardpara, Officer's Colony, NirmaliGaon and Police Reserve, Milannagar, Boiragimoth, Seujpur, Khalihamari, Gangapara, Lachit Nagar, Ambari, Kadamoni, Gandhi Nagar, Lichubari, Padum Nagar, Shantipara, KhaniaGaon and JibonPhukan Nagar <sup>[9]</sup> .	Shops and markets, schools and colleges, banks and offices have been remaining closed under the impact of the urban flooding <sup>[9]</sup> .
July 24, 2015	Flood water inundated Milanagar, Grahambazar, Khalihamari, KP Road, Padum Nagar, Amolapatty, Naliapool, Santipra, Chowkidinghee, Ganagapara, Bansbari, Gabharupathar and Seujpur areas <sup>[10]</sup> .	Drain water entered local houses; the city's main roads were under water <sup>[10]</sup> .
Jul 1, 2016	JibonPhukan Nagar, Bordoloi Avenue, Lachit Nagar, West Milanagar, Khaniagaon, Gangapara, Seujpur, Amolapatty, Padum Nagar, Naliapool, Santipara, KP Road, Durgabari, Vishnu Nagar, Khalihamari, Guardapara and Graham Bazar, Gabharupothar Police Sation <sup>[11]</sup> .	Road damage, NH37 also affected. Drain water entered local houses <sup>[11]</sup> .
July 11, 2019	Prominent areas of the town,	Traffic congestion, Road

	including, Thanacharali, Bagchipara, Chowkidinghee, Graham Bazaar, Santipara, locality next to Bagmibor Nilomoni Phukan HS School and RKB Path, [12].	damage <sup>[12]</sup> .
August 4, 2019	The road from Thana Chariali to Shankardev Hospital was affected [13].	Traffic, Road damage [13].
September 24, 2019	Gangapara, Bagchipara, Pathanpatty, Amolapatty, Graham Bazar, Seujpur, Naliapool, Boiragimoth, Kodomoni, Gandhinagar, Vishnunagar, BholaNath Road, Running Shed Gate, Milan Nagar, Santipara, West Chowkidinghee, Mollukubasa, Railway Colony, Police Reserve, etc <sup>[14]</sup> .	Normal life has been largely affected, unhygienic condition, traffic, road damage [14].
Jun 25, 2020	Gangapara, Bagchipara, Pathanpatty, Amolapatty, Graham Bazar, Seujpur, Naliapool, Boiragimoth, Thanacharali, Chowkidinghee, Milannagar etc.	Traffic Problem, drain water entered local houses, health and hygiene problem, cocking problem, mental stress etc.



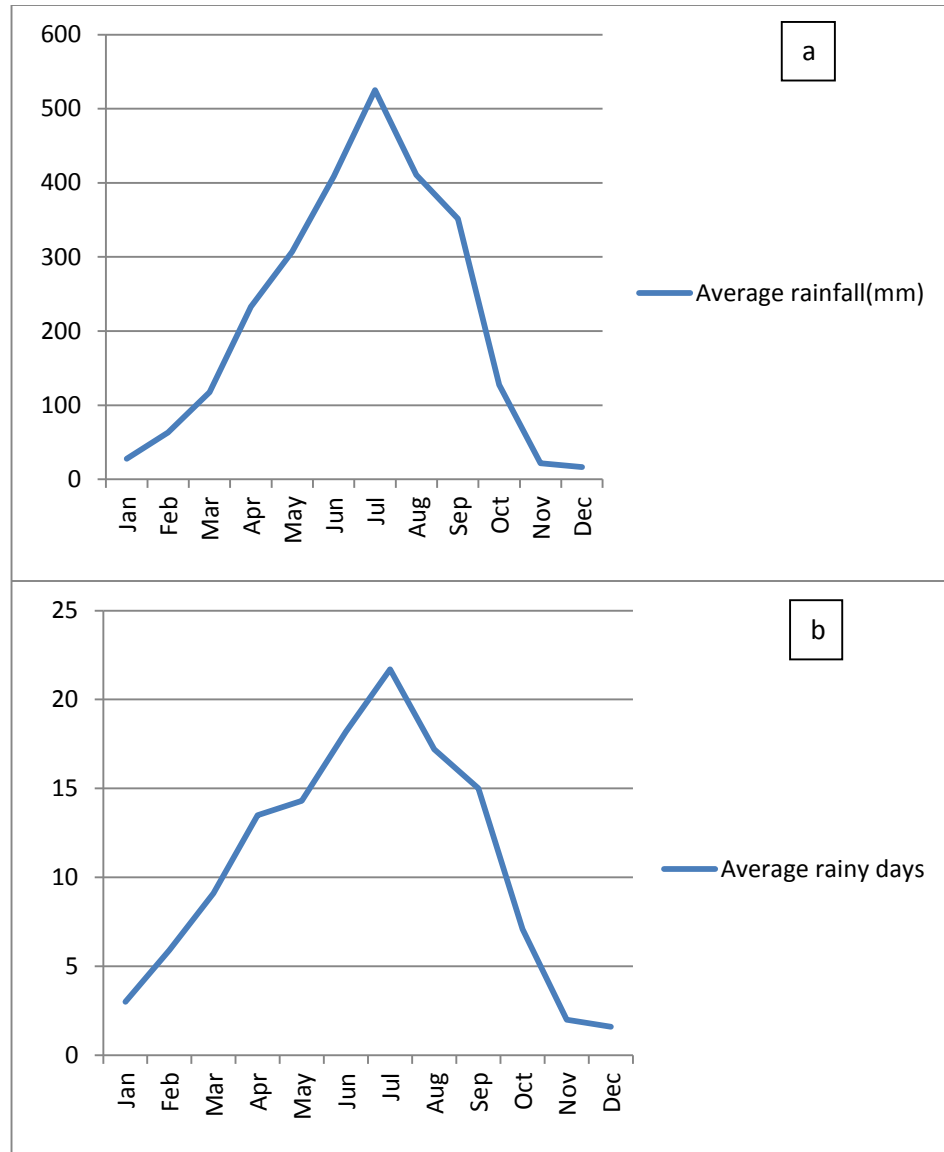
**Fig 3. Location of the Urban Flooding areas in Dibrugarh Town.**

**6. ANALYSIS OF URBAN FLOODING IN DIBRUGARH:** Table 2 has established the fact that urban flood in Dibrugarh is actually happening and the condition is deteriorating with time. There are two prime factors responsible for urban flooding in Dibrugarh, excessive rainfall and improper drainage management. The following table 3 shows the rainfall events in Dibrugarh.

Table 3. Average rainfall and average rainy days in Dibrugarh Town ( 1981-2010)

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average rainfall(mm)	27.8	63.0	117.5	232.9	307.2	408.5	525.0	410.5	351.5	127.5	21.5	16.4	260.9
Average rainy days	3.0	5.9	9.1	13.5	14.3	18.2	21.7	17.2	15.0	7.1	2.0	1.6	128.5

Source: Indian Metrological Department



**Fig.4 (a&b) Graphical representation of average rainfall and average rainy days in Dibrugarh Town.**

Figure.4 shows that average rainfall is higher than 350mm between Jun to September and the very same period average rainy days are also higher than 14. Due to this huge amount of rainfall combine with inadequate drainage system, the chances of occurrence of urban flooding are also higher in these months. In 2019 it was reported that urban flooding in Dibrugarh has already left 49 roads in the town damaged. Dibrugarh Town Protection Drain plays a significant role in carrying of rainwater from the town. It was built in 1954 and it is 22-km long drain. It starts with Dibrujan and ends in Jamira Bogibeel and carry the rainwater from the town to Sessa River. However, because of encroachment and lack of maintenance the drain can't function properly. Another reason is non completion of 9.5 km long portion of the drain. A project of Rs 169.89 crore was taken on drain works in 2014 under an Asian Development Bank (ADB) but it was not completed because, a Spanish

company named CorsanCorviam Construction, which bagged the tender, suddenly left the project in November 2017, after its parent organization in Madrid filed for bankruptcy. Since then the works on the drain has stopped<sup>[10]</sup>. The major consequences of urban flooding are damaging of roads, traffic congestion, shutting down of schools, colleges and offices, creating unhygienic environment as the water partly submerges the residential areas. The recent urban flooding of Dibrugarh in Jun 20, 2020 has caused many problems. It has disrupted the commercial activities as the water entered shops and houses. A part of NH37 was under water. Traffic congestion was extreme because flood water inundated RKB road, KC Gogoi road and Convoy road. All India Radio Centre, Dibrugarh and District and Sessions Court were also inundated. The following figures show a glimpse of urban flooding in Dibrugarh town.

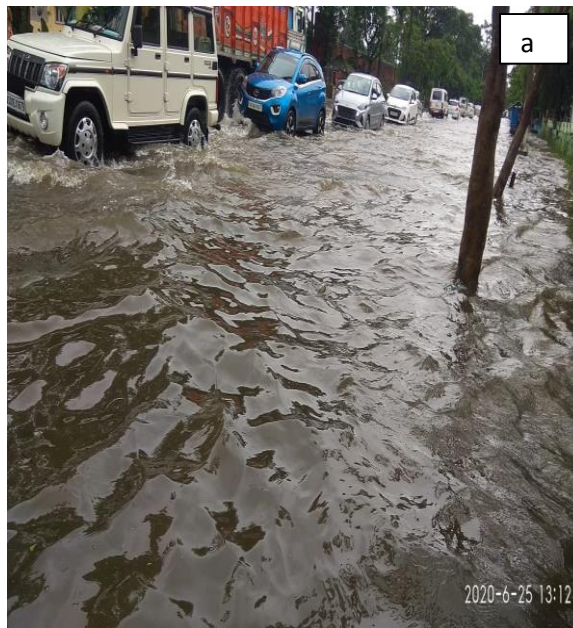


Fig5. Police reserve (July, 2015)



Fig6. Thana Chariali (July, 2015)





**Fig7. (a&b) NH37 (June 25, 2020)**



Fig8. PWD Colony (June 25, 2020)



Fig9. Radio Centre (June 25, 2020)

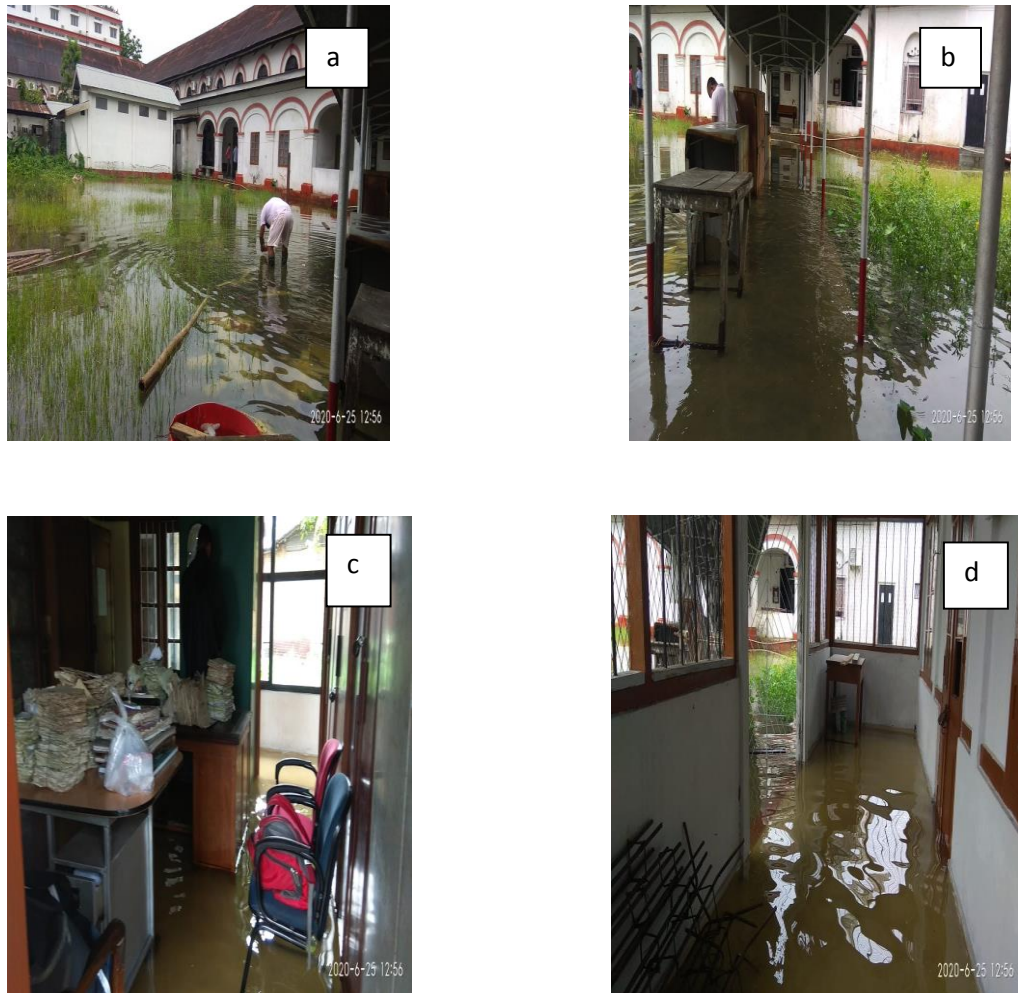


Fig7. (a,b,c&d) Inside District and Sessions Court (Jun25, 2020)

## 7. CONCLUSION:

Urban flood is very real in Dibrugarh during the summer season. Excessive rainfall and poor drainage system are primarily responsible for it. Improper land utilization is one of the reasons which also cause urban flooding. A comprehensive study is very much needed for critically analyzing the situation. The urban flooding of Dibrugarh is not that severe that we can't use the term disaster. But it will become if the proper management strategy is not adopted. There is not a single study about Dibrugarh regarding urban flooding. Therefore it is important to explore more on this problem for better understanding the situation.

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