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INVESTIGATING THE IMPACT OF THE DHANSIRI RIVER FLOOD AND EROSION IN THE WATERSHED

Geetika Bhatia
Department of Humanities, Graphic Era Hill University, Dehradun, Uttarakhand, India 248002

Abstract

River bank erosion and flooding are serious problems in the Golaghat district of Assam because of the basin's hydro-meteorological and topographical characteristics. Due to frequent and severe floods and bank erosion, Dhansiri, the major river of Golaghat district, has a troubled reputation throughout Assam's history. Dhansiri basin flooding and erosion are notorious for their extraordinary severity, regularity, and destructive scope. The banks of the Dhansiri River have been the site of substantial empirical research. And statistical approaches were used to examine how much the river affected the population's social and economic life. This research provides insight into the overall socioeconomic effect of river bank erosion and flood on the population in the regions surrounding the river Dhansiri and the techniques that local people have employed at the household level to mitigate and guard against these hazards. The field of water resources management analyzes the relationships between water's occurrences, distribution, transportation, and qualities on Earth. There is a lot of spatial and temporal diversity in hydrological systems, and they are intrinsically complex. Each regional water resources program must begin with a foundational knowledge of hydrology and basin features including soil type, vegetation, land use, geology, etc. The planning and execution of water resources development on a basin scale and watershed management program relies heavily on an understanding of the basin's hydrology.

KEYWORDS watershed, Erosion, flood, Dhansiri River

INTRODUCTION

The Dhansiri River begins in the valley formed by Naga Hill and Laishang Peak to its south-west. There are two distinct sections of the river's path. I beginning at its spring and ending at its meeting with the Diyung. ii) beginning at the point where the Diyung and Brahmaputra rivers meet. Northern Manipur, southern Manipur, the Karbianglong district to the west, and the Jhanji basin to the east form the boundaries of the Dhansiri basin. The coordinates for the basin are (260) 42° North, (250) 21° North, (94) 37° East, and (93) 10° West. The river is about 352 kilometers long from its headwaters to its mouth, and its basin has a catchment area of 12,584 square kilometers of flat land. Dhansiri catchment also includes the watersheds of Kakodonga and Bhogdoi, two of the river's major tributaries. Although catastrophic, floods may also help alleviate drought by rehydrating parched land and replenishing water supplies. There is no way to completely prevent flooding from occurring, but with the right preparation, it may be controlled effectively. The primary goal of this research was to examine all available resource maps in order to identify potential flood-prone areas. As GIS allows for the integration and administration of several types of data, this article is able to pinpoint the areas most at risk of flooding by analyzing satellite images from the appropriate time frame. Drainage, slope, soil, geology, geomorphology, land use and landcover, lineament, and zones of probable tectonic subsidence thematic layers were generated and assessed by overlay with 40 years of northeast monsoon rainfall to generate a potential flood susceptible zonation map.

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In the event of a flood, local people may utilize flood hazard maps as a reliable resource for determining whether or not they need to evacuate their homes.

LITERATURE REVIEW

Nilesh K. Susware et.al (2021) The sinuosity index of a river is influenced by the morphological changes that occur in the river channel over time as a result of flood episodes. Sinuosity, a property of rivers, is a major factor in how powerful a flood will be in a given channel. Losses from recent floods have risen due to increasing rainfall unpredictability, and similar issues are emerging in the context of sustainable development. The purpose of this study was to assess and make sense of the changes to the Morna River's channel and the stability of its banks in the Indian state of Maharashtra. The study also determined the river's overall planform or pattern. Around the Mangle settlement, the Morna and Warna rivers converge. The upper basin is characterized by a lack of perennial streams. Seasonal rain is the main cause of flooding. The stability and instability of river systems were analyzed using the Sinuosity index. As a result, this might aid in identifying potential hotspots for riverbank erosion and bolster sustainable flood control preparations for these areas in the wake of future storms. The Morna River has a sinuosity index of 1.09–1.44. Using geospatial methods, We have calculated sinuosity indices for the Morna River and its affluents in each of the river's tributary basins. There is a strong relationship between the sinuosity index and river slope, fluvial processes, water discharge, and hydraulic characteristics of the river channel in the Morna basin and sub-watersheds. The agricultural terrain close to the confluence of the Warna and its tributary, the Morna, is at risk of seasonal floods, when there is a lot of rain upstream.

Mustak Ali et.al (2020) Assam, a state in India, is located right in the middle of the Southwestern Monsoon area, hence it gets flooded every year. Long mountain ranges on the state's northern and northeastern borders force surface runoff to pour down the state's extensive alluvial plains, which in turn causes the rivers to rise. Hundreds of animals are killed or injured every year when the Brahmaputra River sweeps through Kaziranga National Park. Animals have a natural tolerance for floods, but when the waters rise over a certain point, they seek refuge in the Karbi Anglong hills. The roadway has become progressively more dangerous to traverse over time. Initiatives stresses the importance of protecting large areas of land. During the monsoons, optical data is insufficient for flood analysis in the area. But, because to Synthetic Aperture Data, researchers may continue their work on the Brahmaputra basin even when the monsoon clouds roll in. In order to detect the "roughness" and "wetness" of the object, SAR sensors emit microwave radiation. Floods, one of the most disruptive natural and cultural phenomena, may now be monitored, studied, and Google Earth Engine (GEE) is a cloud-based platform for planetary-based geospatial research, allowing for its predictions to be made computationally. This research aims to better understand the causes of floods in the Brahmaputra Valley by analyzing dual polarization C-band data from the GEE platform. The study's goals are to (1) locate and categorize flooded regions, and (2) provide more possibilities for visual data interpretation.

Hussein Almohamad (2020) Among the most severe and recurrent shocks on a global scale, the rapid changes in land cover brought on by armed conflicts pose a significant danger to soil and water conservation. During the years of 2009-2010 and 2018-2019, researchers utilized the RUSLE model to analyze how shifting land cover affected soil erosion rates in different areas and over time. This research aimed to describe and contrast soil erosion in the Northern Al-Kabeer river basin in Syria throughout different phases of the war. The average annual soil erosion rate is 4 t ha1 year1 with a standard deviation of 6.4 t ha1 year1. The erosion classes'

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geographical distribution was also calculated. The research found that just roughly 10.1% of the basin is exposed to an acceptable rate of soil erosion, whereas 79.9% of the studied area underwent erosion of some kind. Ten percent of land in untouched areas experienced soil erosion. The data showed that soil erosion increased until 2013/2014, then decreased from 2014/2015 to the present. Fighting has been shown to increase the risk of forest fires, especially on steeper slopes. Across the upper section of the basin, coniferous forest, Post-fire soil loss rates were often 200% to 800% higher than in the pre-fire scenario, and the most prevalent land cover types are transitional woodland and scrub. Soil erosion was reduced from 2013–14 to 2019–20 as a consequence of a ceasefire agreed upon in 2016, which reduced human stresses on soils in disputed regions. The region in question is in the western side of the basin, away from the bulk of the fighting. In contrast, the northeast and east, which are closer to hotspots of armed conflict, have had soil erosion increases of 60-400%. It is likely that forest fires are to blame for these discoveries since territory formerly covered by trees was converted to farms, refugee camps, and roads. Understanding the intricate biophysical and socio-economic linkages of sensitivity to land loss is crucial for ensuring regional environmental protection and preserving the biological integrity of soil and forest systems.

Nabajit Hazarika et.al (2015) More than half a million people depend on the Upper Brahmaputra floodplain, which is often impacted by flooding. This research analyzes the effects of river dynamics on land usage along two tributaries in the region. Topographical maps and Landsat imagery are used to chronicle 40 years of planform change, and hybrid categorization in a geographic information system (GIS) is used to evaluate the related land-use shift. River courses are unstable, as measured by the quantitative movement of banklines. Furthermore, the rate of erosion and deposition seem to have switched places. The confusion matrices show that the accuracy of Landsat image categorization was improved by using a hybrid approach. Classification of land use was accurate to within a range of 88.5% to 96.2% overall. Grasslands are decreasing as settlements and farms expand, as seen by a shift in land use. Agricultural land is among the most vulnerable to the effects of erosion-deposition and river movement. The river's dynamics clearly have an impact on human habitation. The destruction of farmland and dwellings caused people in the floodplains to lose their means of subsistence and force them to relocate within the country. New environmental difficulties have been presented at a speed and size well beyond the coping capacity of the inhabitants as a result of the observed pattern of river dynamics and the resulting land-use change in recent decades.

Rana Sarmah (2016) The purpose of this research is to quantify the sediment production rate in a small floodplain watershed that experiences both high climatic and low physiographic variability. From 2009 to 2014, we use a typical field-based technique to estimate sediment output rates. Sediment output in the research region is predicted to be 618 t/km2/year. Throughout the period of 2009-2014, the average sediment output was calculated to be 618 t/km2/y across all gullies, with individual gullies averaging 417 t/km2/y, gully 2 at 451 t/km2/y, gully 3 at 865 t/km2/y, and gully 4 at 742 t/km2/y. Due mostly to downstream fining of soil texture and increased ground saturation, the rate of sediment output is increasing, on the order of 8t/km2/y/km. There was a 318 mm (49% increase) in precipitation during the ground saturated period (July–October) in 2009–10, leading to a 127 t/km2/y (23%) increase in sediment output. This relationship changed from 266mm (27%) to 85 t/km2/y (12%) in 2010–2011, then from 36mm (3%) to 32 t/km2/y (5%) in 2011–2014. Consequently, variations in rainfall during the time when the earth is saturated greatly impact the sediment output rate. High rates of sediment output were also shown to be primarily attributable to the floodplain nature of the basin and extensive human interventions via the practice of tilling

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agricultural areas during the peak runoff season. Agricultural practices in the future might be negatively impacted by the study area's persistently high silt output rate, which is the result of factors such as intensive farming.

WATER QUALITY

Analysis findings (concentrations of physical and chemical parameters) of 6 ground water samples and 2 surface water samples have been given in Table 1 to understand the nature and scope of existing water quality of groundwater and surface water.

Table 1. Ground Water Quality Results

Parameter	Unit	Limit (Desirable) as per **IS** 10500	Village Khatkhati	Vill. Goutam **Baal**	Bdajan	VIII Hathighara	Vill. Sarthe Timung	Dimapur
Colour Hazen unit		5.0 hazen limit	< 5.00	< 5.00	<5.00	< 5.00	< 5,00	< 5.00
Odour ---		Unobjectionable ---		Unobjectionable				
Temp.			16.8	18.0	18.4	16.2	16.0	18,2
pH	---	6.5 - 8.5	7.24	6.72	7.16	6.42	7.24	6.86
Electrical Conductivity m-mhos/		-	0.13	0.26	0.08	0.12	0.20	0.18
Total Dissolved	mg/l.	500.00	82.6	170.8	50.6	72.0	146.2	126.4
Total hardness as	mg/1.	300.00	56.2	58.4	20.4	24.8	105.0	58.2
Calcium as CP^{-}	mg/l.	75.00	15.4	18.2	4.8	6.6	24.2	12.8
Magnesium as Mg	nig/1.	30.00	4.3	3.2	2,0	2.0	10.8	6.4
Total Alkalinity as	mg/l.	200.00	48.2	40.6	46.2	34.8		64.8
Chloride as C1	mg&	250.00	14.0	20.5	8.2	10.6		32.0
Sulphate as SO^{--}		200.00	5.4	8.6	2.0	3.8	8.2	5.8
Fluoride as F mg/l.		1.00	0.14	0.10	BDL	BDL	0.14	0 10
Sodium as Na	mg/l.		5.4	4.5	5.0	4.6	4.0	4.5
Potassium as **IC**$^{+}$	mg/1.	---	3.2	3.5	3.8	3.0	3.1	3.1
Boron as B'	mg/I.		BDL	BDL	BDL	BDL	BDL	BDL
Total Phosphate	mg/l.		BDL	BDL	BDL.	BDL	BDL	BDL
COD	mg/I.		BDL			BDL	BDL	BDL
Total Kjeldahl	mg/l.		BDL	BDL	BDL	BDL	BDL.	BDL
Sodium Absorption	%			0.26	0.48	iT40		

Flood Problem

Although flooding occurs across the Dhansiri basin, the issue is most severe downstream of the NI-I-37 bridge at Numaligarh. In 1954, 1955, 1959, 1960, 1970, 1976, 1986, 1987, 1989, 1991, 1998, 2014, 2018, and 2021, the basin saw major flooding. Dhansiri is mostly contained inside its source state of Nagaland and its destination state of Assam. The town of Dimapur is located on the river as it winds through the rugged Kohima region of Nagaland. In most cases, flooding happens when the river overflows its bank and lasts for little more

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than a few of days. Similar scenery may be seen all the way to Bokajan during its route in Assam. While the Brahmaputra persists at high levels, the flooding issue in the lower reach downstream of NH-37 worsens. The Assam regions of Sarupathar, Golaghat, Khoomtai, and Bokakhat have all been impacted by the Dhansiri river flood. Flooding in the basin is mostly caused by:

Heavy precipitation, with an annual monsoon average of 1158 mm.

Riverbanks that are very steep upstream.

Upper catchment deforestation and landslide susceptibility.

The river on the plain has a rather meandering course.

Erosion Problem

The basin is in a seismically active zone, which means frequent earthquakes and frequent floods in the hill catchments. This, together with extensive tree cutting in the hills' watershed, has led to severe erosion of the hill sides' soil.

METHODS

To determine outcomes, the research makes use of both primary and secondary data. Households in the research region fill out questionnaires to provide the main data. Secondary data and information is gathered from government institutions including the Brahmaputra Board and the Circle office.

RESULTS

Socio Economic Impact of Bank Erosion and Flood in the Study Area

- **Displacement:** One of the most devastating results of erosion and flooding is the destruction of dwellings, which leaves people less able to provide for themselves. Those who have been displaced sometimes migrate to adjacent communities in search of better economic opportunities, however migration to more distant locations is also prevalent. The most immediate effect of floods and erosion is displacement. Most survivors of the tragedy must depend on their own resources to rebuild their homes. Field research shows that residents of Mainapara's Rangdoi Chuk have relocated to Tenpur because of bank erosion.

- **Loss of Agricultural Land and Home:** The loss of crops and homes as a result of flood and erosion is common. Riverbank erosion has caused the loss of many acres of land in recent years. According to the findings, the agricultural potential of the area under investigation is low. In most cases, farmers are limited to growing just two or three crops every year. The lack of farmable land is mostly attributable to abnormal floods and the associated bank erosion. Table 3 shows that the Dhansiri river eroded away roughly 418 bighas of land in the Golaghat revenue circle between 2012 and 2021. Over a hundred individuals have been become landless and homeless as a result of the loss of very valuable land in the last decade. The loss will have a devastating effect on the community

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- **Psychological Effect:** There are several ways in which humans are impacted by flooding and erosion. River bank erosion and flooding have devastating socioeconomic implications, but they also have profound psychological repercussions. The financial and emotional costs of disasters are exacerbated by the loss of homes, properties, land, and sometimes lives.

- **Poor transport System:** As floods and erosion are common in the region, road infrastructure is lacking.

- **Problems in Education:** Primary and secondary education are available in almost every rural area. But, every year we see the same thing: schools being flooded and destroyed by erosion and other natural disasters. Due of these issues, the school system is hampered by things like class disruptions, a lack of basic facilities, etc.

Table 2: Detail effect of erosion caused by river Dhansiri in Golaghat revenue circle area since the year 2021

Year	Total Damage Area Eroded (area in bigha)	Families become homeless
2011	14	Nil
2012	44	10
2013	95	16
2014	115	33
2015	53	16
2016	07	Nil
2017	Nil	Nil
2018	08	Nil
2019	31	Nil
2020	43	02
2021	08	03
Total	418 bigha	80 nos

Table 3: Number of the flood affected villages in the flood plain of the Dhansiri basin.

Circle name	No. of flood affected villages
Khoomtai circle	17
Golaghat circle	27
Sorupathar circle	44
Bokakhat circle	25

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Table 4: Erosion affected areas under Golaghat revenue circle by the Dhansiri since 1995

SI. No	Name of the villages/towns
1	Salmora Mohorkhuti
2	Napamua
3	Dhansiripar
4	Hahsora
5	Da-Chamuah
6	Borpatharua
7	Kathkatia
8	Golaghat town

Medical Problems: As a result of the dangers, individuals choose to relocate to less sanitary areas, where there is a greater number of people crammed into a smaller space. Several different illnesses are spread by mosquitoes, and floods provide the perfect environment for them to multiply. Malaria, dengue fever, and other water-borne illnesses are rife among those whose homes have been eroded or flooded. And again, a region in need does not get sufficient medical aid. The effects of natural disasters might extend to hospitals at times.

Flood and Erosion Management in the Basin

Management practices pose a significant threat to the Dhansiri basin in Golaghat. The state government of Assam has implemented a variety of flood prevention and control measures, particularly in the river's middle and lower sections, where the Dhansiri is the primary source of flooding and erosion. The Government's Current Mitigation Efforts-

• Embankment construction on both banks of the Dhansiri to reduce flooding. Just 23.05 km of embankment in the Dhansiri sub basin have been built, 18 km of which are on the right bank and 5.05 km on the left.

The government has periodically implemented many anti-erosion measures to safeguard areas particularly vulnerable to the problem. Golaghat Township is included in the 9612 hac of land that has been safeguarded from erosion via a variety of methods.

Survival Strategies

As floods and erosion are both the result of natural processes, it is impossible to guarantee total safety from them. Locals may lessen the impact of floods and erosion by using numerous home approaches in addition to the structural precautions. The capacity of households to cope with flood and river erosion is influenced by factors such as education, income, and employment. Although natural disasters like floods and river erosion are tragic, local coping mechanisms may lessen victims' exposure to harm greatly without any outside intervention. People in the research area often use the following coping mechanisms: -

- Most homes had their basements raised above flood level.
- House relocation away from flood and erosion zones.
- Protective bamboo walls along the riverbanks to lessen erosion.

- Relocation of potentially damaged assets.
- Building a heightened platform equipped with standard public services.
- Using sustainable crops and using innovative planting schedules.
- Flood insurance practices.
- The creation of methods for managing watersheds and agricultural forests.
- The implementation of a flood warning system.
- Mass education.

CONCLUSION

This research analyzes the effects of river dynamics on land usage along two tributaries in the region. Thus, they need plans for their management to promote the area's long-term sustainable growth. Dangers, especially The Assam region known as Golghat is prone to flooding and erosion. People in the study area who have experienced repeated floods or erosion are looking for solutions to these challenges, which continue to impact a large percentage of the region's expanding population.

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