

Department of Geography
Shahid Matangini Hazra Government General Degree College for Women
Affiliated to Vidyasagar University
Chakshrikrishnapur, Kulberia, P.O.: Kulberia, Dist: Purba Medinipur, PIN: 721649

GEOGRAPHY PROJECT REPORT
2022-23

Introduction: Geography is both a spatial and temporal science and it studies the bond between nature and environment, its distribution over space and evolution through time. Thus, geographers have taken a major role in assessing natural disasters like flood, cyclone, droughts and its impact in the society. Later the aspects of man-made disasters or social disasters like poverty, crime, social inequality are included giving the dynamicity to the discipline. The management approaches have also undergone modifications based on perceptions over time like it has changed from the disaster reduction to disaster preparedness when it was understood that natural disasters are unavoidable. Undoubtedly, more concerns with the intersection of socio-economic, physical and technological and political/legal systems and more sharing areas of interest, knowledge and methods with many other fields of study, will make geography more powerful in the aspects of disaster prevention and management.

Curriculum: U.G. B.Sc. 6th Semester Geography CBCS Honours (Paper C14P- Project Report on Disaster Management) under Vidyasagar University

Title of the Report: 'River Overflow Flood in the Tamluk Municipality during the Yaas Cyclone of May, 2021'

Place Visited: Tamluk Municipality, Purba Medinipur District, West Bengal

Field Duration: 08-05-23 to 10-05-23

No. of Student Participant: 36 (Thirty Six)

Supervisor: Nabendu Sekhar Kar, Assistant Professor of Geography

Objectives:

- a. To find out the geomorphic cause of the flood vulnerability of the riverbank of Tamluk Municipality
- b. Assess the flood risk and measure the hazard vulnerability.
- c. Evaluate the existing flood management in the Yaas cyclone induced overtopped flood affected areas.

Findings:

Tamluk town, located at the banks of Rupnarayan River, protected by river bank embankments is always at flood risk, especially during cyclones as this mighty river is tidally active. Cyclone Yaas, which made its landfall on 26th May 2021 at Balasore, Orissa, affected the Purba Medinipur coast also. The surge flooded different parts of the town. Upon inspection it is found that immature reclamation of newly accreted alternate river bars along the river is primary responsible for the flood risk. Although, the vulnerability is comparatively low as Tamluk is a prosperous town; residents are well-off and resilient. The accretion of new lands is still continuing along the river bank. If further reclamations were restricted, the flood risk should decrease as the bank will be elevated by natural processes.



GOVERNMENT OF WEST BENGAL
DEPARTMENT OF GEOGRAPHY

SHAHID MATANGINI HAZRA GOVT. GENERAL DEGREE COLLEGE FOR WOMEN

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REF. NO. xxx

DATE: 17.07.23

TO WHOM IT MAY RELATE

This is to certify that the students below prepared a project report on "River Overflow Flood in the Tamluk Municipality during the Yaas Cyclone of May, 2021: A Case Study" under my supervision for the partial fulfilment of B.Sc. 6th Semester Honours Examination 2023, under Vidyasagar University.

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16.	MARUFA NASRIN	1125142-200030	1420290
17.	MONISHA GHORAI	1125142-200031	1420292
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26.	SANGHAMITRA HAIT	1125142-200044	1420315
27.	SHRABANI SAMANTA	1125142-200046	1420318
28.	SHREYA DE	1125142-200047	1420319
29.	SIULI MANNA	1125142-200048	1420322
30.	SRILEKHA PARIA	1125142-200050	1420324
31.	SUCHISMITA DHARA	1124142-200051	1420325
32.	SUJATA KANDAR	1125142-200053	1420327
33.	TANAYA MAITY	1125142-200054	1420333
34.	TANUJA PATTANAYAK	1125142-200055	1420334
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**River Overflow Flood in the Tangalok Municipality
during the Yaas Cyclone of May, 2011**
A Case Study



Disaster Management based Project Work

Submitted by

Roll No. 1126142 / 200055

Registration No. with Year / 410534 / 2020-2021



6th Semester Geography CBCS Honours Examination

2023

Paper: CH-1

SAHID MAJUMDAR MEMORIAL GOVERNMENT GENERAL
DEGREE COLLEGE FOR WOMEN

Vidyasagar University

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Government of West Bengal
Department of Geography
Shahid Matangini Hazra Government College for Women
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17.	SUJATA KANDAR	1126142-200053	1420327
18.	TANUJA PATTANAYAK	1126142-200055	1420334
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Handwritten signatures and stamps:
A large circular stamp of the Department of Geography, Shahid Matangini Hazra Government College for Women, Purba Medinipur, West Bengal. The stamp contains the text: "DEPARTMENT OF GEOGRAPHY, SHAHID MATANGINI HAZRA GOVT. COLLEGE FOR WOMEN, PURBA MEDINIPUR, WEST BENGAL, PIN-721649".
Handwritten signatures: "Sankar Kar" and "Sankar Kar".
Handwritten text: "Assistant Professor, Department of Geography".

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ACKNOWLEDGEMENTS

I wish to express my deep sense of gratitude to Dr. Ina Dhan Roy Durgupta, Assistant Professor & HOD, Department of Geography, Shahid Matangi-ni Hazra Government General Degree College for Women, for the valuable counselling and active encouragement to prepare this project report on "River overflow flood in the Tamruk Municipality during the Yaas cyclone of May, 2021: A case study".

I would also like to record my indebtedness to Mr. Nabendu Sekhar Kar, Assistant Professor of the same department and supervisor of this project work, for his valuable advice that helped me to overcome various difficulties during field work and post field analysis.

I am also obliged to the following towards the completion of this report:

Sri Dipendra Narayan Roy, chairperson, BOA, Tamralipta Municipality and officials of the municipality for their great help in data collection.

Residents of Tamluk Municipality for their active participation and co-operation during data collection.

Last but not the least I acknowledge my heartfelt thanks to all my friends and well-wishers who are too numerous to mention individually for cooperation of various kinds in the different stages of the preparation of this report.

Tanuja Pattanayak
Signature of the student

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River Overflow Flood In The Tamluk
Municipality during the Yaas Cyclone
of May, 2021

A case study

Prologue

Present report is concerned the study of "River Overflow Flood in the Tamruk Municipality during the Yaas Cyclone of May, 2021".

Section 1: Introduction

Tropical cyclones are warm core Vortex circulation of tropical origin with a small diameter of some hundreds of km, often an approximately circular shape, minimum surface pressure (< 900 mb) with sustained minimum winds of at least 33 sec^{-1} and torrential rain accomplished by thunderstorms. While tropical cyclones can produce extremely powerful winds and torrential rain, they are also able to produce high waves and damaging storm surge as well as spawning tornadoes. Since thunderstorms accompany cyclones, and these storms can strike inland areas long before the cyclone arrives, water draining from the land in streams and estuaries may be impeded by the storm surge that has pushed water up the streams and estuaries.

Purba Medinipur district of West Bengal due to its coastal location, is one of the fourteen most cyclone-prone districts in the country (Rehman et. al., 2020). Purba Medinipur

district faces a total of 22 cyclones including 12 severe cyclones so far during period 1891-2017 (IMD 2021).

Very severe cyclonic storm (VSCS) Yaas was formed over east central Bay of Bengal on 22nd May, 2021 morning (0830 h. IST) as a depression (D) and gradually intensified to deep depression (DD) and further intensified as it turned northeast, becoming a cyclonic storm (CS) on 24th May, 2021 at 00:00 IST with a central pressure of 990 hpa and a wind speed of 35 KT at 16.4°N and 89.6°E . Therefore, it had strengthened into severe cyclonic storm (SCS) by 24th May, 2021 at 18:00 IST that lasted for 12 h and had winds of 48-63 KT, until it reached very severe cyclonic storm. Accordingly, around 12:00 IST on May 25, 2021, the cyclone transitioned into VSCS at 19.5°N and 87.8°E , taking a strong north-eastern route and moving steadily landward with a wind speed of 64-89 KT. Finally, made its landfall at about 20 km to the south of Balasore over north Odisha coast at 21.35°N and 86.95°E , with a maximum sustained wind speed of 130-140 kmph gusting to 155 kmph between 10:30 & 11:30 h IST, of 26th May, 2021 before weakening to a depression over central Jharkh-

-and around 11:30 IST on the 27th of May, 2021. Therefore, it is clear that about 700 km out of the 1005 km trajectory of cyclone Yaas passed through the Bay of Bengal until it was depleted, accumulated energy, and devastatingly impacted the north. coastal districts of Odisha and the adjoining districts of West Bengal such as Purba Medinipur, South 24 Parganas and North 24 Parganas districts.

Yaas caused flood inundation of 5% (239.69 km²) of the land of Purba Medinipur (Khatun et al., 2022). In the northern part of the district Kolaghat and Tamruk divisions sustained the greatest damage, especially those areas located along the mighty Rupnarayan River. Located along the Rupnarayan, the age-old settlement of Tamruk Municipality also witnessed floods in its various parts both on the riverbank wards and inward wards. But the embankment overtop flooding along the Rupnarayan was far more severe. As seen in the records this part of the municipality is always vulnerable to this kind of cyclonic storm surge flood. Mighty floods occurred in past as in 1942 and 1948. The 1942 flood caused such a havoc that it

caused lives of about 50,000 persons in and around Tamluk. Even, in the recent past in 2007 and 2020, such overtopping in a small scale happened. In this context this study aims to:

- i. Find out the geomorphic cause of the flood vulnerability of the river bank of Tamluk Municipality.
- ii. Assess the flood risk and measure the hazard vulnerability.
- iii. Evaluate the existing flood management in the Yaas-induced overtopped flood affected areas.

Section 2: Location of the Study area

Purba Medinipur is one of the twenty three (23 in 2023) administrative districts of West Bengal mostly associated with the ancient port city Tamralipta or Tamralipti. It is true to say that in pre-historic and historic period the sea-town Tamralipta was an important centre. It is probably the oldest Bengal town to which we find references in several sources i.e. both in archaeological as well as indigenous and foreign accounts.

District Purba Medinipur has 4 (four) sub-division, viz. Tamluk, Haldia, Egna and Contai sub-division. There are 5 (five) Municipalities in the district namely Tamluk, Panskura, Haldia, Egna and Contai. Among these the Tamluk Municipality was the oldest one and presently serves as district headquarter. It was established in 1864. Tamluk town is located on the bank of river Rupnarayan about 85 km. from Kolkata and about 50 km. from Haldia connected with Railway and Roadway communication through S.E. Railways and N.H.-

116. Total area of the town about 15.67 km². As in 2023 it consists of twenty (20) wards with a total population of 65306 persons (2011) and population density of 8058 persons/km². Changes in the demographic parameters for the last three decades are shown by the graphs here-with.

Table: Ward-wise distribution of population of Tamluk Municipality, 2011.

Ward No.	Total Population (2011)	Area (sq km)	Population Density (2011)
1	3344	2.22	1509
2	2363	1.05	2252
3	3184	1.65	1933
4	4055	0.73	5540
5	2974	0.29	10101
6	2680	0.37	7334
7	1600	0.10	15972
8	2664	0.20	13616
9	3476	0.20	17273
10	2025	0.40	5011
11	2816	0.48	5888
12	4243	0.26	16147
13	2264	0.08	27019
14	3722	0.99	3775
15	3547	0.55	6495
16	3105	0.48	6464
17	4303	0.62	6976
18	4986	1.57	3168
19	4415	2.01	2193
20	3540	1.42	2486
Total	65306	15.67	8058

LOCATION MAP OF THE STUDY AREA

INDIA



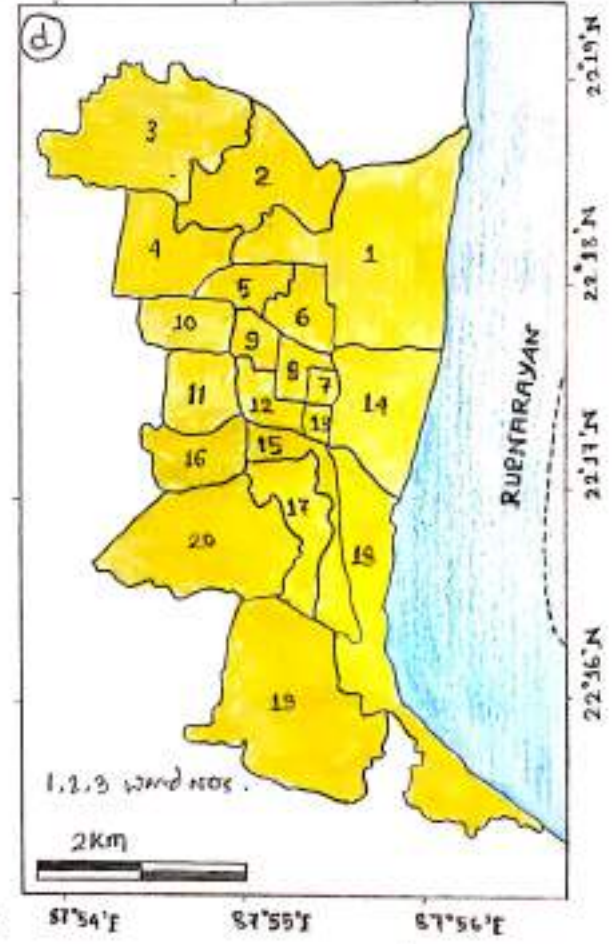
PURBA MEDINIPUR DISTRICT



WEST BENGAL



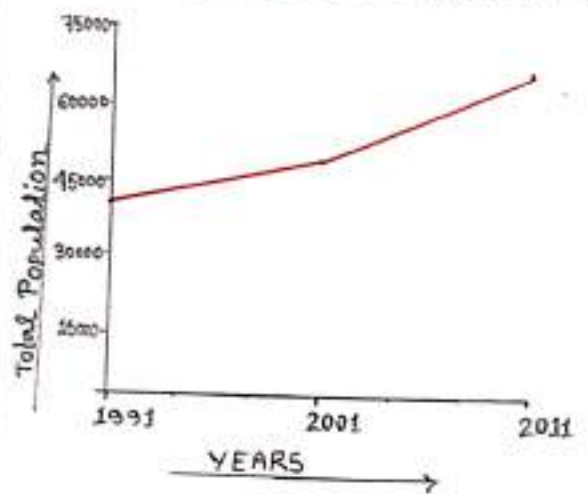
TAMLUK MUNICIPALITY



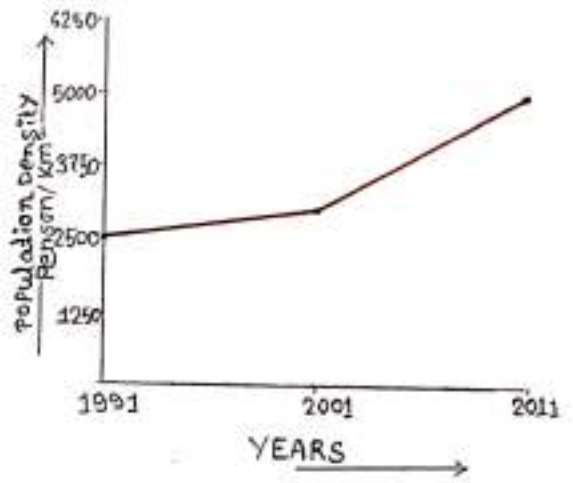
N. Saha
14/04/23

DECADAL CHANGES IN DEMOGRAPHIC PARAMETERS TAMLUK MUNICIPALITY 1991-2011

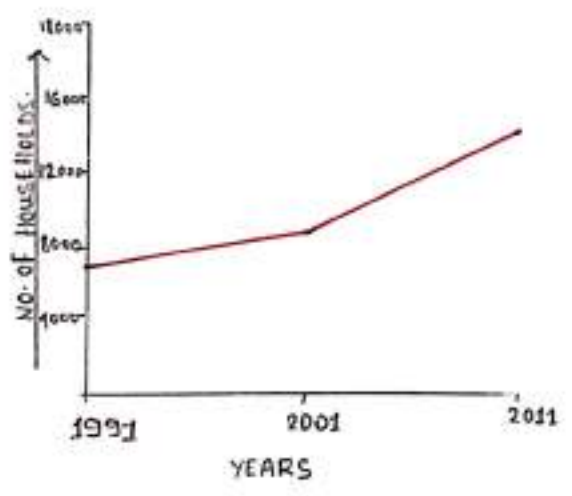
TOTAL POPULATION



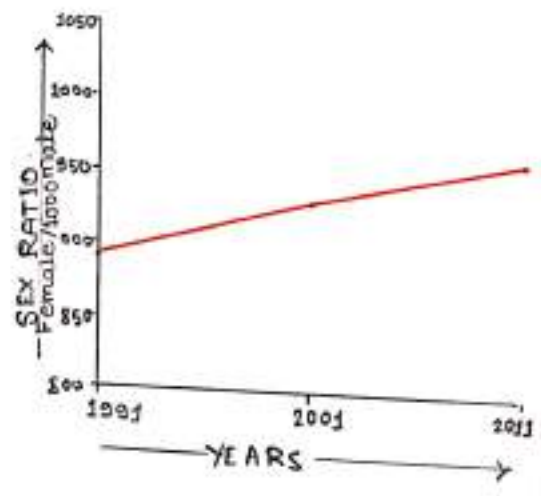
POPULATION DENSITY



NO. OF HOUSEHOLDS



SEX RATIO



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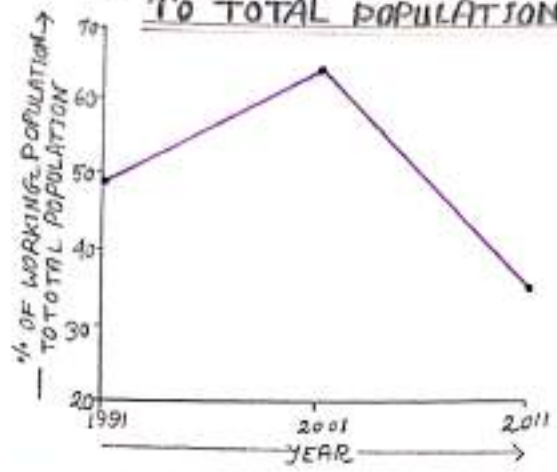
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DECADAL CHANGES IN WORKING POPULATION

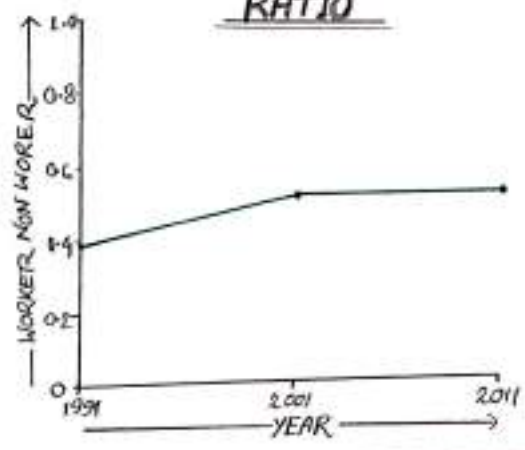
JAMLUK MUNICIPALITY

1991 - 2011

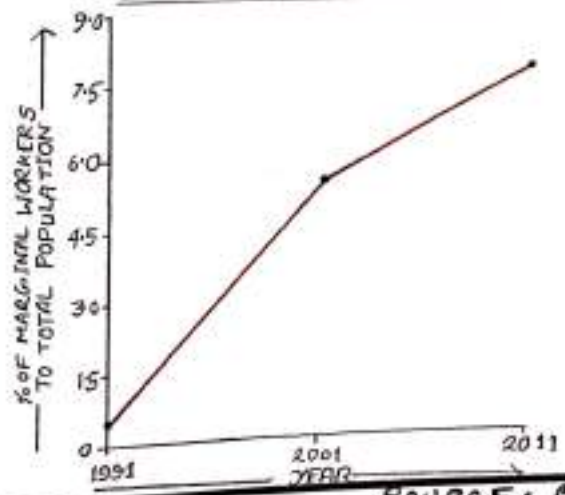
% OF WORKING POPULATION TO TOTAL POPULATION



WORKER NON-WORKER RATIO



% OF MARGINAL WORKERS TO TOTAL POPULATION



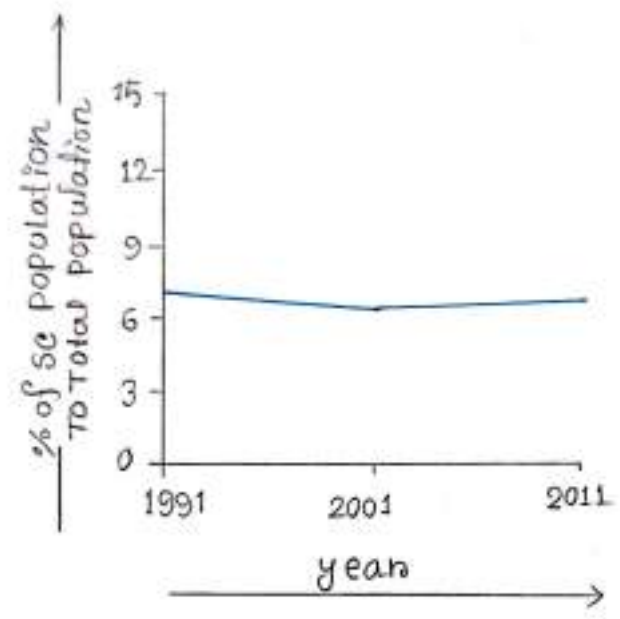
✓ Seal 14/02/23

SOURCE: CENSUS OF INDIA

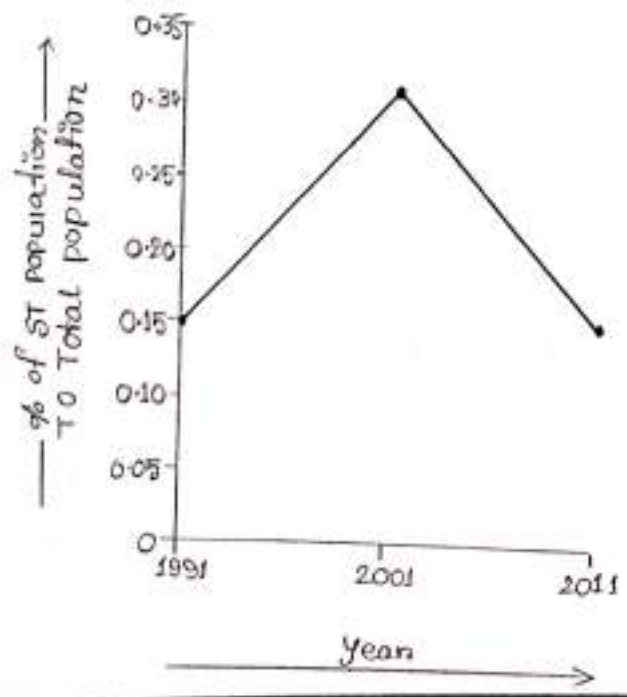
DECADAL CHANGES IN S.C & S.T. POPULATION CONCENTRATION TAMLUK MUNICIPALITY

1991 - 2011

PERCENT OF S.C POPULATION TO TOTAL POPULATION



PERCENT OF S.T. POPULATION TO TOTAL POPULATION



N. S. Das
14/06/23

SOURCE: CENSUS OF INDIA

Section 3: Data and methods ~~methods~~

3.1 Flood inundation analysis

For flood inundation analysis first several maps and images of the study area were collected such as SOI topomaps of 1931-32 and 1969-70 and Landsat-8 and Radar images of 26-29 May 2021. The municipal ward map was collected from Tamluk Municipality. First the ward map is georeferenced and connected to UTM Projection WGS 84 datum and a ward Vector was prepared. Then, with the help of the Vector study area or area of interest (AOI) was extracted by subsetting the collected base maps and images. From the SAR (RADAR) data flooded area was identified and a flood inundation Vector was extracted. Then the ward vector and the inundation Vector was overlaid to flooding four elevation profiles across the municipality were extracted using Google Earth. To trace historical evidences of evolution of Rupnarayan river bank along Tamluk Municipality inch and metric SOI toposheets were compared with 2023 L8 OLI image. The exercises were done using SNAP and QGIS software.

3.2 Risk and Vulnerability assessment

From flood inundation analysis and Google Earth data on selected parameters for flood risk assessment of the wards of the municipality were extracted. Here the selected parameters were ward-wise % wise % of inundated area, centroid distance from riverbank, and average elevation of the ward. A flood risk assessment map was prepared by standardising the data using Z-Score.

By multiplying flood risk score and Social Vulnerability score a composite vulnerability score was computed for the wards of the Tamluk Municipality.

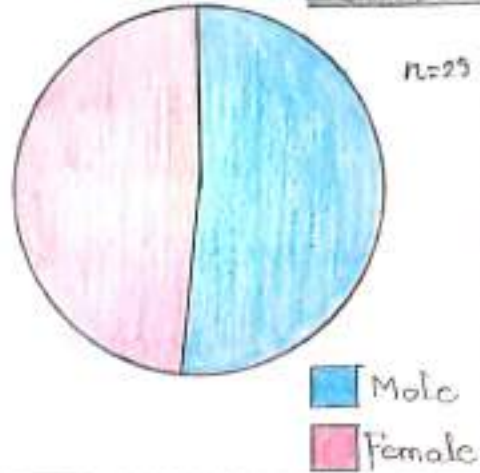
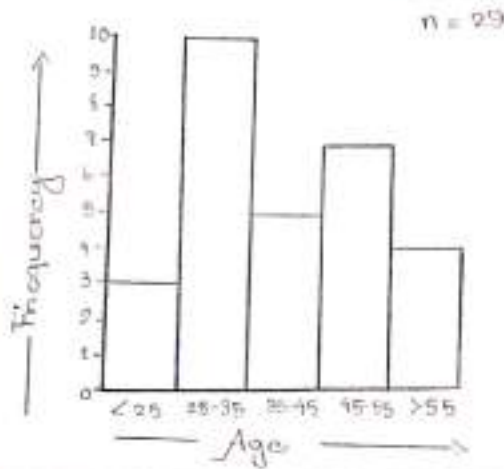
3.3 Yaas inundation: impact & management

For collecting information on impact of Yaas induced flooding a reconnaissance survey or reconnaissance survey was done on 28 Feb 2023 in the flood affected wards of Tamluk Municipality, identified through image analysis. Extensive oral interviews were conducted in the rivers bank wards. On the same

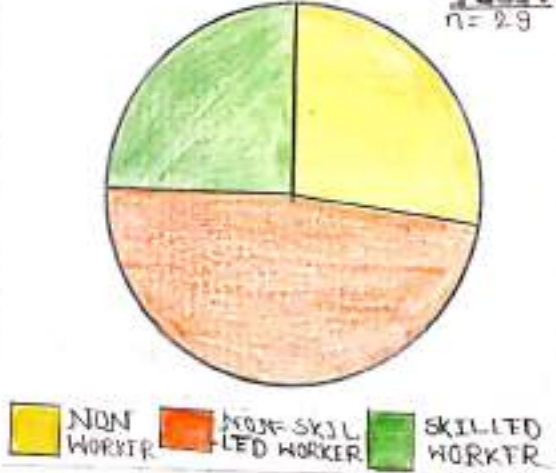
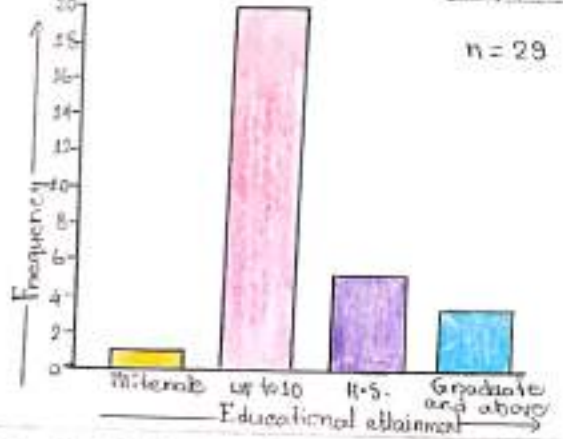
day the Municipal office was visited to collect Secondary information on flood management infrastructure and works done during Yaas inundation. Based on the need a structured questionnaire was prepared (see appendix) and on 22 May 2023 primary household Survey was conducted with the questionnaire in the most flood affected river bank Wards (Ward no. 01, 14 & 18) of the municipality. From wards 01 and 18, 10 households each and from ward 14, nine (09) flood affected households ($n=29$) were surveyed using purposive sampling method: (i) the respondents of the survey are mostly in the age group of 25-55; (ii) almost 50% respondents are female; (iii) the respondents of the survey are mostly attained Secondary education; (iv) the average family size of the households is 4; (v) 90% of the respondents' family income is below Rs. 25,000/month. The results were analysed and several graphs were prepared thereafter.

RESPONDENTS' DETAILS

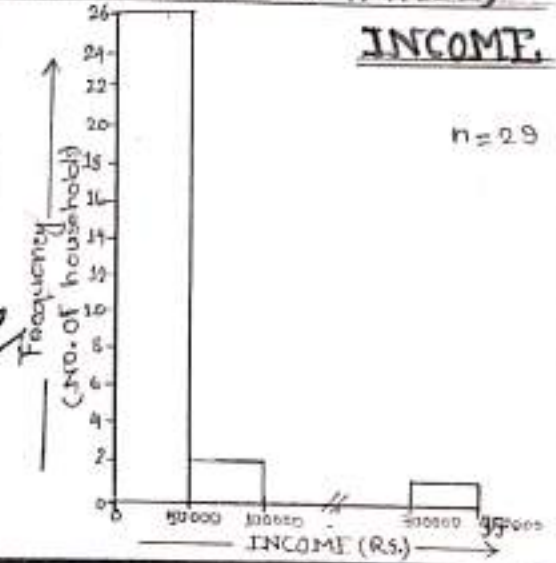
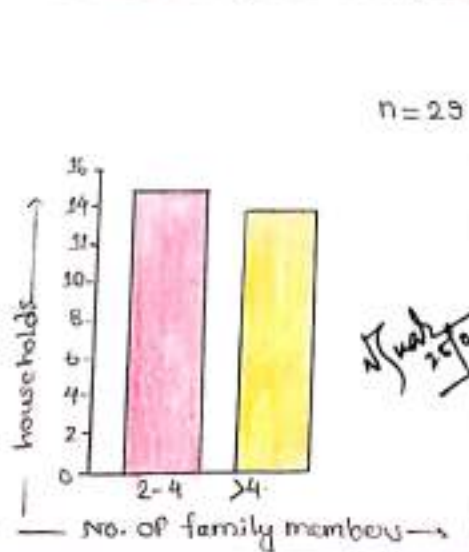
AGE-WISE DISTRIBUTION GENDER-WISE DISTRIBUTION



EDUCATIONAL ATTAINMENT OCCUPATIONAL DISTRIBUTION



NO. OF FAMILY MEMBERS AVERAGE MONTHLY FAMILY INCOME



Section 4: Findings

4.1 Flood inundation analysis

Flood inundation analysis shows that the 01, 03, 14, 18 and 19 number wards are mostly affected by the Yaas inundation while urban flooding was experienced in wards 06 and 17. Ground truth verification and information acquired from the municipality confirmed the fact. But two types of flooding were identified: Rivers overtopping flood in wards 01, 14 & 18 and pluvial (rain-induced) flood in wards 03 and 19.

For wards 03 and 19 the general elevation is comparatively lower as these wards are included under the municipality recently (2001) and mostly covered with agricultural lowlands. However the situation of ward no. 19 was comparatively worse as flood water reached the households and 125 persons were shifted to nearby relief camp. However the damages were less and recovery was faster compared to the rivers bank blocks.

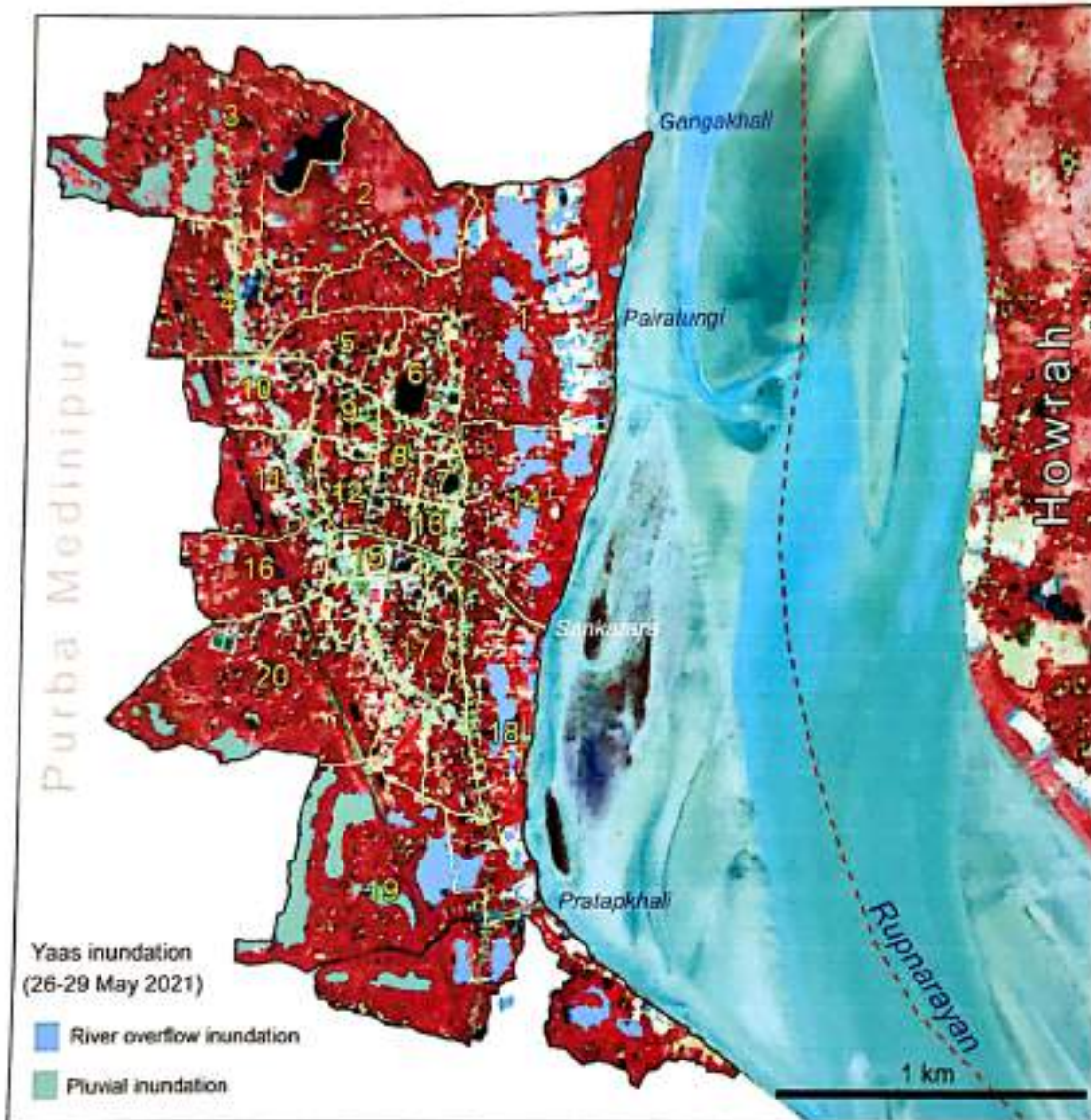
Table: Relief camp details during Yaas inundation, 2021 in Tamluk Municipality (Source: Tamluk Municipal office)

Ward NO.	Relief shelter	Persons accommodated
01	Abasbani Primary School	250
14	U.C. Sankarara Primary school	400
18	Rammohon SSP.	55
18	D.C. Sankarara Primary School	390
19	Kapasbaria Primary School	125
	Total	1220

The most damaging inundation were seen in the riverbank wards of 01, 14 and 18 as these blocks were affected both by excessive rain and river overtopping. The lower part of Rupnarayan, along which the municipality is located, is estuarine in character with active tidal flow. Here the river is 3 km wide on an average, very dynamic and accommodates huge amount of discharge throughout the year. With the Yaas-induced storm surge the embankments got overtopped and the water got stuck for days. As the historical evidences are showing these three rivers

bank wards were reclaimed from a river bar know as coronation char, while the lower part of the municipality comprised of ward 18 is facing active erosion. The elevation profiles drawn across shows that most parts of these wards are 3-4 m below the central part of the town explaining the long term inundation of these three wards.

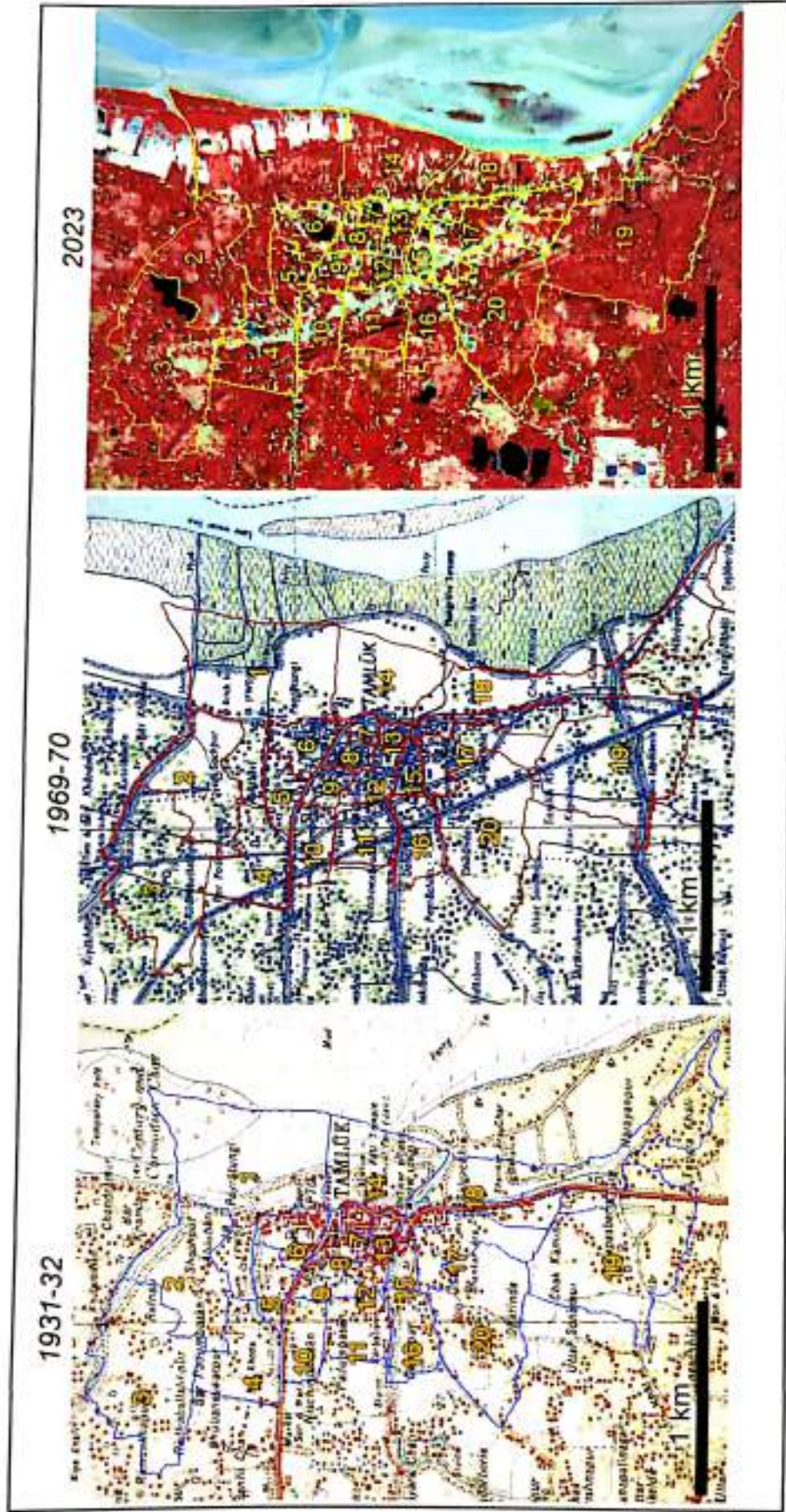
YAAS INUNDATION IN TAMLUK MUNICIPALITY May 26–29, 2021



N. Sual
14/06/23

CHANGE IN THE RIVERBANK OF THE RUPNARAYAN RIVER ALONG THE TAMLUK MUNICIPALITY

1931-32 – 2023



Swachh 14/06/23



JS
14/06/23

Cross Profile 3



Graph Min. Avg. Max. Elevation: 25.5m - 29.6m
 Range Total Distance: 3.17 km - Elevation: 25.5m - 29.6m - Max. Slope: 5.6% - 3.8% - Avg. Slope: 1.9% - 1.7%



Cross Profile 4



Graph Min. Avg. Max. Elevation: 14.3m - 16.1m
 Range Total Distance: 2.35 km - Elevation: 14.3m - 16.1m - Max. Slope: 3.9% - 3.1% - Avg. Slope: 1.2% - 1.1%



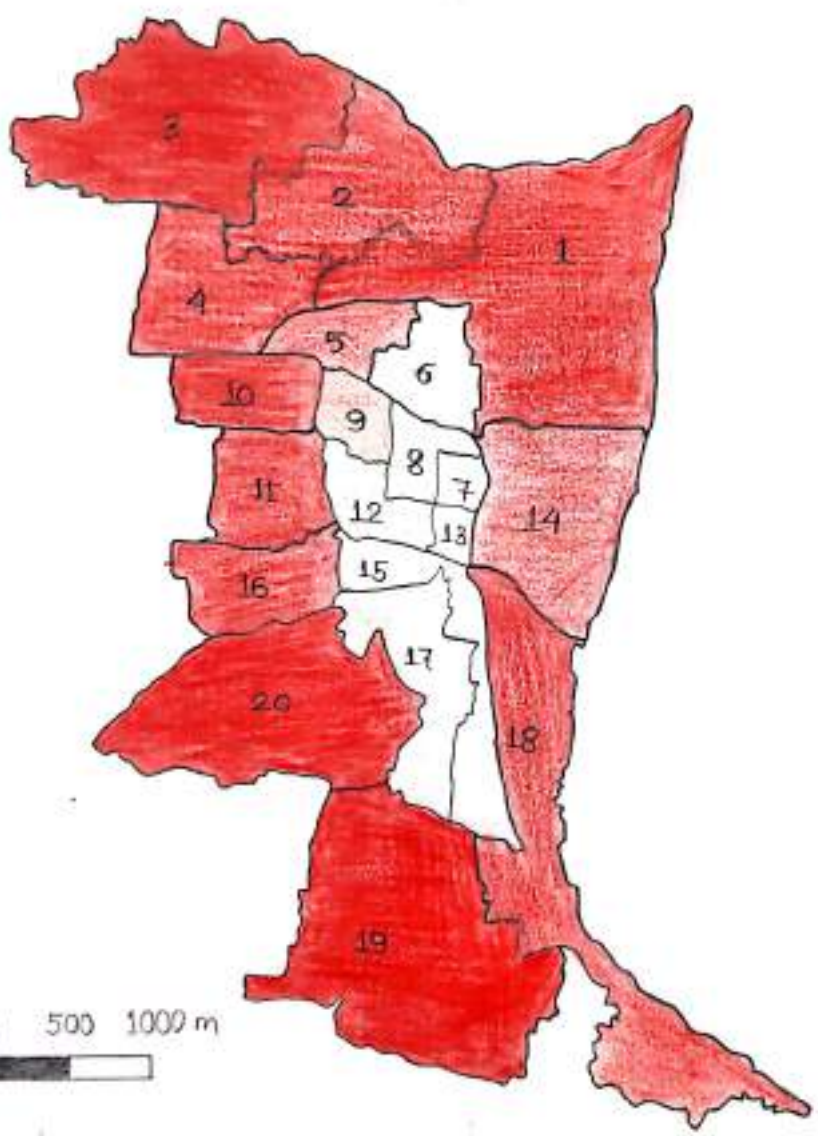
NTS
 14/16/23

4.2 Risk and Vulnerability assessment

Flood risk assessment analysis shows that apart from the older central part of the town the outer wards both along the riverbank and on the western margin are at risk because of the lower elevation and slopes. Wards 03, 19, and 20 are mostly susceptible to pluvial floods while wards 01, 14, and 18 are at risk of both pluvial and overtopping or embankment breaching flood. With the current rate of sea level rise the river bank wards are also under the threat of future overtopping and inundation.

The social vulnerability analysis shows that wards 04, 12, 15, 20, and 18 are vulnerable considering the demographic parameters taken in this study. The composite score shows that the western wards are more vulnerable due to high risk of pluvial flooding, high population density and social backwardness while in case of river margin wards, due to their low population densities they are showing moderate to high vulnerabilities. From this analysis it is observed that the ward no. 18 is at risk of pluvial flood, overtopping and bank erosion along with a high population density.

FLOOD RISK ANALYSIS SCORE TAMLUK MUNICIPALITY



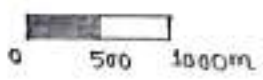
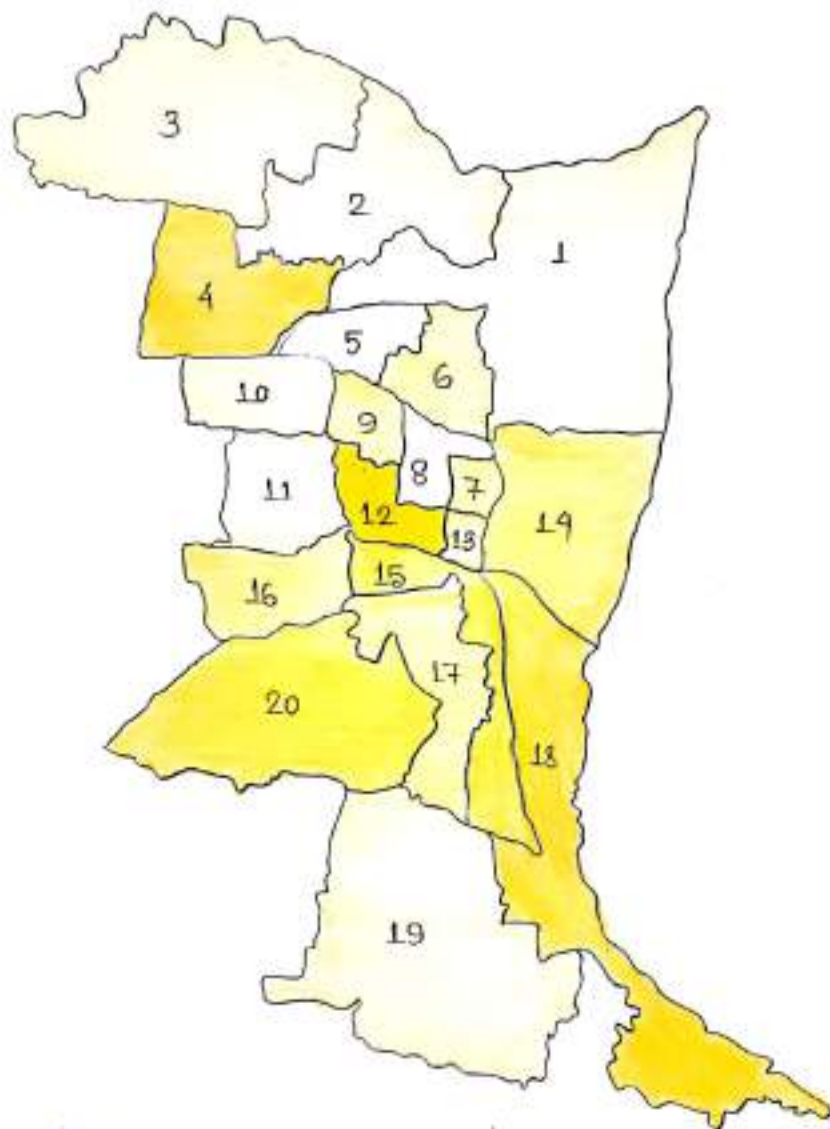
0 500 1000 m

N. Saha
28/06/20

1, 2, 3..... Ward Nos.

INDEX	
	Very high (16-20)
	High (12-14)
	Moderate (10-11)
	Low (7-9)
	Very low (<7)

SOCIAL VULNERABILITY SCORE TAMLUK MUNICIPALITY

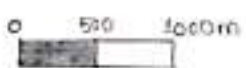
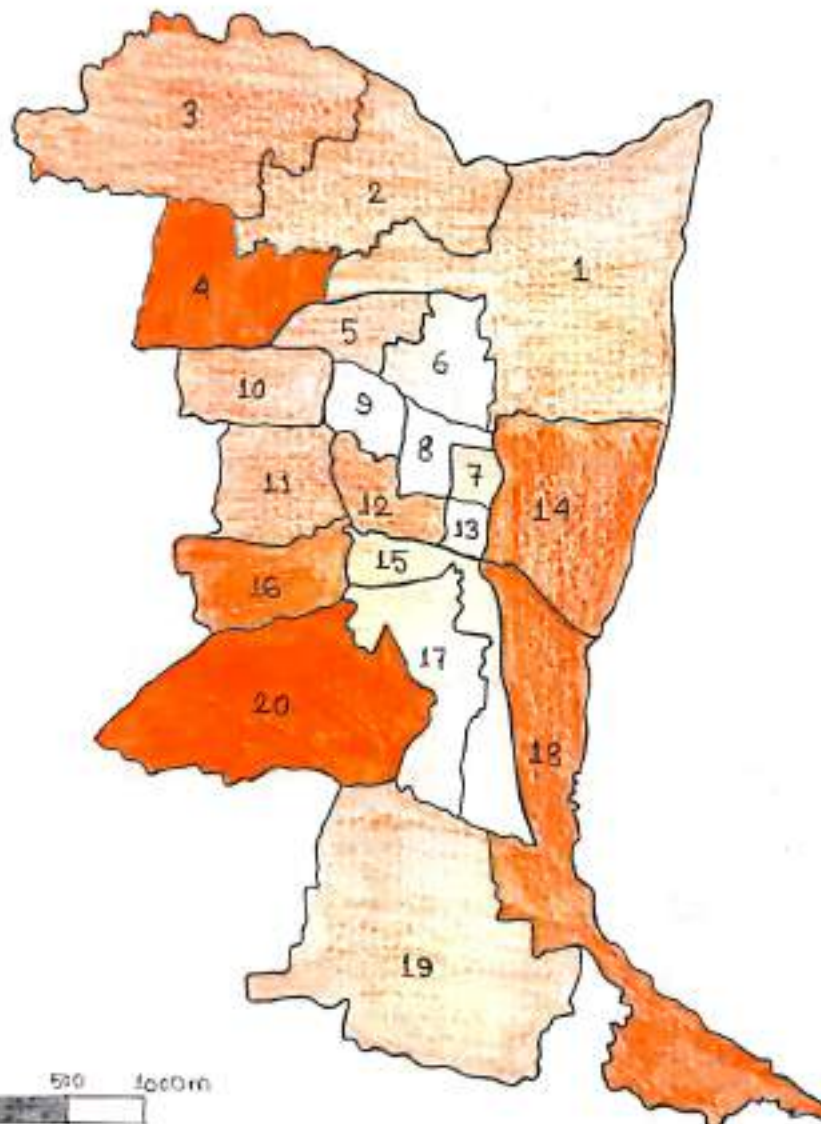


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INDEX SOCIAL VULNERABILITY	
	Very High (>15)
	High (13-15)
	Moderate (11-13)
	Low (9-11)
	Very Low (<9)

1, 2, 3.....Ward Nos.

COMPOSITE VULNERABILITY SCORE TAMLUK MUNICIPALITY



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INDEX	
	Very High (>170)
	High (130-170)
	Moderate (90-130)
	Low (50-90)
	Very low (<50)

1, 2, 3.....Ward Nos.

4.3 Yaas inundation: impact & management

Tamluk received plenty rainfall from the day before of the landfall of the Yaas on 26 May 2021. The surge water started to overtop the embankments at about 12:30 am and devastated anything in its path. The Kaccha houses and the ground floors were inundated completely. At its peak the flood water reached a height of ~ 3 m.

As forecast reached beforehand the Municipality was well prepared with 22 relief camps scattered in all of the wards of the town. The major damages was obviously greater in the river bank wards. Primary Survey in these three wards ($n=29$) brings out the below findings.

- (i) The buildings are mostly 10-20 years old, with an average area of 500 sqm. Most of the residents are living here for 20-30 years and experienced overtop floods frequently in monsoons. The average plinth level is 50% of the building comes under the total valuation and replacement valuation of 1 lac, mostly of mixed structure with thatched roofs and only having the ground floor.

(ii) The surveyed households are located within 800m from the river bank and was under water for almost 15 days. In most cases the long term average inundation level was 1 m. In the affected areas electric and water supply was disrupted for 3 days on an average.

(iii) The total damages account for Rs. 4000/- to 12,000/- for the most households while cleaning cost reached to Rs. 1500/- or more. Damages were done mostly by the first waves of overtop flow.

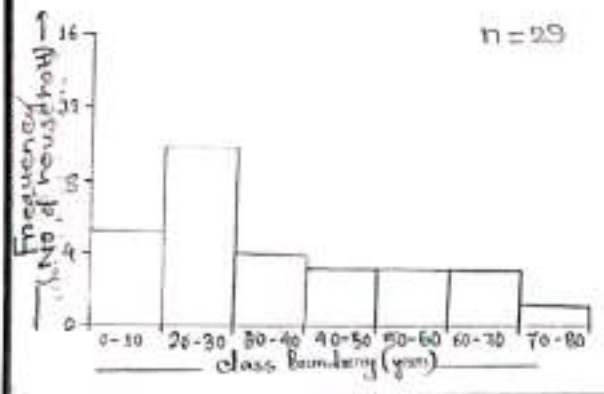
(iv) There is definite relation between family income and damage cost. The damages are more for the rich having various electronic gadgets, cars, motorbikes placed on garage or ground floor while low-income people lost mostly of their everyday belongings.

(v) 40% of the surveyed residents heard Siren alert while 60% was on the river bank or outside during overtopping. The overtopped flood water reached their households within 15 minutes. 50% of the surveyed residents having only ground

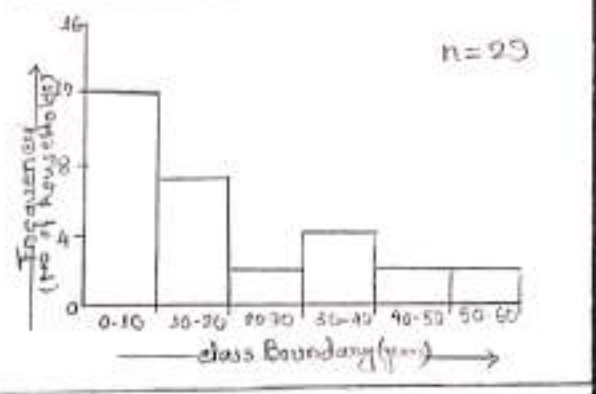
floods on mix-material house were shifted to nearby relief camps or any safe place within 5 hours. As flood occurs quite often and the average income is comparatively high compared to the rural areas they have some emergency savings. Some of them insured their lives and somewhat aware that the rivers also need its space and they are living very near to the river. So more than 50% accepts flood, as long as the duration is less and less devastating.

BUILDING DETAILS

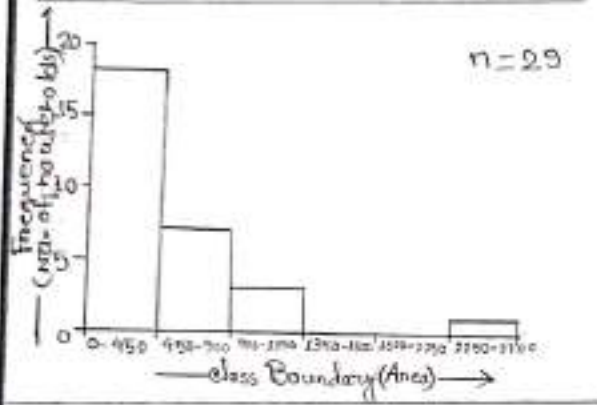
DURATION OF LIVING



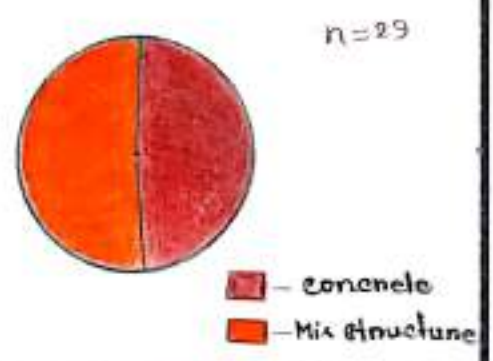
DURATION OF BUILDING



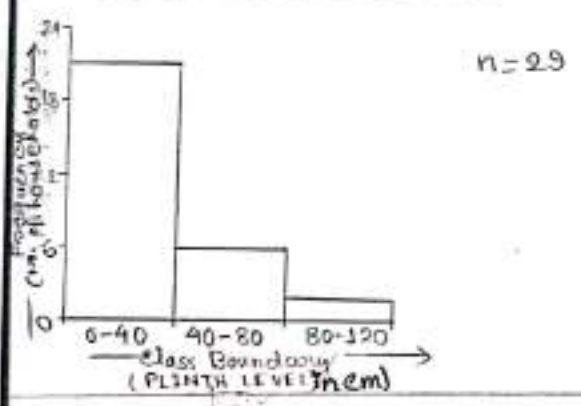
BUILDING AREA (sq. meter)



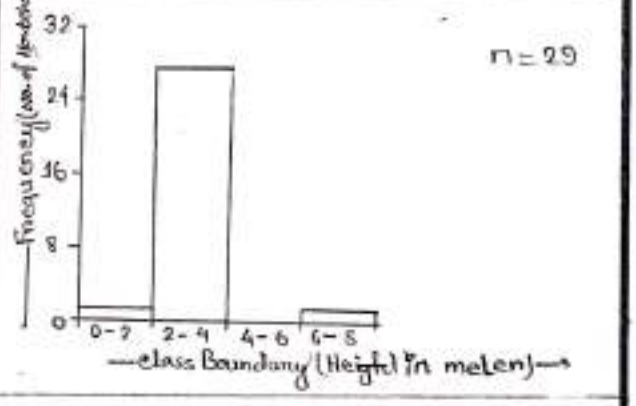
BUILDING TYPE



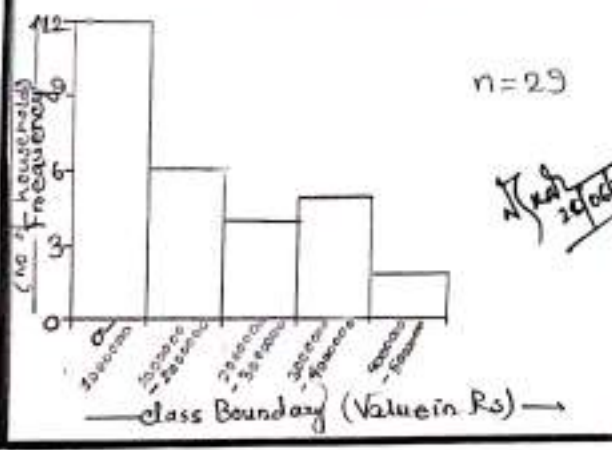
PLINTH LEVEL



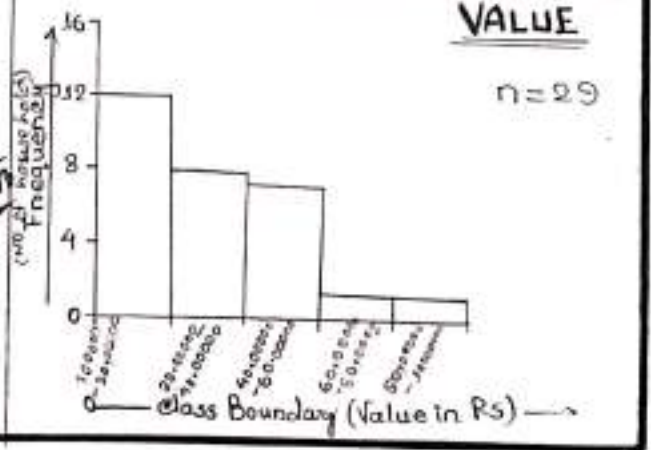
HEIGHT OF THE GROUND FLOOR



BUILDING VALUE (RS)



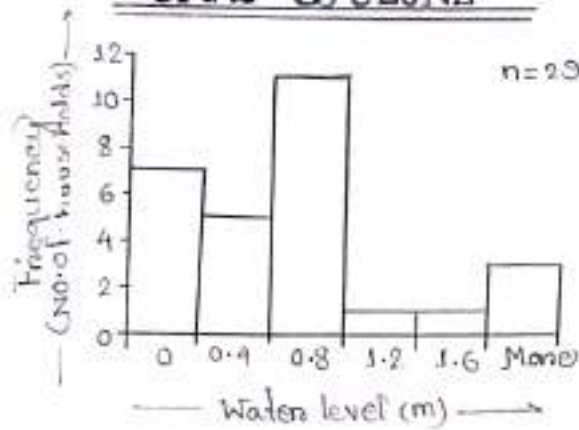
BUILDING REPLACEMENT VALUE



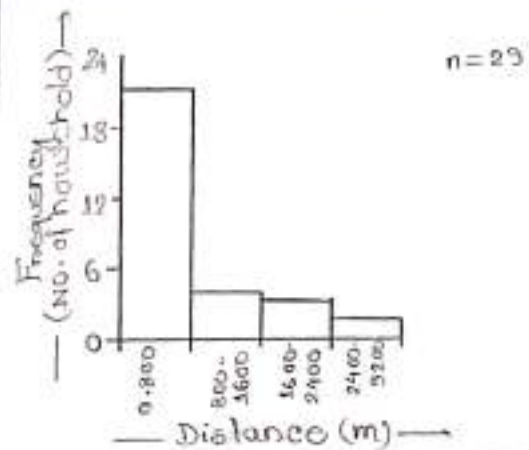
NATURE OF RIVER OVERFLOW FLOOD

MAXIMUM WATER LEVEL (2021)

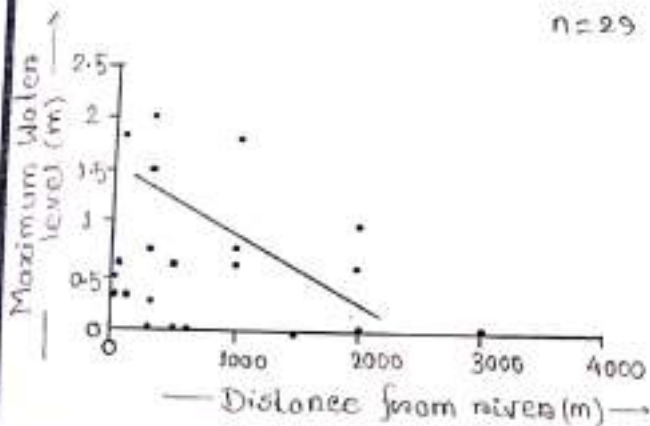
YAAS CYCLONE



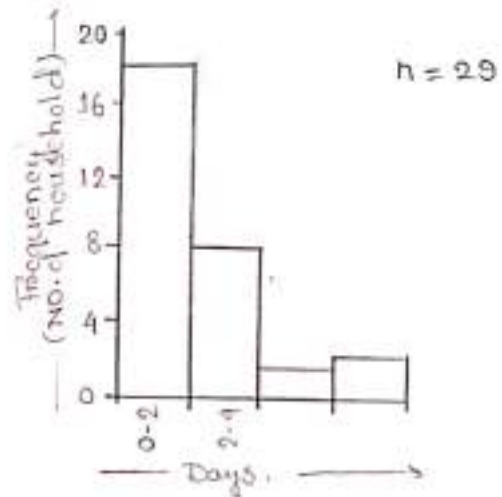
DISTANCE FROM RIVER



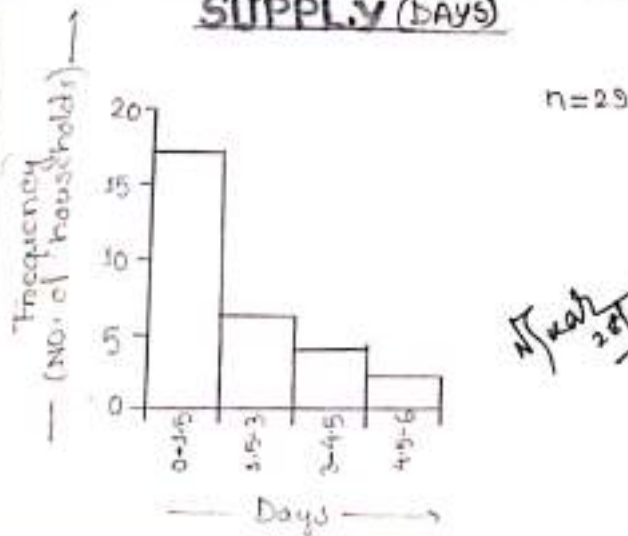
RELATION BETWEEN DISTANCE FROM RIVER AND MAXIMUM WATER LEVEL



INUNDATION DURATION (NO. OF DAYS)

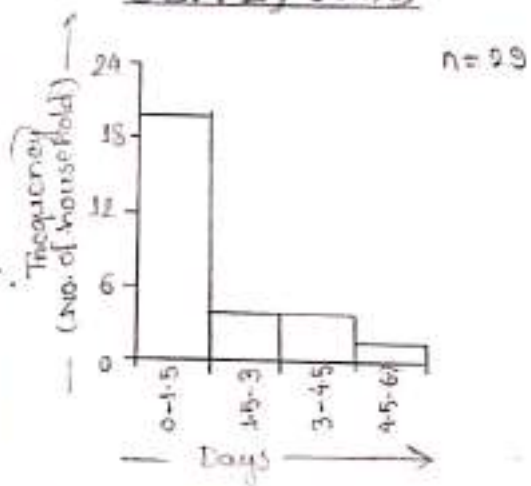


DISRUPTION OF ELECTRIC SUPPLY (DAYS)



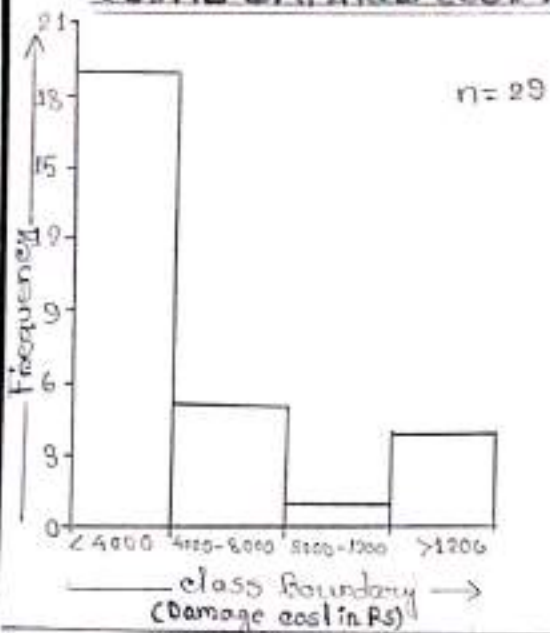
Handwritten note: $\sqrt{29} = 5.38$

DISRUPTION OF WATER SUPPLY (DAYS)

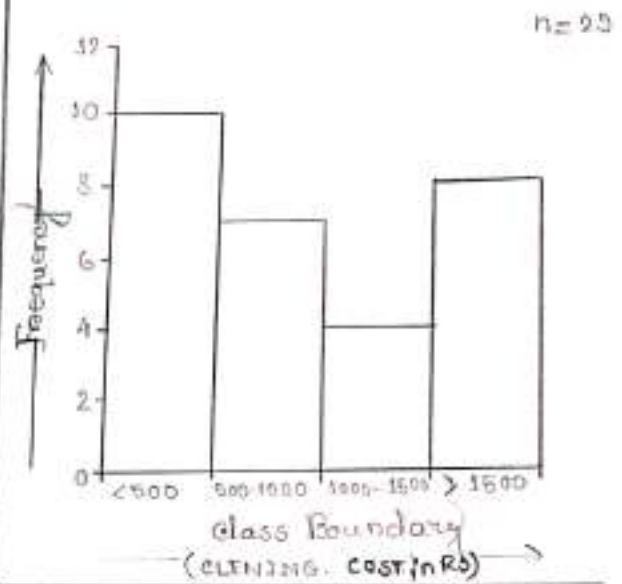


FLOOD DAMAGE DETAILS 2021 YAAS CYCLONE

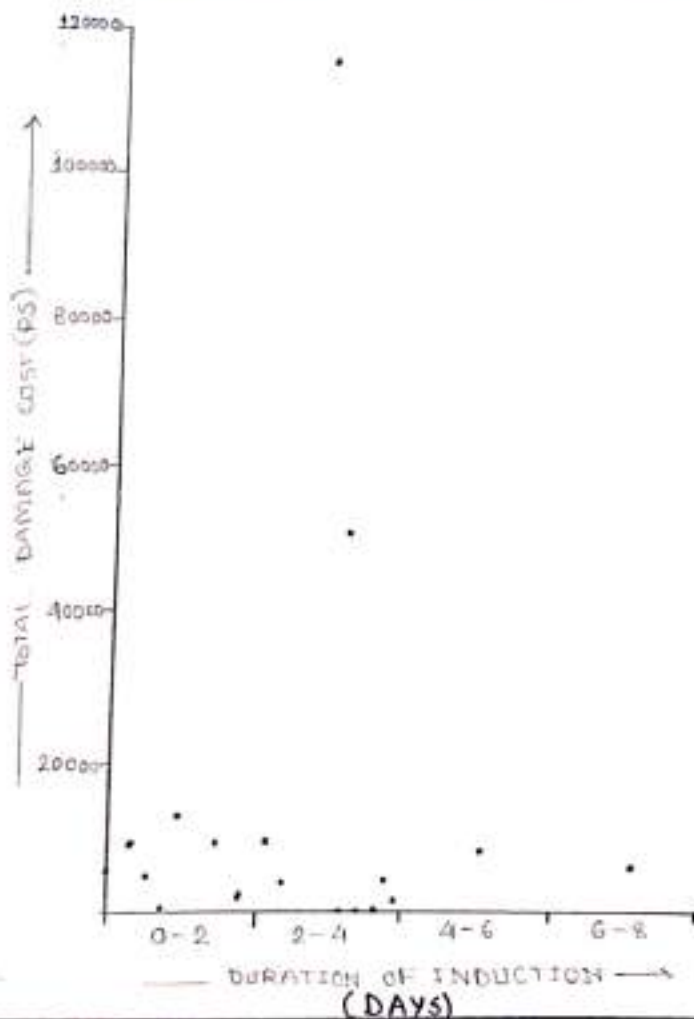
TOTAL DAMAGE COST 2021



CLEANING COST 2021



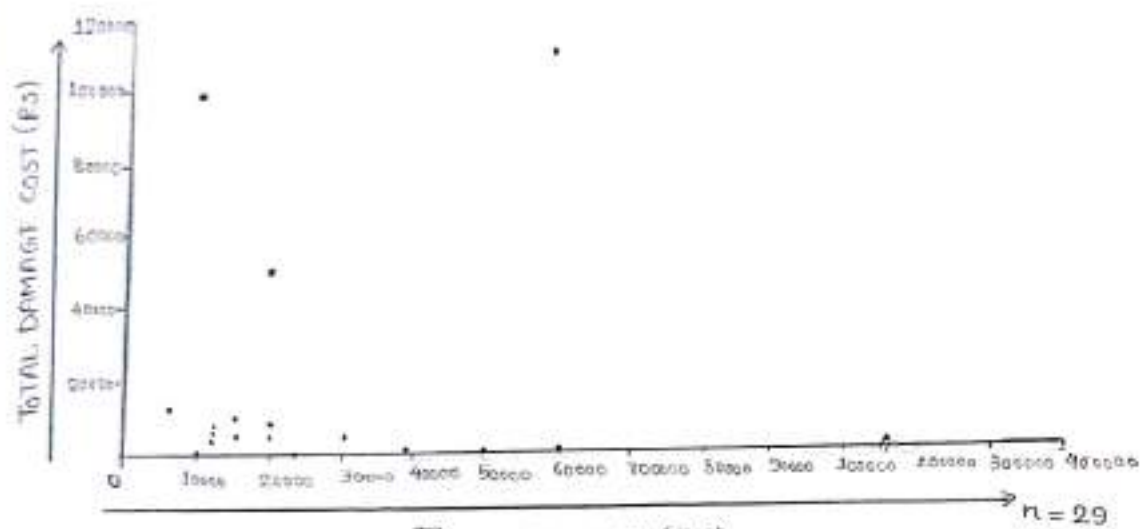
RELATION BETWEEN DURATION OF INUNDATION AND TOTAL DAMAGE COST



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20/06/23

$n=29$

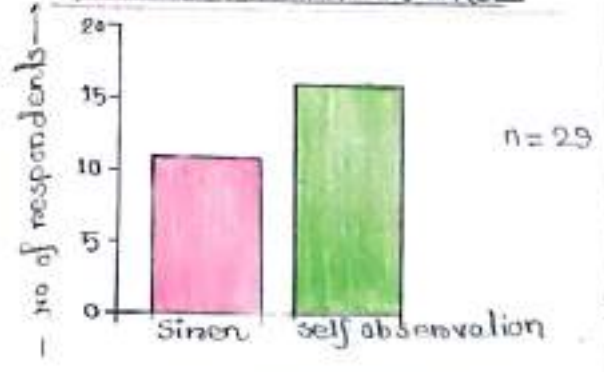
RELATION BETWEEN FAMILY INCOME AND TOTAL DAMAGE COST



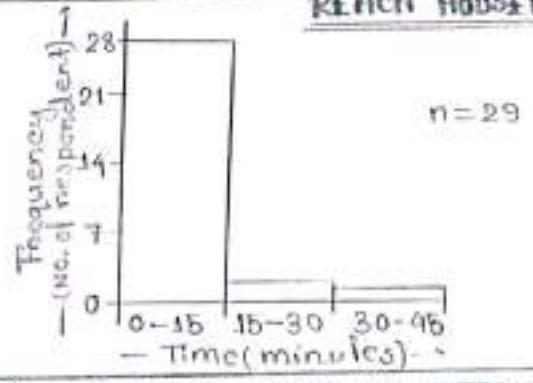
FAMILY INCOME (RS)
(Monthly income in RS)
N/Year 20/06/73

FLOOD DISTASTER RESILIENCE AND MANAGEMENT

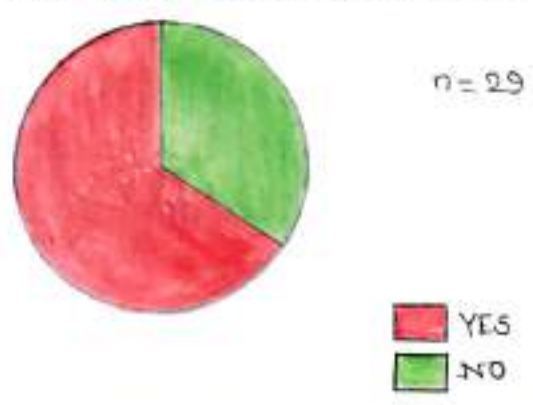
FLOOD ALERT SOURCE



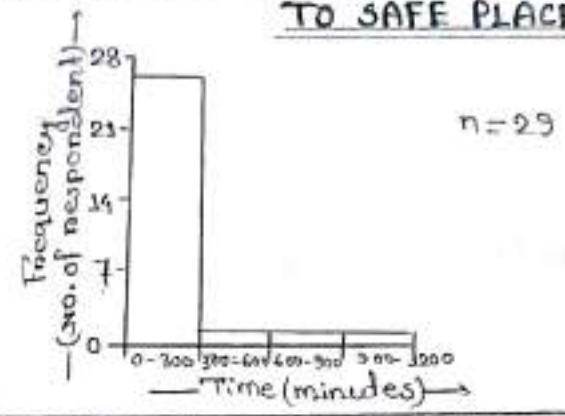
TIME TAKEN BY FLOOD WATER TO REACH HOUSEHOLD



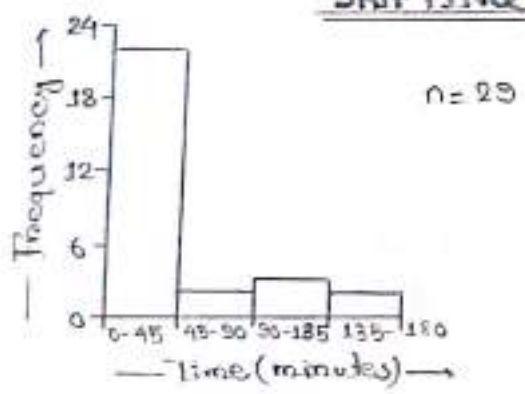
SHIFTED TO SAFE PLACE



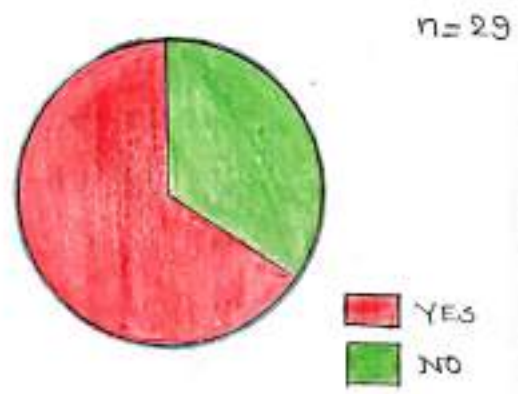
ACTUAL TIME FOR SHIFTING TO SAFE PLACE



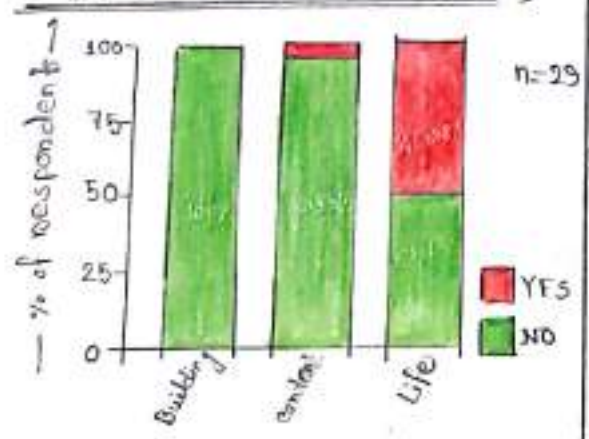
MINIMUM TIME REQUIRED FOR SHIFTING



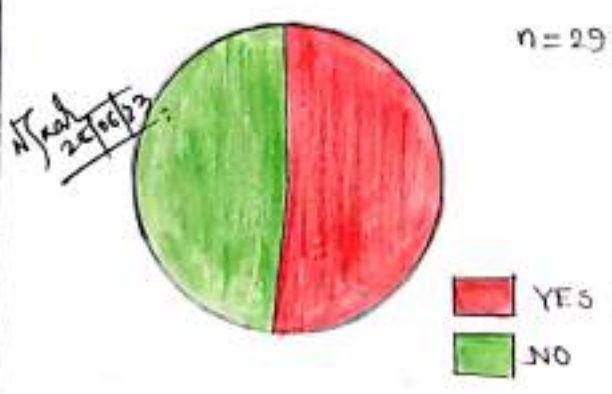
EMERGENCY SAVINGS



INSURANCE COVER (%)



FLOOD ACCEPTANCE



Section 5: Conclusion

A river flood occurs when water levels rise over the top of river banks due to excessive rain from tropical systems making landfall, persistent thunderstorms over the same area for extended periods of time. Tamluk, one of the important towns both historically and administratively. In recent decades an unprecedented economic and population growth is experienced in Tamluk. Recurrent flooding due to its geographical location may hamper its progress. Under changing climate tropical storms are becoming more frequent with a threat of future sea level rise. So Tamluk will be under constant threat from this type of overflowing flood like in the case of Yass cyclone. In this context, this exercise (a) recognises the underlying geomorphic causes of recurring flood inundation of the river bank wards of the Tamluk Municipality; (b) assessed the risk and vulnerability to the ward level; (c) highlights the nature of flooding and its impact on the residents and shows the management possibilities. A positive is that the 50% of the surveyed flood affected population accepts flood as natural. So there is ample opportunity for resilience based sustainable flood management.

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Paul, S., Chowdhury, S. Investigation of the character and impact of tropical cyclone Yaas: a study over coastal districts of west Bengal, India. Saf. Extreme Environ. 3, 219-235 (2021). <https://doi.org/10.1007/s42797-021-00044-y>

Rehman S, Sahana M, Kumar Pet al (2020) Assessing hazards induced vulnerability in coastal districts of India using site-specific indicators; an integrated approach. Assessing hazards induced vulnerability in coastal districts of India using site-specific indicators: an integrated approach.

GeoJournal. <https://doi.org/10.1007/s10708-020-10187-3>





Latitude: 22.290707
Longitude: 87.43194
Accuracy: 1000.0 m
Time: 05-12-2023 16:30
Note: 1

Powered By NoteCam



Latitude: 22.290813
Longitude: 87.528828
Elevation: 28.28150 m
Accuracy: 17000.0 m
Time: 05-12-2023 18:06
Note: 1



Latitude: 22.294111
Longitude: 87.52186
Accuracy: 87.7 m
Time: 05-12-2023 09:42
Note: 1

Powered By NoteCam



Latitude: 22.302817
Longitude: 87.529425
Elevation: 13.11112 m
Accuracy: 18000.0 m
Time: 05-12-2023 12:19
Note: 1



Latitude: 22.294405
Longitude: 87.521425
Elevation: 2.74x24 m
Accuracy: 50.4 m
Time: 05-12-2023 09:19
Note: 1

Powered By NoteCam





QUESTIONNAIRE SURVEY
ON
RIVER OVERFLOW FLOOD ALONG THE RUPNARAYAN RIVER: A CASE STUDY OF
TAMLUK MUNICIPALITY, WEST BENGAL, INDIA

A. General Information

1. Survey date:
2. Survey area:
3. Name of interviewee:
4. Age:
5. Gender:
6. Highest level of education:
7. Occupation:
8. Address:

No:
Name of the interviewer:

Land use type:
 (A) Residential
 (B) Institutional
 (C) Commercial/ Industrial

Location:
Latitude:
Longitude:
App. Distance from river: km
Elevation: m MSL

B. Residential Damage

Section 1: Type of building

9. How long have you been living here? years
10. Age of the building (year of construction): years.
11. Area of the property: m²
12. Door plinth level (height of ground flood from ground): m
13. Construction material: Wood/Bamboo Structures Mud Structures Concrete Structures Mix Structures
14. No. of stories:
15. Height of ground floor: m
16. Height of first floor: m
17. Does your building have a basement floor? Yes No



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18. What is the type of your building (select from below), and the current value of your building?

Classification of Building	Present value (Rs.)
Reinforced cement concrete (RCC)	<input type="checkbox"/>
Mixed (RCC+ Masonry)	<input type="checkbox"/>
Timber structure	<input type="checkbox"/>
Mud Structure	<input type="checkbox"/>
Temporary structures	<input type="checkbox"/>

19. What is the approximate total present replacement value of your properties (inside and outside of the building, including equipment, furniture, means and other)? (Rs.)

Section 2: Flood damage and cost

20. How many times did you experience flood while living at this address?

- Never been flooded One Two
 Three Four More than four times

21. What was the maximum water level and duration of flood entered your building?

Year	Depth (m)	Duration (hrs/days)
2020		
2021		

22. What was the amount of structural damage to your building? (Structural damage is defined as damage to any building components including foundation, walls, floors, windows, roofs, attached carpeting, attached shelves and cabinets etc.)

Category of damage	Damage (Rs.)	
	2020	2021
Built-in shelves and appliances		
Exterior walls, windows, doors (painting included) and roofing		
Interior doors and walls (painting included)		
Footing and foundation		
Other		

24. What was the damage to the outside properties of your building? Please make entries below for whatever is applicable to you.

Category of damage	Damage (Rs.)	
	2020	2021
Livestock's		
Tree/fences		
Vehicles		
Garage		
Parking areas		
Kitchen gardens		
Access roads		



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Purba Medinipur, West Bengal, PIN-721649

Other		
-------	--	--

25. What measure was taken to prevent the building from flood?

Year	Pumped	Used any type of temporary barrier	Other ways	Did nothing	Estimated cost (Rs.)
2020					
2021					

26. What was the clean-up cost after flood occurrence? (Clean-up cost includes the costs of labour and materials to clean up interior and outside of the building)

Cost (Rs.)	Category of damage	
	2020	2021
Cost for labour		
Cost for rented machines and equipment		
Other costs		

Section 3: Flood emergency response

27. Just before the flood, how did you first become aware that flood waters might reach your home?

- TV Siren Radio Observing the river water level Newspaper Other
..... None

28. Did you share the warning with others? Yes No

29. Do you have a mobile phone? Yes No

30. How many hours were there between the time you became aware that flooding might reach your home until the water actually reached to your property? hrs

31. What was the percent of potential damage prevented due to warning? %

32. What is the minimum warning time would you need to move all your transportable contents to a safe location? Hrs

33. Do you have insurance for:

a. Building Yes No

b. Contents Yes No

c. Persons Yes No

34. What is the shortest distance between your building and river? (m/km)

35. Do you have a safe place to move in case of flooding? Yes No

How far is it from your building? (m/km)



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Section 4: Effect on livelihood and income

36. How many people live in your house?
Older than 18 years old: Less than 18 years old:
37. Do you have any disabled family members with you? Yes No; If yes, how many?
38. Do you have children who are going to schools? Yes No; If yes, how many?
39. Do you have any other source of income except to your salary/bussiness? Yes No
40. Do you have any savings in case of an emergency? Yes No
41. How many persons in your household earning?
42. What is the average income of your family per month?Rs.
43. Does flood effect to your living condition by means of additional cost (Rs.)

Categories of damage	Value (Rs.)
Additional money for food	
Additional money for transportation	
Additional money for maintenance	
Additional money for repair access roads, parking areas	
Other	

Type of interruption	2020	2021
44. How long did it take for you and your household to get back to your normal daily routines? (hrs/days/months)		
45. For how many hours water supply was interrupted? (hrs)		
46. For how many hours electrical supply was interrupted? (hrs)		
47. For how many hours telephone connection was interrupted (hrs)		

48. Did you get any charity services (medicines, medical equipment, saline, water purifying tablets, bleaching powder etc.)? Yes No; If yes : Organization name & details:
.....
.....
.....
.....

49. Was there any outbreak of waterborne diseases? Yes No
If yes, then how much you had to pay for treating? Rs.

50. Do you accept living with floods? Yes No

Examined
Barbop ablegay

