KAMALA NEHRU COLLEGE
(University of Delhi)
NAAC Accredited with 'A' Grade
August Kranti Marg, New Delhi – 110049
Phone: 011-26494881, Telefax: 011-26495964
E-mail: office@knc.du.ac.in

ESTD. 1964

कमला नेहरू कॉलेज
(दिल्ली विश्वविद्यालय)
रा. मू. एवं प्र. प. द्वारा 'ए' श्रेणी प्रत्यायित
अगस्त क्रांति मार्ग, नई दिल्ली – 110049
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Additional Documents for Criterion 1.1.2

June 2021 - May 2022

The Institution adheres to the Academic Calendar including for the conduct of CIE

INDEX

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1. Sample Student Assignments in Hindi and English – Political Science and English

Name → Mamta

Roll No. → 20/167

Course → Political Science

Honours

Assignment →

Political Theory

Question

☆ प्रत्यक्ष लोकतंत्र एवं प्रतिनिधि लोकतंत्र में क्या अंतर है? दोनों प्रकार के पक्ष में दिए जाने वाले तर्कों का वर्णन कीजिये.

"प्रत्यक्ष लोकतंत्र"

प्रत्यक्ष लोकतंत्र "स्वैच्छिकवादी लागत" शब्द में दृश्यन को मिलता है।
प्रत्यक्ष लोकतंत्र के अंतर्गत जनता शासन में प्रत्यक्ष रूप से भागीदारी करती है। निर्णय निर्माण की प्रक्रिया में जनता अपना प्रत्यक्ष योगदान देती है। "जब लोग निर्णय लेने के लिए अपनी इच्छा व्यक्त करते हैं तो उस प्रकार के शासन" को प्रत्यक्ष लोकतंत्र कहा जाता है। यह लोगों की भागीदारी को सुनिश्चित करता है। यह सुनिश्चित करता है कि लोग शासन निर्माण कि प्रक्रिया में अधिक से अधिक सहभागी रहे। तथा प्रत्यक्ष रूप से अपने विचारों को व्यक्त करे ताकि उन्हें कि प्रतिनिधित्व की आवश्यकता न पड़े तथा वह किसी भी बड़ी प्रक्रिया में अपने मत को प्रत्यक्ष रूप से सुझाव कर सके।
एक प्रत्यक्ष लोकतंत्र में लोग राजनेताओं के एक अलग वर्ग की आवश्यकता को हटाकर खुद पर शासन करते हैं। इस प्रकार यह कहा जा सकता है प्रत्यक्ष लोकतंत्र एक सहभागी लोकतंत्र है जो सत्ता में लोगों के प्रत्यक्ष सहभागिता पर बल देता है।

प्रत्यक्ष लोकतंत्र के पक्ष मे तर्क

प्रत्यक्ष लोकतंत्र के पक्ष मे तर्क :-

रूसो :- रूसो प्रत्यक्ष लोकतंत्र के पक्ष मे तर्क देते हुए कहते है कि कोई भी दूसरे प्रतिनिधित्व नही कर सकता है। उनका कहना है कि किसी मे भी प्रतिनिधित्व करने की क्षमता नही होती है। उनका यह भी तर्क है कि किसी भी मर्जी का कोई वर्ग दूसरे वर्ग का नेतृत्व नही कर सकता है। किसी मे भी इतना क्षमता नही है कि वह उसके पूरे मर्जी को समझ सके तथा उसका नेतृत्व कर सके। रूसो व्यक्तिगत हित पर अधिक बल देते है। रूसो यह मानते है कि व्यक्ति केवल तभी आजाद होते है जब वे समुदाय के जीवन को एक आकार देने मे सक्षम हो। इसके लिए यह जरूरी है कि व्यक्ति कानून बनाने मे सीधे तौर पर सक्रिय (active) तौर पर व नियमित तौर पर उसमे भाग ले। इसके उनका कहना है कि कोई व्यक्ति ही अपने इच्छाओ तथा हितो को पूरी तरह

Date

की सम्भवता है परंतु कोई दूसरा व्यक्ति उसकी इच्छाओं तथा हितों को नहीं समझ सकता वो भी इसी तरह से यह सम्भव नहीं है।

रूसो का मानना है कि व्यक्ति के "आत्म विकास के लिए सहभागिता एक बुनियादी जरूरत है" जो प्रत्यक्ष लोकतंत्र में ही सम्भव हो सकती है।

रूसो प्रत्यक्ष लोकतंत्र के पक्ष में तर्क देते हुए निजी इच्छा तथा सामान्य इच्छा की बात करते हैं उनका कहना है कि सामान्य इच्छा (General will) तभी सामने आती है जब लोग अपने स्वार्थों को छोड़ कर विचार विमर्श की प्रक्रिया में शामिल हो और यह सिर्फ प्रत्यक्ष लोकतंत्र में ही सम्भव है।

रूसो प्रतिनिधित्व लोकतंत्र की आलोचना करते हैं तथा उनका कहना है कि राजनीतिक सहभागिता के लिए नागरिकों का शामिल होना आवश्यक है तथा "कोई भी प्रतिनिधित्व इतना सक्षम नहीं है कि वह पूर्ण प्रतिनिधित्व कर सके।" इसलिए प्रत्यक्ष लोकतंत्र राजनीतिक सहभागिता के विचार को व्यक्त करता है तथा रूसो यह भी कहते हैं कि व्यक्ति तभी आजाद हो सकता है जब वह अपने विचार को स्वयं चुने तथा उस पर किसी भी प्रकार की जबरदस्ती न हो।

डेविड मिलर (David Miller)

"डेविड मिलर" भी प्रत्यक्ष लोकतंत्र को बेहतर कहते हुए तक देते है कि कोई प्रतिनिधि पूरी तरह से पूर्ण सक्षम नहीं है कि वह पुरुषों को प्रतिनिधित्व पूर्ण तथा सक्षम रूप से कर सके उन्हे भी किसी दूसरे की सलाह की आवश्यकता पड़ती है।

प्रतिनिधि लोकतंत्र

प्रतिनिधि लोकतंत्र मे जनता अपने प्रतिनिधियो के माध्यम से सरकार को चुनते है। जनता मतदान के द्वारा अपने इच्छा के अनुसार अपने प्रतिनिधियो को चुनते है तथा सरकार मे भेजते है। प्रतिनिधि जनता और सरकार के बीच कड़ी का काम करते है। जनता द्वारा चुने गए प्रतिनिधि ही सरकार तक लोगो की पहुंच को सुनिश्चित करते है। परंतु इसमे जनता प्रत्यक्ष रूप से सरकार मे भाग नही लेती वह अपने प्रतिनिधियो के माध्यम से ही सरकार तक अपनी पहुंच को कायम करते है। लोकतंत्र मे प्रतिनिधि जनता द्वारा निर्वाचित होते है।

चुनावो को प्रतिनिधिक का मुख्य कसौटी माना जाता है। प्रतिनिधि लोकतंत्र मे जनता द्वारा चुने गए प्रतिनिधियो के द्वारा सरकार कार्य करती है।

प्रतिनिधित्व लोकतंत्र के पक्ष मे तर्क

"जोसेफ शुम्पीटर"

प्रतिनिधित्व लोकतंत्र के पक्ष मे अक्सर यह तर्क दिया जाता है यह बड़े जनसंख्या वाले देश के लिए सही है। कुछ पक्षकारो का यह भी तर्क है कि लोगो मे सही निर्णय लेने की क्षमता नही होती है।

जोसेफ शुम्पीटर प्रतिनिधि लोकतंत्र के पक्ष मे है। उनका कहना है कि नागरिक का काम सिर्फ मतदान करके प्रतिनिधि को चुनना है और फिर निर्णय लेने की प्रक्रिया को उन पर छोड़ देना चाहिए। उनका कहना है कि आम नागरिक मे इतनी बुद्धि नही है कि वह निर्णय ले सके। उनका कहना है

कि है अधिक मे अगर कुछ दो कहा है तो उसका परिणाम बहुत बुरी नजर आ जाता है परंतु कम संख्या मे गलती हुई नजर नहीं आती है। उनका कहना है कि राजनीति मे निर्णय निर्माण की प्रक्रिया बहुत पेचीदा है जो आम नागरिको की समझ की बात नहीं है उनका कहना है इसके लिए प्रतिनिधि प्रक्रिया ही सही है जिसमे नागरिक पाँच साल मे एक बार वोट देते है तथा निर्णय प्रक्रिया फिर प्रतिनिधियो पर छोड़ देते है।

उनका कहना है कि नागरिक को प्रतिनिधि को चुनकर निष्क्रिय हो जाना चाहिए क्योकि उनके पास निर्णय लेने की क्षमता नहीं है।

स्चुम्पीटर के मन मे नागरिको को लेकर उनकी क्षमता पर संदेह है वे नागरिको को वोट देकर निष्क्रिय होने जाने की बात करते है।

जबकि कुछ का कहना है कि अगर एक बार लोगो ने अपना प्रतिनिधित्व चुन लिया तो वो कभी भी स्वतंत्र नहीं हो सकते है कुछ प्रतिनिधित्व को लोकतंत्र के लिए खतरा मानते है उनका तर्क है कि प्रतिनिधित्व लोकतंत्र मे जनता का पूर्ण प्रतिनिधित्व सम्भव ही नहीं है जबकि शुम्पीटर कहते है लोगो मे कितनी काबिलियत ही नहीं है कि वह निर्णय ले सके।

हन्नाह पिटकिन

हन्नाह पिटकिन प्रतिनिधि लोकतंत्र के पक्ष मे है वह अपनी पुस्तक (The Concept of Representation) मे इसके बारे मे बताती है। पिटकिन के अनुसार आधुनिक लोकतंत्र प्रतिबिंब प्रतिनिधित्व व वर्णात्मक प्रतिनिधित्व का विरुद्ध है। उनका मानना है कि प्रतिनिधित्व इस्य समाज का हिस्सा है इसलिए वे मतदाताओ के प्रति उत्तरदायी एवं जवाबदेह होते। वह कहती है कि प्रतिनिधि लोकतंत्र जनता व सरकार के बीच एक सेतु का काम करता है।

जे. एस मिल

जे. एस मिल भी प्रतिनिधित्व लोकतंत्र के पक्ष मे तर्क देते है उनका कहना है कि प्रतिनिधियो अपने विवेक, अपनी बुद्धि के अनुसार काम करने की आजादी होनी चाहिए तथा प्रतिनिधि पर किसी भी तरह का दबाव नही होना चाहिए। उसका यह भी कहना है कि प्रतिनिधि लोक सेवक है, ये लोग सरकार को दिशा - निर्देश देते है। उनका कहना है कि राजनीतिक कार्यो को

मजबूत बनाने के लिए यह आवश्यक है कि प्रतिनिधि को कार्य करने की स्वतंत्रता दी उनके अनुसार प्रतिनिधि को शिक्षित व जागरूक होना चाहिए तभी वह जनता की इच्छाओं व आवश्यकताओं को समझ तथा पूरा कर सके। उनके अनुसार प्रतिनिधि के लिए शिक्षा आवश्यक है जो उसे जिम्मेदार बनाती है। इस प्रकार मिल भी प्रतिनिधि लोकतंत्र के पक्ष में तर्क देकर उसे अपनाने की बात करते हैं।

निष्कर्ष [conclusion]

"प्रत्यक्ष" और "प्रतिनिधित्व" लोकतंत्र की अगर चर्चा की जाए तो दोनों का अपना अपना महत्व है दोनों ही लोकतंत्र पर हमे पक्ष और विपक्ष सामने आते है प्रत्यक्ष लोकतंत्र की अगर बात कि जाए तो वह हमे कैसे देशो मे देखने को मिलता है जहाँ जनसंख्या का स्तर कम है उदाहरण - "केंटेक्स, स्विजरलैंड"
स्विजरलैंड मे हमे प्रत्यक्ष लोकतंत्र देखने को मिलता है क्योंकि वहाँ जनसंख्या कम है परंतु अगर इसे भारत के परिदृश्य मे देखा जाए तो यह यहाँ संभव नही है क्योंकि इसका मुख्य कारण भारत की विशाल जनसंख्या है इसलिए हमे 21 वी शताब्दी मे प्रत्यक्ष लोकतंत्र देखने को कम मिलता है
इसके विपरीत अगर 'प्रतिनिधि लोकतंत्र' की बात की जाए तो यह हमे बहुत से देशो मे देखने को मिलता है जहाँ जनता वोट के माध्यम से अपने प्रतिनिधि को चुनती है यहाँ जनता प्रत्यक्ष रूप से शासन प्रक्रिया मे भाग नही लेती बल्कि अपने प्रतिनिधियो द्वारा भाग लेती है

प्रतिनिधि लोकतंत्र को दूसरी श्रेणी में रखा जाता है। विश्व के अधिकतर देशों में लोकतंत्र का यह रूप अधिक पाया जाता है। यहाँ जनता मतदान के द्वारा अपने प्रतिनिधि को चुनकर भेजती है।

इस प्रकार यह कहा जा सकता है कि देश की परिस्थितियों तथा उपयोगिता को देखकर ही कोई व्यवस्था को अपनाया जाता है। यह उक्त देश कि "उपयोगिता पर निर्भर करता" है कि वह प्रत्यक्ष लोकतंत्र को अनुकूल मानता है या अप्रत्यक्ष लोकतंत्र को। परंतु वास्तव में कहें तो यहाँ प्रतिनिधि लोकतंत्र अधिक महत्वपूर्ण है तथा चुनाव लोकतंत्र का एक अहम हिस्सा है।

Manaam
19/1785
30th Oct 2021

Topic _____ Date _____

ROUGH STRUCTURE.

The answer discusses how Satrapi weaves together the personal and the political in 'Persepolis: Story of a Childhood' in three broad points :-

(•) Through the use of mirrors and frames :
Mirrors / frames to denote two selves - personal and political as existing together.
(i) Panel of Marji looking at herself in the mirror with 4 horns.
(ii) Father as being politically outside because of his personal choice of rebelling against Shah.
(iii) Irony of Marji's mother's passport.

(•) Through the use shadows to denote personal is foil to political and vice-versa :
(i) Women of same county ~~due~~ demonstrating against one another as shadows.
(ii) Silence and shadow after Neda's death.

(•) Personal way of dealing with trauma (caused by political turmoil).

Manaam
19/1785
30th October 2021

Topic _____ Date _____

Born in 1969 in Iran, Marjane Satrapi uses her skills of writing and drawing to challenge the political turmoil that muffles Iran, where women are the direct targets. As Hillary Chute says in The Texture of Retracing, Satrapi makes the "hidden visible" (Pg 106). 'Persepolis: Story of a Child' which was published in 2000 takes the journey of a young girl in the war-struck Iran. This essay seeks to discuss the political and personal elements Satrapi has used in 'Persepolis' in three sub-points; one, the use of mirror/frame to show that everyone has duel selves - political and personal. Two, Satrapi uses shadow to show that the two selves are foil to one another, and lastly, the personal ways of dealing with the political upheaval.

In 'Persepolis' mirrors and frames depict two selves: political and personal which are intertwined. In the chapter 'The Heroes', Marji hears about the torture inflicted on the political prisoners. The next day when she goes out to play, she imagines all sorts of torture techniques like eating garbage. When she sees herself in the mirror, there are horns and intimidating eyes. She says she had "the diabolical feeling of power ..." (Pg 57). The self on the mirror is the political self, inspired by the figures of authority (Islamic Revolutionaries). As a child, she does not realize the seriousness of the torture inflicted. She gets driven to power and imagines similar torture techniques in the games. However, soon she feels "overwhelmed" and starts crying. This is on the next panel when she turns away from the mirror, a part of her reflection is still visible, reflecting that even though she has turned away from her political side, it still hovers at the back. Her eyes look intimidated unlike the intimidating eyes in the mirror. The position of her arms is different. In the mirror, her arms were straight and she looked tall. But now, her arms are crossed - giving a sense of vulnerability. Satrapi uses a child's lens to highlight personal is political and vice versa.

Topic _____ Date _____

Like mirrors, frames serve a similar function. In the fourth chapter, Marji's father takes pictures of the demonstration, which is "forbidden" (Pg 33). The panel has no frames but the pictures kept together look like single panels themselves. The father is outside these pictures and hence rendered without a frame, because he is viewed as an outsider by Shah. The father's personal stance of rebelling against Shah has pushed him politically outside. Through this, Satrapi highlights Shah's gruesome regime where one had to suppress the personal to be accepted in the political sphere. 'Persepolis' seeks to question these ideologies. This is what Babak Elahi in Frames and Mirrors called "re-historicizing" (Pg 314).

In the chapter 'Kim Wilde', the mother's passport has a picture of her in scarf (Pg 130). She looks "unrecognizable" which is ironic as the purpose of a passport picture is to confirm one's identity. Here, it does the opposite because she does not even look like her real self. The imposition of scarf on women is a political act of coercion which ~~expresses~~ represses the personal identity of women. Satrapi plays with the irony to create her own "frame of mind", as said by Scott McCloud in Understanding Comics, to question the forced frame on Iranian women under Khomeini's rule.

Now the answer looks at the use of shadow to highlight the consequences of personal on political and vice versa. The two are never alone. Both of them act as foil to one another. In the first chapter on page 9, the women of the same country demonstrate against each other about the imposition of veil. The long horizontal panel is equally divided into two groups of women, one who are veiled and the other who are not. Their fisted hands are in the air and they are both shouting either for or against the veil. The panel gives equal space to both the groups, one shouting "the veil!" and other "freedom". It seems like they are each other's shadow,

Citizen

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duelling against one another.

The second last chapter is very troubling, because it shows the peak of Iran-Iraq war. When Marji sees Neda's bracelet attached to "I don't Know what..." (Pg 146). Her death traumatizes Marji so much that she hides her face and shadow of her palms cover her eyes. The next panel is totally black. Death becomes foil to life, juxtaposed to personal being foil to political.

lastly, the essay looks at personal ways of dealing with trauma. on page 138, Marji dances to Kim Wilde's songs after being pulled up by Islamic Revolutionaries. There is sharp contrast between culture and choice of clothing which is highlighted when the "guardians of Revolution" pull up Marji who wears a denim jacket. She is called a "litle whore" for wearing what she likes. Even after the scary encounter, Marji prefers to dance to American songs. This is a larger commentary that Satrapi wants to make - the need to see personal and political differently. Golnar Nabizadeh in Vision and Precarity calls 'Persepolis' a "work of witness" (154). Here, marji becomes a "child witness-narrator" (159), term by Leigh Gilmore in Witnessing Persepolis.

Through her "autobiofictionalography" (Pg 950), term by Theresa M. Tensuan, Satrapi brings political and personal together to show that everybody has duel selves. This is depicted in 'Persepolis' through the use of mirrors and frames. Furthermore, the contrasting nature of the two selves (personal and political) is discussed in the next section which sees them as foils to one another. Personal is political and political events impact personal life. Lastly, Satrapi wants to highlight the need to see the two contrasting selves differently to avoid trauma which arises when political and personal clash with one another.

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2. Sample Practical Assignment – Geography

Urban Flood, Risk and Preparedness in Guwahati

Report submitted to University of Delhi, in partial fulfilment of the requirements for the award of the degree of

Bachelor of Arts (Geography Hons.)

(Paper Code- 12291602)

Miss. Taveri Rajkhowa

Supervised by

Mr Joseph K. Ravi

Semester VI, Jan-May, 2021.

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Declaration

I hereby affirm that the work for this report "Urban Flood, Risk and Preparedness in Guwahati" being submitted as part of the requirements of the BA course of the University of Delhi, was carried out entirely by myself. I also affirm that it was not part of any other program/ course of the study and has not been submitted to any other university for the award of any degree

Date: 30th April, 21 Name of the Student: Taveri Rajkhowa

Preface

According to the UNISDR Terminology on Disaster Risk Reduction, 2009, Disaster is a serious disruption of the functioning of a community or society involving widespread human, material, economic or environmental losses and impacts which exceeds the ability of the affected community or society to cope using its own resources. It is often described as a result of the combination of the exposure to hazard, the conditions of vulnerability that are present and insufficient capacity or measures to reduce or cope with the potential negative consequences. Earth and its environment are dynamic. This effect of this ever-changing nature of earth is visible in the form of disasters. With the growing human population and its increasing density in the few liveable areas on the earth surface makes them susceptible to various disasters that may affect the area including natural and man-made. Hence preparedness, awareness and disaster risk mitigation measures become very important to reduce the chances of damage and loss of lives.

The basis for this research originates from the current state of the country and Guwahati cities disaster risk reduction strategy. The rising concern of urban flood which is a yearly event in the city and the lack of improvement by the concerned authority as well as lack in the community level preparedness is a major issue that is being addressed in this report. In order to bring changes to these practises, it is important to bring political, economic, cultural and social changes and for that the study the inter-relationship between these factors along with the geography of the region is very important.

Subjected to the limitations of time and resources every possible attempt has been made to study the problem deeply.

Acknowledgment

Foremost I would like to express my sincere gratitude to my advisor, Mr. Joseph Ravi Kumar for the continuous support throughout the research and report, for his patience, motivation, enthusiasm and immense knowledge.

I would also like to express my gratitude towards Dr. Kalpana Bhakuni, Principal, Kamala Nehru College and Dr. Pratibha Bhalla, Head of the Department, Department of Geography, Kamala Nehru College for the approval of the work and also providing us with such opportunity.

My thanks and appreciation goes to my colleagues and people who have willingly helped me out with their abilities.

Last but not the least; I would like to thank my family for supporting me spiritually throughout writing this report and my life in general.

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Introduction

1.1 Background

The development of the earliest cities can be dated back to the 18th century in Mesopotamia and Egypt with the change in economic activity, from primarily being agriculture to that of trade and manufacturing. But an unprecedented urban growth occurred with the British Industrial Revolution in the 18th century and since then there was no turning back. Till 2017, 4.1 billion people live in urban areas, which is over half of the world population (55%) and is estimated that by 2050, 68% of the world population will live in urban areas.[1]

Map 1 World Urban Population, 2017

The rapid growth of cities as a result of growing population and migration has led to the increase in the number of mega cities worldwide but along with it comes many negative impacts of urbanization among which one is urban flooding. The gradual population increase resulted in increasing urbanization, more impervious area and less infiltration and greater flood risks. Overburdened drainage, frenzied and unregulated construction, no regards to the natural topography and hydro-geomorphology all make urban floods a man-made disaster (Mitashi and Varnika, 2019). Disasters due to water-related hazards (floods, droughts and windstorms) comprised nearly 90% of the 1000 most disastrous events between 1900 and 2006 (Adikari and Yoshitani, 2009). Economic losses due to water-related hazards increased

[1] According to the World Urbanization Prospects, Department of Economic and Social Affairs. United Nations

over 500% since the early 1980s, primarily due to rapid urbanization in exposed locations (Adikari and Yoshitani, 2009). Flood and drought hazards also caused nearly 0.6 trillion USD worth of damage (28% of the total from all disasters) in the 20 years since 1992 (UNISDR, 2012). In 2013, floods and droughts accounted for over a quarter of all insured losses around the world (Swiss Re, 2014). In 2000, about 30% of global urban land was located in the high frequency flood zone and it is estimated that by 2030 (Fig. 2) almost half of the global urban extension will take place in the high frequency flood zone (Burak, Inci and Ying, 2015).

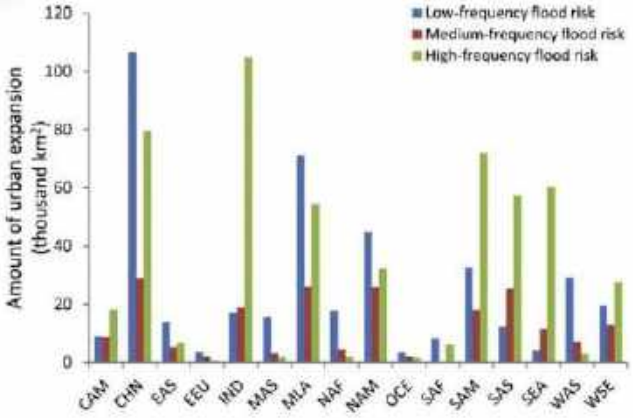


Figure 1 Percentage increase in urban extend by 2030

1.2 Urban Floods in India

According to the World Bank Data, 2019 the urban population of India has risen to 34.47% with the major population concentrated in cities like Mumbai, Delhi, Bangalore, Hyderabad, Ahmedabad and others. Urban population is projected to be around 433 million by 2021.

There have been specific cases of urban flood disasters in India over the past several years where major cities in India have been severely affected. The most notable amongst these are the floods in Hyderabad and Ahmedabad in 2000, Delhi in 2002, 2003, 2009 and 2010, Chennai in 2004 and 2005, Mumbai in 2005, Surat in 2006, Kolkata in 2007, Jamshedpur in 2008 and Guwahati in 2010. (Singh, Khole and Rase, 2015)

In Indian cities and towns, large habitations are coming up in low-lying areas, often encroaching over drainage channels. The absence of a proper sewerage system, most of the habitations discharge their sewage into the existing storm water channels. The net result has been that the width of the natural drainage channels has become inadequate and the capacity for draining the rainwater has been greatly reduced. Moreover, urbanisation leads to increase in impervious areas which, in turn, significantly increase the rate of runoff, resulting in an overwhelming of designed capacity of the storm water drainage system. As a result of all these happenings, even small amounts of rainfall can cause urban flooding. (NDM Guidelines).

1.3 Urban Floods in Guwahati

The city of Guwahati experiences inundation and waterlogging problems after every medium to heavy shower. Rapid urbanization with increased housing and construction activities in the city has led to more rooftops, driveways, streets and other impervious or hard surfaces (CDP, 2006). This has resulted in decreasing land capacity to soak up and carry excess water. Moreover the unplanned expansion of the city to accumulate increasing population has led to severe encroachment in the wetlands, low lying areas, hills and shrinkage of forest cover (Thakur and Goswami, 1993). These denuded hills and loss of wetlands thus lead to artificial floods and water logging. Immediately after every down pour the city drains gets silted up with silts coming with storm water running down the hills flooding the streets (Soil Conservation Dept., Govt. of Assam, 2003).

1.4 Urban Flood Preparedness

The nature and factors causing urban flooding is quite different from riverine floods and hence the prevention, preparedness and education for urban flood are different. The management of urban flooding includes extensive use of science and technology by establishing standing and supportive mechanisms both at the national, state and the local levels for improved forecasting, early warning and communication. (NDMA, 2014) Capacity development includes target groups such as government officials, elected representatives, urban planners etc. Different organizations such as The State ATIs, NDRF and Civil Defence have a role to play in capacity development. NGOs play a great role in rehabilitation, reconstruction and mitigation of urban flood too. Awareness generation at the household level plays a crucial role in building a sense of preparedness amongst people special efforts should be made to reach out to women, children and differently-abled. Household level preparedness also encourages preparing a flood checklist. (NDMA, 2014)

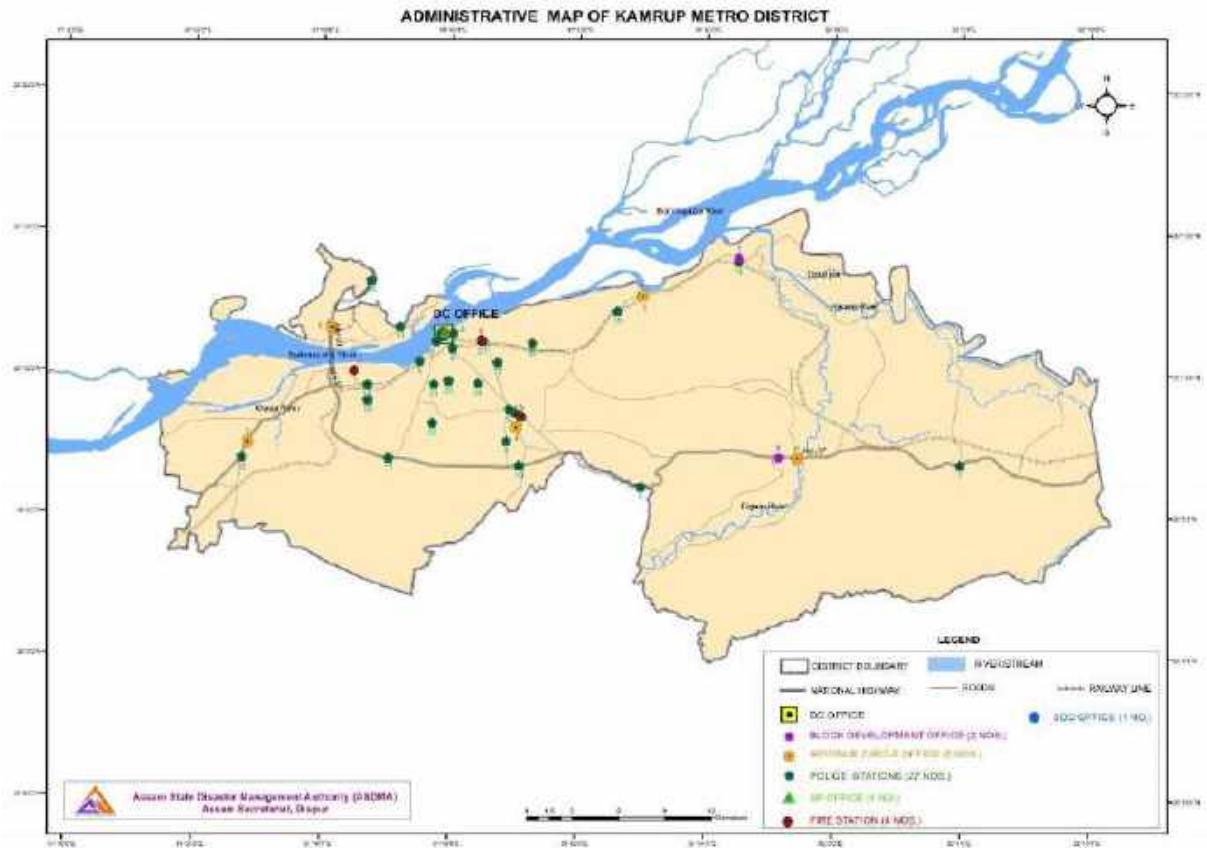
1.5 Study Area

The geographical location of Guwahati City is 90 33’18” E and 91 10’41” E longitudes and 25 50’33” N and 26 15’50” N latitudes. The city is situated on an undulating plain with varying altitudes of 49.5 m to 55.5 m above Mean Sea Level (MSL). The city is located at the banks of the river Brahmaputra and several of its tributaries pass through the city. The Southern and Eastern sides of the city are surrounded by hillocks. Apart from the hilly tracts, swamps, marshes, water bodies like Deepor Bill, Silpukhuri, Dighali Pukhuri, Borsola Beel and silsakoo Beel etc also cover the city. Guwahati has a humid subtropical climate, falling

just short of a Tropical Savanna climate. The average temperature is 31.5 c to 24.7 c in summers and 24.9 c to 12.5 c in winters. Average annual rainfall in Guwahati is more than 1700 mm and among the heaviest in India.

According to the 2011 census, Guwahati City had a population of 968,549 which witnessed a very high rate of growth due to large numbers of migrants.

The city is vulnerable to various hazards like flood, landslide, storm, riverbank erosion, urban flash food and water logging. Man-made disasters like fire incident (domestic and commercial), bomb blast and road accident also occur time to time.



Map 2 Administrative Map of Guwahati
Source: ASDMA

The survey for community resilience is done in the Lakhimi Nagar, Hatigaon region located in the southern part of Guwahati and is near to National Highway 37.

1.6 Statement of the Problem

Urban flooding is one of the rising problems among the urban agglomerations around the world. The vulnerability and potential damages of urban flooding is still quite unknown due to variation in the level of urban development around the world and in the level of intensity of urban flooding. The effects of urban flooding also varies among the different social groups

that a city caters too and hence its impact analysis has to be done in such a manner in order to plan the mitigation programs accordingly. Guwahati is the gateway and the main economic centre of the North-Eastern region of India which naturally makes it an attraction for the people of this region. The gradual increase of population in the city due to migration is leading to unplanned growth of the city including encroachment, high density settlement regions etc. An unplanned drainage system also is a major factor leading to flooding. The geographical location and climatic conditions of the city too makes it vulnerable to flooding each year and hence a proper planning along with preparedness from administrative to community level is required.

1.7 Aim

The aim of the study is analyze the vulnerability and risk profile of Kamrup (Metropolitan) district as well as Guwahati city along with discussion about the types of disaster the city faces is being done. The report also aims to learn about the urban flood situation of Guwahati, gravity of the issue and the major reasons. The study also tries to focus on the city drainage system, land-use pattern and the major flood affected areas. It also aims in studying the level of community preparedness and recovery.

1.8 Objective of the Study

1. To study the various disasters affecting Kamrup District.
2. To study the vulnerability profile of Guwahati in regards to urban flood.
3. To study the level of community preparedness and recovery for urban floods in Guwahati.

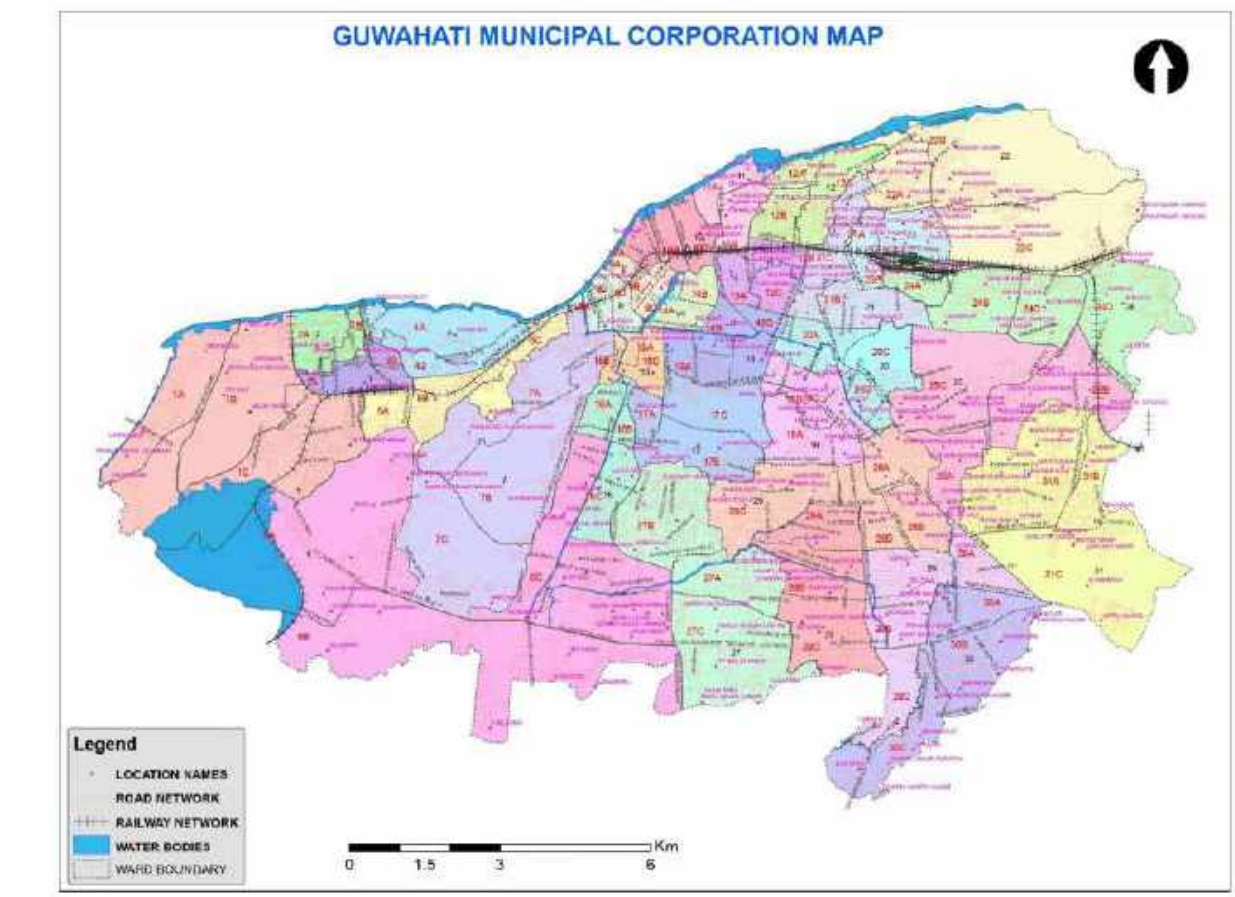
1.9 Data-Base & Methodology

The sources of data include the rainfall data given by Indian Meteorological Department and National Disaster Management Guidelines for Urban Flood, 2014. Data for the survey is being acquired through a questionnaire method of data collection.

The analysis of the report on the topic “Urban Flood, Planning and Preparedness in Guwahati” is done using spatial variation for the impact of flood in Guwahati and pattern analysis of the land use in the natural drainage systems. A quantitative approach is being taken to study with the questionnaire method of data collection for analyzing along with secondary data sources mentioned above.

Risk and Vulnerability Profile of Guwahati

The district Kamrup Metro was created bifurcating the old Kamrup district on 3rd February' 2003.The head quarter of the district is Guwahati. Once known as Pragjyotishpur meaning the City of Eastern Light. Guwahati derives its name from the Assamese words "Guwa" means areca nut and "Haat" means market. It is believed that areca nuts grew in abundance in the area, and the place served as a convenient trading centre for that. During the onset of the colonial age, the name was anglicised to Gawhatty. The spelling was modified to Gauhati in the early part of the twentieth century, and ultimately rectified to *i.e.* Guwahati in the penultimate decade of that century. Guwahati is the largest city and the only metropolis of North Eastern India. It is also major commercial and educational hub of Assam and the north-eastern region of India. It is a centre for administrative and political activities of Assam, and an important regional hub for transportation.



Map 3 Guwahati Ward Map
Source: Guwahati Municipal Corporation

2.1 Location

The geographical location of Guwahati City is 90 33'18" E and 91 10'41" E longitudes and 25 50'33" N and 26 15'50" N latitudes. The city is situated on an undulating plain with varying altitudes of 49.5 m to 55.5 m above Mean Sea Level (MSL). The Southern and Eastern sides of the city are surrounded by hillocks. Swamps, marshes, water bodies like Deepor Beel, Silpukhuri, Dighali Pukhuri, etc. also cover the city. Guwahati lies in between the Brahmaputra River and the Shillong Plateau and straddles the valley of the river Bharalu which is a small tributary of the Brahmaputra. To its west lies the Nilachal Hill on the southern banks of the Brahmaputra, to the north is the Chitrachal Hill and to the south lies the Narakasar Hill to the west south-west of the city lies Deeporbill, a permanent freshwater lake (Ramsar).

2.2 Climate

Guwahati has a humid subtropical climate, falling just short of a Tropical Savannah climate. The average temperature is 31.5 c to 24.7 c in summers and 24.9 c to 12.5 c and 24.9 c to 12.5 c in winters. The winter season starts from December and ends in February followed by the summer season from March to May. The monsoon season starts from June and continues till September followed by the post monsoon season (October – November). Average annual rainfall in Guwahati is more than 1700 mm and among the heaviest in India. The average relative humidity in the city is more than 76.6%. The irregular annual distribution and heavy rainfall pattern leads to run offs and severe drainage congestions leading to flash floods situation every time in urban areas.

Climate Data for Guwahati

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record High °C	28.8	32.2	38.4	39.0	37.0	38.3	36.5	36.2	35.8	34.3	31.0	28.1	39
Average High °C	23.6	26.0	29.9	30.7	31.0	31.9	31.7	32.1	31.4	30.2	27.5	24.4	29.2
Daily Mean °C	17.1	19.0	22.9	25.3	26.7	28.4	28.5	28.8	27.9	26.0	22.2	18.1	24.24
Average Low °C	10.3	11.9	15.7	19.9	22.4	24.8	25.3	25.4	24.4	21.9	16.8	11.8	19.22
Record Low	4.7	5.1	8.3	13.0	16.2	20.4	21.4	22.1	19.7	13.6	10.3	6.0	4.7

°C (°F)													
Rainfall mm	11.9	18.3	55.8	147.9	244.2	316.4	345.4	264.3	185.9	91.2	18.7	7.1	1717.7
Avg. Rainy Days	1.8	2.9	5.8	13.1	17.0	19.6	22.3	18.5	15.2	7.4	2.8	1.3	127.7
% Humidity	79	65	57	68	75	81	83	82	83	82	82	82	76.6
Mean Monthly Sunshine Hours	226	215	220	201	192	132	124	161	138	204	231	232	2278

Source: World Meteorological Organization – NOAA (Extremes & Humidity, 1971-1990)

Table 1 Climate Data of Guwahati

2.3 Area and Demography

The Guwahati Municipal Corporation, the city's local government, administers an area of 216 square Kilometres, while the Guwahati Metropolitan Development Authority, the planning and development body, administers an area of 262 square Kilometres. According to the 2011 census, Guwahati City had a population of 968,549 which witnessed a very high rate of growth due to large number of migrants. After 1991 the rate has declined to almost 2.5% per annum. Considering this rate the estimated present population of the city has crossed the 12 lakh figure. With this trend the projected population in Guwahati will cross 25 lakh by 2030.

Guwahati Metropolitan	Total	Male	Female
Population	9,62,334	4,98,450	4,63,884
Literates	7,97,613	4,25,837	3,71,776
Children (0-6)	90,636	46,749	43,887
Average Literature (%)	91.50%	94.27%	88.52%
Sex Ratio	931		
Child Sex Ratio	939		

Table 2 Demographic Data
Source: Census 2011

2.4 Vulnerability Profile of Guwahati

According to the Disaster Score Card for States and Union Territories of India, 2018, Assam ranks 7th among the States of India in terms of Disaster Risk Index.

Sl.No.	State	Hazard	Vulnerability	Exposure	Hazard Vulnerability Exposure	Capacity	Risk	Disaster Risk Index	Rank
		(Scale of 10)						(Scale of 100)	
	1	2	3	4	5	6	7	8	9
1.	Maharashtra	4.07	4.75	5.67	5.69	4.43	5.58	54.75	1
2	West Bengal	4.31	3.40	4.62	4.81	3.64	5.18	51.78	2
3	Uttar Pradesh	2.2	5.41	5.09	3.29	3.03	4.22	42.24	3
4	Madhya Pradesh	2.81	3.86	2.96	2.16	3.10	2.08	30.79	4
5	Rajasthan	2.29	4.34	3.29	2.22	3.91	3.00	30.04	5
6	Karnataka	2.78	3.60	4.03	2.11	3.29	2.98	29.82	6
7	Assam	3.03	2.53	2.05	2.14	4.19	2.8 7	28.75	7
8	Andhra Pradesh	4.25	3.03	3.17	1.97	3.70	2.7 6	27.58	8
9	Gujarat	3.66	3.82	4.05	2.10	4.93	2.7	27.44	9
10	Bihar	3.13	3.15	3.31	1.80	4.12	2.5 0	24.99	10

Table 3 Disaster Risk Index of States and Union Territories

On the other hand, as observed in the above Figure 2, Guwahati is one of the major cities in India that are highly exposed to major disasters. Guwahati is highly susceptible to disasters such as earthquake, floods, storms and cyclones and industrial and fire hazards. The geographical extent of the disasters extends from particular vulnerable localities to the entire Greater Guwahati. The magnitude also varies accordingly in that pattern. Heightened vulnerabilities to disaster risks can be related to expanding the population, unplanned urbanization and industrialization, development within high-risk zones, environmental degradation and climate change. Besides natural factors discussed in the preceding text, various human-induced activities like increasing demographic pressure, deteriorating environmental conditions, deforestation, unscientific development, faulty agricultural practices and open grazing, unplanned urbanization, construction of large dams on rivers are also responsible for an increase in the frequency of disasters in the country.

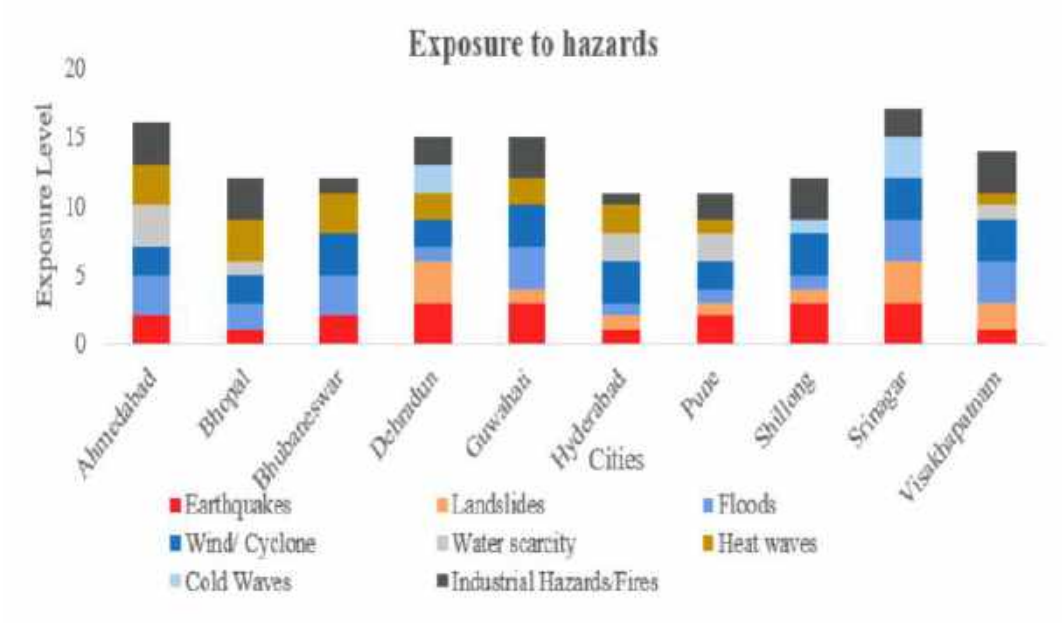


Figure 2 Cities exposed to Hazards
Sources- Ministry of Urban and Housing Affair, Gov. of India.

On the other hand, table 4 depicts that the disaster preparedness and mitigation status of Guwahati in comparison to the other major cities of India is low in terms of prevention, human resource, early warning system and rehabilitation, emergency services, building codes etc.

Variables	Ahmedabad	Bhopal	Bhubaneswar	Dehradun	Guwahati	Hyderabad	Pune	Shillong	Srinagar	Visakhapatnam
Adaptation Strategies in the cities										
Prevention(preparedness drills/mock drills, regular training)		H		L	L	L	L	L	L	M
Human Resource-trained workforce for community interaction, community awareness initiative etc	L	H	L	L	L	M	L	L	L	M
Early warning system and rehabilitation	M	H	L	L	L	L	L	H	L	M
Updated previous disaster database	L	H	M	L	M	M	M	M	L	M
Mitigation Actions by Category										
Emergency Services- like dedicated control room for information dispensation and coordination and Necessary equipments in place and functioning	L	H	L	L	L	L	L	L	L	L
Natural Resource Protection				M	M			M	M	M
Building codes for current and future construction	L	H	L	L	L	L	L	L	L	H

Table 4 Disaster Preparedness & Mitigation Status of city
Source- Ministry of Urban and Housing Affair, Gov. of India

Vulnerability Index of the district of Kamrup (M) is as follows:

Sub District	Earthquake						Flood						Landslide				Fire				Industrial Hazard		Terrorism	Red Count
	H	EI	RL	SR	IL	C	H	EI	RL	SR	IR	C	FC	H	SR	C	H	SR	IL	C	SR	C	H	
Guwahati	100	698	48	933	17.1	9	100	698	488	93	17.1	9	N/A	10	93	9	100	93	17.1	9	93	9	100	0
Azara	34	29	79	915	21.23	9.72	34	29	79	915	21.23	9.72	125.31	34	915	9.72	34	915	21.23	9.72	915	9.72	34	4
Sonapur	40	432	25	971	32.98	12.64	40	432	25	971	32.98	12.64	1288.76	40	971	12.64	40	971	32.98	12.64	971	12.64	40	3
Chandrapur	42	121	16	950	38.59	13.94	42	121	16	950	38.59	13.94	62.86	42	950	13.94	42	950	38.59	13.94	950	13.94	42	4
Dispur	N/A	14	N/A	929	17.23	9.77	N/A	14	N/A	929	17.23	9.77	N/A	N/A	929	9.77	N/A	929	17.23	9.77	929	9.77	N/A	2

	Very Less
	Less
	High
	Very High

H- Hospital	EI- Educational Institute	RL- Road Length	SR- Sex Ratio	IL- Illiteracy	C- Children (0-6)	FC- Forest Cover

The major disasters faced by Guwahati city are discussed below.

Earthquake

As per the latest seismic zoning map of India, the Kamrup Metropolitan district falls under High Risk Zone- V and is located in Assam gap of Himalayas, which is one of the six most active seismic regions of India, where a maximum intensity of IX can be expected. The vulnerability profile of the city is quite high due to the haphazard and uncontrolled growth. Huge urban population combined with poor quality and ill-maintained infrastructure, low quality building stock and lower resilience of the high density society increases the risks of earthquake in the urban region. Moreover, the urban infrastructure is often designed and constructed without satisfying minimum safety standards.

Riverine Flood

Riverine floods generally occur when the flow rate of water exceeds the capacity of the river channel. Guwahati is flanked by the Brahmaputra River on its northern periphery, while around 5 major rivers/ streams drain through it namely Bharalu, Mora Bharalu, Basistha, Bahini and Pamohi. The Monsoons or even nondescript heavy showers have often resulted in these tributary rivers/ streams causing floods by overflowing their banks or even breaching their embankments. But such phenomenon within the main city is generally accompanied by similar flooding in the adjoining sub-urban and rural areas, which is caused by the Brahmaputra River and its tributaries. The magnitude of the flood depends on the amount of rainfall in the catchment areas of the rivers concerned, which is variable from time to time. The temporal and spatial spread of such rainfall is also important factors determining not only the extent but also the duration of such floods.

Areal Floods

Areal floods occur when the ground is saturated and water either cannot run off or cannot run off quickly enough to stop accumulating. Such type of floods can be experienced by areas with poor drainage facilities within a city. Besides, such floods can also occur due to water-logging. Guwahati has been suffering from such type of floods each year either by parts of the city or all of it. The main reasons for the cities vulnerability to areal flood is due to disrupted connectivity of the storm-water drainages; and the profile and gradient of the existing drains is not as per hydrological requirements. Besides, size of the feeder drains is also inadequate. The open drains are extremely narrow and gets clogged and littered by

garbage disposal due to which water carrying capacity gets significantly reduced. Encroachments due to building of additional structures like walls, stairs, RCC rooms, etc. have at places blocked the natural outflow of water from the areas concerned even through the artificial gutters/ sewers. The natural drainage systems of the city too are being encroached and are not regulated by the concerned authorities. The elevation of certain areas within the city like Anil Nagar, Nabin Nagar, Lachit Nagar and Pub Sarania areas is comparatively lower than the surrounding areas of Guwahati, giving them a bowl-shaped topography. This condition has resulted in rolling of flood-waters into these areas. Some of the major areas affected by water logging are Hatigaon and Sijubari area, Ananda Nagar, Anil Nagar, Nabin nagar, Mathura nagar, Ulubari, Rajgarh etc.

Land Slide

Guwahati has witnessed landslides in the hills within its periphery and those surrounding it - whenever heavy rainfall strikes it. Because, most of such hills are under different degrees of human habitation, which more often than not do not take any measure for land retention on the slopes – viz. planting trees and building effective retention walls. In fact, the Geological Survey of India has warned that most of the 14 inhabited hills in the city are highly vulnerable to landslides.

Soil Erosion

In the case of Guwahati, in addition to the erosion caused by Brahmaputra and its tributaries, water flowing down the hills dotting the city also tends to denude the top soil of such hill land. The hills have been laid barren by loss of vegetation and human settlement. The negative effects of erosion include loss of available land, siltation and ultimate blockage of river and drainage channels, and so on. It is major threat to many places like Azara and Chandrapur Revenue Circle.

Storm

On account of the hot humid nature of the climate of Guwahati, storms are quite frequent here. The atmospheric condition in the city during the months of March – April, a particular type of storm – christened Bordoichila – regularly occurs over that period. Such storms lead to destruction of public and private properties as well as causes flash floods in the city.

Tropical Cyclones

Guwahati experiences tropical cyclones time and again, on account of its aerial proximity to the Bay of Bengal, and regular formation of depression over that sea. Such cyclones have been found to cause widespread devastation in the city, including disruption of electricity supply and telecommunication links and other storm like conditions.

Fires

The fire takes places in Kamrup Metropolitan district mainly due to short circuit and careless handling of domestic LPG cylinders in the houses. Mainly fire takes place from March to April when the climate remains very dry and probability is more instance of fire breakout.

Terrorism

Bomb blasts, grenade attacks and other terrorist activities create disaster for the society at large. Being affected by insurgency and other militant activities, the city is particularly vulnerable on that count. Bomb blasts of 2008 and 2009 have been significant terrorist attacks in the city.

Industrial Accidents

Guwahati has a number of large industries including the Noonmati Refinery. Although the industries claim proper safety measures, the city may still be vulnerable on that front.

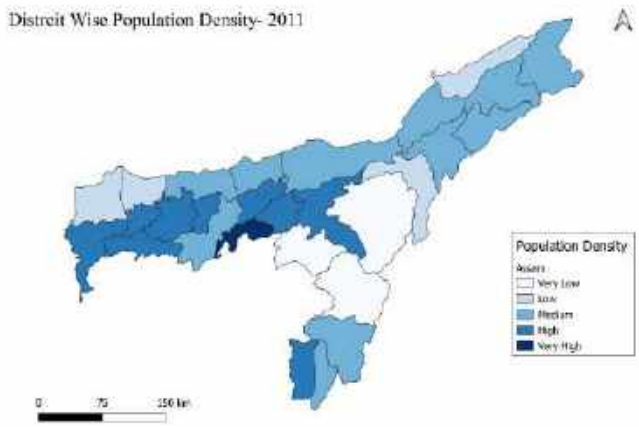
It can be observed from the above Guwahati and Kamrup Metropolitan district is naturally disaster prone to disasters such as earthquake, floods, landslide etc. Along with it due to the growing population, the chances of man-made disasters too have increased along with increasing vulnerability. In such a situation it is very important to upgrade the disaster preparedness level upon which discussion has been done further in the report.

Urban Floods in Guwahati

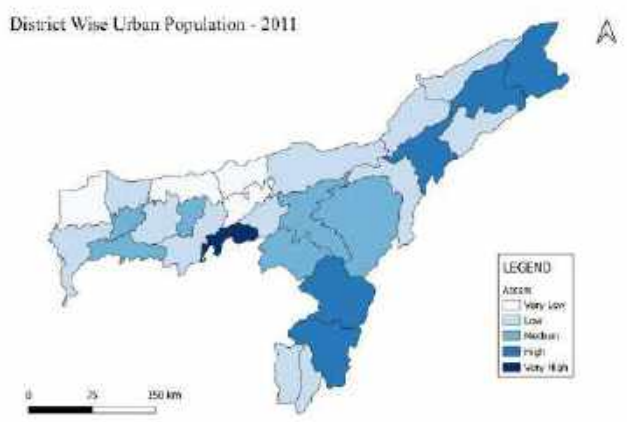
Urban Flooding is one of the most reoccurring hydro-meteorological disasters presently in the world. It is different from rural flooding as urbanisation leads to developed catchments, which increases the flood peaks from 1.8 to 8 times and flood volumes by up to 6 times.

In the last 20 years, with the growth of Guwahati city as the economic heart and gateway of the North Eastern region of India, the problem of urban flood has grown along with it. Despite having an intricate network of rivers and beels[2] forming a natural drainage system, the city is effected by flash floods each summer with the heavy downpour during the monsoon season. According to the Assam Disaster Management Authority, the flood of 2017 was the worst one with four deaths and over 2000 residents affected and many evacuated.

As observed in the maps below (Fig 4, 5), Kamrup Metropolitan District which majorly constitutes of Guwahati city has the highest density of population (2695.43 per sq. km) as well as the highest concentration of urban population in Assam (9.75 lakh) along with an urban agglomeration of 275[2] km.



Map 5 District wise population density of Assam



Map 4 District wise urban population of Assam

[2] Beels: Assamese word for Wetland.

3.1 Flood effected regions of Guwahati

The graph below shows that 52.34 percent of the Guwahati Municipal Area is flood prone. Of this, 16.27 percent belongs to the chronically inundated category, 13.34 percent to the occasionally inundated category and 22.73 percent to the rarely inundated category.

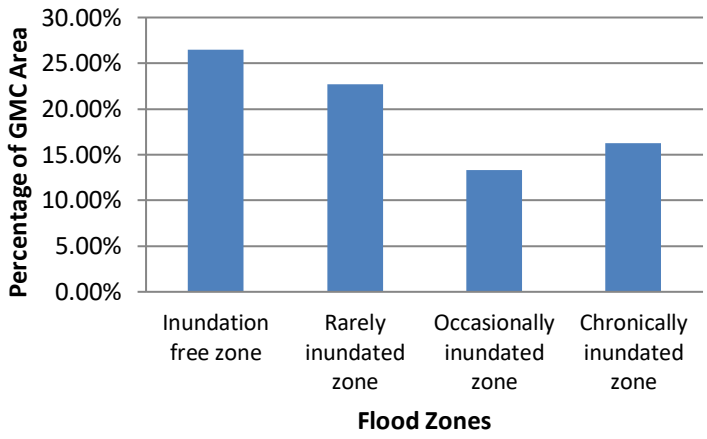
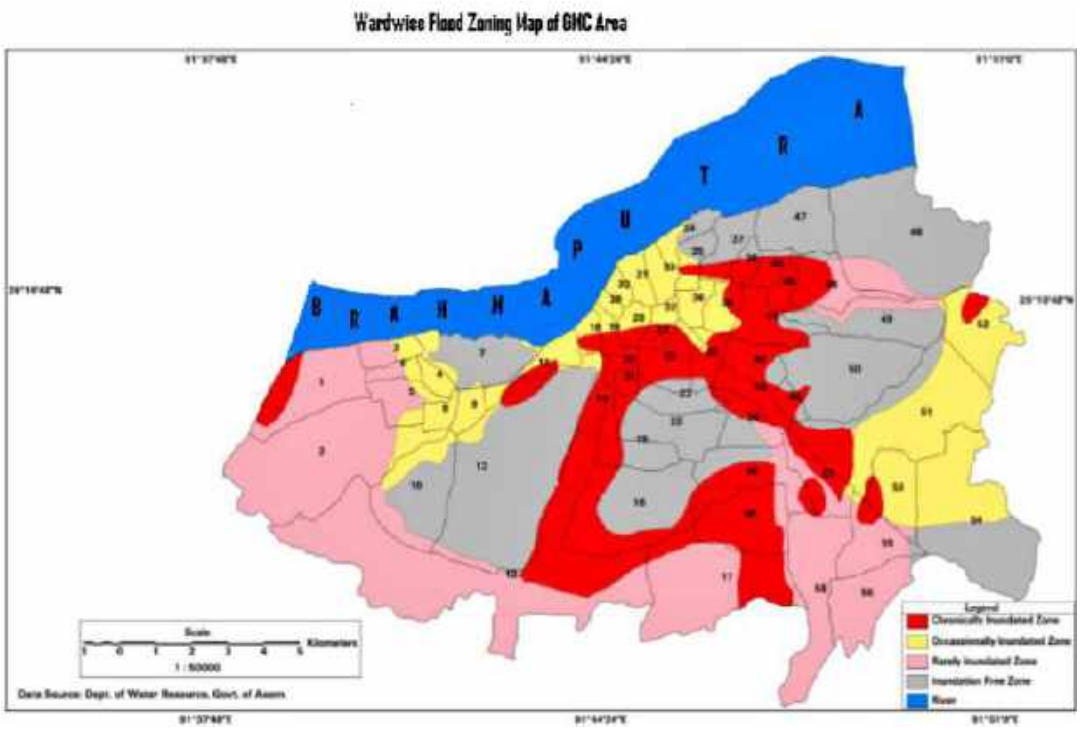


Figure 3 Flood zones of Guwahati

Source: Flood zone mapping of Guwahati Municipal Corporation area using GIS technology.pdf

The different wards falling under different risk zones were identified by overlaying the ward map of the GMC area on the Flood Zone Map



Map 6 Ward wise flood zones of India

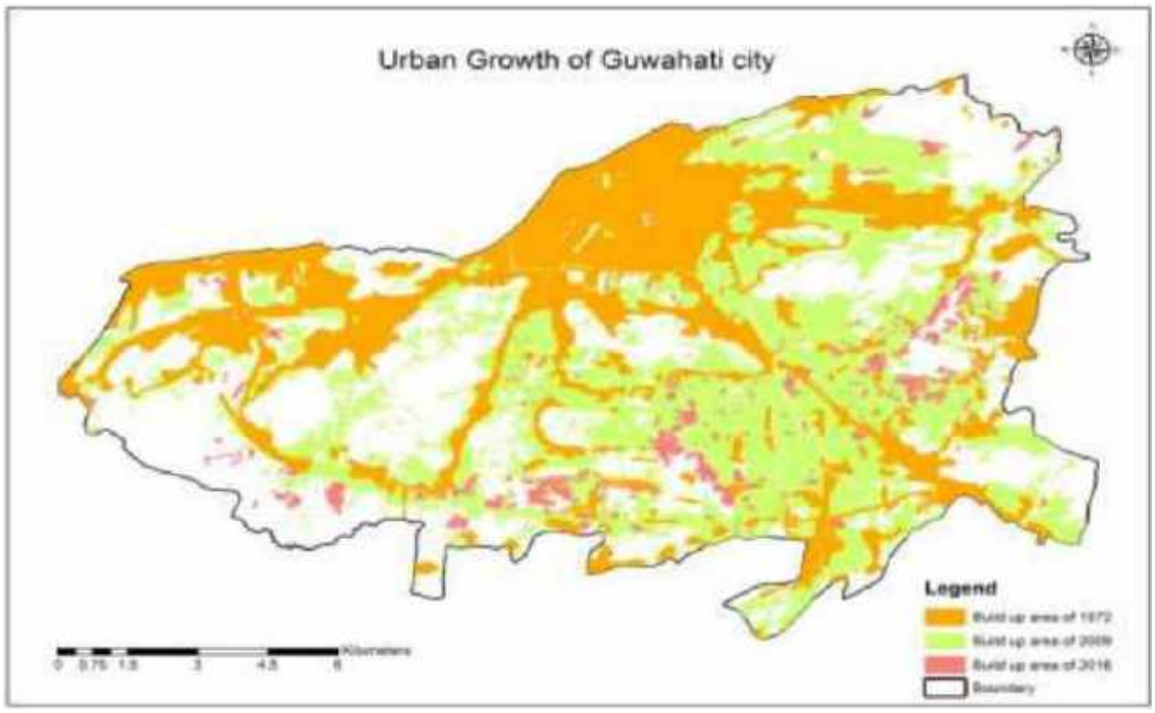
Source: Flood zone mapping of Guwahati Municipal Corporation area using GIS technology.pdf

Some of the major areas affected by water-logging have been are:

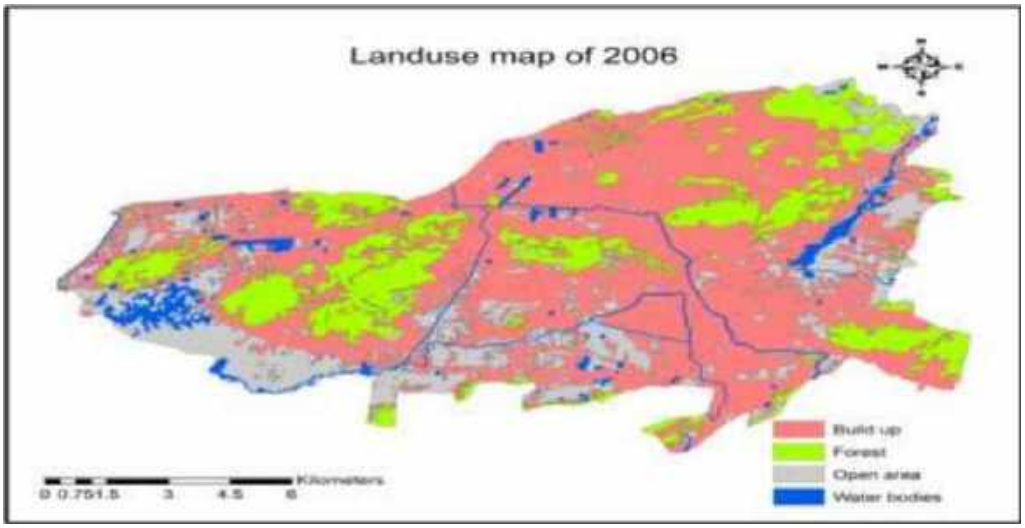
Mathura Nagar & adjoining areas, Jonali Point area on the Zoo (RG Baruah) Road, Tarun Nagar & Srinagar areas (South of Bharalu River), Anil Nagar & Nabin Nagar areas (North of Bharalu River), Rajgarh, Pub Sarania & Lachit Nagar areas, Rajgarh Road Bye-lanes, Usha Court Point *area* on the Zoo (RG Baruah) Road, Bhangagarh Flyover Point, Ananda Nagar area on GS Road, Hatigaon & Sijubari areas, MLA Hostel area in Dispur, Kalpa Bhatta Chowk area of Noonmati, Uzanbazar area, Ambari area, Ulubari & Manipuri Basti areas, Tokobari & Krishna Nagar areas, Kumarpara area, Barsapara & Dhirenpara areas, Lalganesh area, Manasha Mandir Path area of SantipurRest Camp of Pandu, National Highway 37 (Guwahati Bypass from Jalukbari to Khanapara)**.**

3.2 Urban growth and Land use change

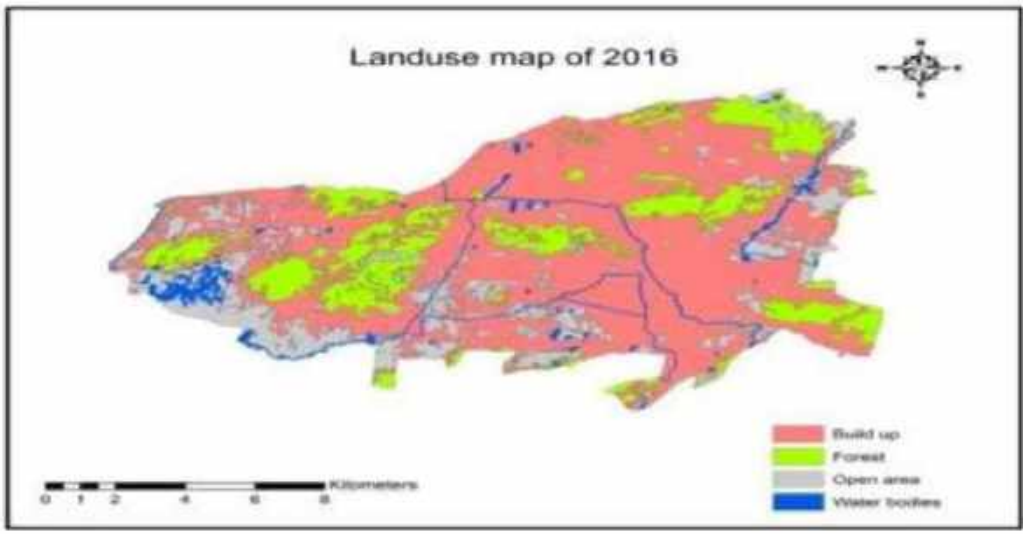
The Guwahati Metropolitan area is one of many cities in India which face problem of unplanned Land use Land Cover change due to nominal or non-existence of planning leading to rapid and haphazard growth of urban population leading to encroachments in wetlands, ponds, hills etc. and degrades the natural environment as well as the microclimate. The high population growth and enormous human migration occurred during the last decade in the city which resulted in urban sprawl in the city.



Map 7 Urban Growth
Source- Impact Of Urban Growth On Land use , A Case Study Of Guwahati City, Assam.



Map 8 Land Use map of 2006
Source- Impact Of Urban Growth On Land use , A Case Study Of Guwahati City



Map 9 Land Use map of 2016
Source- Impact Of Urban Growth On Land use, A Case Study Of Guwahati City

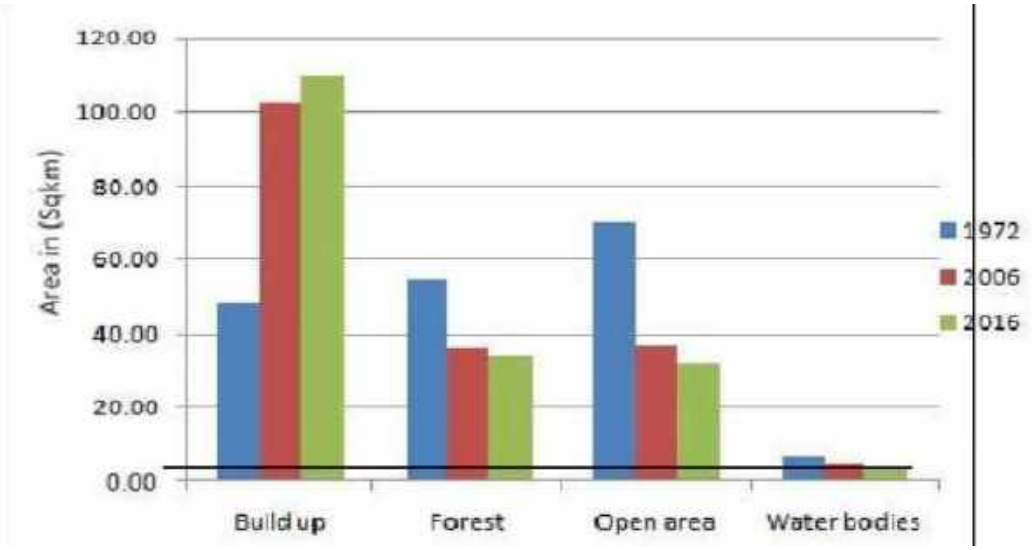


Figure 4 Changing pattern of land use types from 1972 to 2016
Source- Impact Of Urban Growth On Land use, A Case Study of Guwahati City

It is clear from the above graph and map that, build up area, forest cover, open areas and water bodies saw major changes. Built-up area is increasing at the cost of decreasing of open land, forest area and water bodies. In 1972 built up area covered (48.34) Sq.km which increased and reached (102.30) Sq.km in 2006. From 2006 to 2016 built-up area increased up to (110.21) Sq.km. In 1972 open land covered 69.78 sq.km areas. In 2006 it reduced up to (36.55sqkm) area which further reduced to (31.89 sq.km) in the year 2016. De-expansion of crop land is at the cost of expansion of built-up land. Water bodies are get shrieked day by day due to rapid urban growth, population pressure etc. It occupies (3.66) sq.km of total study area according to 2016 data. In 1972 top sheet shows that it occupies (6.88) sq.km which reduced to (4.92) sq. km in 2006. In 1972 forest land covered (54.72) sq.km area and in 2006 it reduced to, (35.98) sq. km area. In 2016 forest area covered is further reduced up to (33.99) sq. km area.

3.3 Land Use Change and Its impact on the Natural Drainage System

Guwahati city lacks a planned drainage system hence it depends heavily on the natural drainage basins. It has five broad natural drainage basins. The existing drain system of the city consists of:

1. Bharalu Basin (catchment area=100 sq. km)
2. Silsako Beel Basin (Catchment area = 92 sq. Km)
3. Deepar Beel Basin (Catchment area= 144 sq.km)
4. Kalmoni Basin (Catchment area= 66.5 sq.km)
5. Fore shore Basin

The existing natural drain channels are:

i. Bharalu-Bahini river system
ii. Mora Bharalu River
iii. River Basistha
iv. Lakhimijan Channel
v. Bondajan Channel
vi. Khanajan River
vii. Kalmoni River

Given the volume of rainwater Guwahati receives, the main storm-water carrying channel—the Bharalu – simply does not have the carrying capacity to deal with it. The conditions of

these channels are not very convincing as they are constantly covered with garbage, waste material, siltation caused due to destruction of the hills, earth-filling and sewage as well as encroachment of major chucks of the basins leading to an increase incidence and intensity of urban flooding. Once occupying 4,000 hectares, Deepor Beel has shrunk to less than 500 hectares.

3.4 Risk Reduction Methods taken by Authorities

As stated in the report on urban floods in Guwahati by Assam State Disaster Management Authority, the district administration along with GMDA, GMC has taken up the following short-term and long-term measures in order reduce the impact of floods in Guwahati-

Long-Term Measures

1. Application of modern techniques like GIS for the detailed survey of drainage pattern etc. as a planning tool
2. Creation of new drainage channels along the southern side of the NH bypass
3. Construction of linking channel from the southern part of NH to Deepor Beel
4. Re-sectioning of Khanajan to Khanamukh and providing a multiple sluice-gate at Khanamukh with pumping facility
5. Diversion of refinery drain directly towards R. Brahmaputra (Work is under progress)
6. Periodic de-siltation of the water bodies like natural drainage channels and Beel.
7. Imposing a ban on earth cutting in hilly areas.
8. Taking up works for stabilisation of slopes and preservation of wetlands. The following measures can be taken which support the flood mitigation and effective management wetland in Guwahati city.
    - Existing manholes of drain are inadequate; more manholes and inlet are required for the quick disposal of silt and stagnated water.
    - The dumping (dumping of rice bran and other wastes from the wholesale fish market) of waste in Sola Beel should be stopped.
    - Silt pit of proper size should be constructed in suitable areas and provision of periodical cleaning the silt pit should be done to avoid blockage in the drainage system.
    - Effective garbage collection system to be n place so that this does not block the drainage channels.

- A new canal to take excess water may be built from Konna towards west parallel to Kakermara where HFL of the river is lower than the city level.
- The Deepar Beel could be a major possible recreational area for the city.
- To overcome sewage entering into the Beels, the complete solution would be to provide sewage treatment and solid waste management for all residential and other urban areas.

9. Installing and maintaining silt traps at crucial points within the drainage channels.
10. Installing a dedicated power supply line to the pump sets.
11. Removing encroachments, prohibiting new construction, and enforcing laws to protect further degradation and afforestation programmes from the surrounding hills.
12. Clearing of waterway of the culverts blocked by cables and pipes.
13. Development of satellite townships to ease the pressure of increasing population on core area of city. All these recommendations shall have to be enforced through legal amendments and Master Plan.

Short-Term and on-going measures

1. Identification of the worst-affected areas in the city.
2. Clearing of all drains before and during monsoon season.
3. Impose strict penalties for indiscriminate garbage disposal in drains.
4. Maintenance and repair of pump-sets.
5. Employing trolley-mounted pumps for dealing with water-logging due to flash floods.
6. To control flash floods, Rain water harvesting to increase water absorption by ground to be promoted and made mandatory in certain cases.
7. Restrict the use of hazardous plastic bags, which leads to choking of natural drains.
8. Fixation of uniform road level across the city depending upon various Municipal zones.
9. Storm water drainage network, along with GIS mapping of all drains in Guwahati City.
10. Install early flood warning system in the entire city for faster information dissipation.
11. Soliciting citizen group's participation in identification and monitoring of works.
12. Constitution of teams of magistrates to monitor the implementation of works.
13. Mock drills, DM audit, awareness generation, Capacity building and training, and documentation of on-going efforts for future reference.

14. Maintaining and upgrading the basic civic services will bring about considerable changes in the urban flood scenario. The sectors of intervention are very clearly delineated to strengthen the city's resilience against floods.

3.5 Disaster Management Strategy by the Authority (Disaster Management Plan, GDD)

The work relating to disaster management may be divided into three phases: Pre Disaster, During Disaster and Post Disaster.

1. **Pre-Disaster** :

The phase prior to the disaster concerned basically comprises the following steps:

- *Planning & Taking Stock*: The Disaster Management Plan would be fine-tuned and specific micro-plans would be prepared for each individual disaster. Accordingly, S.O.P. would be prepared for each of the During Disaster Processes. Before that, inventories of all the existing resources including manpower would to be prepared. The resources required by the Department would be compared with the existing resources, and arrangements done to meet any shortfall.

  The organization-wise specific steps required in this regard are:

  Guwahati Development Department:

  - ✓ Take indent of resources from GMC and GMDA.
  - ✓ Provide such resources after proper scrutiny

  GMDA:

  - ✓ Prepare inventories of all the resources including manpower
  - ✓ Prepare disaster-specific plan and SOPs accordingly. Note down requirement of resources, and compare with existing resources.
  - ✓ Take steps for meeting shortfall, including procurement from own fund or by giving indent to GDD.

  GMC:

  - ✓ Prepare inventories of all the resources including manpower
  - ✓ Prepare disaster-specific plan and SOPs accordingly. Note down requirement of resources, and compare with existing resources.

- ✓ Take steps for meeting shortfall, including procurement from own fund or by giving indent to GDD.

- *Creating Awareness and Setting up of Community Action Groups:* The Disaster Management Plan would be given wide publicity. Similarly, disaster specific plans would also be adequately publicized. For better public cooperation, community action groups would to be set up.

  The organization-wise specific steps required in this regard are:

  Guwahati Development Department:

  - ✓ Provide wide publicity to the DM Plans through DIPR, etc..
  - ✓ Coordinate with ASDMA for incorporation of the plans into the state-wide gamut of things.

  GMDA:

  - ✓ Take up IEC activities.
  - ✓ Inform public about SOP of different machineries.

  GMC:

  - ✓ Disseminate concept and plan of Disaster Management at all levels.
  - ✓ Make the plan and inventories readily available to District Administration as well as other line departments.
  - ✓ Organize Ward Sabhas and liaise with local NGOs/ CBOs.
  - ✓ Constitute Ward-Level Residents' Welfare Societies/ Nagrik Samitees for disaster specific purposes.
  - ✓ Form work-wise Action Groups from amongst members of RWS/ NS. Such Action Groups may comprise the following.

Warning Action Group	Evacuation Action Group
Shelter Management Action Group	Relief and Rehabilitation Action Group
First Aid and Medical Action Group	Water and Sanitation Action Group
Cattle Management and Carcass Disposal (Veterinary) Action Group	Erosion Control Action Group
Damage Assessment Group	Counselling Action Group

- *Preparation*: Adequate preparation would be done prior to striking of any disaster; so that the effect is mitigated, losses are minimized and the system can be back to normal within the shortest possible time.

  The organization-wise specific steps required in this regard are:

  Guwahati Development Department:

  - ✓ Ensure all pending projects are completed by the organizations concerned.
  - ✓ Check and approve the SOPs concerned, and inform relevant Deptt.s accordingly.

  GMDA:

  - ✓ Set up efficient management teams for various disaster related works.
  - ✓ Complete works related to flood-preparedness including installation of pumps, excavation of channels and water-bodies, etc.
  - ✓ Take steps for stabilization of hill slopes, including rejuvenation of vegetative cover, in order to mitigate probability of landslides.

  GMC:

  - ✓ Set up efficient management teams for various disaster related works.
  - ✓ Adopt proper and efficient Solid Waste Management system and ensure practice of the same by the members of public.
  - ✓ Clear out the drains regularly.
  - ✓ Check the encroachment of natural drains and evict them (if any).
  - ✓ Carry out safety audit of water tanks of GMC.
  - ✓ Issue notice to all owners for occupancy certificate.
  - ✓ Take steps for ensuring retrofitting of seismically fragile buildings.
- *Prediction and Early Warning:* Proper prediction and early warning system has to be adopted for each of the disasters. GMDA would coordinate with ASDMA, NESAC (ISRO) and WR Deptt. for accomplishing that.

  The disaster-wise specific steps required in this regard are:

- *Riverine and Areal Floods*:
  - ✓ Set up Automated Rain Gauges/ Weather Stations all across the city to get rainfall data at 5 minutes interval. The data would be immediately transmitted to a central data-base for continuous and online monitoring and analysis.
  - ✓ Using HEC-RAS model and using river geometry and Manning's Formula, probability of floods would be predicted.
  - ✓ Information on probability of floods would be immediately disseminated by SMS to all stakeholders including department officials involved and representatives of public.

2. During Disaster

In case of the onset of any disaster, the specific tasks that need to be accomplished are as follows.

- ➢ Disseminate of information timely to all stake-holders concerned.
- ➢ Rescue and Evacuation.
- ➢ Clear out the Debris and Removal of Road Blockage.
- ➢ Immediate Restoration of Infrastructure.
- ➢ Provide Emergency Water Supply.
- ➢ Clearing out the Drains.

For that, GMC has set up an Emergency Support Functions (ESF) System in accordance with the Incident Response System (IRS) adopted by NDMA. GMDA would also have its ESF in due course.:

- Emergency Support Functions (ESF) of GMC:.

The Emergency Support Functions (ESFs) are various identified response teams, which will assess their strength before any emergency and accordingly will prepare their Standard Operational Procedures to mitigate any disaster. Their well preparedness will help to reduce the damage of any disaster/emergency. These Emergency Support Functions (ESFs) will be identified as per the needs felt during any disaster. For an effective operational system of the ESF, the following points are to be ensured:

- ➢ Individual ESFs must prepare their Standard Operational Procedures (SOP) and Plan befitting the requirement in the District Response Plan;
- ➢ Time to time each ESF is to undergo simulation exercise or mock drill to understand short comings; and

- The response system is to be up graded regularly depending on the shortcomings.

3. Post- Disaster-

After any disaster has occurred, the specific tasks that need to be accomplished are as follows.

- **Provision of medical and health facilities to prevent Epidemics**: Although it is primarily the job of the health department and PHE Department, GMC has to provide safe drinking water from its plants to the victims/ affected people. For that, it may use water-tankers as well.
- **Carcass Disposal:** GMC has to take steps in that direction.
- **Damage Assessment:** Both GMC and GMDA have to undertake damage assessment exercise and submit report within time as per the revised CRF guidelines.
- **Reporting:** Reporting on the losses and damages have to be made at the earliest, although the proper damage assessment may take some time. This is to facilitate proper policy decision for restoration of essential services at the earliest.
- **Reconstruction of Roads and other Infrastructure destroyed by Floods**: Such reconstruction infrastructure has to be done by GMC/GMDA (as the case may be) on sanction of fund from the CRF/ State Relief Department.
- **Counselling:** GMC may undertake the venture after flood, with the senior citizens going to people who would have lost family members or large amount of property in the floods, and try to get them out of their trauma.

Urban flood in Guwahati is quite evident due to its topographical placement but also has aggravated due to human interference and the destruction we are causing to the eco system. Also the ground action by the responsible authorities is lacking to a great extend which can lead to further damages of property and human life. Hence proper mitigation strategy to curb the risk of flood in the city is required.

Community Awareness and Prepardness to Disaster

4.1 Importance of Community Preparedness

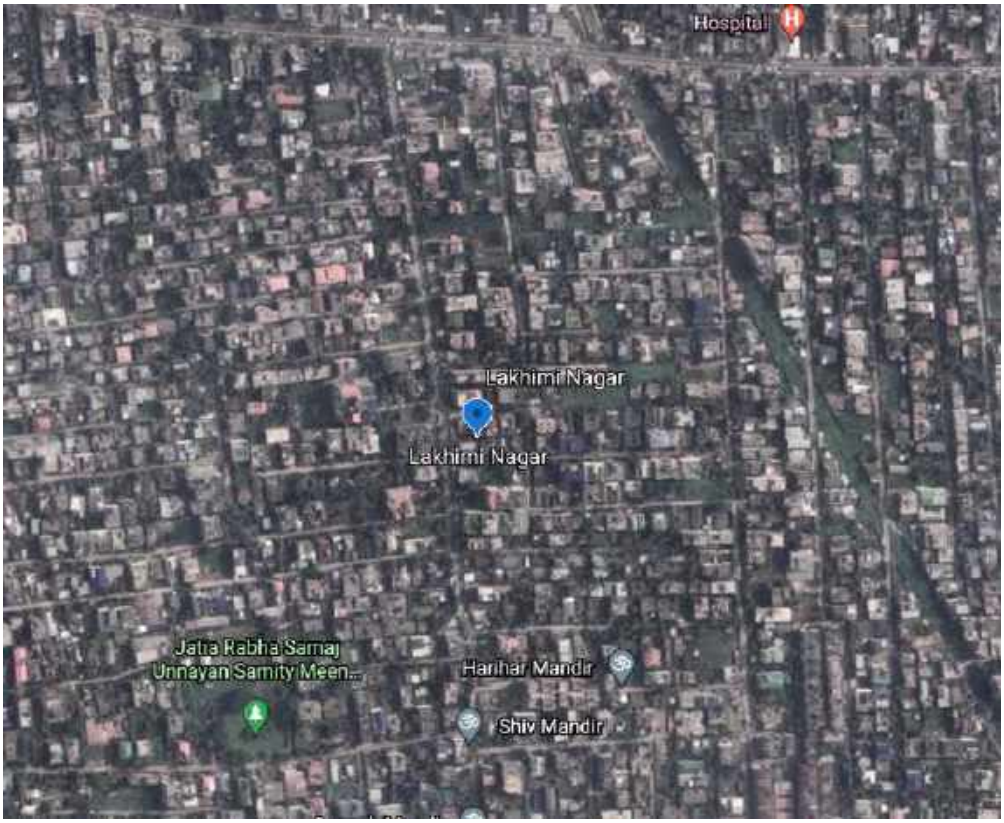
By 'community', we mean both rural and urban neighbourhoods. There's no specific way to define community, most definitions include shared experiences, locality, culture, language, and social interests. These characteristics infer that a community needs to have some common social structures as glues, which can be schools, community policies, common rules, and regulations and most often a clearly defined geographical area (UNISDR, 2006).

Disaster preparedness refers to measures taken to prepare for and reduce the effects of disaster. That is, to predict and, where possible, prevent disasters, mitigate their impact on vulnerable populations, and respond to and effectively cope with their consequences. Disaster preparedness provides a platform to design effective, realistic and coordinated planning, reduces duplication of efforts and increase the overall effectiveness of National Societies, household and community member's disaster preparedness and response efforts. Disaster preparedness activities embedded with risk reduction measures can prevent disaster situations and also result in saving maximum lives and livelihoods during any disaster situation, enabling the affected population to get back to normalcy within a short time period. (IFRC)

Community-based disaster management (CBDM) is a bottom-up approach because solutions are coming from the community itself and not in the form of a request from higher authorities. It involves successive stages that are processed to reduce disaster risk. The different stages in CBDM are disaster/vulnerability risk assessment, risk reduction planning, early warning systems, post-disaster relief, and participatory monitoring and evaluation.

4.2 Community Profile

The survey was conducted in the Lakhimi Nagar, Hatigaon locality. It is located in the southern part of Guwahati. The survey was conducted from 12th February 2021 till 14th March 2021. The sample size of the survey was 51 people.

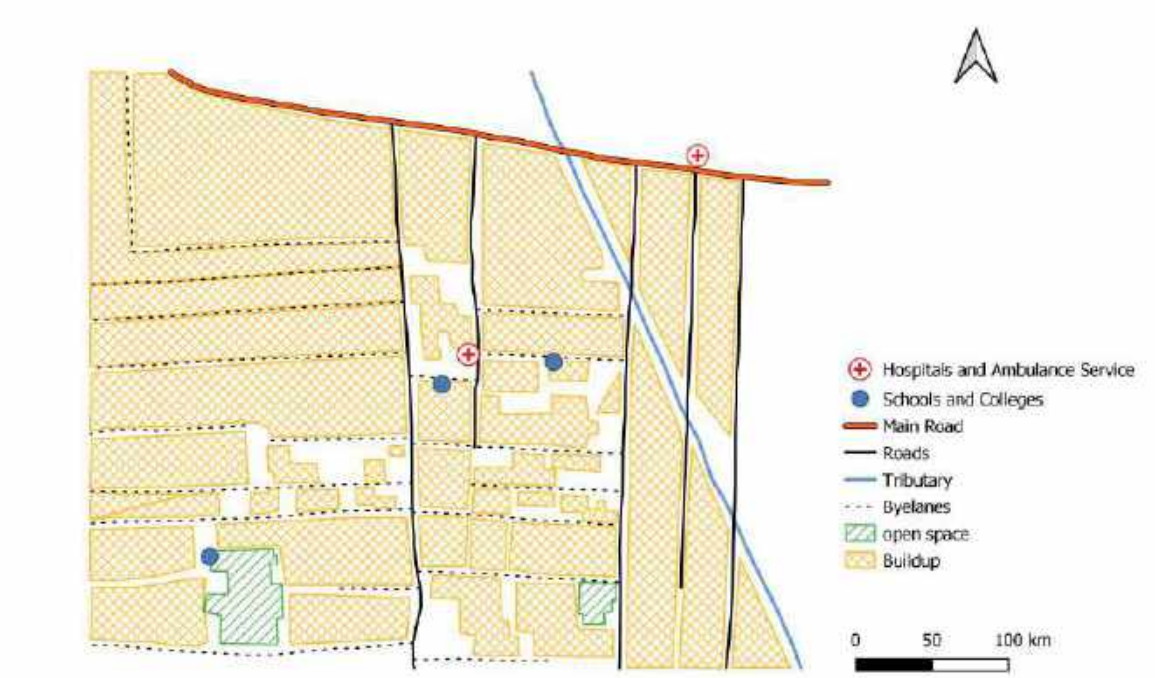


Map 10 Lakhimi Nagar
Source: Google Map

Lakhimi Nagar is an upscale affluent neighbourhood located at 26.14°N to 91.78°E and is severely affected by flash floods each year and is listed by GMC as flood affected region. It is in close proximity to Dispur, which is the state capital as well as the administrative centre of Assam. It is well connected to the National Highway 37, major institution such as Indian Institute of Technology, Guwahati, Guwahati University, Lokpriya Gopinath Bordoloi International Airport, and Apollo Hospital etc.

As aforementioned, the survey was conducted in pre-selected specified locations in the Lakhimi Nagar area. The following profiles will reflect the composition and structure of the selected sample and community.

4.3 Physical Environment



Map 11 Study Area Map

The study area as shown in map 11 is a densely populated region with packed build up which includes apartments, housing complexes and individual houses as well which makes it highly vulnerable to hazards such as earthquake, fire, flood etc. and which can make evacuation difficult. A network of by lane can be visible which is connected to one road known as Lakhimi Nagar road which is further connected to the main road. A lack of proper road planning is observed which can delay search and rescue as well as evacuation leading to further injury and death due to congestion. Hospital and ambulance service is in proximity. Schools and open grounds too are available in the area which can be used as shelter but may not be enough for the population.

4.3 Demographic Profile

From the 51 people surveyed, the age ranged from 15 to 64 years. 46% of the respondents fell under 30 to 38 years old category. 57% of the surveyed population is female where 23% of it is male. 49.01% of the respondents has a family size of 4 members which (including themselves) in their household whereas 35.29% have 3 members. This reveals that a significant majority of the people live in nucleated or small families. The remaining 12% lives in joint families with 5 and above family members.

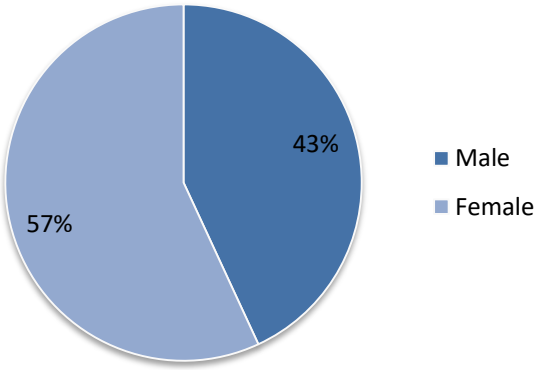


Figure 5 Gender Composition

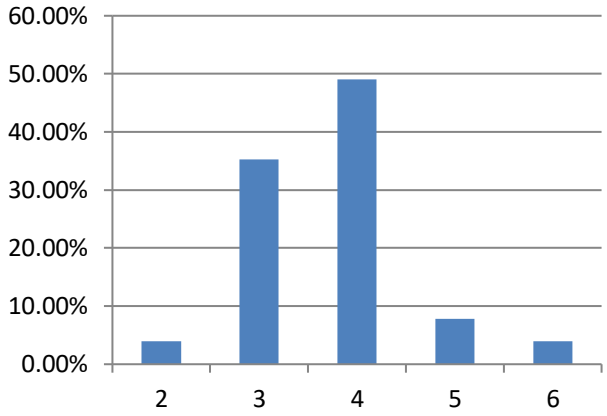


Figure 6 No. of Family Members

With regards to the family composition, 82% of the respondents do not have a disabled or member with serious health condition. 52% of the remaining respondents have 1 or 2 senior citizens in their houses. Remaining 6% have 3 or 4 senior citizens in their household. 60% have 1 adult male (15-64 years old), 26% have 2 adult males and the remaining 14% have 0, 3 and 4 adult males in their household. 72% have 1 adult female (15-64 years old) and 20% have 2 adult females in their houses. Remaining 8% have 0 and 3 adult females. Concerning young adult's (19-24 years old) percentage, 78% of the respondents do not have a family member who falls in this category. The next 14% have 1 young adult in their household. Remaining 8% have 2 to 4 young adults as their family members. 76% of the respondents have no teenagers (below 15 years old) in their houses. Next 16% and 8% have 1 and 2 teenagers in their houses. 50% have no infants, 26% have 1 infant, 20% have 2 infants and 4% have 3 and above infants in their household.

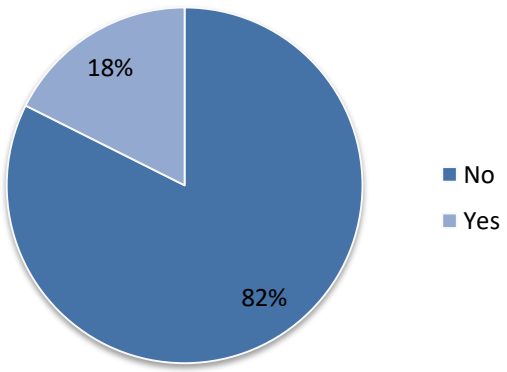


Figure 8 Disable Members

Figure 7 Family Composition

4.4 Socio- Economic Profile

6% of the respondents were 10th pass, 29% were 12th pass, 45% of the respondents are graduates, and 20% are post-graduates. Hence, the majority of respondents have a higher education degree.

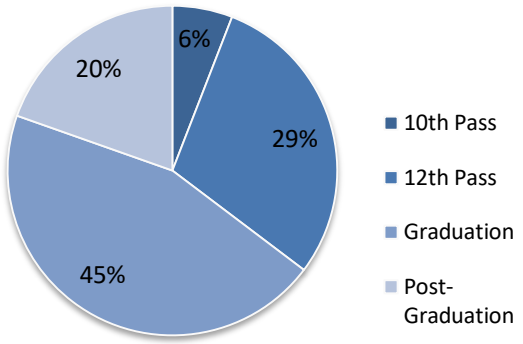


Figure 9 Education Qualification

57% of the respondents are students who do receive some form of mock drills and disaster awareness through schools and colleges. 25.5% are professional, technical and related works, 9.8% are service, 2% are sales worker and executive, administrative and managerial work each and 3.9% have works that are not classified by occupation. Majority of the respondents are government employees, which makes it compulsory for them to take part in disaster awareness and mock drills.

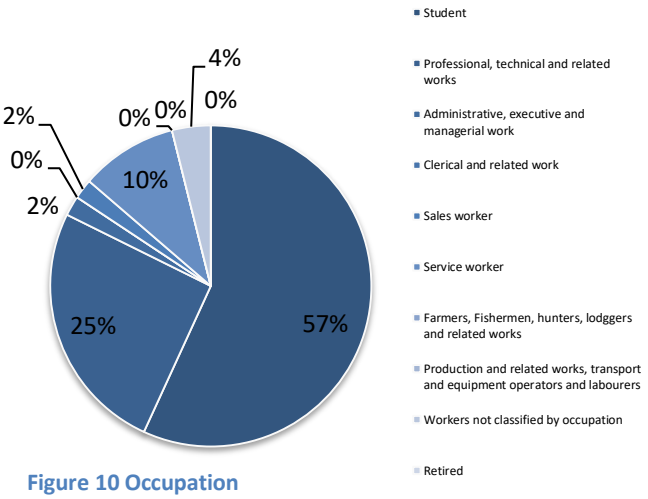


Figure 10 Occupation

41% of the respondents have an income of 300000 to 800000, 33% have more than 800000, 22% have 70000 to 300000 and 4% have less than 70000. Hence, the majority of the respondents belong to the middle, upper middle and higher class group.

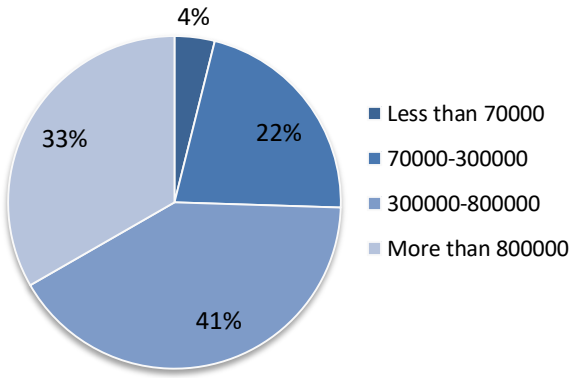


Figure 11 Annual Income

59% of the respondents resided in apartments, 16% in housing complexes, 15% in bungalows or Villas and 10% in Assam type houses[3].

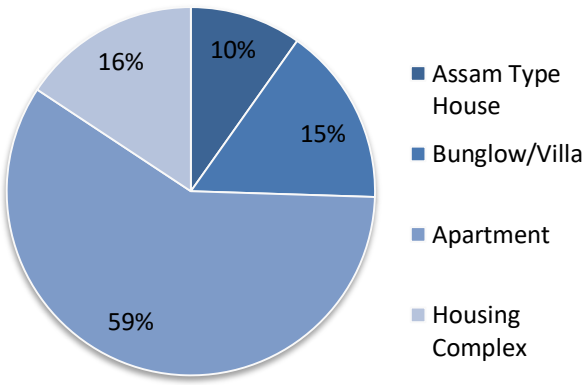


Figure 12 House Type

[3] Style of architecture prevalent in Assam and Sylhet region Built to be earthquake proof and made of materials like Bamboo, wood, mud plaster etc.

4.5 Community Awareness

80% of the respondents received or read about any preparedness for a disaster like flood from government agencies. 78% of have received it through newspaper, 61% through television which are the most popular forms telecommunication. 27% of the information was received through radio which use has reduced over the year. Information received through relatives, friends and community is only 12%. Other forms of sources include journals, social media and messages from telecom providers.

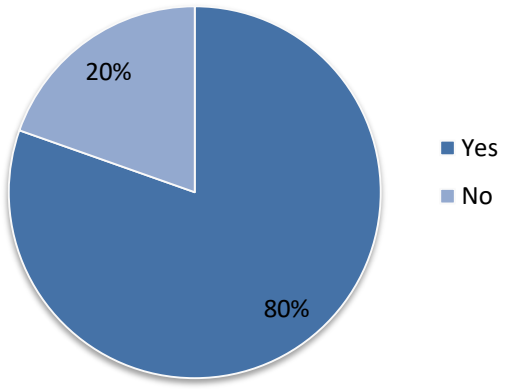


Figure 13 Preparedness Information

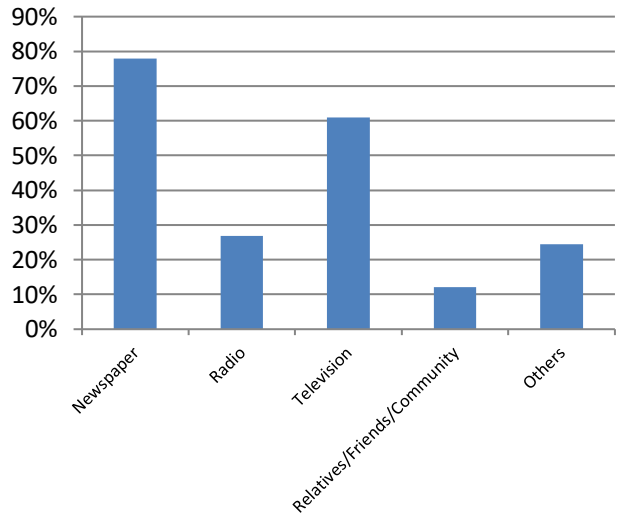


Figure 14 Source of Information

Around 86% of the respondents do not have flood alarm system in their locality whereas 14% does have one. It can be interpreted that the difference between both the scenarios is quite drastic showing major drawback in the conduct of the disaster management authority of the city in regards to preparedness of urban flood.

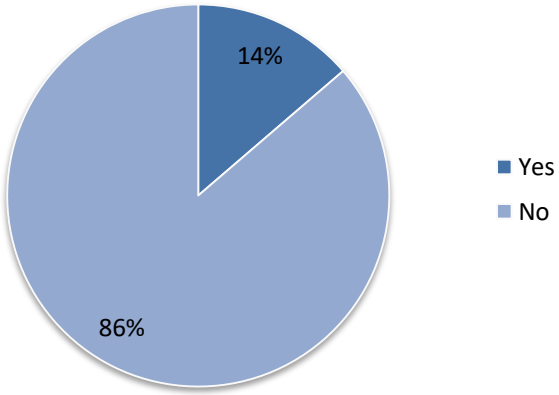


Figure 15 Availability of Flood Alarm System

4.6 Community Preparedness

39% of the respondents do not have an emergency evacuation plan in their residents where as 35% have one. From the graph, only apartment building have emergency evacuation plan in place which too accounts for only 20% of the respondents. The lowest number, i.e. 10%, can be found among Assam Type housing which is more susceptible to floods due to lack of elevation. It is also interesting to observe that 25% of the respondents were not aware if there is any emergency evacuation plan functioning in their residents or not.

From the graph we can interpret that 84.3% of the residents do not have a rainwater harvesting plan installed in their household which can act as a drinking water supply during flood situations. Since the set-up of a rainwater harvesting system is expensive, an effort is being made to understand the relation between income and the existence of the system. But it can be observed even in the higher income groups of 300000 to 800000 to more than 800000, only 6% and 4% have installed such system respectively. This can also indicate the government to have not provided the infrastructure for the same.[4]

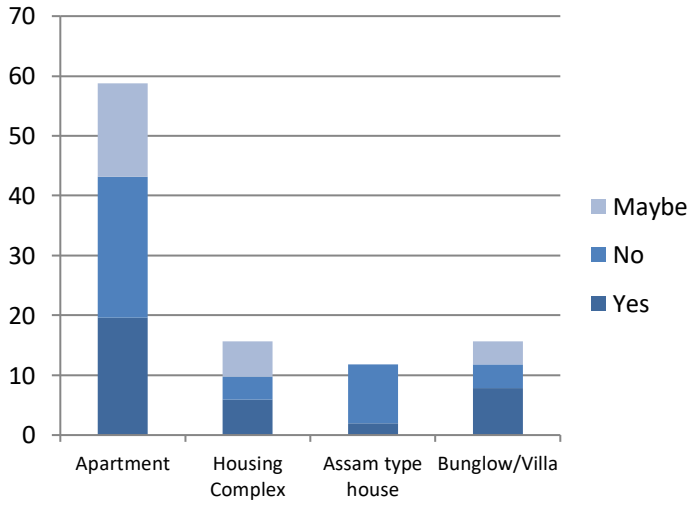


Figure 16 Availability of Evacuation Plan in Housing Types

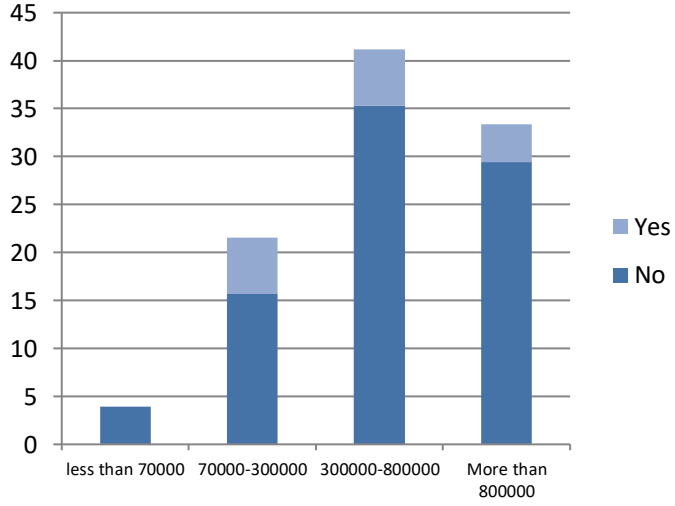


Figure 17 Relation between Rainwater harvesting and Annual Income

[4] According to NDA Guidelines, 2010, every building proposed for construction shall be provided with required facilities and infrastructure for conservation and harvesting of rainwater.

Table 5 Cross Tabulation between Income-Education Qualification-Availability of Disaster Management Kit

Annual Income	Less Than 70000				70000-300000				300000-800000				More than 800000			
Education Qualification	10th	12th	Graduate	Post Graduate	10th	12th	Graduate	Post Graduate	10th	12th	Graduate	Post Graduate	10th	12th	Graduate	Post Graduate
Yes	0	1	0	0	0	0	1	0	0	4	4	4	0	2	4	0
No	0	1	0	0	2	1	5	2	1	1	4	3	0	5	5	1

Disaster management kit was readily available to only 39.2% of the respondents. From the table 5, it can be observed that the highest no. of disaster management kit was ready for the income group of 300000 to 800000 and had the education qualification of 12th pass, graduate and Post-graduate.

In Figure 18, it is observed, 90.2% of the respondents will have water in their kit, followed by flash light, first aid kit and food. The lowest importance is given to hand cracked and battery radio.

While in figure 19, majority of the respondents would check their power line first followed by checking gas line or LPG, disinfecting and sanitizing their surroundings, checking water purity, checking housing structure and seeking medical attention and at last sourcing food and water after a flash flood. It can be observed that the community level preparedness of the study area is quite low despite being an affluent neighborhood which can be due to lack of awareness.

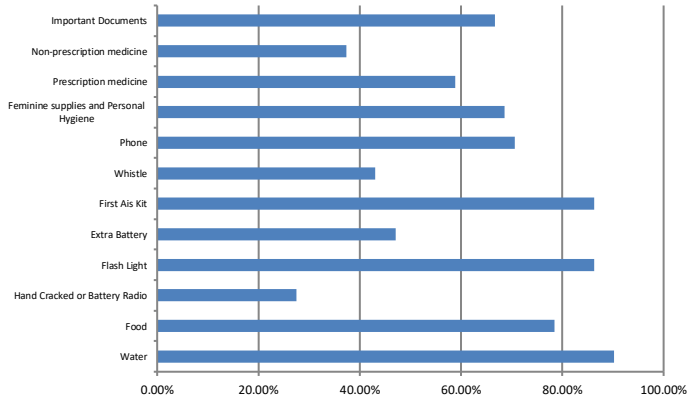


Figure 18 Emergency Disaster Kit Content

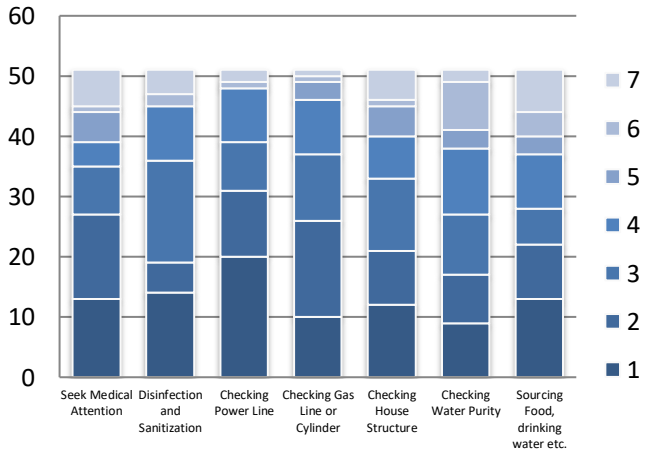


Figure 19 Steps taken after Flood

Conclusion

With the nature of location of the city and the amount of rainfall that it receives flash floods have been recurring events in Guwahati city for the last 20 years with its intensity increasing each year. Yet, the preparedness and mitigation for this disaster has been poor for both in community and administrative level.

As it can be observed in the chapter two of the report; unprecedented, unplanned urban growth, lack of planned drainage system, encroachment of the existing natural drainage basins and wetlands, un-regulated land use along with other factors such as encroachment of the hills, un-regulated waste management system etc. are the major causes of urban flood in the city. The city also lacks proper implementation of early warning system, awareness generation, Capacity building and training etc. The situation can be improved if the city authority intervenes and implements proper city resilience systems such as strict imposition and regulation of the guidelines for construction of buildings on slope, Conservation of green areas/wetlands/beels, protecting and managing natural drainage systems of the city, handling waste and use land fill sites judiciously and taking up proper structural and non-structural measures to mitigate the flood situation.

In regards to the community level preparedness in the concerned study area for urban flood, the preparedness and awareness level is very low even among highly educated and economically well off citizens which is indeed a matter of concern. In such a situation the interference of community action groups such as the RWAs/ SDAs, youth clubs and other social-cultural organisations and NGOs have a major role in all other DM actions. Awareness generation programmes should target both students and staff of educational institutions like schools, colleges, universities and officials at various levels is also necessary. The role of public representatives also becomes important sensitizing on all the factors, related to urban floods and awareness generation.

What we citizens in general, be it authorities or fellow commoners, need to understand is that we cannot prevent the occurrence of disasters but we can definitely reduce its impact on our as well as the communities life by working together.

Annexure

Questionnaire

Urban Flood Preparedness

This survey is being conducted on the topic "Flood Preparedness" as a part of subject related research for B.A (Hons) Geography, Kamala Nehru College, University of Delhi. The questionnaire contains 3 sections:

1. Personal Details
2. Family Details
3. Preparedness

Awareness and Recovery The questionnaire contains 17 questions which will take 5-10 mins. Your personal information and responses will be kept confidential. Your cooperation is appreciated.

Personal Details

1. Name
2. Email ID
3. Phone No.
4. Gender
5. Age
6. Education Qualification
7. Occupation
8. Family Details
9. Annual Family Income
10. Does anyone in your household have a disability or health condition that would impact their ability to evacuate in case of an emergency?

Preparedness, Awareness and Recovery

1. Have you ever received or read about any preparedness for a disaster like flood?
2. If yes, where did you read or receive it from?
3. What is your housing type?

4. Do you have a rainwater harvesting system installed in your house/apartment/complex?
5. Do your house/ building/complex has an emergency evacuation plan?
6. Have you heard of any flood alarm system in your locality?
7. Do you have an emergency disaster kit ready?
8. What will your emergency disaster kit consists of?
    a) Water Food
    b) Hand Cracked or Battery Radio Flash light
    c) Extra Battery
    d) First Aid kit
    e) Whistle Phone
    f) Feminine supplies and personal hygiene items
    g) Prescription medication
    h) Non- prescription medication
    i) Important documents
9. Rank the order of steps taken by you after a flood.
    a) Seek medical attention
    b) Disinfection and Sanitization of your home and surrounding
    c) Checking the power line by electrician
    d) Checking the gas pipeline or LPG cylinder
    e) Checking your house structure
    f) Checking the water purity
    g) Sourcing fresh food, drinking water and clothes

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