SLUMS AND ENVIRONMENTAL IMPACT: A STUDY OF UPPER ASSAM

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SUBMITTED BY

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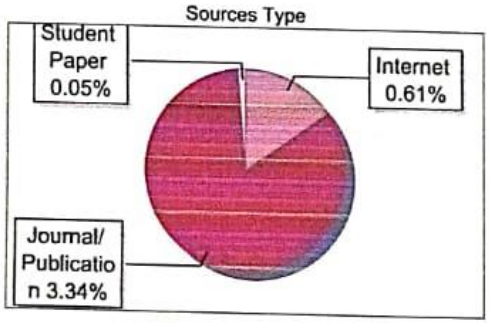

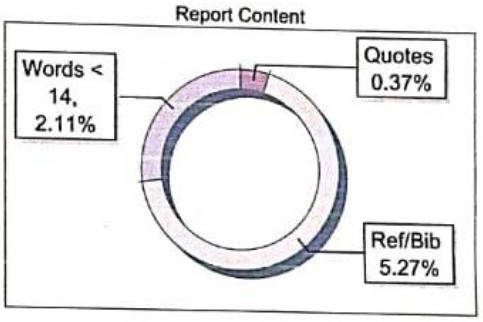

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This thesis is not only a testament to the collective efforts of those mentioned above but also a reflection of my personal and academic growth. The challenges encountered along the way have been instrumental in shaping my perspective and refining my research skills.

As I submit this thesis, I am filled with a sense of accomplishment and gratitude. It is my hope that this work contributes meaningfully to the existing body of knowledge in Slums and environmental impact: A Study of Upper Assam and inspires future research endeavors.

Preeti Barsha Borah

May, 2024

ABBREVIATIONS

AIDS---acquired immune deficiency syndrome

$CaCo_3$---- Calcium Carbonate

Cl --- Chloride

C. Govt---- Central Government

CHC --- Civil Hospital Centres

cm-- Centimetre

℃ ----Degree Celsius

Dec ---December

Et al---- And others

Fe ---Ferus (Iron)

Fig ---- Figure

GIS --- Geographic Information System

GPS--- Global Positioning System

HC ----Harijan Coloney

HCHO--- Formaldehyde

HH ----Household

HIV ----Human Immunodeficiency Virus infection

IAQ ----Indoor Air Quality

IS---- Indian Standard

Kg--- Kilogram

LPG-- Liquid Petroleum Gas

LULC ---Land Use Land Cover

MB---- Municipality Board

Mg ----Magnesium

M. Corp ---- Municipality Corporation

NGO--- Non-Government Organisations

No---- Number

NSS---- National Sample Survey

OBC ----Other Backward Class

OSM--- Open Street Map

pH--- Potential of Hydrogen

PHC----Primary Health Centres

PM --- Particulate Matter

S. Govt ---State Government

SC---- Scheduled Caste

S. Govt ----State Government

Sl---- Serial

ST---- Scheduled Tribe

Sq. Km ---- Square Kilometre

TC ---Town Committee

TDS--- Total Dissolved Solids

Temp ----Temperature

TVOC ----Total Volatile Organic Component

ULB ---Urban Local Body

UN --- United Nations

UNCTAD--- United Nations Conference on Trade and Development

USA ----United States of America

US$-----United States Dollar

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CHAPTER 1
INTRODUCTION

1.1 Theoretical and Conceptual Framework:

The discipline of geography entails a systematic analysis of the interaction between human and the natural environment. Various conceptual approaches have emerged within the realm of geography such as determinism, possibilism, neo-determinism etc. Determinism described that the natural environment exerts predominant control over human beings. In contrast, the possibilism accords greater importance to human asserting that nature can influence human endeavours to some aspects but human possess the intellect to find out the potentialities within nature and adopt it to their needs. Another approach, neo-determinism described the mutual interaction between nature and human activities emphasizing the necessities of maintaining delicate equilibrium between the two. Any disruption in this balance can yield adverse consequences for nature and human. The origin of this imbalance can trace back approximately 10,000 years, when human initiated agricultural and industrial activities.

In the 21st century, a multitude of challenges have arisen as threats to human beings and Mother Earth with the primary underlying factor being population growth. A burgeoning population results into heightened of resource consumption and increase exploitation of nature. Currently, the global population stands 8 billion according to the 2022 edition of the United Nation's World Population Prospects (WPP) and projections estimating an increase to 9 billion by 2050. This report also mentioned that India surpasses China in 2023. Along with population growth, there is a surging pressure on land and resources. The imbalanced growth of population gives rise to socio-economic and environmental problems encompassing issues such as food scarcity, sanitation problems and scarcity of safe drinking water, proliferation of poverty, regional disparities, conflicts, escalating crime rates, social and political unrest, environmental pollution, global warming, challenges associated with waste disposal, pandemics and more. These global problems are growing faster with the global urbanisation rate. According to United Nations, the current urbanisation rate of world is 55%. Moreover, the swift expansion of urban areas is accompanied by surging of population leading to the proliferations of slums in nearly most of countries in the worldwide. According to Vale L.

(2007), slums have become an integral facet of urbanisation with their prevalence dating back to the 18th century and persisting through the late 20th century in the United States and Europe, primarily due to the rapid urbanisation of the general population growth.

Slums are prevalent worldwide and their existence varies related to the geological setting and layout. The growth of slums is a significant global challenge for humanity, particularly impacting the prospects of the future generations. As the urbanisation accelerates, the urban population growth with increased the demand of land and other resources causes shrinkage of land and resources, eventually leading to a concurrent slum formation particularly among the marginal communities. With the increasing number of slum residents, poor living conditions are also escalated. To achieve the objectives of sustainable development, it is imperative to transform regions into slum-free zones, a goal contingent upon eradicating poverty through the provision of opportunities and strategies that foster slum-free urbanization. Enhancing the quality life of slum dwellers stands as one of the most critical developmental imperatives of the 21st century. According to the World's Cities Report-2020, approximately 1.6 billion population or 20% of the world's population inhabit in inadequate housing with one billion residing in slums and informal settlements. Population projections suggest that around 3 billion people will live in slums by 2030 (UN Habitat). These settlements called by various names including blighted areas, deteriorated areas, marginal areas, transitional areas, sub-standard settlement, unplanned settlement, uncontrolled settlement, spontaneous settlement, provisional settlement, squatter settlement, overnight settlement, urban villages, shanty towns, run-down neighborhoods, among others. Slums are known by different names in different countries like "Ranchos*"* in Venezuela, "Favelas*"* in Brazil, "Vilas*"* in Argentina, "Colonies*"* in Mexico (Neves 2012), "Barang barang*"* in Philippines among others. In India slums are known as "Jhuggi-Jhopri" in Delhi, "Zopadpatti or Chawls" in Mumbai, "Ahatas" in Kanpur*, "*Cheris" in Chennai, "Keris*"* in Bengaluru, "Bustee" in Kolkata (Hussain, 2012; Barik, 2018) or Basti in Assam, among other names. For census purposes in India, slums are categorised as notified and non-notified slums in India. Notified slums are the areas within a town or city, which are notified as 'Slum' by State, Union Territories administration or local government, housing and Slum Boards, municipalities under any Act etc. Non-notified slums are those which have not been formally notified or recognized as slum under any act, municipality or local government. A recognized slum is a compact area of at least 300 people or about 60-70 households of poorly built congested tenements, in unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities (Primary Census Abstract, 2011;

Sengupta P. et al., 2016). According to the report of Ministry of Statistics and Programme Implementation, Government of India, the estimated number of total slums in India were 33,510. Out of these, 41% notified and 59% were non-notified. Maharashtra has 7723 (23%) slums followed by Andhra Pradesh (13.5%) and West Bengal (12%). Though, slums are known by different names but the living conditions, socio- economic and overall environmental factors are in a state of being down and out.

Slum is a complex term to define because its characteristics are varying from place to place or region to region. The earliest definition on slum published in the James Hardy Vaux*'*s 1812 *Vocabulary of Flash Languages;* mentioned as the synonymous with 'racket' or 'criminal trade' (Prunty, 1998; Davis, 2006). Slums are defined differently by different scholars and organisations in different ways. The definition, adopted by the *U.S.A. Housing Act of 1949*, declared that "*Slum can be said to include any predominantly residential area where the dwelling, by reason of dilapidation, overcrowding, faulty arrangement of designs, lack of ventilation, light or sanitary facilities or any combination of these factors are detrimental to safety, health and morals*" (Risbud, 2003). The widely used definition of a slum is UN HABITAT's definition, a United Nations agency that has become an international authority on slums, presented the following understanding in their first global audit of slum conditions (UN Habitat, 2003, p.11): Slums are too complex to define according to one single parameter. Slums are a relative concept and what is considered a slum in one city will be regarded as adequate in another city even in the same country, local variations among slums are too wide to define universally applicable criteria. Slums change too fast to render any criterion valid for a reasonably long period of time (Rains et el., 2018). UN Habitat defined slums as rundown areas within a city or town characterized by poor housing, squalor and a lack of in tenure security (Fig 1.1). A slum is a densely populated settlement with a collection of poorly built tenements, mostly of temporary nature, crowded together, usually with inadequate sanitary and drinking water facilities contributing to unhygienic conditions within the confined space (*NSS Report, No. 534, mohua.gov.in*).

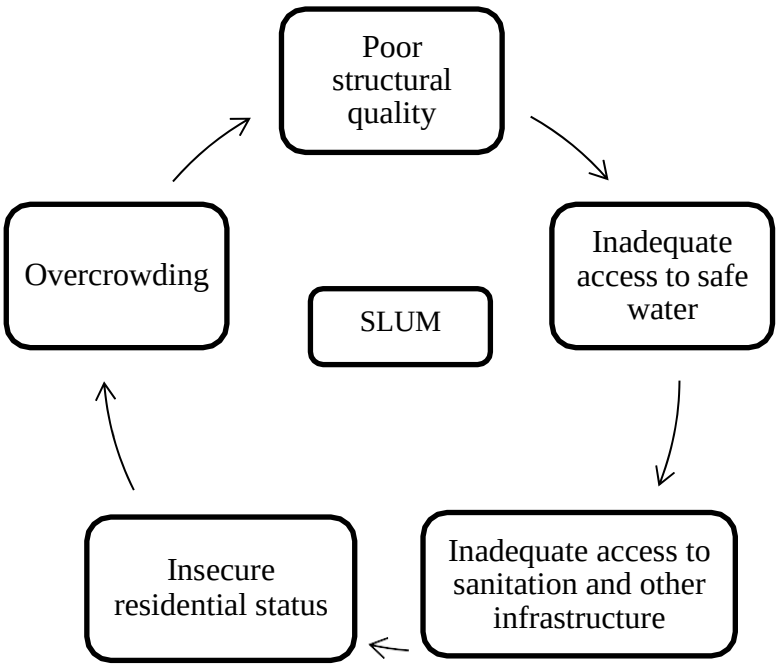


Fig. 1.1: Characteristics of slums (UN-Habitat 2002c:12).

The characteristics of slums vary from country to country and region to region. In section-3 of the Act on Improvement of Slums and its Clearance Act, Government of India, 1956**,** slums were defined as primarily those inhabited places or areas where human habitation is unfit due to dilapidation, congestion, wrong designs and provision of these buildings, restricted arrangements of sanitation, ventilation facilities, streets, no entry of light, or a combination of any of these factors that are damaging to health, safety, and ethics. The Assam Act No. XII of 1961 included the following areas as slums in Assam:

i) Area in any respect unfit for human habitation or

ii) Area by reason of dilapidation, overcrowding, faulty arrangement and design of such buildings, narrowness or faulty arrangement of streets, lack of ventilation, light or sanitation facilities or any combination of some or all of these factors are detrimental to the safety, health or morals of the people of the area.

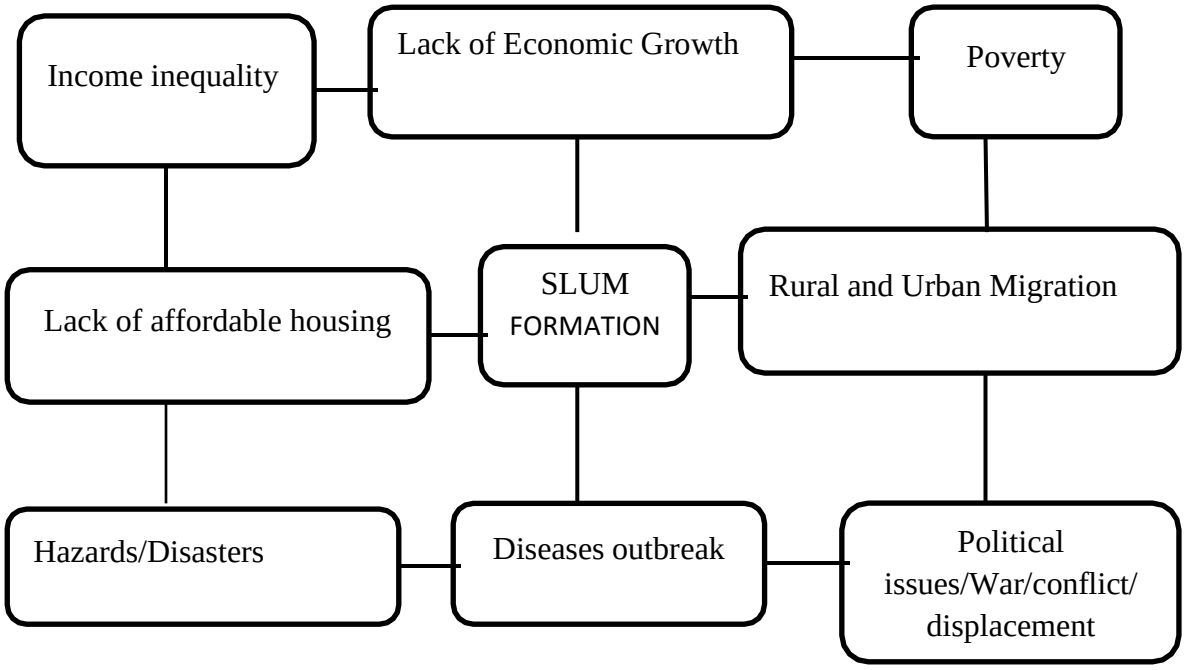


Fig 1.2: Factors related to Slum formation

Several causes are responsible for the formation of slums including income inequality, lack of economic growth, occurrences of hazards and disasters including natural and man-made disasters, proliferation of poverty etc. (Fig 1.2). The report of the Committee on Slum Statistics/Census of India (2010) defined '*Slum as a compact settlement of at least 20 households with a collection of poorly built tenements, mostly of temporary nature, crowded together usually with inadequate sanitary and drinking water facilities in unhygienic conditions*. In India, the official record of slums is incomplete. Government agencies have only recently started to count the number of slum people. Slums in a small number of cities were included in the census of 2001 for the first time and all urban centres were included for the first time in 2011 (Krishna, 2019). Therefore, considering different definitions of slums and their characteristics, the concept of slum is not just about poor building structures; it includes both the socio-economic and environmental characteristics of the slum dwellers (Fig. 1.3).

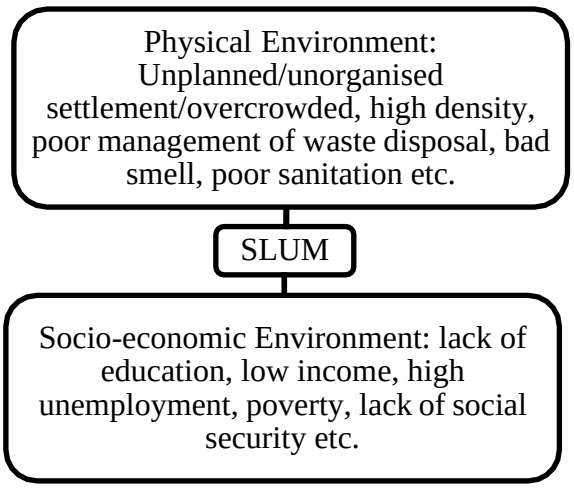


Fig. 1.3: Slum Characteristics based on environment

1.2 Literature Review:

A literature review is a collection of books, research publications and other documents related to a defined problem. Different national and international books, research articles, government reports and documentaries have been reviewed to understand the concept and characteristics of slums in different parts of the world. These literature reviews help to understand the methods of slum surveying and its problems, strategies or projects applied by different countries etc. and also help to find out the research gaps in slum studies. Slum formation is a global problem and a common phenomenon in the developing countries. Studies on slums have been done by a number of researchers, scholars, planners, ministries of different countries, writers, various organisations etc. Though, many studies have been done on slums around the world, Assam has seen very few of them. The various studies on slums reported about the growth of slums and their precarious condition in different parts of the world.

1.2.1 Global context:

According to UN-SDG database (2023), the proportion of urban population living in slums declined slightly from 25.4% in 2014 to 24.2% in 2020. This indicates a very slow decline of global slum population. In 2020, nearly 1.1 billion population lived in informal settlements and 85% slum dwellers are concentrated in three regions including Central and Southern Asia (359 million), Eastern and South Eastern Asia (306 million) and Africa (230 million). The growing population in developing countries put risk the achievement of the targets of Sustainable Development Goals by 2030. The global report on human settlement (2003) have mentioned about the challenges of slums in relation to their location and environmental problems, such as challenges of slums near industries, near dumping site, challenge of earth movement and flood. Sean (2013) discussed about various theories of

slum. He said that the Modernization theory portrays slums as a natural and temporary manifestation of a market failure arising from the dynamics of structural change in labour markets. Last J. M. (1998) has discussed in his book '*Public Health and Ecology'* on real life problem and the solution to the same. He talked about human health in a changing world. It highlights how human activities affecting the earth's climate in the light of the changing scenario of the global besides climate change biosphere. The ecologists basically consider the 'environment' and 'community' as it contains a singly working system (Clarke, 1954). Seabrook (1996) described in his book "*In the Cities of South: Scenes from a Developing World***"** about a small slum in Dhaka of Bangladesh that a refuge for people displaced by erosion, cyclones, floods, famine or that more recent generator of insecurity development that has been found a Faustian bargain in a precarious ledge of land between a toxic factory and a poisoned lake and mainly concentrated his thoughts on "*Think global, act local" Which was said by Patrick Geddes in 1915.* Bolay (2011) have mentioned that slums are the physical symbol of contemporary cities, characterized in terms of housing and the surrounding environment – by material deficiency that gives rise to their precarious and insalubrious nature. Urban development should be understood from historical perspective and development should be done with the collaboration of scientist, planners and politicians. Ramin (2009) discussed about the vulnerability and negative health effects of rapid urbanisation and impact of global climate change on the slum dwellers of Africa. He said that to design the appropriate adaptation policies further research study is needed to understand about the impact of climate change on the slum dwellers. The various phenomenon like climate change, extreme heat waves, heat spells, sudden cold, rain spells, pollution from vehicles, solid waste disposal, sewerage, pipelines etc. effects the slum dwellers and the municipality is not successful to mitigate the needs of the slum dwellers leading to a poor/degraded lifestyle for the dwellers in terms of infrastructure and health. Teferi and Newman (2017) suggested that slum policies could be shifted from the Modernist high-rise slum clearance approach to a more organic, community-based renewal of slums themselves in which infrastructure for energy, water and waste can be brought in. The Organic Model based on in situ slum upgrading is an instrument that promises to promote empowerment, integrated urban development and social cohesion as well as the environmental upgrading and economic development.

1.2.2 Indian context:

Rapid growth and expansion of cities to all directions lead to a massive unplanned concentration of people in an urban sprawl with all its attendant problems of acute

congestion, functional obsolescence, ugliness, poor housing, civic and cultural stagnation, tensions, blight and decay giving rise to the reality of slums as pointed out by Desai and Pillai (1972) and Rathor (2003). Mohanty and Mohanty (2005) explained that the effects of the urban explosion are dramatically manifested in teeming slums in the centre of a city and mushrooming shanty habitats at its periphery. The growth of slum is a manifestation of the urban poverty as the majority of urban poor live in the slums. Studies undertaken urbanization, slums and slum clearance and environmental improvements in India highlight various issues relating to the urban slums. Johar (2017) discussed about various causes of slum growth such as poor government policies, shortage of affordable land, low state investment in infrastructure, failure of the market to meet the enormous demand for affordable housing, an ineffective urban planning system, rural urban migration etc. Verma (2002) beautifully mentioned that the root cause of urban slum growth is not urban poverty but the urban wealth that indicates the urban inequality. Chhabra (1985) gives an overview of stresses facing Indian society, including population pressures on land and agriculture, topsoil erosion, deforestation, flooding, unemployment, urban slums and political unrest and included that the urban population in India is expected to double in the next 15 years to reach a level of 350-400 million at present 20-33% of the total urban population lives in slums without basic facilities. The integration of economic and environmental policies in urban development is more required and significant at the large urban agglomeration region. Urbanisation or growth of slums has led to indiscriminate exploitation of the environment (Dattatri and Srinivasan, 1989). Slum indicators include poor housing condition, inaccessible roads, inadequate piped water lack of electricity, and drainage channels leading to incessant flooding etc. The deteriorating environmental conditions in urban areas are also related with the rapid increase in population in cities (Bhargava, 1981; Bowonder, 1986; Desai, 1989; and Ghose, 2000). Bandyopadhyay and Agrawal (2013) considering today's poor urban environmental quality in India, the majority of families affected by urban development projects are located in slum areas which are under consideration for resettlement or rehabilitation.

1.2.3 Regional context:

The latest data from the Office of Registrar General & Census Commissioner, India reveals that the total slum population in Assam stood at 1, 97,266 across 31 towns in the state mainly concentrated in the towns like Dibrugarh, Guwahati, Tinsukia, Dhubri, Tezpur, Silchar, Nagaon, Jorhat etc. The slums create seemingly insoluble problems for the region as the growth of industrialization in association with the development of transport and

communication as well as trade and commerce has led to increasing inflow of unskilled and uneducated groups of people and thus leading to the growth of slum areas in the towns & cities of the state**.** Compared to the problems of water and sanitation the menace of air pollution in Indian cities is rather grim. Industries and automobiles plying on roads emit tonnes of pollutants every day in the air, putting the average citizen of the cities and slums to greater health risks. A significant source of air pollution is the combustion of fuels by power plants, industrial houses, industrial boilers, residential stoves and vehicles. Phukan (2013) has mentioned that the phenomenon of slum is regarded as a challenge for the Jorhat city of Assam, India where seven slum areas have already been emerged. This study was conducted in all the slums to investigate the level of some basic amenities such as housing, sanitation system and water facilities etc. In the study he found that these aspects their livelihood are poor which generates several problems especially it degrades urban ecology. Zaman et al., (2018) found that the problems of unhygienic toilet facilities lead to contamination of the ground water which depended on the soil distinctiveness and the distance between the sources of water and the toilets. Garbage management, disposal and drainage system were pathetic. Open and uncovered domestic wastes were hazardous to health. There was unplanned construction of shops, houses, roads and drains in certain slum pockets. All this affected the environment of the Guwahati city**.**

It has been mentioned in the book '*Jorhat: Climate Ready City, Strategy for Building Resilience to Urban Climate Change'* Published by Asian Cities Climate Change Resilience Network (ACCCRN) that Jorhat is an emerging city and the key issues of this district of Upper Assam are water related problems like water logging and high rate of immigration leads to the basic amenities problems. Das P. (2018) found that people migrated in search of jobs to the cities like Ledo, Margherita, Digboi, which are major industrial regions of Upper Assam and adding the slum population in Tinsukia district. Some other causes like political disturbance, terrorism activities resulted into the decline of commercial activities which leads to increase of urban poor and growth of slums in Tinsukia District of Upper Assam. Acharjee et al. (2010) discussed in the paper "Visual Change Detection Study of some of the urban areas of Assam, India" that remote sensing as an efficient tool for change detection of land cover/ forest cover. Through satellite imagery they found that the vast change occurred due to migration of the people to cities in search of jobs and cultural advantage that has resulted in the expansion of urban areas and surrounding peri-urban environments. But its effected the quality of life of urban dwellers, particularly the slum population.

1.3 Significance of the study

Slum areas are mostly located as temporary urban dwellers isolated from rest of the urban development and exhibit pathological social symptoms such as high level of poverty, overcrowding and limited access to basic amenities. drug abuse, crime and alcoholism issues along with very low level of living standard, low level of education, improper sewage or waste disposal methods, pollution, unsanitary living condition and health hygiene problems etc. The major problems of slums in India are shortage of space, prone to natural and man-made hazards, poor living conditions, health hazards, social problems etc. In Assam unplanned slum settlements are mainly growing in urban centres, places near the river banks like the Brahmaputra and its tributaries and wetlands, etc. which creates many problems like water pollution, soil pollution and erosion etc. The environmental problem like flood along with socio-economic drawbacks has developed a peculiar society in this region. It is expected that the study will highlight the gravity of the problems faced by the slum dwellers and provide a framework for better development of the area and the study will also involves the assessment of the impacts of slum growth to the environment and its focus is to identify the impacts and causes of slums growth, to identify indicators of slum formation and the possible mitigation measures for overall development of slums in the region in its initial stage. It becomes a major task for a country to remove poverty by providing basic amenities and develop new strategies to meet the goals of sustainable development. Government, community development groups, humanitarian activities geared towards slum removal are examined in this research. Understanding of the socio-environmental dynamics is crucial for developing strategies to improve the standard of living of slum residents. It also essential for assessing health risks and improvement of healthcare facilities and solutions to those problems. Investigating the slum environment provides insights into urban planning problems and potentialities for creating more sustainable urbanisation. Slums are also regarded as informal economic hubs and can provide insights into income generation potentialities for economic development. Investigating slum conditions highlights the issues related to housing condition, access to education, social security etc. Comparative studies of slum environments of different regions can provide region specific problems and their solutions. Study on slum environment can inform and helping governments, organisations to recommendations policies and programs that address to provide the specific needs of slum residents. Understanding of slum environment and its interaction with broader urban ecosystem is vital for environmental management and conservation. This research offers an opportunity to generate new ideas or knowledge in the field of urban studies, socio-environmental studies and public policies.

1.4 Study area:

India is the 7th largest country in terms of area and the second largest populous country in the world with a population of 121 crore. Recently, a data published by UN declared India is the most populous country in the world. According to 2011 census, North East India have 449,80,294 population. Assam, is known as the gateway of North East India is a major tea and crude oil hub with highest number of populations among the 8 states of North East India. Geographically, the state is extended from 22º19′ to 28º16′ North Latitude and 89º42′ to 96º30′ East Longitude with an area of 78,438 square kilometre surrounded on three sides viz. the north, east and south by the foot hills of the Eastern Himalayas bordered in the North by Bhutan and Arunachal Pradesh in the north east, the south-western border share with Meghalaya, Mizoram and Tripura, the south and eastern border with Nagaland and Manipur and it merges with West Bengal and Bangladesh plains to the west. Assam was divided into five administrative divisions during British Administration namely Upper Assam, Lower Assam, and Middle Assam. The Upper Assam is located between 26º75′ North latitude to 95º22′ East longitudes with a total area of about 19,025 square kilometres with an average elevation of 80 metre is bounded by Arunachal Pradesh on the north eastern side and Nagaland in the south and eastern side of Upper Assam. The Brahmaputra River and some of its major tributaries are flowing through the region. The average rainfall is 2045 mm and average temperature is 23°C. In 2016, two new districts were formed in the Upper Assam and its number of districts increased from 7 to 9. These are Jorhat, Dibrugarh, Dhemaji, Golaghat, Charaideo, Lakhimpur, Majuli, Sivasagar, and Tinsukia. The district Majuli was curved out from Jorhat District and Charaideo was curved out from Sivasagar District. Among these districts Golaghat, Jorhat, Sivasagar, Dibrugarh and Tinsukia districts are situated on the south bank of the Brahmaputra River and rest are located on the North bank of The Brahmaputra River. Four major towns of these districts have been selected for study which were Jorhat, Golaghat, Dibrugarh and Tinsukia (Fig1.4). Total 11 slum areas namely: Harijan colony of Jorhat, Golaghat Harijan colony, Santipara slum, Dhobi Patti, South Amolapatti, Barbari Dusadpatti, Paltan Bazar, Guardpara slums of Dibrugarh town, Sripuria and Nepali Mandir slum of Tinsukia town were selected for study.

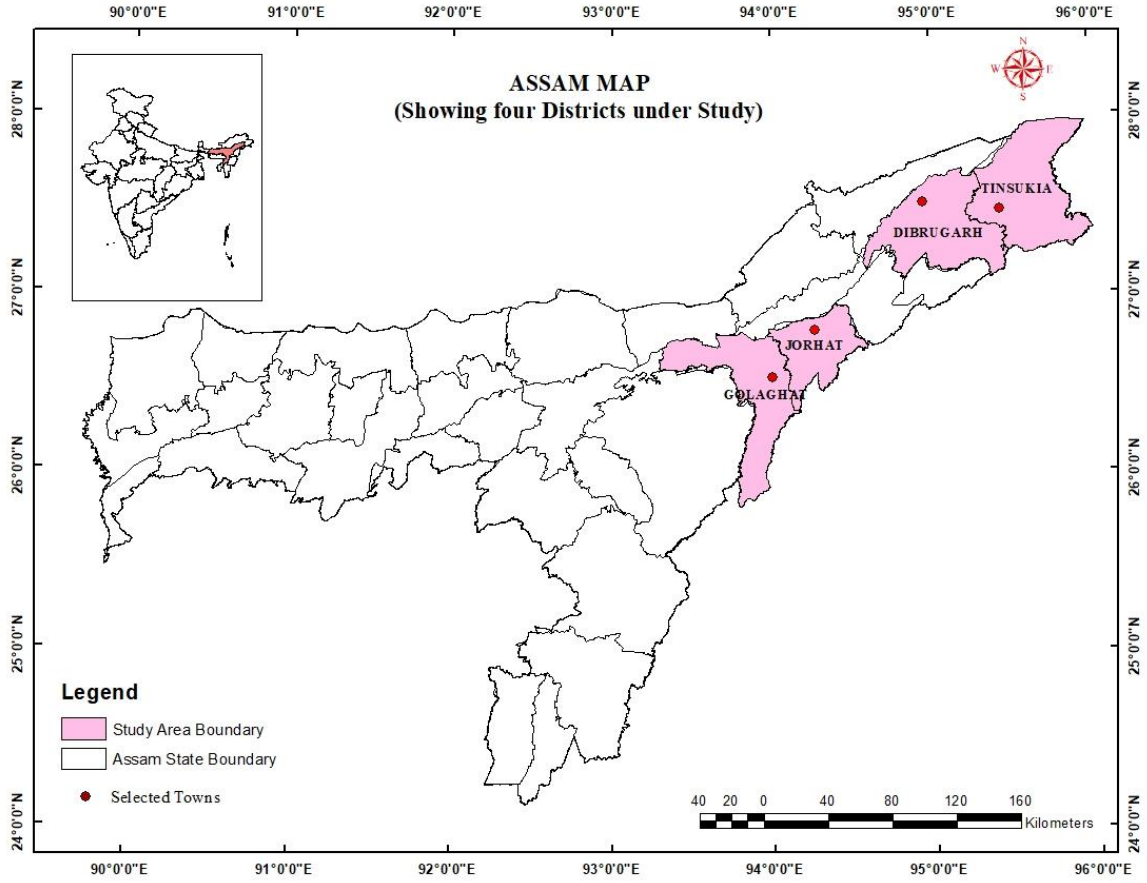


Fig.1.4: Location map of the selected Study areas of Upper Assam

1.5 Objectives:

I) To investigate the factors of growth of Slums in the study area.

II) To analyse the geo-environmental impact of Slums in the area.

III) To assess the social impact of Slums on the region.

IV) To propose workable strategies for the holistic development of Slum areas.

1.6 Research Questions:

I) What are the factors related to slum growth?

II) In what way growth of slums affects the town and city planning?

III) What strategies can be adopted for the improvement of slum areas?

1.6 Database and Methodology:

The aim of the study is to find out the present scenario of the environmental and social impact of slums in the study area. A wide range of literature has been reviewed on environmental aspects of slum population from both the national and international spectrum, it has been realised that one third of urban population lives in slum. The secondary data is

collected from Municipality offices, Town and Country Planning Offices, etc. To find the location and mapping of the study area satellite imagery, Google Earth, weather data, GPS camera and GIS software Arc Map 10.8 were used. After the secondary data collected from Municipality offices, 30% samples were selected for the study (Table1.1). Simple random sampling has been used for the collection of primary data. A structured Schedule survey was conducted at individual household to collect both specific and general information. Questions were based on the present socio-economic and environmental scenario of the study area as well as future prospects for the development of the area in near future is taken into consideration. A pilot survey has also been conducted. A complete analysis is conducted on the environmental impact of slums, taking into account sanitary facilities, waste outputs, garbage disposal methods, environmental concerns, drinking water quality, soil quality of waste dumping sites and indoor air quality. The residents are interviewed individually and collectively using a prescribed schedule survey to learn about their personal experiences and communal challenges. Indoor air quality data has been collected through *SMILEDRIVE* indoor air quality monitor instrument. To measure the drinking water quality a physicochemical test has been done in laboratory and the parameters includes pH, Total Dissolved Solids (TDS) , Iron (Fe), Calcium Carbonate ($CaCo_3$), Magesium (Mg), and Chloride (Cl) (Fig. 1.5).

Table 1.1: Sample size of Slums

Sl. No.	Towns	No of Slums	30% sample	No. of slums taken as sample
1	Dibrugarh	24	**7.**2	**7**
2	Tinsukia	5	1.5	2
3	Jorhat	4	1.2	1
4	Golaghat	4	1.2	1
	Total	37	11.1	11

Source: Municipality offices (Dibrugarh, Tinsukia, Jorhat and Golaghat)

Again 30% households were selected for schedule survey (Table1.2).

Table 1.2: Sample size of Household

Sl. No.	Name of the town	Name of the slums	Total HH, 2011	30% of HH Sample	Sample household taken
1	Dibrugarh	Paltan bazar	790	237	237
		Santipara Harijan colony	470	141	141
		Amaraguri	341	102.3	102
		Guard Para	160	48	48
		Dhobi Patti	126	37.8	38
		South Amolapatti	81	24.3	24
		Barbari Dusadpatti	68	20.4	20
2	Tinsukia	Sripuria	253	75.9	76
		Nepali-Mandir	112	33.6	34
3	Jorhat	Harijan Colony	169	50.7	51
4	Golaghat	Harijan Colony	120	36	36
		Total	2690		807

Source: Municipality Offices (Dibrugarh, Tinsukia, Jorhat and Golaghat)

1.6.1 Population Forecasting:

Population forecasting helps to assess future population increase that leads to the understanding of future problems i.e. shortage of land and housing and their increasing demand along with the demand of water supply, electricity and other basic needs, future planning policies etc. There are two major methods, which can apply for population forecasting: Arithmetic Progression Method and Geometric Progression Method. Geometric increase method is suitable for population forecasting of new emerging small towns and cities. Population of the study area has been calculated by using Geometric increase method from 2021 to 2051 in this research that shows a rapid increase of population in the region including rural and urban population. Mathematically it is calculated as:

$$P_n = P_o\ [1+r/100]\ \text{^n}$$

Where, P_n = Population (Predicted) after 'n' number of decades

P_o = last known population

r = growth rate (increase of population/initial population*100 (%)

n = Number of decades between P_o and P_n

Gini Coefficient method is used to measure the urban poverty by using urban and slum population (Gini, 1912; Brown, 1994). The formula used to measure the Gini Coefficient is:

$$G = \frac{1}{10000}(\sum \text{XiYi} + 1) - (\sum \text{Xi} + 1\text{Yi})$$

1.6.2 Comparative Study of Slums:

The Composite score or Simple Ranking method is used to analyse the level of socio-economic condition of each slum and assess their development. To calculate the composite score the following formula has been used:

$$Cj = \sum_{i=1}^{n} Ri$$

Where Cj= Composite rank values or composite score of jth area,

$Ri = Rank\ of\ indicators$ of development

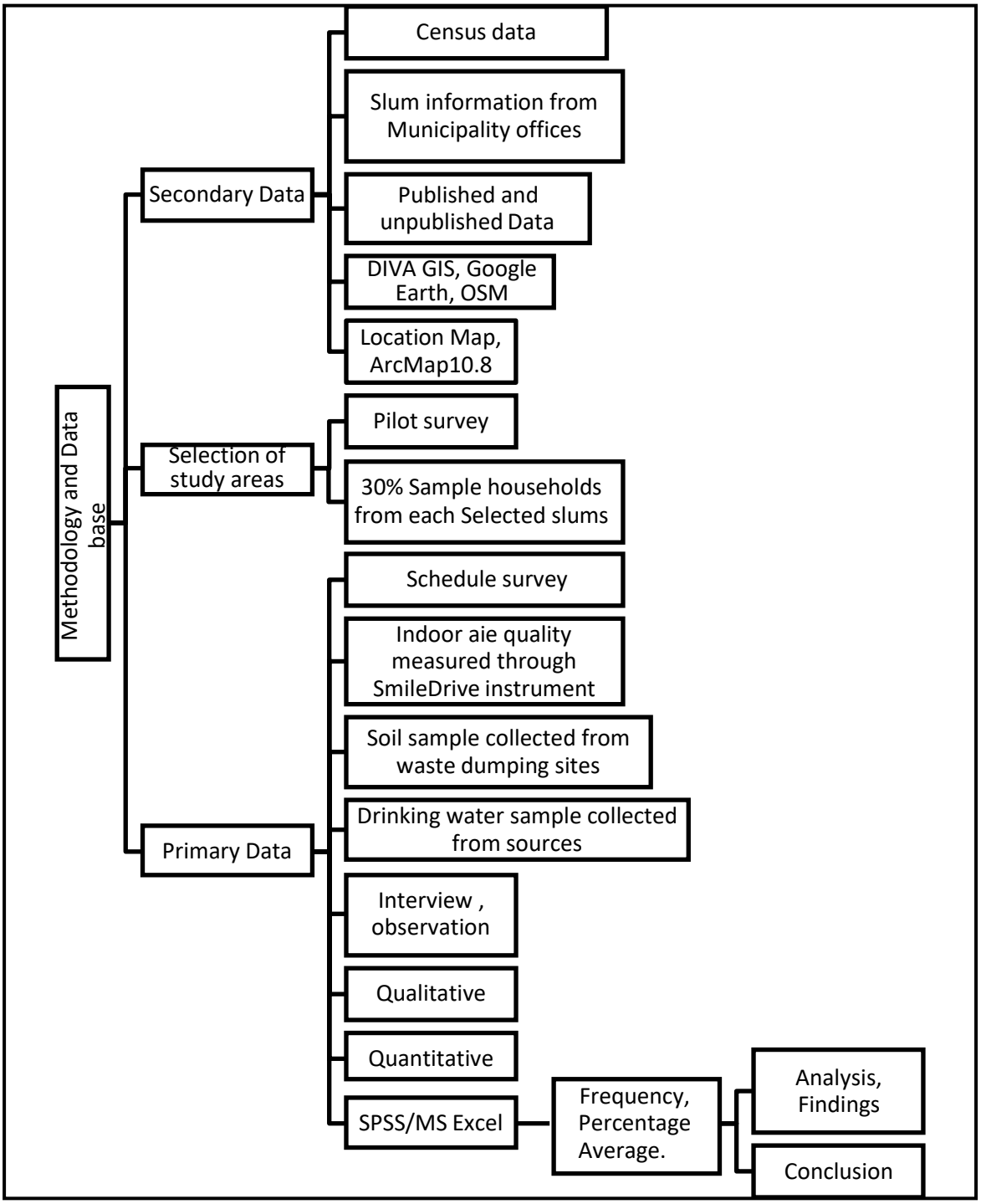


Fig.1.5: Database and Methodology

1.7 Organization of Thesis:

The structure of the thesis is based on objectives, research findings and discussions. To fulfil the objectives and requirements this thesis is organised into six chapters.

The chapters of this work are briefly explained in the following:

1.7.1 Chapter 1: Introduction

The first chapter is on the theoretical-conceptual framework, introduction of background followed by statement of the problem, literature review and the prime focus is on discussing the definitions, previous works and ideas, which have already been done related to this topic and knowledge area. In addition to this objectives, methodology of data collection, which includes the methods of statistical techniques, plans, followed by database and methodological part and analysis, brief introduction of study location, scope and organisation of chapters. The chapter gives a humble effort to introduce the various aspects of slums in India as well as in North East India and in different parts of Assam especially in Upper Assam.

1.7.2 Chapter 2: Geographical Profile of the Study Area

The second chapter provides an overview of the study area. The historical and geographical background of study area. The physical profile includes latitudinal and longitudinal extension, physiographic characteristics, climatic condition, vegetation (national parks and reserve forest) including biodiversity and their characteristics and distribution, major drainage systems (the Brahmaputra and its tributaries) and soil types. This chapter also discussed about demographic characteristics, socio-economic condition, land use pattern and its changes in the study area. In addition to these, transport system including major roads, railways and their length and distribution, some other basic facilities are discussed in this chapter. The demographic characteristics included the literacy rate, language spoken, religion, distribution of Scheduled caste and Scheduled tribes and their migration. The economic aspects were major resources distribution, industries, e-states, number of workers including both main and marginal workers, their participation rate and other facilities, such as number of hospitals, medical colleges have been discussed in this chapter based on statistical handbook data of Assam. This chapter introduced the socio-economic, demographic and geographical characteristics of the region, which are directly and indirectly impact on the growth of slums and their environment.

1.7.3 Chapter 3: Dynamics of Slum Growth in the Study Area

The third chapter included the dynamics of slum growth and development in the study area. This chapter provides a general information related to urbanisation of the region and discussed on the number of urban centres, number of different types of towns and their population growth. This chapter also discusses about the distribution of slums, migration and causes of slum growth in the study area. Total population, rural and urban population have

been projected to analyse the future scenario of population. A comparison of the studied slums has been done by using statistical methods based on proportion of urban and slum population percentages and number of slum households in this chapter.

1.7.4 Chapter 4: Slums and Geo-Environmental Impact

This chapter deals with the growth of slums and environmental impact in the area, followed by analysis of findings and discussion of slum areas distributed in different parts of Upper Assam. Tabulation and classification of data, results etc. are included in this chapter. Spatial distribution of slums and their problems have been examined by studying some socio-economic and environmental parameters. Data have been analysed based on demographic profile, occupation, income status, housing condition, sanitation facilities. The crime rates have been discussed briefly. To assess the environmental condition of slums a lab test has been done of drinking water samples and soil pH of garbage dumping sites. Indoor air quality measured by air quality monitoring instrument and analysed in this chapter.

1.7.5 Chapter 5: Findings and Strategies for Slum Improvement

Various strategies, prospects of development, changes in planning policies, role of slum dwellers and leaders in the overall development of slum areas are included in this chapter. Based on the problems studied, policy recommendations proposed along with Government initiatives for the improvement of slums have been discussed in this chapter.

1.7.6 Chapter 6: Summary and Conclusion

This chapter concludes and sum up the ideas of the chapters in brief including findings. Throughout this chapter, it tried to combine various views on slum worldwide and precarity of slum growth. In the cities of developing countries like India, slum areas have numerable problems with the undergoing process of rapid urbanisation that cannot be ignored in the contemporary world. Therefore, this chapter revolves around the conceptual framework of slum formation, present scenario of world urban poor distribution along with India with special reference to Assam and Upper Assam division. This chapter has been followed by References, Photographs and Appendices.

CHAPTER 2

GEOGRAPHICAL PROFILE OF THE STUDY AREA

2.1 Historical Background of the Study Area:

Assam is known as the gateway of North East India and a major tea hub of India. North East India region was introduced to British India only after the treaty of *Yandaboo* in the year 1826 and consequently become a part of British colonial administration. For administration, Assam was divided into two major administrative divisions in 1843: the Upper Assam from east of the Jia Bharali River on the north bank and east of Dhansiri river on the south bank and the Lower Assam from west of Sonkosh in the north and Karaibari in the south bank. The headquarters of the Upper Assam Division was at Sivasagar until 1912, when it was shifted to Jorhat. The headquarters of Lower Assam was in Guwahati. Later, Assam was divided into five administrative divisions. The Upper Assam administrative division initially consisted of 7 districts. In 2016, two new districts were curved out from Jorhat and Sivasagar and the region at present comprises 9 districts. These are Jorhat, Golaghat, Sivasagar, Dibrugarh, Tinsukia, Dhemaji, Lakhimpur, Charaideo and Majuli.

2.2 Location:

Assam is located between 24º13' and 27º58' North latitude and 89º45' East longitude to 96º04' East longitude. It shares the boundary with 6 northeastern states including Arunachal Pradesh in the North and northeast direction, Nagaland and Manipur in the east and southeast, Mizoram in the south and Meghalaya, Tripura, Bangladesh and West Bengal are located in the west and south west direction. The northern boundary shares an international boundary with Bhutan and western boundary shares an international boundary with Bangladesh. The Upper Assam region is located between 26◦75′ North latitude and 94◦22′ East longitude with a total area of about 8,901 sq. km and the average elevation of the region is 80 meters above the sea level. Within the Upper Assam region, major towns are Jorhat, Golaghat, Bokakhat, Sivasagar, Nazira, Dibrugarh, Moran, Digboi, Duliajan, Tinsukia, Ledo, and Margherita. Among these, four major towns were selected for the study: Jorhat, Golaghat, Dibrugarh and Tinsukia.

2.2.1 Jorhat: Jorhat is located at a latitude of 26º75´78´´North and a longitude of 94º20´98´´ East. This city is known as the cultural city of Assam and the second fastest growing city

after Guwahati. Jorhat serves as a gateway to Upper Assam and the state of Nagaland in the North East India. The city is renowned for numerous pioneering achievements. In 1923, Jorhat became the first town in greater Assam to embrace electricity supply. The inaugural airplane landing on northeastern region occurred in Jorhat in 1928. It also hosts the oldest golf course in Asia and the third oldest globally at the Jorhat Gymkhana Club. Adding to these, the town Jorhat is the home of Assam's first stadium and world's largest tea experimental centre named the Tocklai Tea Research Centre. The city witnessed the establishment of the first non-government college in Assam, the Jagannath Boruah college. Jorhat is a hub for research institutions such as North East Institute of Science and Technology, Rain Forest Research Institute and the Central Muga Eri Research Institute. The city is further enriched by the presence of renowned universities such as Assam Agricultural University and Kaziranga University. Today, Jorhat is a rapidly developing city, emerging as a prominent business and commercial centre in northeastern India. Jorhat continues to evolve as a dynamic urban landscape, contributing significantly to the region's economic and cultural vibrancy with a current population exceeding 0.1 million (Jorhat.assam.gov.in). For the administrative purposes, the district is divided into three subdivisions which are Jorhat (Sadar), Mariyani and Titabar. Again, each sub-division is divided into 6 revenue circles, 8 Community Development Blocks and 848 villages. In 2016, Majuli was upgraded to a new district. The district consists of 11 towns including 4 Statutory Towns and 7 Census Towns (censusindia.gov.in). Jorhat district covers an area of 2,851 Square Kilometres that comprises 2,758.82 Square Kilometres rural area and 92.18 Square Kilometres urban areas (District Census Handbook, Jorhat, Assam, 2011).

2.2.2 Golaghat: Golaghat is situated between the latitude of 26°45´84´´ North and longitude of 93°98´78´´ East. It is believed that the name of Golaghat is originated from the words 'Gola' meaning a shop and 'Ghat' meaning a bathing and landing place or enclosure for boats etc. There was a 'Gola' (shop) near the 'Ghat' (river bank) on the river Dhansiri. When the British took control of Assam, the Doyang-Dhansiri valley was incorporated under the newly formed Golaghat subdivision of the Sivasagar district in 1846. For the administrative purposes, the district is divided into three subdivisions Golaghat, Bokakhat and Sarupathar. In the district, there are 6 revenue circles with 1,125 villages. The district consists of 5 statutory towns and 2 census towns. Golaghat district covers an area of 3,502 square kilometres under which rural area covers 3,465.55 square kilometres and urban area covers 36.45 square kilometres (District Census Handbook, Golaghat, Assam, 2011).

2.2.3 Dibrugarh: Dibrugarh extended between 27°45'38" North latitude and 95°29'8" East longitude. The district is one of the fastest growing cities in Assam which is a major industrial, transformational and educational hub in Assam. According to the 2011 census, Dibrugarh district of Upper Assam has the highest slum dwellers in Assam. This district is an administrative district of Assam and its head quarter is located in Dibrugarh town. The district has a single sub division and seven circles. The revenue circles are Dibrugarh East, Dibrugarh West, Chabua, Tengakhat, Naharkatia, Tingkhong, and Moran. There are 9 towns, which include 3 statutory towns and 6 census towns. Total area covered by Dibrugarh district is 3,381 square kilometres, which comprises 3,335.52 square kilometres rural and 45.48 square kilometres urban area (District Census Handbook, Dibrugarh, Assam, 2011).

2.2.4 Tinsukia: Tinsukia is located between the latitudinal and longitudinal extension of 27.5291° North and 95.6458° East in the upper Assam. The district is surrounded by Arunachal Pradesh in the south-east, Dibrugarh district in the south-west and Dhemaji district in the north. Tinsukia was officially declared as the 23rd district of Assam on 1st October 1989, split from Dibrugarh. The district comprises three sub divisions: Tinsukia, Margherita, and Sadiya. Historically, Tinsukia was known as *Bangmara*, originally referred as *Changmai Pathar*, the capital of *Muttack* Kingdom. In 1823, the British first explored tea plants in Sadiya and the first tea plantation was started in *Chabua* near Tinsukia. In a pivotal moment for the region's economic progress, the Dibru-Sadiya Railway was inaugurated in 1882 by the Assam Railway and Trading Company, centred on Tinsukia, which was a significant milestone in the economic development of north-east India. There are total 4 revenue circles and 1,168 villages. The names of Revenue Circles are Sadiya, Doom Dooma, Tinsukia, and Margherita. It has 86 Gaon Panchayats and 7 Community Development Blocks. Tinsukia district covers an area of 3,790 square kilometres (Rural: 3,728.504 square kilometres and Urban: 61.496 square kilometres). The district comprises 13 Towns including 5 Statutory Towns and 8 Census Towns. Tinsukia (MB + OG) is the most populous with 1,16,322 persons, while *Kachujan* Gaon (TC) is the smallest in population with 3,246 persons (District Census Handbook, Tinsukia, Assam, 2011).

2.2.5 Sivasagar: Sivasagar was known as "Rangpur". It is a historical city of Assam. It was the capital of the Ahom dynasty, who ruled Assam for more than six hundred years before the advent of the British. The name Sivasagar signifies “The ocean of Lord Siva”. The origin of the name of the district Sivasagar is associated with the Shiva temple on the bank of a tank in Shivapur, the then Ahom capital Rongpur. Initially, the place came to be known as Shivapur being associated with the great Siva temple (Siva Dol) built on the bank of a big pond. Then

with passage of time, the name Sivasagar, alluding to the pond and the town gained popularity. Geographically, Sivasagar lies between 26°45’ North latitude and 94°25 East longitudes. For the administrative purposes, the entire district is divided into three sub-divisions Sivasagar, Nazira and Charaideo. There are total 6 revenue circles namely Demow, Sivasagar, Amguri, Nazira, Sonari and Mahmora. The district has 875 numbers of villages, 9 Community Development Blocks and 7 towns that includes 6 statutory towns and 1 census town. Sivasagar district covers an area of 2,668 square kilometres. About 2,625.07 square kilometres area is considered as rural area and urban area comprises 42.93 square kilometres (District Census Handbook, Sivasagar, Assam, 2011). The Charaideo was curved out as a new district from Sivasagar District in the year 2016.

2.2.6 Lakhimpur: The Lakhimpur district was a part of old *Pragjyogtishpur* during 7th and 8th centuries. The undivided Lakhimpur district covered the areas of the present Dhemaji, Dibrugarh and Tinsukia districts, which were subsequently curved out from the district. The district is situated between 26°48' North latitude and 94°20' East longitude Lakhimpur district is bounded on the north by Subansiri and Siang district of Arunachal Pradesh, on the east by a portion of Lohit district of Arunachal Pradesh and a part of Dhemaji district, on the south by Jorhat and on the west by Sonitpur district. Lakhimpur district with its headquarters at North Lakhimpur and the sub-divisional headquarters at Dhakuakhana includes the 7 Revenue circles namely Lakhimpur, Dhakuakhana, Kadam, Nauboicha, Bihpuria, Narayanpur and Subansiri (Ghilamara) that covers 1,184 villages. There are 9 Community Development Blocks in this district. Lakhimpur district covers an area of 2,277 square kilometres, out of which 2,240.85 square kilometres covers by rural areas and urban area covers 36.15 square kilometres. The district comprises four towns which are all Statutory Towns. North Lakhimpur (Municipality Board) is the most populous with 59,814 persons while Narayanpur (Town Committee) is the smallest in population with 6,001 persons (District Census Handbook, Lakhimpur, Assam, 2011).

2.2.7 Dhemaji: Dhemaji, situated in the eastern part of Assam, holds cultural and historical significance with its etymology derived from two Assamese words - "dhal," means flood, and "Dhemali," meaning "Play." Another interpretation mentioned that the term Dhemaji originate from the Bodo term "Dall Maji," where "Dall" signifies water, and "Maji" means a broad area. Geographically, this district located between 27°05'27" North latitude and 94°12'18" East longitude. Dhemaji is administratively divided into two Sub-divisions: Dhemaji and Jonai, encompasses six revenue circles - Dhemaji, Sissiborgaon, Dhakuakhana, Jonai, Subansiri and Gogamukh, covering a total of 1,319 villages, with 55 of them being

uninhabited. According to the District Census Handbook of Dhemaji, Assam, 2011, it has two statutory towns and two census towns contribute to the district's urban landscape. The district divided into five Community Development blocks namely Bordoloni, Dhemaji, Machkhowa, Sissiborgaon, and Murkongselek. The district has an area of 3,237 square kilometres comprising 3,221.45 square kilometres of rural and 15.55 square kilometres of urban area.

2.2.8 Majuli: Majuli is one of the largest mid-river inhabited island in the world, located in upper reaches of the Brahmaputra River within 26º 50´ North latitude and 94º35′ East longitude with an area of 553 square kilometres. It is Assam's 33rd number district formed in 2016.

2.2.9 Charaideo: Charaideo was the first permanent capital of Ahom kingdom, at present located between 27°02´80´´ North latitude and 95°03´12´´ East longitude with an area of 1,069.15 square kilometres. This district was formed in 15 August, 2015. It has been curved out from Sivasagar District. Total population in the district is about 4,71,418 according to 2011 census.

2.3 Physiography:

The physiography of Assam geographically is one of the enhanced regions in India. Assam consists of three well-defined geological structural units: the structural core is the Karbi plateau, which is an extension part of the Meghalaya Plateau. The second unit is the Tertiary depositional zone, which has given rise to the folded hills of the Barail range and its neighbouring parts of the Dima Hasao (earlier known as North Cachar) Hill district and the third structural unit comprises the alluvial depositional plains of the Brahmaputra and the Barak (dgm.assam.gov.in)**.**

The upper Assam administrative division can be divided into the following physiographic divisions:

1. The Brahmaputra River valley including the active flood affected Char land regions,
2. Foothill zones of the northeast and southern regions based on their physiographic characteristics like majestic river plains, hills etc.

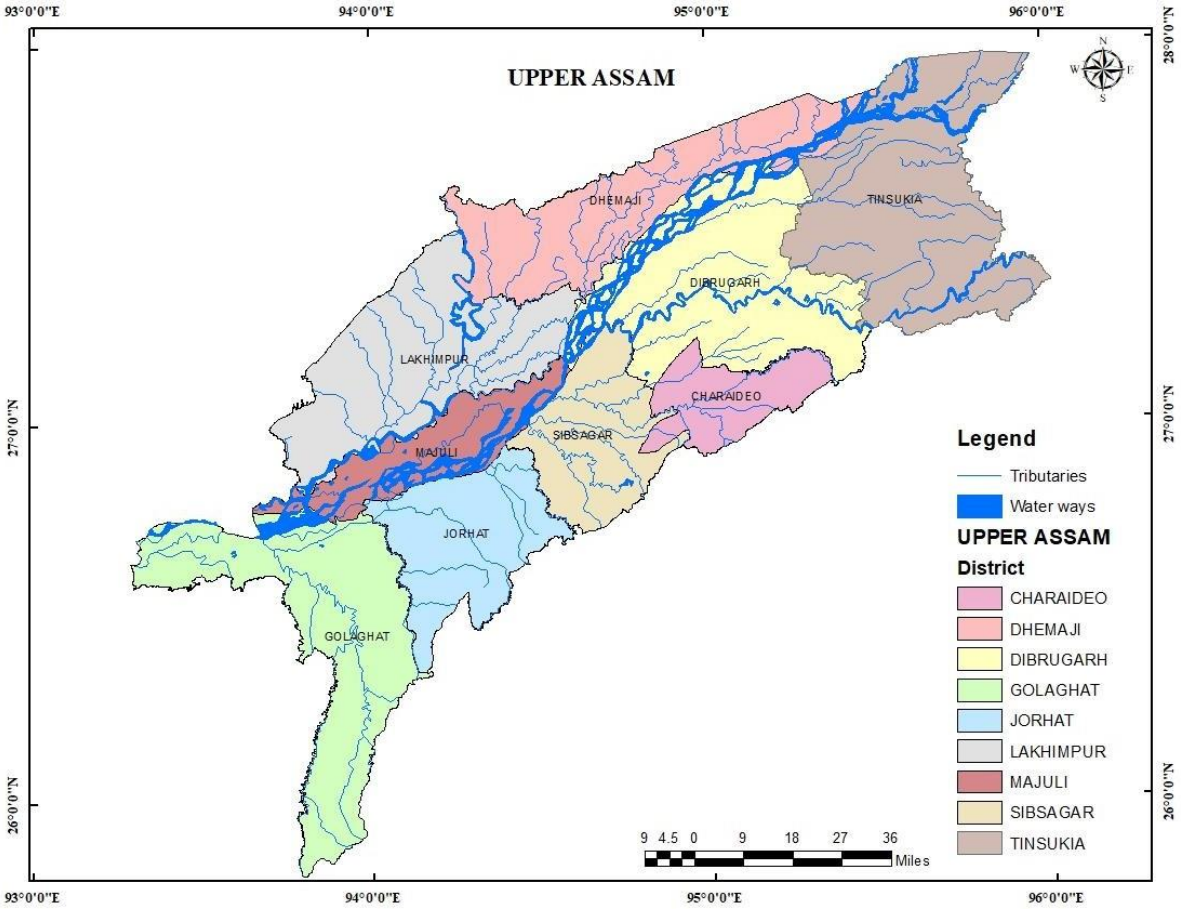
In the Brahmaputra valley, a major population of Assam resides having peculiar demographic characteristics. The majority of the people are Hindus and speak the Assamese language and its variants. Sadia is a town of Tinsukia district in Upper Assam, where the Brahmaputra enters Assam and flows from east to west through the middle of Assam. Upper Assam lies in the eastern Brahmaputra valley region covering the districts Golaghat, Jorhat, Sivasagar, Dibrugarh, Tinsukia, Lakhimpur and Dhemaji. The region is lie in the Upper Brahmaputra,

therefore, the Brahmaputra along with its major Himalayan origin tributaries are flowing through the region, which is one of the most productive regions and also an active flood-prone area in Assam. Almost all of the major towns of upper Assam are located on the bank of the Brahmaputra River or its tributaries, such as Tinsukia town on the Dibru River, Jorhat town on Bhogdoi River, and Dibrugarh town on the bank of the Brahmaputra River etc.

2.4 Drainage:

The Brahmaputra is one of the longest Rivers in the world often regarded as the lifeline of Assam and some of its major tributaries are flowing through the region. It originates in the Tibetan plateau and flows eastward covering for more than 2900 km length before emptying into the Bay of Bengal. Within Assam its total length is 720 km. and has as many as 109 tributaries covering an area of 70,660 square kilometres (Taher and Ahmed, 2005). The important north bank tributaries of the Brahmaputra in Upper Assam from east to west are the Dibang, Luhit, Subansiri, Buri Dihing, Dibru, Dikhou, Bhogdoi and Dhansiri. The salient features of North bank tributaries or right bank tributaries are very steep slopes and shallow braided channels, also have boulders, pebbles and coarse sandy beds and carry a very heavy slit charge and flashy flood etc. The characteristics of left-bank or south-bank tributaries are rivers with flatter grades, fine alluvial soils, comparatively low slit charge and deep meandering channels. The Subansiri is the largest tributary of Brahmaputra flowing through Lakhimpur and Dhemaji district of Upper Assam. The main source of all these tributaries is the eastern Himalayan hills and as a result, these are perennial rivers. During summer and rainy days, these tributaries become more active and creates tremendous destruction by flooding and river erosion. Besides the common annual flood, devastating floods are seen to create havoc at an interval of 5-6 years. Due to the loss of land people leave their areas and settle in the nearest towns, which could also be a reason of slum formation. The Dibang river originating in Arunachal Pradesh joins the Lohit River and form the Brahmaputra River. The Lohit rivers carries abundant lateritic soil suitable for tea and rubber cultivation. The trans-Himalayan Subansiri River is the largest tributary of the Brahmaputra River. Another two important rivers following through Dibrugarh and Tinsukia are the Dibru and Burhi Dehing River. The areas of these river banks carry new alluvium soils, which are classified as loam, sandy loam, clay loam, that supports the cultivation of different crops and vegetables including both kharif and rabi crops. The region is also the tea hub of India. The Bhogdoi is the main river of Jorhat, originates in Naga Hills and it is a heavily polluted river in the region, due to coal mining, tea cultivation, encroachment and waste discharge from Jorhat town. In 2019, Ministry of Environment, Forest and Climate Change declared this

river as the most polluted river in Assam. Fig. 2.1 represents the major rivers in Upper Assam.



(Data source: DIVA GIS Website).

Fig.2.1: Rivers in Upper Assam

2.5 Climate:

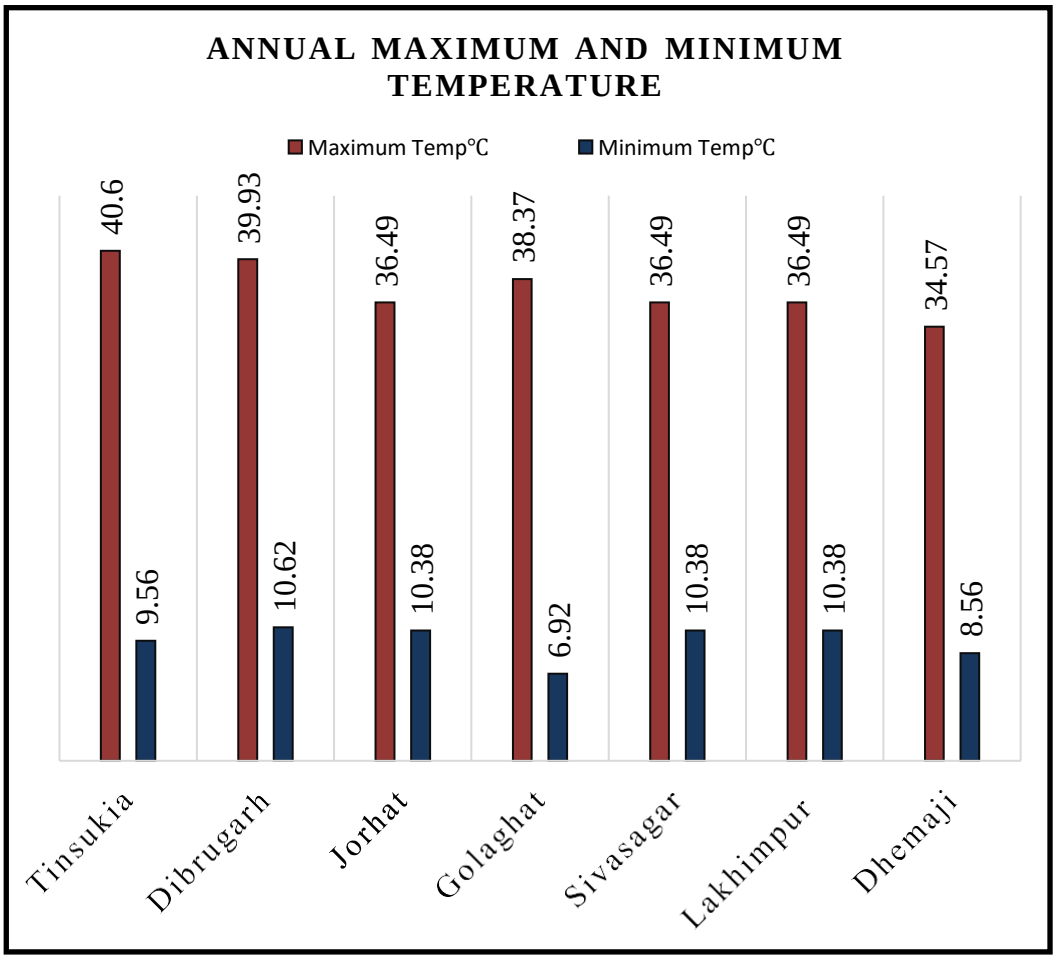
Climate governs agricultural activities, natural vegetation, water supply, human settlement and industries etc. The North East India as well as Assam experiences different type of climate in relation to the Brahmaputra plain because different dominant factors influencing the climate of Assam. Assam is located above the tropic of cancer; therefore, the region enjoys subtropical climate. During the month of January and July the average rainfall is 2045 mm and average temperature is 23°C. According to Koppen's climatic classification, Assam enjoys Humid Meso-thermal Gangetic (cwg) type of climate but Assam has many different climatic characteristics. Based on the regional characteristics, the districts of upper Assam experiences humid sub-tropical climate (cfa).

In 2021, the maximum temperature recorded in Tinsukia district that was 40.6°C and the minimum temperature was recorded in Golaghat district (Fig. 2.2).

Table 2.1: Annual Maximum and Minimum Temperature in Districts of Upper Assam (2021).

Sl. No.	Districts	Maximum Temp℃	Minimum Temp℃
1	Tinsukia	40.6	9.56
2	Dibrugarh	39.93	10.62
3	Jorhat	36.49	10.38
4	Golaghat	38.37	6.92
5	Sivasagar	36.49	10.38
6	Lakhimpur	36.49	10.38
7	Dhemaji	34.57	8.56

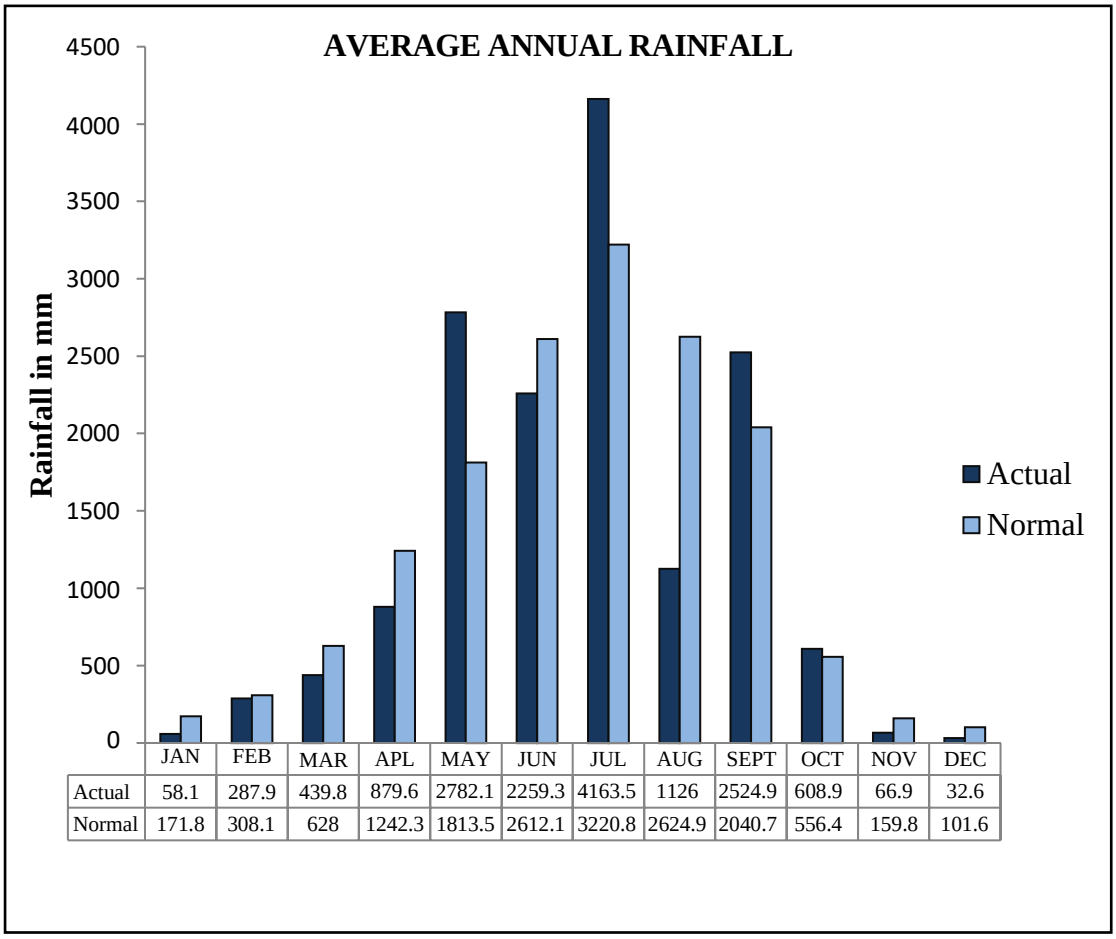
Source: Export from https://power.larc.nasa.gov, 2021



Source: Export from https://power.larc.nasa.gov, 2021

Fig. 2.2: Annual maximum and minimum Temperature in Districts of Upper Assam (2021).

Assam gets maximum rainfall in August and July followed by September from south west monsoon. In the year 2020, the highest average rainfall both actual and normal has been seen in the month of July. Generally, the eastern side of Assam situated on the foot hill zones of eastern Himalaya therefore the type of rainfall is orographic rainfall. The amount of rainfall increases towards the eastern side. Tinsukia is the eastern most district located foot hill zones of Arunachal Himalaya which receives 300-400 cm rainfall, Dibrugarh it ranges from 200 cm to 300 cm etc. (Fig. 2.3).



	JAN	FEB	MAR	APL	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
Actual	58.1	287.9	439.8	879.6	2782.1	2259.3	4163.5	1126	2524.9	608.9	66.9	32.6
Normal	171.8	308.1	628	1242.3	1813.5	2612.1	3220.8	2624.9	2040.7	556.4	159.8	101.6

Source: Assam Statistical Handbook, 2020

Fig 2.3: Average Annual Rainfall of Upper Assam, 2020

2.6 Biodiversity:

Assam is rich in biodiversity due to unique climatic condition, topographic conditions. In the region of Upper Assam, notable National Parks, Wildlife Sanctuaries, Reserve forests, grasslands and wetlands are situated, such as the Kaziranga National Park with an area 430 sq. km, located in the Golaghat district of Upper Assam. Due to various geographical reasons, there are four types of vegetation have been seen; alluvial inundated grasslands, alluvial savanna woodland, tropical moist mixed deciduous forest, and tropical

semi-evergreen forests. Kumbhir, Indian gooseberry, orchids, cotton trees, elephant apple trees etc. plant species are found here. The park is renowned for its one-horned rhinoceros as home to the world's largest population of Indian Rhinoceros along with tigers, swamp deer, leopards, wild water buffalo, Indian elephant and various bird species. Nambor Doigrung wildlife sanctuary (97.15 square kilometres) famous for its hot water springs located in the Golaghat District of upper Assam. Both type of evergreen and deciduous vegetation has been found in the districts of Upper Assam. Some of the important plant species are Agar, Halong, Nahar, different types of orchids etc. Numerous rare animal and bird species including aquatic species like one-horned rhinoceros, hornbill, white-winged duck, and Brahmaputra River dolphin (Shisu/ Platanishgangatica) are also found in this region. Dibru-Saikhowa National Park covers the areas of Dibrugarh and Tinsukia Districts. It is regarded as a Biosphere reserve and an identified bird area (IBA) situated on the south Bank of the Brahmaputra River with an area of 340 square kilometres. The forest types constitute semi-evergreen, deciduous forests, littoral and swamp forests. It is the largest Swamp Forest in North East India. The Maguri Motapung Wetland is a part of this national park. Some of the important species are the Tiger, elephant, leopard, Jungle cat, Small Indian Civet, squirrels, Gangetic Dolphin (Shisu-Gangetic Dolphin)/ Platanishgangatica), and Hoolock Gibbon and also home to feral horses (Equus Ferus). It is also famous for bird species, especially for rare white-winged wood ducks. The Dehing Patkai National Park is another Rainforest located in the Dibrugarh and Tinsukia Districts of Upper Assam with an area of 231.65 square kilometres, spread up to Arunachal Pradesh. On 9th June of 2021, the Forest department of Assam officially notified it as a National Park. In addition, the Pani Dehing wetland was declared as wildlife sanctuary by the government of Assam in August, 1996. It is a captivating wetland spanning about 33.93 square kilometres, which serves as a haven for migratory birds, boasting a rich diversity of approximately 165 species of birds. It is located in the Sivasagar District of Upper Assam. A tributary of the Brahmaputra River named Dishang River is flowing through the sanctuary. Along with the bird species varieties of fishes are also found here. Hollongapar Gibbon wildlife sanctuary established in 1997 by the Assam Government is located in Jorhat District of Upper Assam. This wildlife sanctuary named after the only Ape Hoolock Gibbon found in India. It covers only 20.98 square kilometres area dominated by semi-evergreen forest and the dominant plant species is the Halong the State tree of Assam. Different varieties of Bamboo, Agar, Holokh, Ajar etc. plant species are also found here. In Hollongapar, seven out of nine non-human primates are found in North Eastern India, which includes Hoolock Gibbon, Capped Langur, Slow Loris, Rhesus

Macaque, Assamese Macaque, Pigtailed Macaque and Stump tailed Macaque. Some of the bird species found here are Hornbill, Green Pigeon, Bulbul, Dove, Woodpecker, Black-headed Oriole Drongo etc. The main concern related to this wildlife sanctuary is human habitat and their illegal occupations like the collection of large quantities of leaves and grasses, expansion of agricultural fields, human and elephant conflict etc. are major issues in the surrounding areas of this wildlife sanctuary. Bherjan Borajan Padumoni Wildlife Sanctuary is an ideal for the Primate species located in the Tinsukia district with an area of 7.22 square kilometres. Bordoibam Bilmukh Bird Wildlife Sanctuary shares the area between the Lakhimpur and Dhemaji districts of Upper Assam. Subansiri, the largest tributary of the Brahmaputra River is flowing through this sanctuary.

2.7 Demographic Profile:

According to the 2011 census, the region has a population of 7,840,943. The total urban population constitutes only 14.4 %. The decadal growth rate from 2001-2011 was 17.05%. In this decade, population density increases from 339 to 398 persons per square kilometre. The total number of slum dwellers was 197,266 out of which 101,424 were male; 95,842 were female and the child population (0-6 years) was 22,229.

2.7.1 Literacy Rate:

The term literacy generally indicates the population who can read and write. According to the census of India, literacy defines as the people aged 7 or above, who have the skills of reading writing with understanding. The literacy rate is calculated by dividing total literates by total population and multiplied by 100. According to the 2011 census, the literacy rate in Assam was 73%. A recent report published by National Sample Survey revealed that in 2021, the literacy rate was 77.7%, which indicates the literacy rate increased by 4% in during the period. The literacy rate of slum population in India was 88.76% (male) and 79.11% (female). The literacy rate of slum population in Assam was 85.5% (male) and 75.4% (female) (Table2.2).

Table 2.2: Gender wise Literacy Rate of Slum Population in India and Assam, 2011

Sl. No.	Gender	Literacy Rate of Slum Population in India and Assam, 2011	
		India	Assam
1	Male	88.76%	85.5%
2	Female	79.11%	75.4%

Source: Census of India, 2011

2.7.2 Religion:

At the time of 2011 census, Hindu is the major religion with 1,91,80,759 persons that consisted 61% of population, followed by Muslim with 34% (106,79,345 persons) in the study area. Christianity accounts for 3.7% (11,65,867 persons) and other religions like Buddhism, Jainism are less than 1%. Around 54,993 Buddhists and 25,949 Jains are living in Assam. Other categories, which include unclassified sect and religion not stated, constitutes 77,991 persons in the region. The majority of religious population in Upper Assam are mainly Hindu. The rural and urban distribution of different religious population varies from place to place (Table 2.3).

Table 2.3. Major Religious Communities in Assam and Districts of Upper Assam, 2011

State/ Districts	Total/ Rural/ Urban	Major Religious Communities					
		Hindu			Muslim		
		Persons	Males	Females	Persons	Males	Females
Assam	**Total**	1,91,80,759	97,96,805	93,83,954	106,79,345	54,63,393	52,15,952
	Rural	15,69,971	80,06,062	76,93,809	98,77,218	50,52,341	48,24,877
	Urban	34,80,888	17,90,743	16,90,145	8,02,127	4,11,052	3,91,075
Tinsukia	**Total**	11,81,347	605,368	5,75,979	48,373	25,364	23,009
	Rural	9,48,835	4,83,479	4,65,356	22,277	11,508	10,769
	Urban	2,32,512	1,21,889	1,10,623	26,096	13,856	12,240
Dibrugarh	**Total**	11,98,401	6,11,787	5,86,614	64,526	32,943	31,583
	Rural	9,91,131	5,04,404	4,86,727	34,255	17,370	16,885
	Urban	2,07,270	1,07,383	99,887	30,271	15,573	14,698
Jorhat	**Total**	10,08,219	5,14,051	4,94,168	54,684	27,951	26,733
	Rural	8,13,987	4,13,829	400,158	33,627	17,043	16,584
	Urban	1,94,232	100,222	94,010	21,057	10,908	10,149
Golaghat	**Total**	9,17,426	4,67,432	4,49,994	90,312	46,014	44,298
	Rural	8,36,151	4,25,749	4,10,402	76,616	39,046	37,570
	Urban	81,275	41,683	39,592	13,696	6,968	6,728
Sivasagar	**Total**	10,07,277	5,16,041	4,91,236	95,553	48,832	46,721
	Rural	9,18,325	4,69,028	4,49,297	76,107	38,796	37,311
	Urban	88,952	47,013	41,939	19,446	10,036	9,410
Lakhimpur	**Total**	7,97,130	4,05,041	3,92,089	1,93,476	98,301	95,175
	Rural	7,29,124	3,69,866	3,59,258	1,71,210	86,919	84,291
	Urban	68,006	35,175	32,831	22,266	11,382	10,884
Dhemaji	**Total**	6,55,052	3,35,290	3,19,762	13,475	7,013	6,462
	Rural	6,12,245	3,13,175	2,99,070	8,917	4,619	4,298
	Urban	42,807	22,115	20,692	4,558	2,394	2,164

Source: https://censusindia.gov.in/nada/index.php/catalog/11365

2.7.3 Language:

Assamese is the official language and one of the major languages spoken in Assam with 48.3%, followed by Sylheti (dialect of Bengali) with 28.9% and Hindi with 6.7%. The Bodo is an additional official language in Bodoland territorial Council areas of Assam. and each tribe speak their own languages. Along with these, many other languages such as Odia, Punjabi etc. are spoken in Assam

2.7.4 Scheduled Castes and Scheduled Tribes in Assam:

India as well as Assam is a land inhabitant by a number of caste and tribal groups. The population of Assam is a broad racial mixture of Mongolian, Indo-Burmese, Indo-Iranian and Aryan origin. Bodo, Karbi, Mishing, Kachari, Deori, Rabha, Dimasa, Tiwa, Tai-Phake, Singphow, Kuki etc. are some of the major tribes in Assam. Similarly, Harijan, Bansphor, Bhuinmali, Brittial/Bania, Dhupi/Dhobi, Dugla, Hira, Jalkeot, Jhalo, Kaibartta etc. are groups of scheduled caste population distributed in different parts of Assam (Table 2.4).

Table 2.4: Scheduled Caste and Scheduled Tribes Population in Upper Assam, 2011

Sl. No.	Districts of Upper Assam	Scheduled Caste	Scheduled Tribes
1	Tinsukia	37,688.	82,066.
2	Dibrugarh	58,876.	1,02,871.
3	Jorhat	64,787	62,368
4	Golaghat	62,298	1,11,765
5	Sivasagar	34,847	37,334
6	Lakhimpur	81,840	2,49,426
7	Dhemaji	44,225	3,25,560
	Total	3,84,561	9,71,390

Source: Statistical Handbook of Assam, 2021

The socio-economic conditions of most of these groups are lack behind and their ecological condition is also not qualitative. Therefore, many of these group of people's inhabitant places are regarded as slum areas in Assam, especially the Harijan colonies.

Table 2.5: Percentage of Slum Population in Scheduled Castes and Scheduled Tribes Category (India and Assam 2001-2011)

Sl. No.	Year	Scheduled Caste		Scheduled Tribe	
		India	Assam	India	Assam
1	**2001**	18.5%	14.9%	2.8%	0.3%
2	**2011**	20.4%	21.5%	3.4%	1.9%

Source: Office of the Registrar General and Census Commissioner, India, 2001 and 2011

2.7.5 Population Migration:

Population migration can be defined as the mobility of individuals or group of individuals from one place to another in order to work or live temporally or to settle another place. According to the definition of census of India, a movement of people is termed as migration, when it involves change of residence from one village or town to another village and town. It is one of the major reasons of population change of a region and also related to the formation of informal settlements like slums. According to 2011 census, total 5,08,859 females belonged to Scheduled Tribes and 3,29,765 females belonged to Scheduled Caste, migrated due to their marriage in Assam. Other reasons of migration are education, households change etc. Table 2.6 and Table 2.7 shows the total Scheduled Tribe and Scheduled Caste population migration within the state by last residents all duration. The highest SC migrants found in Jorhat followed by Lakhimpur, Dibrugarh and Golaghat. Although, the highest SC Urban migrants has been seen in Dibrugarh that was 3,740 and the lowest SC urban migration found in Dhemaji, which was 607 persons. In contrast the highest ST migrants found in Dhemaji followed by Lakhimpur and Jorhat. The ST urban migrants found the highest in Dibrugarh (3,317) and the lowest in Sivasagar (683).

Table 2.6: Scheduled Caste Migration, 2011

Assam and Districts of Upper Assam	Total/Rural/ Urban	Total Migrants			Reason of Migration		
					Work/Employment		
		Persons	Males	Females	Persons	Males	Females
Assam	**Total**	731,674	249,633	482,041	30,957	26,978	3,979
	Rural	491,218	130,804	360,414	23,663	20,699	2,964
	Urban	87,661	34,482	53,179	6,328	5,533	795
Tinsukia	**Total**	11,488	4,687	6,801	972	877	95
	Rural	7,259	2,880	4,379	624	570	54
	Urban	2,757	1,058	1,699	330	290	40
Dibrugarh	**Total**	20,295	7,866	12,429	1,094	999	95
	Rural	10,629	2,855	7,774	674	616	58
	Urban	3,740	1,529	2,211	400	366	34
Jorhat	**Total**	33,634	12,255	21,379	1,000	858	142
	Rural	20,483	5,414	15,069	738	641	97

	Urban	2,810	1,064	1,746	219	184	35
Golaghat	**Total**	20,242	6,559	13,683	935	801	134
	Rural	14,960	4,016	10,944	767	656	111
	Urban	1,915	788	1,127	141	125	16
Sivasagar	**Total**	14,584	4,286	10,298	703	625	78
	Rural	10,877	2,609	8,268	522	461	61
	Urban	1,539	517	1,022	166	152	14
Dhemaji	**Total**	15,792	6,852	8,940	635	556	79
	Rural	11,935	4,897	7,038	572	506	66
	Urban	607	246	361	46	37	9
Lakhimpur	**Total**	20,928	6,071	14,857	734	634	100
	Rural	16,196	3,743	12,453	602	517	85
	Urban	902	338	564	92	85	7

Source: censusindia.gov.in

Table 2.7: Scheduled Tribe Migration, 2011

Assam and Districts of Upper Assam	**Total/ Rural/ Urban**	**Total Migrants**			**Reason for migration**		
					Work/employment		
		Persons	**Males**	**Females**	**Persons**	**Males**	**Females**
Assam	**Total**	1,294,548	471,581	822,967	54,827	45,235	9,592
	Rural	954,391	296,304	658,087	47,181	39,025	8,156
	Urban	53,428	23,543	29,885	5,931	4,993	938
Tinsukia	**Total**	29,723	12,685	17,038	1,892	1,680	212
	Rural	22,792	8,969	13,823	1,515	1,344	171
	Urban	2,158	1,011	1,147	327	294	33
Dibrugarh	**Total**	38,596	12,583	26,013	2,210	1,938	272
	Rural	24,129	4,935	19,194	1,672	1,476	196
	Urban	3,317	1,463	1,854	477	422	55
Jorhat	**Total**	44,992	13,963	31,029	1,104	823	281
	Rural	28,845	5,382	23,463	912	685	227
	Urban	1,039	455	584	130	106	24
Golaghat	**Total**	39,113	14,911	24,202	1,470	1,276	194

	Rural	29,527	10,037	19,490	1,284	1,134	150
	Urban	1,622	741	881	120	103	17
Sivasagar	**Total**	13,434	4,036	9,398	779	667	112
	Rural	9,818	2,193	7,625	619	533	86
	Urban	683	283	400	140	117	23
Lakhimpur	**Total**	49,717	9,446	40,271	1,328	1,090	238
	Rural	43,356	6,842	36,514	1,172	966	206
	Urban	909	342	567	103	88	15
Dhemaji	**Total**	107,747	41,408	66,339	3,068	2,511	557
	Rural	83,319	29,280	54,039	2,838	2,332	506
	Urban	1,828	761	1,067	143	117	26

Source: censusindia.gov.in

The comparison between Scheduled Caste (SC) and Scheduled Tribe (ST) urban migrants shows that the number of SC urban migrants is higher than that of ST urban migrants, according to the 2011 census data**.** The total number of SC urban migrants was 11,222, while the number of ST urban migrants was 8,136. Dibrugarh district had the highest number of urban migrants, including both SC and ST groups. The lowest number of SC urban migrants was found in Golaghat district, whereas the lowest number of ST urban migrants was seen in Jorhat district (Fig.2.4 and Fig.2.5).

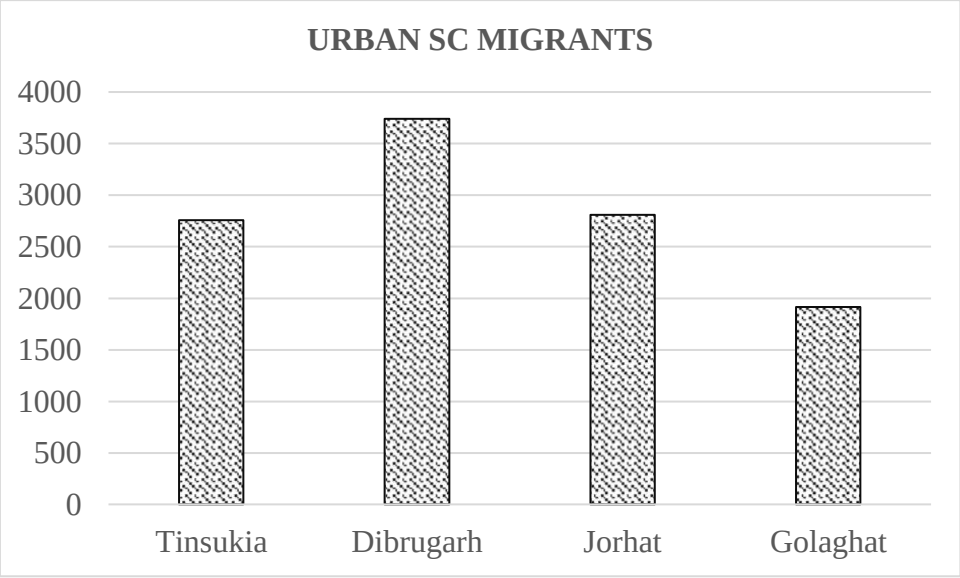


Fig.2.4: Urban SC migrants in the study area

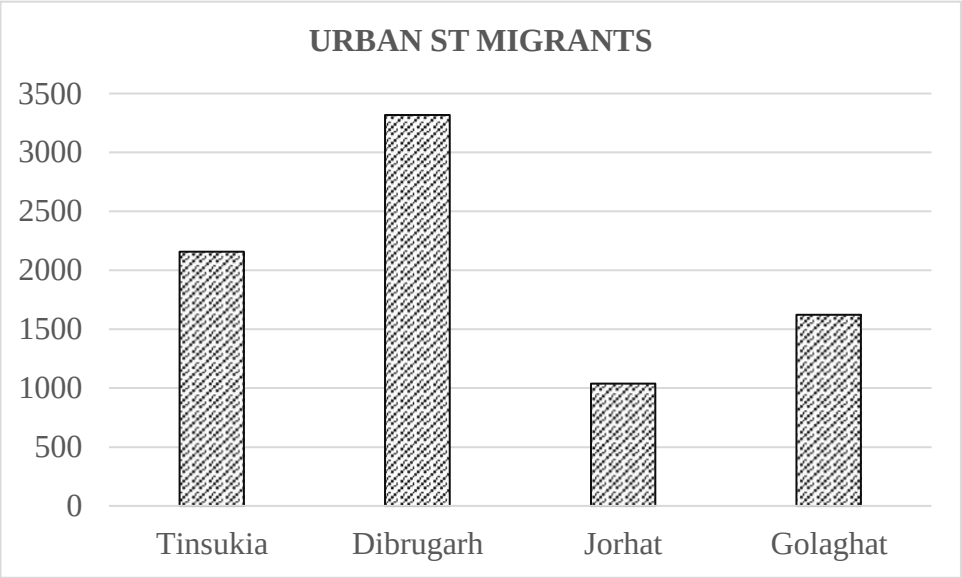


Fig.2.5: Urban ST migrants in the study area

2.8 Economy:

Assam is considered as one of the economically poor states in the country. It holds 28th rank in 2023 (GDP with Rs.1,18,504,000) in India. The state constantly performing better in GDP and it is estimated that the growth will be Rs.5.67 Lakhs in 2024, according to economic survey of Assam. The economy of Assam is depending mainly on agriculture.

2.8.1 Resources and Industries in Upper Assam:

The region is rich in resources including mineral resources and forest resources. The major mineral resources are petroleum, coal, limestone etc., that have been regularly extracted for a long. The presence of oil in the forest and fields of Upper Assam was discovered around 1822. Assam is landlocked and situated in the easternmost periphery of India and the region is linked to the mainland by a flood and cyclone-prone narrow corridor with weak transportation infrastructure. Apart from flood, Assam is also located in the earthquake-prone zone-v in India. Although, the Brahmaputra River is suitable for navigation, it does not have sufficient infrastructure for international trade and the success of such a navigable trade route will be dependent on proper channel maintenance and diplomatic and trade relationships with Bangladesh. Therefore, the industrial development in Assam is very slow by Indian standards, though the region is rich in mineral resources. Though Assam displays a poor overall industrial performance. There are several other industries distributed in the Upper Assam such as the coal industry in Ledo, Tinsukia district; chemical fertilizer plant and petrochemical industries at Namrup, Dibrugarh; sugar mills at Barua Bamun Gaon of Golaghat district, cosmetics plant of Hindustan Unilever Limited (HUL) at Doom Dooma

in Tinsukia in Upper Assam, tourism industry, food processing industry, jute mill, textile and yarn mills, a silk mill, etc. Unfortunately, many of these industries are facing loss and closer due to a lack of infrastructure and improper management practices. As the region is rich in crude oil and most of the oilfields of Assam are located in the Upper Assam region of the Brahmaputra Valley. Asia's first oil refinery, the Digboi oil refinery is located in the Tinsukia district of Upper Assam. Assam has four oil refineries located at Guwahati, Digboi, Numaligarh and Bongaigaon, with a total capacity of 7 MMTPA (Million Metric Tonnes per annum). Out of these, Digboi and Numaligarh are located in Upper Assam. One of the biggest public sector oil companies in the country, Oil India Ltd. has its plant and headquarters at Duliajan. The major agriculture-based industry in Assam is Tea, which is an internationally renowned sector. Dibrugarh, the "Tea city of India" is located in Upper Assam. The major large-scale industry, the Brahmaputra Craker and Polymer Limited (BCPL) is located in Dibrugarh district.

2.8.2 Industrial Areas:

Assam has 16 industrial estates, three industrial growth centres, 10 Integrated Infrastructure Development Depots, 17 industrial areas, 11 growth centres, six mini-industrial estates, one export promotion park and one food processing industrial park. Table 2.8 shows the major industrial areas of Upper Assam districts. Assam is also the most popular tourist destination among the northeastern states. Between 2019-2020, the Gross State Domestic Product (GSDP) was US$ 47.56 billion, whereas the Net State Domestic Product (NSDP) was US$ 42.50 billion.

Table 2.8: Major Industrial E-state Areas in Upper Assam

Sl. No.	Districts	Industrial E-states	Area in sq. m.	Name of industrial area	Area in sq. m.
1	Tinsukia	Tinsukia (Borguri)	149,833.6	Buraburi, Sadiya	267,600
1.1	Tinsukia	Uluppathar, Margherita	169,735	Doomdooma	749,347
1.2	Tinsukia	-	-	Lakhimpria Nepali Gaon	401,400
2	Dibrugarh	Lahowal	21,421.63	Beheating	32,373.79
3	Jorhat	Cinamora	34,069.77	-	

4	Golaghat	-		Jonaki Nagar	77,445
5	Sivasagar	Darikapar)	40,140	-	
6	Lakhimpur	Rajabari, Bihpuria	130,909.1	Bechagaon	120,398.4

Source: Assam Statistical Handbook, 2020

2.8.3 Working population in Upper Assam:

The total number of working populations including main and marginal workers in Assam is 11,969,690 (38.36%), out of which Upper Assam comprises 25,82,016 (21.57%) working population. The main and marginal workers are distributed under different categories like cultivated worker, agricultural labourers, household industry workers and other workers **(**Table 2.9, 2.10 and 2.11).

2.8.4 Cultivated/farm worker: Total number of cultivated or farm worker in Assam are 40, 61,627 out of which 18,45,346 are male and 4,91,321 are female. The total number of cultivated workers number in Upper Assam is 11,00,156.

2.8.5 Agricultural labour: In Upper Assam, the total number of agricultural labourers was 2,89,685.

2.8.6 Household Industry worker: In Upper Assam, the total worker of this category was 78,052.

2.8.7 Other Workers: This category of main and marginal worker section includes total 33,28,811 workers in Upper Assam districts. Tinsukia has the highest number of main and marginal workers with 5,57,196 workers followed by Dibrugarh**.** The percentage of male workers are higher than the female in each district of Upper Assam (Table 2.9). Table 2.10 shows the workers of different categories and table 2.11 included gender wise Non workers in the nine districts of Upper Assam.

Table 2.9: Main and Marginal worker composition in Upper Assam, 2011

Sl. No.	Districts	Main and Marginal workers					
		Total	Percentage	Male	Percentage	Female	Percentage
1	Tinsukia	5,57,196	41.96	3,66,623	53.9	1,90,573	29.42
2	Dibrugarh	5,60,557	42.26	3,68,013	54.4	1,92,544	29.63
3	Jorhat	4,98,618	45.65	3,20,746	57.6	1,77,872	33.22
4	Golaghat	4,79,928	44.98	3,09,104	56.91	1,70,824	32.62
5	Sivasagar	4,85,717	42.2	3,25,071	55.17	1,60,646	28.59
6	Lakhimpur	4,29,995	41.26	2,82,250	53.29	1,47,745	28.83
7	Dhemaji	3,16,800	46.17	1,86,577	53.12	1,30,223	38.89

Source: Compiled from District Census Handbooks, 2011

Table 2.10: Main and Marginal Workers of Different Categories, 2011

Sl. No.	Districts	Main and marginal workers			
		Cultivators	Agricultural labor	Household Industrial workers	Others
1	Tinsukia	1,49,482	47,756	13,241	3,46,717
2	Dibrugarh	1,35,194	61,209	14,362	3,49,792
3	Jorhat	15,476	2,533	2,642	22,337
4	Golaghat	1,90,590	66,616	15,068	2,07,654
5	Sivasagar	1,38,100	48,468	14,532	2,84,617
6	Dhemaji	2,31,937	19,181	7 ,224	58,458
7	Lakhimpur	2,39,377	43,922	10,983	1,35,713

Source: Compiled from District Census Handbooks, 2011

Table 2.11: Non- Worker composition in Upper Assam Districts, 2011

Sl. No.	Districts	Non- Workers					
		Total	Percentage	Male	Percentage	Female	Percentage
1	Tinsukia	7,70,733	58.04	3,13,608	46.1	4,57,125	70.58
2	Dibrugarh	7,65,778	57.74	3,08,421	45.6	4,57,357	70.37
3	Jorhat	5,93,638	54.35	2,36,059	42.4	3,57,579	66.78
4	Golaghat	5,86,960	55.02	2,34,057	43.09	3,52,903	67.38
5	Sivasagar	6,65,333	57.8	2,64,145	44.83	4,01,188	71.41
6	Lakhimpur	6,12,142	58.74	2,47,424	46.71	3,64,718	71.17
7	Dhemaji	3,69,333	53.83	1,64,672	46.88	204,661	61.11

Source: Data Compiled from District Census Handbooks, 2011

2.8.8 Work participation of Slums:

According to 2011 census, 36% of India's slum population is working population, with 86% main workers and 16% marginal workers. Sikkim and Tamil Nadu have the highest work participation rates among slum dwellers, 41% each. Bihar has the lowest work participation rate that is 29%. In Assam, the total work participation rate among slum population is 36%, classified with 86% as main workers and 17% as marginal workers.

2.9 Transport and Communication:

Transport and communication play an important role in the socioeconomic development of a country or region. In India transport and communication facilities growing at a rapid pace but compared to the other states Assam including other northeastern states, this growth is a very poor state. But in recent days many transport development policies introduced in the region. The two longest river bridges, the Dr Bhupen Hazarika Bridge (Dhola-Sadia Bridge) and the Bogibeel Bridges are located in the Tinsukia and Dibrugarh district of the Upper Assam. The Bogibeel Bridge at 4.94 km is the country's longest road-cum-rail bridge on the Brahmaputra River. Dibrugarh becomes accessible without travelling via Guwahati. The train journey from Delhi to Dibrugarh reduces by 3 hours (from 37 hours to 34) and the distance by 170 kilometres. The 2018 statistics report published by the Ministry of Road Transport and Highways; the total major road length of Assam is 3,43,609 kilometres. In Upper Assam, total major road length is 1,028.5 kilometres out of 7,547.39 kilometres in 2018 (Table 2.12).

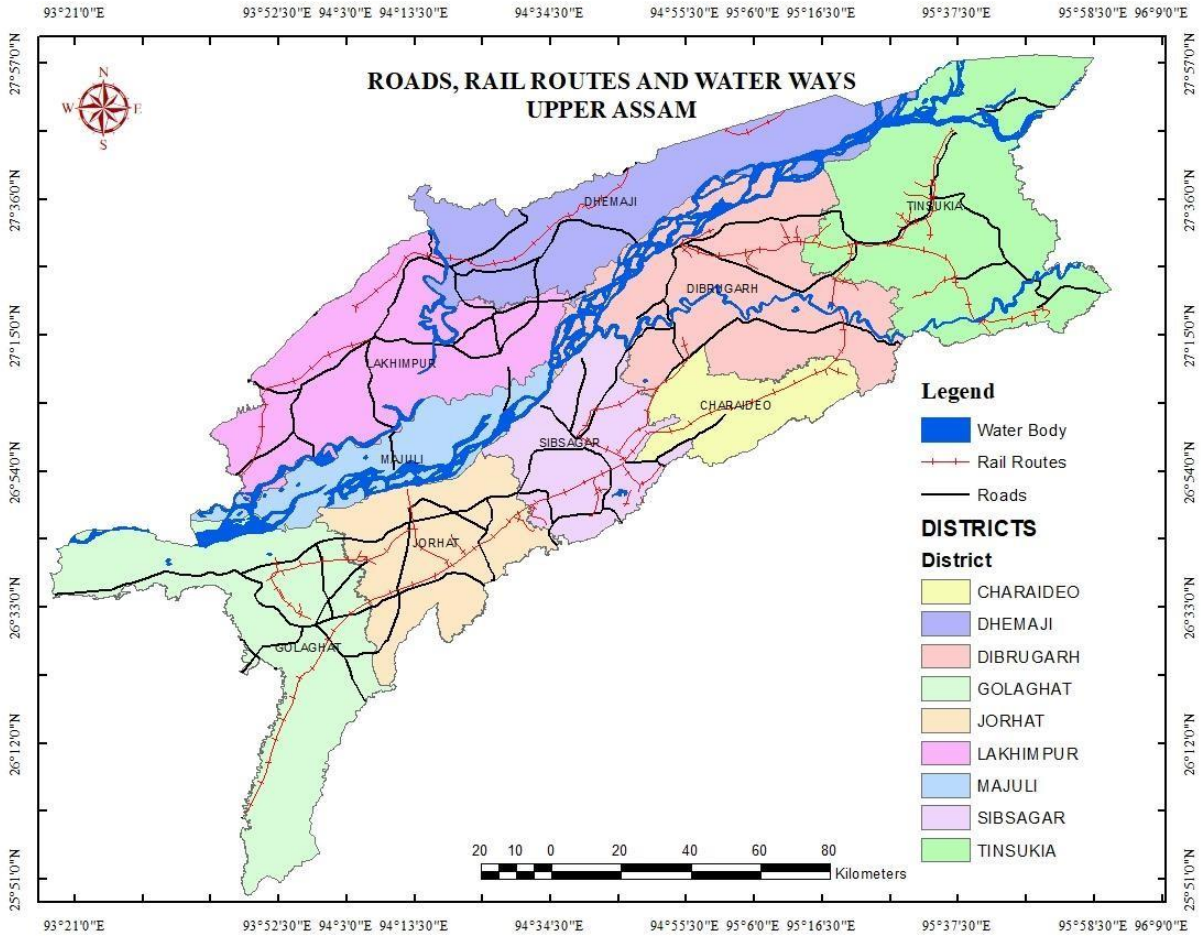
Table 2.12: Length of Roads in Upper Assam, 2020

Sl. No.	Districts	Major Road in km.	State highways in km.	Urban Roads in km.	Rural Roads in km.	Total road length excluding National Highways
1	Dhemaji	42	45	74	1467	1628
2	Dibrugarh	162.77	109	77	1784	2132.77
3	Golaghat	156.75	160	118	2081	2515.75
4	Jorhat/ Majuli	89.09	127	83	1947	2246.09
5	Lakhimpur	97.36	121	39	1953	2210.36
6	Sivasagar/ Charaideo	309.59	100	93	2780	3282.59
7	Tinsukia	170.94	41	81	1784	2076.94
	Total	1028.5	703	565	14,816	16,092.5

Source: Public Works Department, Assam

Although, the laying down of railway lines was started between 1881 and 1884 in Upper Assam the state railway network is not yet well developed. The Dibrugarh-Sadia line was the first railway line constructed in Assam. So far railway communication is concerned with both broad-gauge and metre-gauge lines that pass from west to east of Upper Assam in the north and southern parts. The total length of railway lines in Assam is 2518.99 kilometres respectively in 2019-2020 that increased to 2571.19 kilometres in 2022-2023. The Upper Assam only two North-eastern states, Arunachal Pradesh and Nagaland are connected.

There are many rivers in Upper Assam at present and water transport plays an important role in the movement of people and goods, especially in the river Brahmaputra. The transport and communication system are not up to the desired level in Upper Assam. National highways, state highways, village roads, road connectivity **(**Fig.2.6).



(Source: Map Data, DIVA GIS)

Fig.2.6: Major Transport Routes in Upper Assam

Rowriah (Jorhat), Mohanbari (Dibrugarh) and Lilabari (Lakhimpur) are three important air stations in Upper Assam. During the British era, two important economic resources were discovered in Upper Assam, these are petroleum and tea. To collect resources and export to other countries roadways and railways were constructed by the British Government. But they constructed the roads only joined major resource regions and industrial purposes not for common people. After independence, the situation started to improve gradually. Due to various reasons, the transport and communication system is still not well developed in Upper Assam. The development of transport and communication lack behind in the region includes both natural and anthropological factors such as devastating floods, heavy rainfall, the presence of numerous turbulent rivers, poor industrialisation, lack of proper planning policies etc. In Upper Assam, most of the interior places are connected by public bus services, auto-rickshaw, minibus, battery rickshaws, and trekker services as well as private and public buses.

2.10 Land Use Land Cover Pattern:

Urbanisation brings about land use and land cover change are a multiplying phenomenon worldwide. The impacts of chaotic urban growth are associated with serious problems such as growth of the informal settlement, environmental pollution, additional infrastructure, decreases of wetlands and destruction of ecological structures etc. Population growth and the changes in economic activities are two important factors which change the land use pattern of any place with time. Land use simply indicates the use of land for different purposes such as agricultural land use and non-agricultural land use (built up, barren, grazing areas, etc). The total area of Assam is 78,438 square kilometres, which is classified into the following major land use and land cover classes based on uses (Table 2.13):

Table 2.13: Land Use and Land Cover data of Assam, 2011

Sl. No.	Classifications	Sub- categories	Area in sq. km
1	Agriculture	Crop Land	24416.9
		Current shifting Cultivation	58.36
		Fallow	500.54
		Plantation	3822.19
2	Barren/uncultivable/wastelands	Sandy area	42.09
		Scrub land	4091.09
3	Built up	Mining	136.01
		Rural	640.09
		Urban	743.55
4	Forest	Deciduous	27237.11
		Evergreen/ semi-evergreen	43667
		Forest plantation	83.81
		Scrub forest	1280.81
5	Grass/ grazing	Grass/ grazing	3032.65
6	Wetlands/ water bodies	Inland wetlands	1152.7
		Rivers/streams/canals	6746.3
		Water bodies	87.11

Source: Assam statistical handbook 2020.

The land use and land cover change in the upper Assam districts is bring about by the rapid urban growth. A recent data published in Assam statistical handbook revealed that among various categories, land use for forest area is the highest in Golaghat district. Non-agricultural land use area is the highest in Dibrugarh district, which includes land use for settlements, roads, industries and other infrastructural activities. Land Use Land cover data from 1998 to 2019, reveals that the land use for forest areas is shrinking and build up areas are expanding along with other classes (Fig. 2.7). Table 2.14 shows the land use and land cover of upper Assam districts during 2018-2019, where the barren land area is the highest in Tinsukia district and the lowest in Lakhimpur district. The land use area under permanent pastures grazing is the highest in Sivasagar district according to the Assam statistical handbook data.

Table 2.14: Land use pattern of Upper Assam, 2018-2019 (Areas in Hectares)

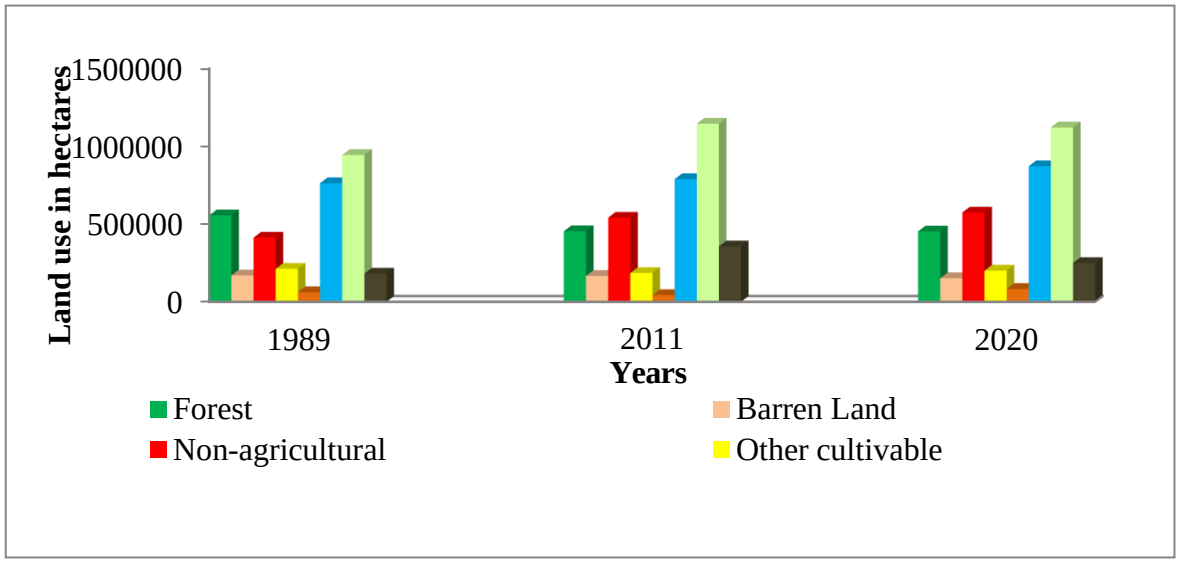
Sl. No.	**Districts**	**Total area**	**Forest**	**Barren land**	**Non-agricultural**	**Other cultivable land excluding fallow land**		
						Permanent pastures and Grazing	**Culturable wastel and**	**Land under Misc, trees, groves not included in net area sown**
		1	2	3	4	5	6	7
1	**Tinsukia**	379000	126468	51394	33759	5637	3677	14118
2	**Dibrugarh**	338100	21794	23164	101837	5069	11064	13020
3	**Jorhat**	285100	25247	7764	69291	4566	6584	13711
4	**Golaghat**	350200	157642	6243	15265	6868	7814	3940
5	Sivasagar	266800	30465	13454	36519	13514	6028	15276
6	Lakhimpur	227700	31061	33	69226	3223	8720	6270
7	Dhemaji	323700	59355	49469	87513	15811	17061	18107

(Cont...)

Sl. No.	Fallow Land		Net Area sown	Total Cropped area	Area sown more than once
	Fallow other than current fallow	Current Fallow			
	8	9	10	11	12
1	6929	7513	94725	197750	103025
2	3886	1564	70934	114541	43607
3	8990	4252	130705	144388	13683
4	4654	4737	152761	167116	14355
5	6264	12345	132935	151290	18355
6	4845	7659	145433	162258	16825
7	3868	5239	143321	182629	39308

Source: Statistical Handbook of Assam, 2020

According to the data published in statistical handbook, in Assam the built-up area increased from 23.9 sq. km in 1976 to 115.1 sq. km in 2015 and becoming the dominant land cover class accounting for 41.8% of the total geographical area. An important consequence of urbanisation in developing countries is the high growth rate of urban poverty, which is manifested most clearly in the proliferation and expansion of slums, home to a growing proportion of urban dwellers.



Source: Statistical Handbook of Assam

Fig.2.7: Land use of Upper Assam in different Decades

The land use and land cover of the selected study area for the 2022 year has been calculated by using ArcGIS 10.8 (Table 2.15 and Fig. 2.8, 2.9, 2.10 and 2.11).

Table 2.15: LULC of Selected Districts, 2022

LAND USE LAND COVER CLASSES IN SQ KM AND PERCENTAGE														
Districts	Water Body	%	Vegetation	%	Flooded Vegetation	%	Agricultural land	%	Built Up	%	Sand bars	%	Grassland	%
Jorhat	22.42	1.2	445	23.96	8.1	0.43	953.89	51.2	388.82	20.9	9.14	0.49	35.74	1.92
Golaghat	123.17	3.62	647.47	20.09	23.29	0.73	1351.6	41.9	727.95	22.6	80.67	2.5	268.8	8.34
Dibrugarh	271.62	8.03	820.56	24.27	18.69	0.55	1140.56	33.7	460.3	13.6	481.8	14.3	187.3	5.34
Tinsukia	145.92	3.83	1706.2	44.76	19.65	0.52	920.37	24.1	512.47	13.4	185.19	4.88	321.7	8.45
Total	563.13	16.68	3619.3	113.1	69.73	2.23	4366.42	151	2089.54	70.5	756.8	22.1	813.5	24.1

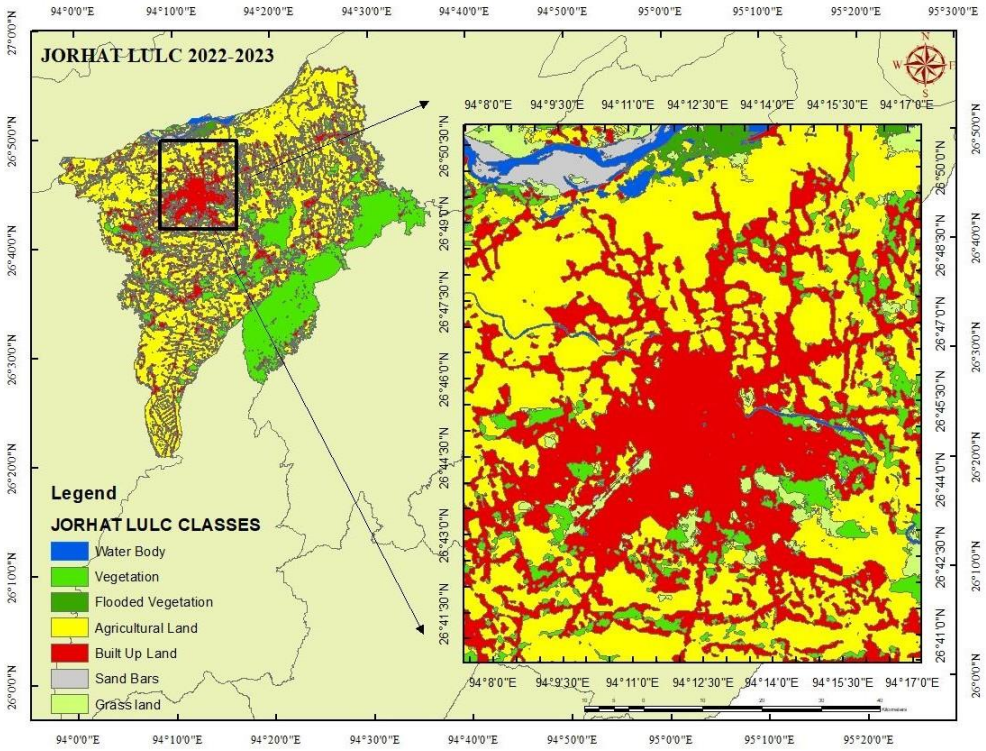


Fig.2.8: Land Use Land Cover, Jorhat, Upper Assam (Esri landcover 2022-2023)

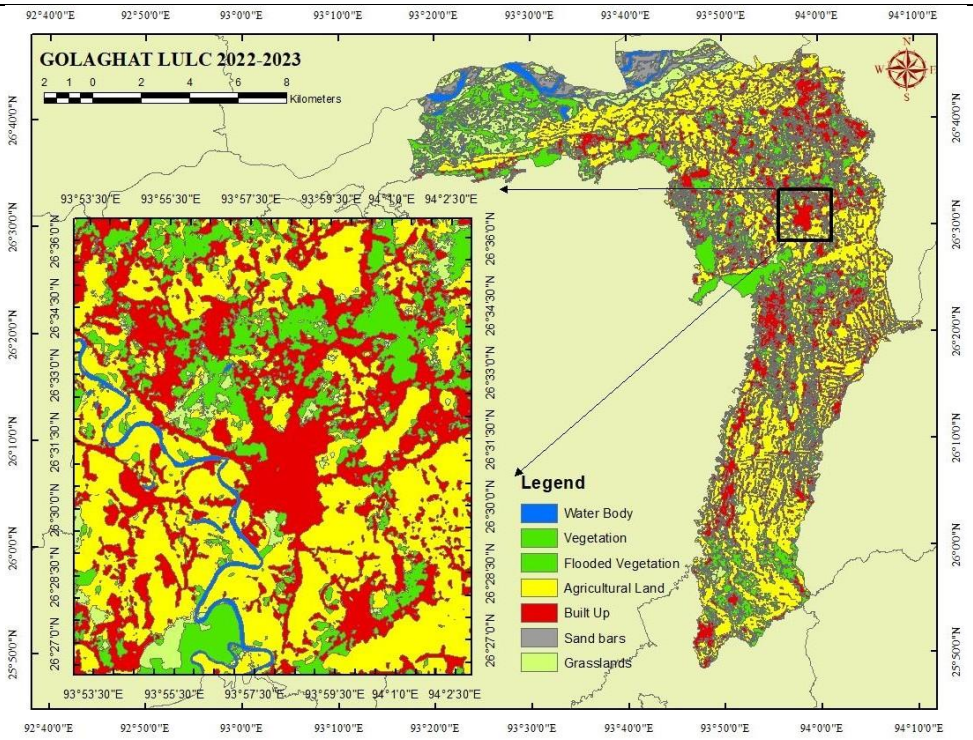


Fig.2.9: Land Use Land Cover, Golaghat, Upper Assam (Esri landcover 2022-2023)

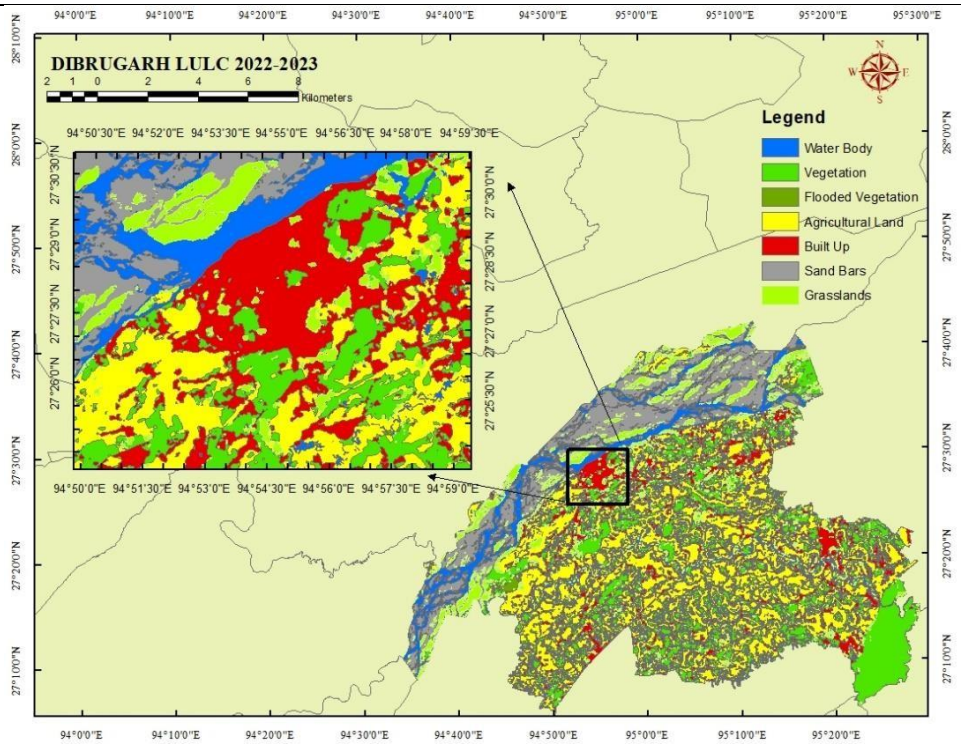


Fig.2.10: Land Use Land Cover, Dibrugarh, Upper Assam (Esri landcover 2022-2023)

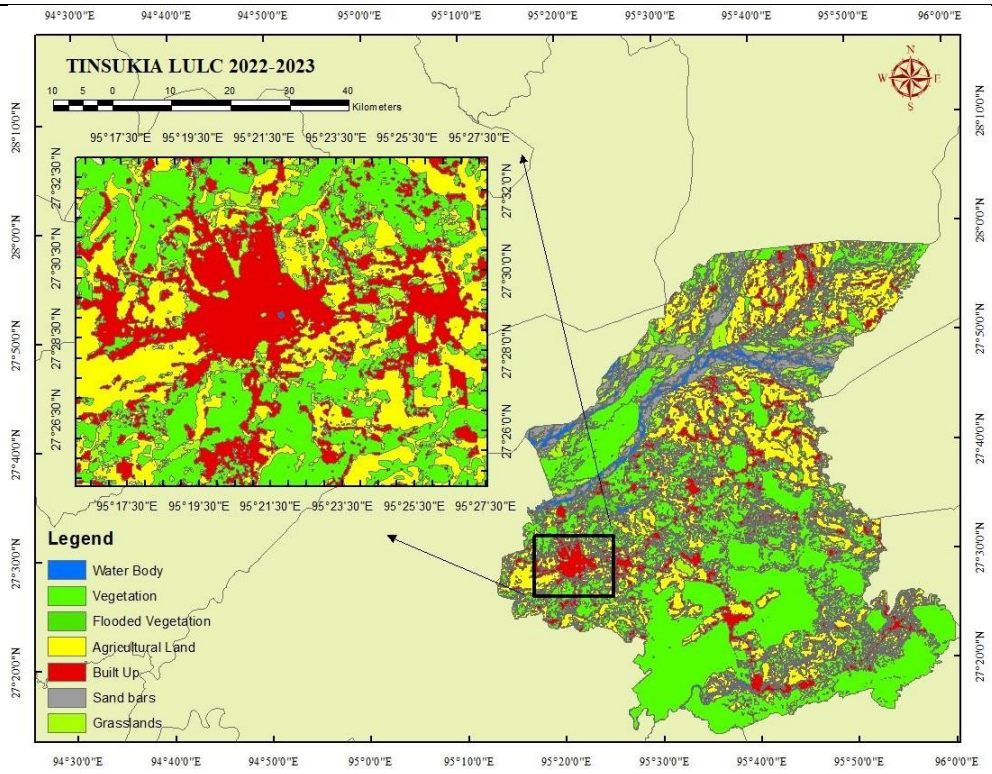


Fig.2.11: Land Use Land Cover, Tinsukia, Upper Assam (Esri landcover 2022-2023)

2.11 Other Basic Amenities:

Assam is back ward in terms of basic amenities such as medical, educational, recreational, and cultural facilities in comparisons to the rest of the country of which Upper Assam part is culturally rich region. Jorhat district is known as the Cultural town of Assam. According to the data of economic survey of Assam, there are were 36,323 lower primary schools in 2020-2021 and it decreased to 34,390 in 2022-2023. Table 2.16 shows the Pupil Teacher Ratio and dropouts in the districts of Upper Assam. This data indicates that the dropouts in both lower Primary (LP) and Upper Primary (UP) were high in Tinsukia District during 2020-2021. The ratio between pupil and teachers (PTR) were also found high in the district.

Table 2.16: District-Wise Pupil Teacher Ratio (PTR), Drop Out in Assam, 2020-21

Sl. No.	Districts	PTR LP	PTR UP	Dropout LP	Dropout UP
1	Lakhimpur	20	12	1.6	4.2
2	Dhemaji	17	15	1.8	0.8
3	Tinsukia	23	27	4.7	5.4
4	Dibrugarh	22	20	4.3	4.2
5	Sivasagar	9	7	0.9	1.7
6	Jorhat	17	13	1.5	3.1
7	Golaghat	23	18	3.5	4.5

Source: Statistical Handbook of Assam, 2020

If recreational and cultural facilities are taken into account, Upper Assam has the oldest Golf course in Asia, cinema halls, public libraries, planetarium, Women's University, Agriculture University, Medical college and hospital etc. are located in Jorhat district. In Dibrugarh, the tea city of Assam also having State University, Assam Medical College and Hospital in Dibrugarh district. These two Medical Colleges and Hospitals in Dibrugarh and Jorhat district are only major government hospitals in Upper Assam (Table 2.17). Apart from these, many Primary Health Centres (PHC), Civil Hospital Centres (CHC), private hospitals are located in the region but the private health facilities are very costly due to which poor people are not preferred to visit private hospitals. These facilities are not enough in comparison to the high density of population in this part of Assam that too is mostly located in urban areas.

Table 2.17: List of Health Institution of Upper Assam Districts (2020-2021)

Sl. No.	District	No. of Sub. Centres	No. of PHCs	No. of CHCs	District / Sub Divisional Hospitals	No. of District Hospitals
1	Dhemaji	98	22	4	0	1
2	Dibrugarh	231	30	7	0	0
3	Golaghat	144	40	4	1	1
4	Jorhat	144	44	5	2	0
5	Lakhimpur	156	30	8	1	1
6	Sivasagar	219	45	4	2	1
7	Tinsukia	164	23	6	0	1
Assam		**1156**	**234**	**38**	**6**	**5**

Source: Assam Statistical Handbook, 2020

2.12 Chapter Conclusion

Upper Assam is rapidly growing in urbanization and industrialization. Along with these, different economic activities also arose and people migrated towards this region. Four towns namely Jorhat, Golaghat, Dibrugarh and Tinsukia has been selected for the study because these four towns have high number of slums in the region. The loss of land and shelter during the flood is also a plus factor in the growth of informal settlements such as slums in the Upper Assam region. In conclusion, the growth of population and migration impact the environmental condition of the region.

CHAPTER 3
DYNAMICS OF SLUM GROWTH AND DEVELOPMENT IN THE STUDY AREA

3.1 Introduction:

According to UN-Habitat's Strategic Vision, by the year 2050, when two-thirds of the world's population will live in cities, there will be 3 billion urban slum dwellers. Slums are growing at a rate 5 to 10 times faster than the rate, at which the international community expects them to be upgraded. Members of the United Nations have not only fallen behind in meeting the goal, but the problem appears to be much larger or the solutions appear to be much different than what was envisioned in the year 2000. Various studies on slums have reported on the expansion of slums and their perilous status in various parts of the world.

The reality of slum problems is multi-dimensional wherein the impacts vary from human to physical and also from region to region. In Assam, the ecological impact on the wetlands is very serious to extended due to encroachment and growth of slums, while on the social fronts the adverse impact can be seen from health issues to social evils like the crime such as theft, domestic violence, drug addiction etc. The rate of crimes such as petty thefts, snatching, murders and also burglary has been increasing at a rapid pace (Das B., 2021**).** This illegal type of settlement is also a result of lack of monitoring or ignorance of administration. Most of these dwellers living on rent but some of them constructed their own house in the area. Removing of illegal settlements is a major issue in Assam. Whenever administration tried to remove these settlements, there has always been a clash between administration and the dwellers. This situation has been seen in different districts in Assam, which covers headlines of news many times. A news article published in India news on 17th Dec, 2021 that Supreme Court of India directed the demolition of nearly 1200 slum units in Gujarat and Haryana on heading 'All major cities turning into slums". Das (2006) included that according to 2001 census the total number of identified slums fewer than 81 urban local bodies distributed across the state is 829, out of which 64 pockets are distributed in seven towns of Western Assam, that all the Slum pockets socially isolated from the rest, partly by choice and partly by location. Their link with the rest of the community is their identification with the labour market, but an additional link is through politics. While formal development is a process with long planning periods and thus the built landscape appears static, informal or spontaneous settlements seem to be subject to high dynamics in their unfinished urban form However, the dynamics and morphological characteristics of physical transformation in such

settlements of urban poverty have been hardly empirically studied on a global scale or temporal consistent foundation (Kraff et al., 2020).

According to the 2011 census, the Population density is the highest in Sivasagar district among the five selected districts. The reasons behind this can be high birth rate, migration etc. Sivasagar is a famous historical city and a major oil hub of Assam. Sivasagar is a major tourist place in upper Assam. Generating income through tourism is a major source for livelihood for many. Such opportunities also attract migrants adding to large changes in the demographic changes in the area. The second highest population density found in Dibrugarh district followed by Jorhat, Tinsukia and Golaghat districts**.**

3.2 Dynamics of Urbanization in Assam

The world is urbanizing rapidly in recent decades. This has been mostly pronounced to developing countries especially in Asian and Australian countries. In 1950, the world urban population was only 30% that increased to 51% in 2010. It is estimated that by 2020, the share of urban population increased to 56.2% (UNCTAD, e-Handbook, 2021). Thus, urbanisation is a process of population growth including current residents and net migrated population into the urban centres. It is a parameter to measure the economic and social growth of a country or region, but it brings many allied problems such as pollution, urban poor settlements and informal as well as unplanned settlement formation etc. The upper Assam is a major industrial region in Assam and the urbanization rate is growing day by day. This region has many slum pockets and most of them are recent formations. These slum pockets are formed due to various reasons like the availability of fertile land on the Brahmaputra River, industries mining sites, development in transport and communication, failure of policies, ignorance towards the formation of informal settlements, terrorism, flood hazards and most importantly illegal migration especially from Bangladesh.

3.2.1 Growth of Urban Population in Upper Assam:

The population including rural and urban is increasing in the study area. According to the 2001 and 2011 census report, total population in the districts of Upper Assam increased from 67,93,324 to 76,92,728 persons. Rural population increased from 58,87,307 in 2001 to 66,16,271 in 2011 and urban population increased from 9,06,017 in 2001 to 9,76,430 persons in 2011 (Table 3.1). In the same decade, the level of urbanization based on urban population percentage was 14.1 and 15.3 percent in 2021 (Handbook of Urban Statics, 2022, p.4).

Table 3.1: Population Composition of Upper Assam, 2001-2011

Sl. No.	Districts	Total Population		Rural		Urban	
		2001	2011	2001	2011	2001	2011
1	Jorhat	9,99,221	10,92,256	8,27,901	8,71,722	1,71,320	2,20,534
2	Golaghat	9,46,279	10,66,888	8,65,141	9,69,152	81,138	97,736
3	Dibrugarh	11,85,072	13,26,335	9,56,634	10,82,605	2,28,438	2,43,730
4	Tinsukia	11,50,062	13,27,929	9,26,105	10,63,186	2,23,957	2,64,743
5	Sivasagar	10,51,736	11,51,050	9,54,557	10,40,954	97,179	10,096
6	Lakhimpur	8,89,010	10,42,137	8,23,857	9,50,804	65,153	91,333
7	Dhemaji	5,71,944	6,86,133	5,33,112	6,37,848	38,832	48,258
	Total	67,93,324	76,92,728	58,87,307	66,16,271	906,017	9,76,430

Source: District Census Handbook of Assam, 2011

Similarly, in Upper Assam, the total population growth in the period 2001 and 2011 was 13.24%. The total rural and urban growth rates were 12.38% and 8%. Population growth rate found the highest urban growth found in Lakhimpur (Fig. 3.1).

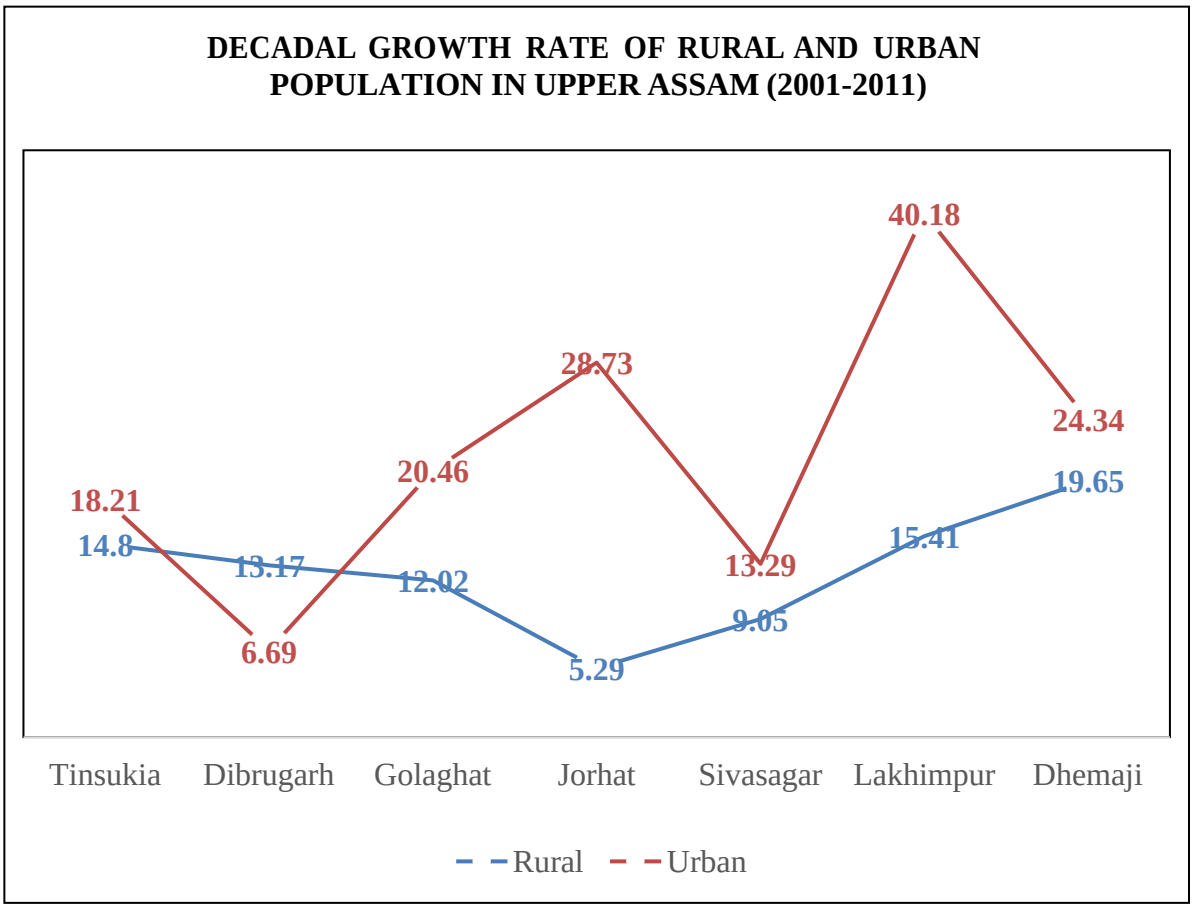


Fig. 3.1: Decadal Growth Rate of Population in Upper Assam (2001-2011)

3.2.2 Forecasting of Population of Upper Assam:

The forecasted population by using geometric progression method shows that population is increasing. The projected total population will be increase from 88,69,331 persons in 2021 to 2,12,68,438 persons in 2051. Out of which rural population will increase from 75,02,189 persons in 2021 to 2,12,68,438 persons in 2051. Similarly, the urban population will increase from 12,12,140 persons in 2021 to 23,18,932 persons in 2051 (Table 3.2 and Fig 3.2).

Table 3.2: Projected Total, Rural and Urban Population of Upper Assam districts for the year 2021, 2031, 2041 and 2051 using Geometric Progression Method

Census Year	Total Population	Increase of population(x)	Increase in percentage (r)
1991	57,88,421	-	-
2001	67,93,324	10,04,903	17.36
2011	76,92,728	8,99,404	13.23
2021 (P)	88,69,331(P)	11,76,603(P)	-
2031(P)	10,225,895(P)	13,56,564(P)	-
2041 (P)	11,789,946(P)	15,64,051(P)	-
2051(P)	13,593,218(P)	18,03,272(P)	-

Cont.

Census Year	Urban Population	Increase of population (x)	Increase in percentage (r)
1991	6,42,525	-	-
2001	906,017	2,63,492	41
2011	976,430	70,413	7.28
2021 (P)	12,12,140 (P)	2,35,710(P)	
2031(P)	1,504,750 (P)	2,92,610(P)	
2041 (P)	18,67,997(P)	3,63,247(P)	
2051(P)	23,18,932(P)	4,50,935(P)	

Cont.

Census Year	Rural Population	Increase of population(x)	Increase in percentage(r)
1991	51,45,896	-	-
2001	58,87,307	7,41,411	14.40
2011	66,16,271	7,28,964	12.38
2021 (P)	75,02,189 (P)	8,85,918(P)	-
2031(P)	85,06,733(P)	10,04,544(P)	-
2041 (P)	1,58,83,822(P)	73,77,089(P)	-
2051(P)	2,12,68,438(P)	53,84,616(P)	-

Source: Compiled from Assam Statistical Handbook

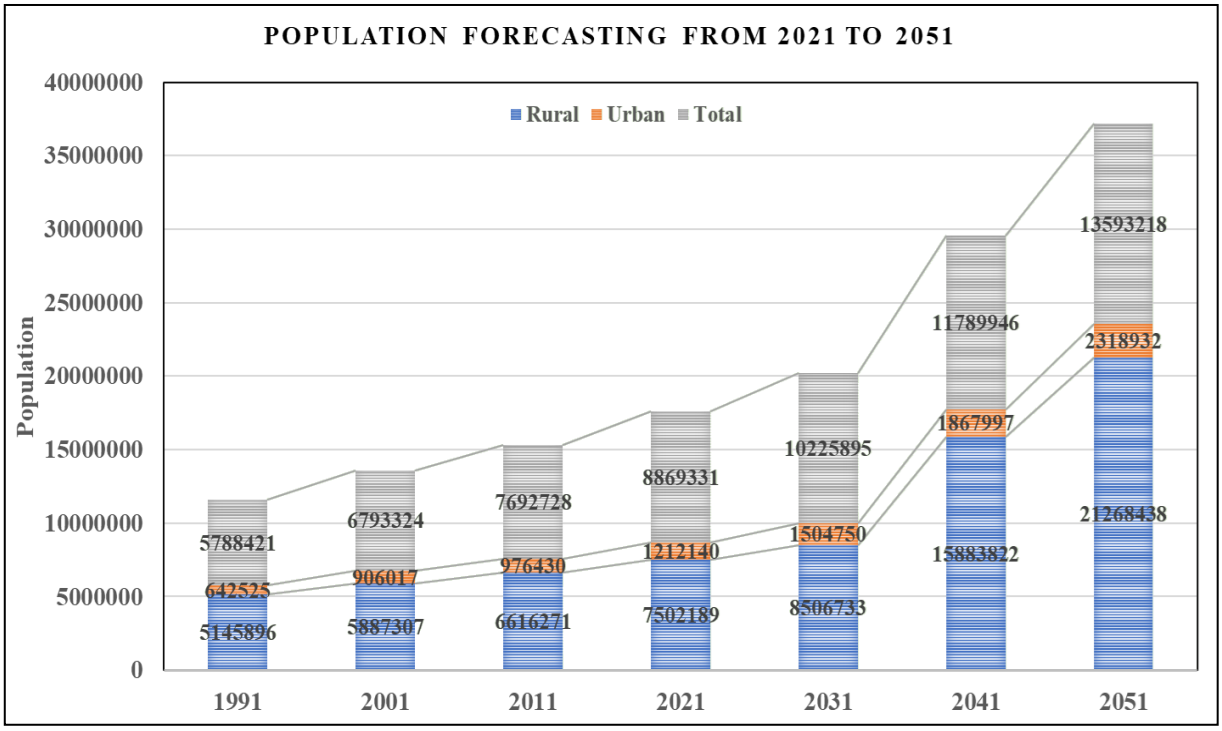


Fig 3.2: Population Forecasting from 2021 to 2051

3.2.3 Trend of Urbanisation:

In India, towns are classified as statutory towns and census towns based on population and economic activities. The town with a municipality, corporation, cantonment board or notified town area committee is termed as statutory town. According to 2011 Census, in India there were 4,041 such towns as against 3,799 in 2001. The Handbook of Urban Statistics (2022) data state that 557 new statutory towns are added. Therefore, total statutory towns in India increased to 4,598. Census town is one with minimum population of 5,000, at least 75% of the male main working force engaged in non-agricultural activities and population density of at least 400 persons per sq. km. According to 2011 census, in India there were 3,784 Census Towns as against 1,362 in 2001. The number of towns is increasing in Assam also. In the year 1971, total statutory town was 51 that increased to 88 in 2011. In 1971, total census towns were 21 increased to 126 in 2011. There was total 214 towns were formed in Assam, including statutory and census towns from 1971 to 2011 (Table: 3.3). In 2019, 10 new statutory towns were formed in Assam and its number increased to 98.

Table 3.3: Growth of Urban Centers in Assam (1971-2011)

Sl. No.	Year	Number of Towns					
		Statutory	Increase (%)	Census	Increase (%)	Total	Total increase (%)
1	1971	51	-	21	-	72	
2	1991	74	45.1	19	-9.52	93	29.17
3	2001	80	8.12	45	136.84	125	34.41
4	2011	88	10	126	180	214	71.2

Source: Data compiled from Assam Statistical Handbook.

According to the census of India in 1991, the total urban population was 25.7% that increased to 31.14 % in 2011. The urbanisation process in Assam is still very slow. In 1991 the urban population was 11.8% and it increased to 14.10% in 2011. The lowest urban population in Dhemaji and the highest urban population found in Tinsukia district. Similarly, the decadal growth rate of urban population is the highest in and the lowest in district (Table 3.4).

Table 3.4: Progress in urban population growth in Upper Assam (1991-2011)

Sl. No.	Districts	1991	2001	2011	Growth rate 2001-2011 (%)
1	Jorhat	1,33,032	1,71,320	2,20,534	28.72
2	Golaghat	48,838	81,138	97,736	20.45
3	Dibrugarh	1,63,580	2,28,438	2,43,730	6.69
4	Tinsukia	1,58,674	2,23,957	2,64,743	18.21
5	Sivasagar	65,689	97,179	1,10,096	13.29
6	Lakhimpur	49,130	65,153	91,333	40.18
7	Dhemaji	8,891	38,832	48,285	24.34

Source: Compiled from Statistical Handbooks of Assam

3.2.4 Ranking of Upper Assam Districts in Proportion to Urban Population

Based on census data of urban population from 1991 to 2011, the Lakhimpur district ranked at the same position in Assam. Dhemaji displaced to 24th rank from 23rd in 1991 and the Tinsukia district upgrade to 3rd rank from 5th rank. The Dibrugarh District lost its 3rd rank and stand at 4th ranked in 2011. In 1991 Jorhat ranked on 6th and in 2011 it stands on 5th rank. Similarly, Golaghat district changed its rank from 18th in 1991 to 16th in 2011. Sivasagar ranked in 12th position in 1991, 11th in 2001 and 19th position in 2011 (Table 3.5).

Table 3.5: Ranking of Upper Assam Districts in Proportion to Urban Population in Assam

Sl. No.	Districts	Rank in 1991	Rank in 2001	Rank in 2011
1	Jorhat	6	7	5
2	Golaghat	18	13	16
3	Dibrugarh	3	4	4
4	Tinsukia	5	3	3
5	Sivasagar	12	11	19
6	Lakhimpur	17	17	17
7	Dhemaji	23	21	24

Source: Compiled from Statistical Handbook of Assam

If the districts ranking is compiled within the Upper Assam, then it is found that in 1991 Dibrugarh has the highest urban population holding 1st rank. Dhemaji continues to maintain the lowest rank and Jorhat was in 3rd rank from 1991 to 2011. In 2001 and 2011 Tinsukia district ranked 1st in terms of urban population proportion (Table 3.6).

Table 3.6: Ranking of Upper Assam Districts in Proportion to Urban Population within Upper Assam Districts

Sl. No.	Districts	Rank in 1991	Rank in 2001	Rank in 2011	Composite rank score
1	Jorhat	3	3	3	9
2	Golaghat	6	5	5	16
3	Dibrugarh	1	1	2	4
4	Tinsukia	2	2	1	5
5	Sivasagar	4	4	4	12
6	Lakhimpur	5	6	6	17
7	Dhemaji	7	7	7	21

Source: Compiled by Author based on Census Data

This urban population ranking shows that three districts of upper Assam Dibrugarh, Tinsukia and Jorhat district holding first three ranks since 1991 to 2011. The composite rank score shows the highly populated district ranked first and lowest populated district at the bottom rank **(**Table3.6).

3.5 Growth and Distribution Pattern of Slums in Study area:

According to the Register General Census data of India, the number of slums in 2001 reported in Assam was 12 that increased to 31 slums in 2011. The report published by Town and Country Planning Department, the total number of identified slums in Assam were 205 spreads over 28 towns based on surveys through urban local bodies. The 2001 census report reveals that the total slum pockets distributed in 81 urban local bodies across the state was 829. The number of slums and slum population in Assam is increasing along with urbanization in India as well as in Assam due to several reasons such as illegal migration, especially from Bangladesh, Nepal, Bhutan etc. are used as vote bank, failure of planning policies, natural calamities, poverty etc. Though the average slum dwellers are fewer in Assam compared to the other states in India, numerous small slum pockets and informal settlements are growing in different parts. Many of these are non-permanent and some are not included in the official records. Therefore, it is hard to get actual numbers of slums and dwellers in Assam. According to the 2011 census, approximately 1,97,266 slum dwellers are distributed in different parts of Assam comprising about 42,533 Households (Table 3.7). The census of India classified slums into three categories Notified, Non-notified and registered or identified slums. In Assam, out of the total slum population total 9,163 lived in notified, 70,979 in non-notified and 117,124 were lived in identified slum as stated by 2011 census.

Table 3.7: Slum Population in Assam, 2011

Sl. No.	Districts	Area Name	Households	Total Population	Sex Ratio
1	Dhubri	1. Gauripur (TC)	1,515	7,794	958
		2. Dhubri (MB)	3,733	18,501	967
		3. Sapatgram (TC)	1,086	4,944	943
		4. Bilasipara (TC)	1,641	7,571	941
		5. Chapar (TC)	815	3,904	923
2	Dibrugarh	1.Dibrugarh (MB+OG)	5,830	27,089	916
3	Cachar	1. Silchar (MB+OG)	4,746	22,749	992
		2. Lakhipur (MB)	712	3,630	1007
4	Kamrup Metro	1. Guwahati (M Corp.)	5,883	25,739	927
5	Nagaon	1. Nagaon (MB+OG)	3,855	18,110	946
		2. Hojai (MB)	38	168	1024

		3. Lanka (MB)	148	809	908
6	Jorhat	1.Jorhat (MB+OG) (TC.)	2,430	9,665	913
7	Sonitpur	1. Rangapara (TC)	603	2,645	908
		2. Tezpur (MB+OG)	787	3,692	898
8	Chirang	1. Bijni (TC)	1,213	5,728	995
9	Sivasagar	1. Sivasagar (MB)	206	881	863
		2. Nazira (MB)	531	2,352	1002
		3. Moranhat (TC)	373	2,109	762
10	Golaghat	1. Bokakhat (TC)	66	327	869
		2. Golaghat (MB)	1,002	3,979	994
11	Bongaigaon	1. Bongaigaon (MB)	1,271	6,140	980
12	Nalbari	1. Nalbari (MB)	1,175	5,360	973
13	Karimganj	1. Karimganj (MB)	841	4,157	933
14	Tinsukia	1. Tinsukia (MB+OG)	172	748	752
		2. Margherita (TC)	612	2,694	942
15	Darang	1. Kharupatia (TC)	641	3,022	926
16	Hailakandi	1. Lala (TC)	234	1,125	981
17	Lakhimpur	1. North Lakhimpur (MB)	198	842	972
18	Udalguri	1. Udalguri (TC)	106	484	898
19	Barpeta	1. Sarthebari (TC)	70	308	974
	Assam Total		42,533	1,97,266	945

Source: Statistical Handbook of Assam, 2019

These slums are smaller than the other slum areas of India but the population density is very high and environmentally deteriorated. Several slum pockets have been found in the Upper Assam region, especially in Dibrugarh and Tinsukia District. The highest slum pocket found in Dibrugarh District is 24, which include both notified and non-notified slum areas. The lowest number of slums found in Golaghat town (Table 3.8). Sivasagar another town in Upper Assam has only one slum named Cholegaon.

Table 3.8: Slum Pockets in the Study Area

Sl. No.	Towns	Number of slum pockets	Slum type based on census
1	Dibrugarh (MB)	24	Notified and non- notified
2	Tinsukia (MB)	7	Notified
3	Jorhat (MB)	5	Notified
4	Golaghat (MB)	4	Notified

Source: Municipality Offices, Dibrugarh, Tinsukia, Jorhat, Golaghat

The slum dwellers are suffering from many problems and living unsustainable life in inhabitable areas. Apart from these, many informal settlements have been found in the peripheries of the towns which are not included in the list of slum areas as they are very small in size and some of them are recently formed, for example *Banjaran Basti*, *Mallipatti* slum areas in Dibrugarh district located on the bank of the Brahmaputra River. According to the 2011 census, the urban population is the highest in Tinsukia district and the lowest in Golaghat district. The percentage of slum population to the total urban population found the highest in Tinsukia district that is 16.64 % followed by Dibrugarh, Golaghat and the lowest is 4.38% in Jorhat district among the study areas of Upper Assam. Gini Coefficient method is used to measure income inequality (Fig.3.3). The value ranges between 0 to 1 and 0 indicates perfectly equal and 1 indicates perfect inequality. The slum population is the result of urban poverty. The Gini coefficient value of slum population to urban population is found 0.25 that indicates there is inequality between urban population and slum population in the study area (Table 3.9).

Table 3.9: Percentage of Slum Population to Total Urban Population, 2011

Sl. No	Districts	Urban Population	Slum Population	% of Slum Population to Total Urban Population	Gini coefficient
1	Tinsukia	2,64,743	44,057	16.64	
2	Dibrugarh (MB+OG)	2,43,730	36,166	14.83	0.25
3	Jorhat (MB+TC)	2,20,534	9,665	4.38	
4	Golaghat (MB)	97,736	4,306	4.40	

MB: Municipality Board

OG: Out Growth

TC: Town Committee

Source: Data Compiled from Assam Statistical Handbook, 2011

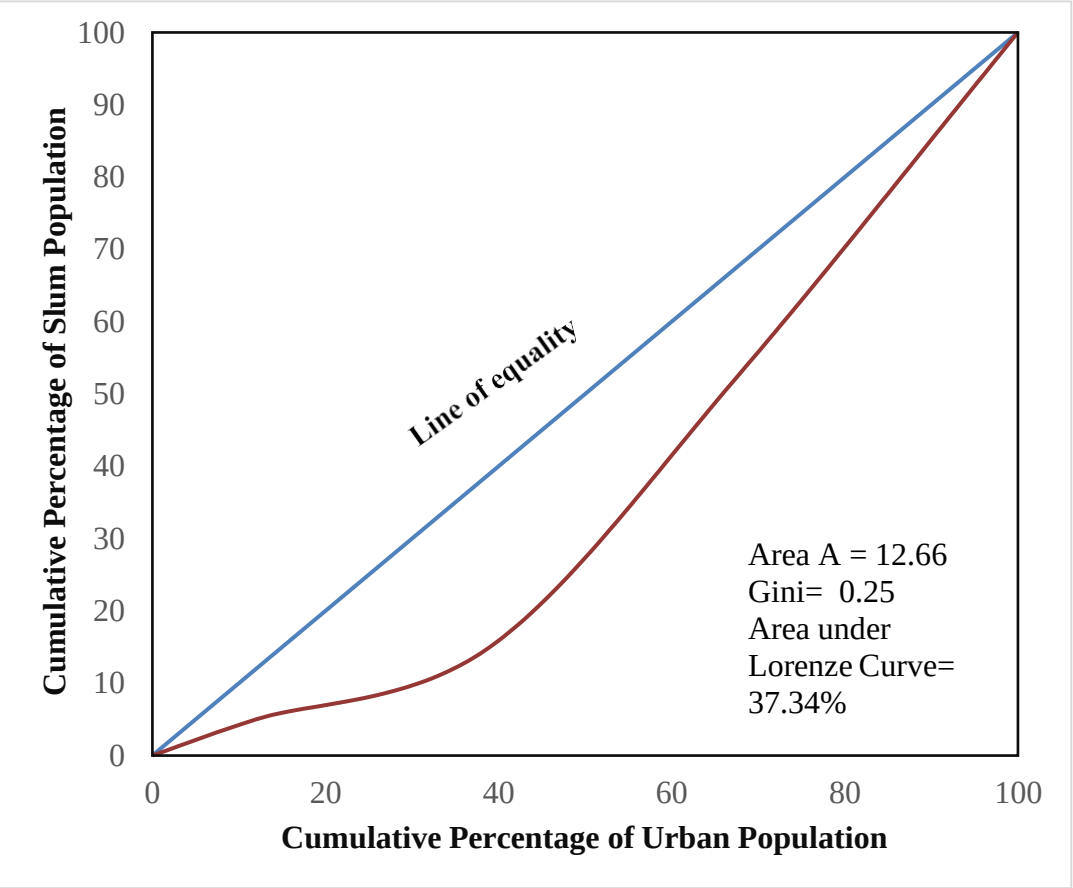


Fig.3.3: Lorenze Curve and Gini Coefficient

3.6 Distribution of Slums in Selected Towns of Upper Assam

The report published by the Ministry of Statistics and Programme Implementation; Government of India (2013) stated that at all-India level 44% of slums were identified. Out of which 48% of notified and 41% of non-notified slums were located on private land. Slums are generally located near railway lines, fringe areas, river or wetland site, dumping sites etc. In Upper Assam, the highest number of slums have been found in Dibrugarh district followed by Tinsukia district. Most of these slums are sited on the bank of the Brahmaputra River, especially in Dibrugarh. Slums in Tinsukia are mostly located near railway sites. Sites and reasons of its selection are varying from place to place.

3.6.1 Jorhat: There are four major slum areas are located in Jorhat district namely Rajamaidam New colony, Jorhat Harijan colony, Fancy Ali area and Puja Dubi Basti (Table 3.10). The Rajamaidam new colony and Harijan colony slums are located on bank of the *Tocklai* stream, a small river now turned to be a drain. The Puja Dubi slum is located on the bank of the Bhogdoi River. These slums are origin about more than 15 years ago. At present, new slum areas emerging in the district.

Table 3.10: Slum areas in Jorhat, 2011

Ward No.	Name of the slum	Ownership of Land	Area in Sq. km (Approx)	Slum Population (Approx.)	No of HH
4	Horizon colony	Govt/Private	0.16	1200	169
4	Rajamaidam New Colony	Private	0.053	985	118
3	Puja Dobi	Private/Govt	0.2	926	200
4	Fancy Ali area	Private	0.017	759	107
12	Tarajan Smasan	Private/Govt	0.22	563	69

Source: Municipality Board, Jorhat

3.6.2 Dibrugarh: The highest number of slums has been found in Dibrugarh town of Upper Assam that is 24 slums, including both notified and non-notified slums. The Guardpara, Amaraguri and many new temporary settlements are located near the Dibrugarh Town Protection (DTP) Dyke of the town. According to census data, in Dibrugarh, the numbers of slums in the study areas are increases from 10 to 24 between 2001 and 2011. The slum population increases from 21,562 to 36,166 in this decade. The percentage of increase in slum population in this decade was 67.73%. The slums are mostly located on the bank of the Brahmaputra River in this town. The areas are more prone to flood because of their location near the rivers and due to open drainage system. (Table 3.11).

Table 3.11: Slums in Dibrugarh, 2011

Ward No.	Slums	Ownership of land	Area in sq, km	Slum Population	No of HH
		Notified Slum			
17	Graham Baazar	S. Govt/ULB	0.259	5658	1095
12	Paltan Baazar	Private	0.234	4062	790
16	Loharpatty	Private	0.047	2951	570
22	Dibrujan	Private	0.216	2578	540
12	Santipara Harizon Colony	S.Govt/ULB/Private	0.088	2278	470
21	Gangapara	Private	0.043	1022	240
17	Tinkunia	Private	0.059	922	170
08	Mirzabag	Private	0.068	702	142

05	Tulsigaon	Private	0.071	551	123
04	Pathanpatty	Private	0.083	511	102
	Total		**1.168**	**21,235**	**4,242**
		Non-Notified Slum			
22	Chandmarighat	C. Govt.	0.132	3199	627
09	Amaraguri	S. Govt.	0.063	1633	341
04	Shasanpara	Private	0.069	1391	416
	Itabhata Suwoni Gaon	C. Govt.	0.042	1315	306
09	Kalibari	Private	0.054	1191	244
10	Koilaghat	S. Govt.	0.046	1024	207
06	Chiring Chapari	Private	0.058	900	196
	Horizon Colony Kalishtan	C. Govt.	0.075	806	189
02	Kauripatty	Private	0.054	749	166
07	Guardpara (North Amolapatty)	Private	0.041	735	160
02	Boiragimath	Private	0.034	692	157
09	Dhobipatty (North Amolapatty)	Private	0.028	587	126
07	South Amolapatty (near kabarsthan)	Private	0.039	358	81
03	Borbari Dusadpatty	Private	0.080	351	68
	Total		**0.815**	**14,931**	**3,284**
	Grand Total		**1.983**	**36,166**	**7526**

Source: Municipality Office, Dibrugarh

3.6.2 Tinsukia: According to the Municipality record, there are 9 Non-Notified Slum areas located in Tinsukia town namely Sripuria and West Sripuria, Parbatia, Devipukhuri, Bang Pukhuri, Nepali Mandir, Mazdoor Colony, Harijan Colony and Dhekiajuri Masjid Patti (Table 3.12).

Table 3.12: Slums in Tinsukia, 2011

Ward No.	Name of the slum	Ownership of Land	Area in Sq. km	Slum Population	No of HH
1	Sripuria, West Sripuria	Govt.	0.4	3306	842
7	Parbatia	Private	0.2	542	112
9	Devi Pukhuri,	Private	0.33	626	147
10	Bang Pukhuri, Nepali Mandir	Private	0.6	1332	323
15	Mazdoor Colony, Harijan Colony, Dhekiajuri Masjid Patty	Private/ Govt.	0.45	2960	740

Source: Municipality Office, Tinsukia

3.6.3 Golaghat: According to the report of Municipality Board of Golaghat town, there are four slum areas in the town namely Harijan colony, Smart compound area, Kalithan Ali area, Namghar Ali area (Table 3.13).

Table 3.13: Slums in Golaghat, 2011

Ward No.	Name of the slum	Ownership of Land	Area in Sq. km	Slum Population	No of HH
10	Horizon Colony	Govt.	0.01416	1020	289
7	Smart compound area	Govt/Private	0.0053	985	178
4	Kalithan Ali area	Private	0.0061	926	160
5	Namghar Ali area	Private	0.0081	759	107

Source: Municipality Office, Golaghat

3.6.4 Sivasagar: The official record of Municipality office of Sivasagar town stated only one non notified slum is located in Sivasagar town named Cholegaon. According to 2011 census, total population in this slum were 881 persons living in 206 households (Table 3.14). This slum is located near city center approximately 5 km distance occupied by Scheduled Caste population.

Table 3.14: Slums in Sivasagar, 2011

Sl. No.	Slum Name	Ownership of land	Area in sq. km	Slum population	No of HH
1	Cholegaon	Private/Govt.	Approx. 0.3	881	206

Source: Municipality Board, Sivasagar

From the data mentioned above, we found that slums are located on different parts of the town are belonged to some private owner, government (including central, state government and Urban local Body-ULB) and some slum areas are located on both private and government owned lands **(**Table:3.15). There is total 41 slums in the study area. Out of which, 9 (21.95%) slums located on government land, 25 (60.98%) on private lands and 7 (17.07%) located on land belonged to both private and government (Fig.3.4). In the study area average 2.25 slums are situated on government land, average 6.25 on private land and average 1.75 occupied both government and private owned land.

Table 3.15: Ownership of Land of Slums in the Study Area

Sl. No.	Towns	Ownership of Land and Number of slums		
		Government	Private	Govt. and Private
1	Jorhat	0	2	2
2	Golaghat	1	2	1
3	Dibrugarh	6	17	1
4	Tinsukia	2	4	3
	Total	**9**	**25**	**7**

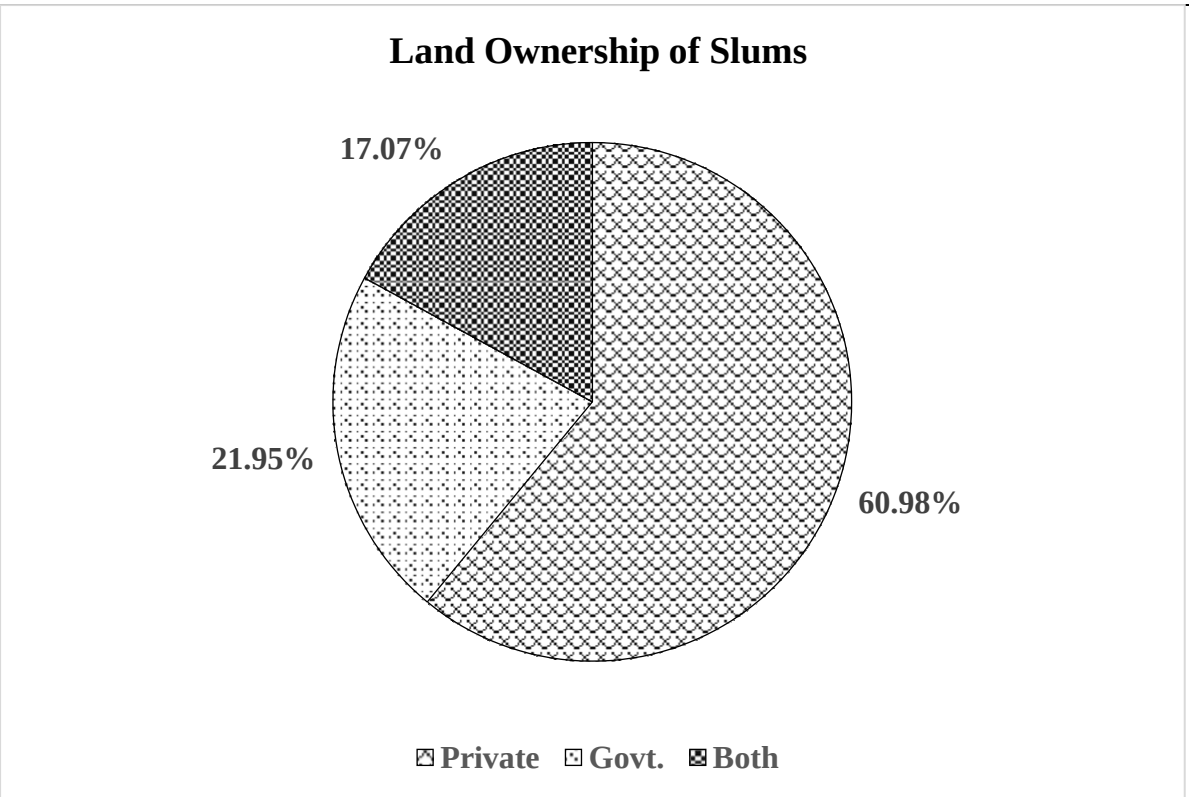


Fig.3.4: Land ownership and Percentages of Slums in the Study Area

In this study, it was found that the slums located on government land includes the slums located along railway lines, riversides and other government open lands (Table 3.16).

The slums located on the private lands indicates the presence of cheap rental houses. Some slums share both government and private lands.

Table 3.16: Location of Slums

Slums	Location
Paltan bazar	Cantonment
Santipara Harijan colony	Railway
Amaraguri	River
Guard Para	River
Dhobi Patti	River
South Amolapatti	Nallah
Barbari Dusadpatti	Nallah
Sripuria	Railway/Nallah
Nepali-Mandir	Railway
Jorhat Harijan Colony	Nallah
Golaghat Harijan Colony	Town Periphery

Source: Municipality Offices

3.7 Factors for the Growth of Slums in the Study Area:

Slums and informal settlements are formed in urban centres due to various regions especially due to rural urban migration. People migrated to cities and towns economic and ecological causes and settled down as informal settlement like slums. Therefore, these settlements are also termed as “waiting room” in urban areas. Other causes of slum formation are recent political unrest, uncertainties in global economies and diverging environmental extremes are adding weight to the global migration phenomena (Niva et. al., 2019). Access to the railway led to the proximity to Bombay city; hence, the migrant population settled close to the railway lines (Desai, 1994). In the studied slum areas, residents belong to Scheduled Caste and Scheduled Tribe population were found high. The dominant reason of their migration is the work opportunities. In this category, male population migration is higher than the female. In contrast, the main reason of female migration is their marriage. In the studied slums, it was found that all the slum dwellers were immigrants. They were migrated to Assam in different decades. The residents of Santipara Harijan colony, Jorhat and Golaghat Harijan colony slums were migrated to Assam before 1984. High percentage of immigrants found from Bihar and Uttar Pradesh (Table 3.15). The slums, which are situated on private or government land are migrated to Assam 5-10 years ago. They are living in rent

houses, especially in Paltan bazar, Barbari Dusadpatti and South Amolapatti slums. It was found that a total of around 52% migrated from Bihar, 20% from Uttar Pradesh, 23 % from different parts of Assam, 3 % from Rajasthan and 1 % from other states includes West Bengal, Jharkhand, respectively in the slums. The intra-state migration or the migration within the state of Assam, takes place from Dhubri, Goalpara, Nalbari, Dergaon (Golaghat), Tinsukia, Dhemaji, Sivasagar, Tezpur and different parts of Dibrugarh District. Around 75.49% migrants of Amaraguri slum are native or intra-state migrants, which takes place from Tezpur, Sivasagar, Grahem Bazar, Dikom Tea Estate and Chabua. The migrants of Guardpara slum in Dibrugarh town are only intra-state migrants. Around 77% residents of this slum migrated from Notun Gaon village of Dibrugarh district and 23% from other districts of Assam, which are from Dhemaji, Lakhimpur and Naharkatiya Sasoni area of Dibrugarh district **(**Fig:3.5). The origin of slum dwellers of Santipara Harijan Colony, Jorhat Harijan Colony, Golaghat Harijan Colony are belonged to Bihar, Uttar Pradesh and Rajasthan states of India. This interstate migration of these Harijan slum dwellers took place before 1984. The main reason of women migration is their marriage.

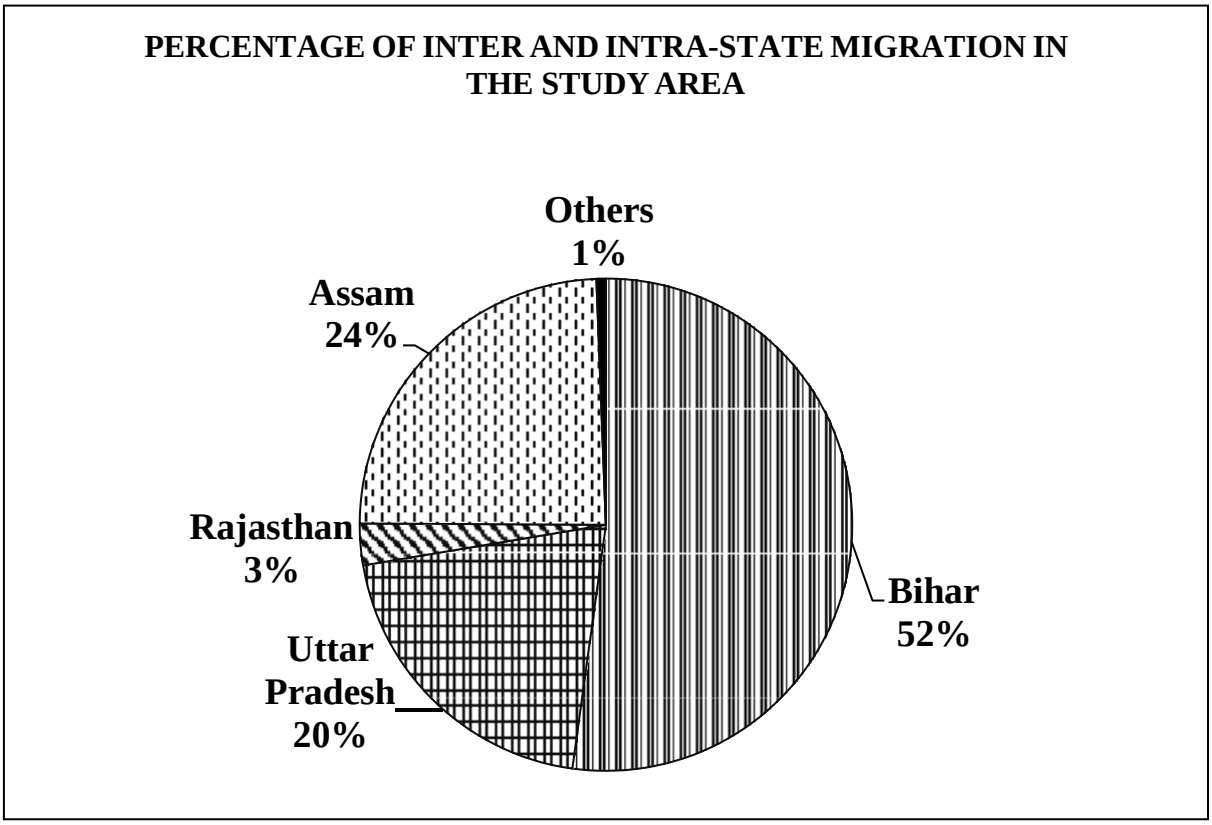


Fig. 3.5: Total Percentages of Inter and Intra-State Migration in the Slums

The slums, particularly the Harijan Colonies, are home to "Harijan People" popularly known as "Dalits" who belonged to Scheduled Caste (SC) population. Their predominant

language is Hindi. Therefore, the Santipara harijan colony, Jorhat and Golaghat Harijan Colony, Sripuria slum areas have 100% SC dwellers. In Dhobi Patti, 26.32% belonged to general caste (minority population), 50% belonged to SC and the backward class (OBC) found 23.68%. In Barbari Dusadpatti 75% SC and 25% minority were found. In Dhobi Patti and Barbari Dusadpatti slum areas, most slum dweller's native language is Hindi that indicates they were migrated to Assam. In Amaraguri, Guardpara and South Amolapatti slum areas total SC (15%), ST (49%) and OBC (16%) were found and the rest were belonged to general caste (Table 3.17). The dominant language is Assamese followed by Hindi and Bengali in these slums. The demographic study of slum dwellers found a distinction emerges of two groups based on tenure and housing arrangements. The first group, who have owned houses within the slum areas more than 15 years, suggesting a degree of stability and possibly a deeper integration into the local communities. The long-term residents are likely to have established social networks and a stronger sense of ownership of land. Another group, who were in residing in rental accommodations on private land within the slum areas for less than 15 years. This group experiences more precarious and possibly more vulnerable socio-economic status. These differences are crucial for designing urban and slum development policies to improve their living condition and to support their diverse needs.

Table 3.17: Origin of Migration, Caste, Living Period, and Dominant Language spoken in the Surveyed Slums

Sl. No.	Slums	Origin of Migration	Caste	Dominant Language	Living since
1	Paltan Bazar	Bihar (Muzaffarpur, Chapra, Anna and Motihari)	SC/OBC	Hindi	5-10Years
2	Santipara	Bihar, Uttar Pradesh,	SC	Hindi	More than 15 years
3	Amaraguri	Bihar, Uttar Pradesh, Sivasagar, Tinsukia, Tezpur	ST/SC/OBC	Assamese/Hindi	More than 15 years
4	Guardpara	Tinsukia, Dibrugarh Sasoni, Dhubri, Dhemaji, Lakhimpur	ST/SC/OBC	Assamese	More than 15 years
5	Dhobi Patti	Uttar Pradesh, Bihar, Dhubri, Goalpara	General/ SC/OBC	Hindi	10-15 years.
6	S. Amolapatti	Bihar, Nalbari, Tinsukia,	General/	Assamese/Hindi	10-15

		Dibrugarh	SC/OBC		years.
7	B. Dusadpatti	Bihar, Uttar Pradesh, Sivasagar, Tinsukia, Tezpur	SC	Hindi	10-15 years.
8	Sripuria	West Bengal, Bihar, Uttar Pradesh, Dibrugarh, Jorhat	SC	Hindi/Assamese/ Bengali	10-15 years.
9	Nepali Mandir	Bihar, Uttar Pradesh, Rajasthan, Tinsukia, Dibrugarh,	SC/OBC	Hindi/ Assamese/ Bengali	10-15 years.
10	Jorhat HC	Uttar Pradesh and Bihar, Golaghat Dergaon.	SC	Hindi	More than 15 years
11	Golaghat HC.	Bihar, Uttar Pradesh, Rajasthan	SC	Hindi	More than 15 years

Source: Field Survey

Demolition of Slums without rehabilitation is also causes growth of new slums in other places of Upper Assam**.** There was many news on slum demolitions from different parts of India and Assam in different times**.** According to an article by Virani in Hindustan Times, the forest department razes 123 slum tenements on reserved forest land in Dasisar's Ganpat Patil Nagar in Mumbai. Recently, the Sirpuria slum, located on railway land in Tinsukia town, has been demolished due the construction of a railway flyover in 2023. The dwellers move to the different parts of the Tinsukia districts or other parts of the state (Fig. 3.6 and 3.7). Many temporary small slums have been emerged along the bank of the Brahmaputra River, especially in the Dibrugarh district, including Pujaghat Basti and Mallipatii.

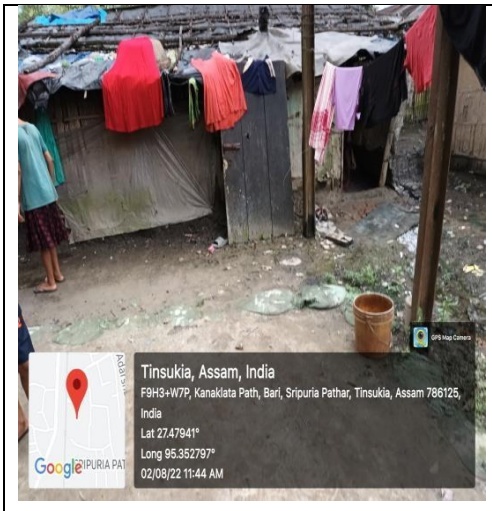


Fig. 3.6: Sripuria slum, Tinsukia, 2022

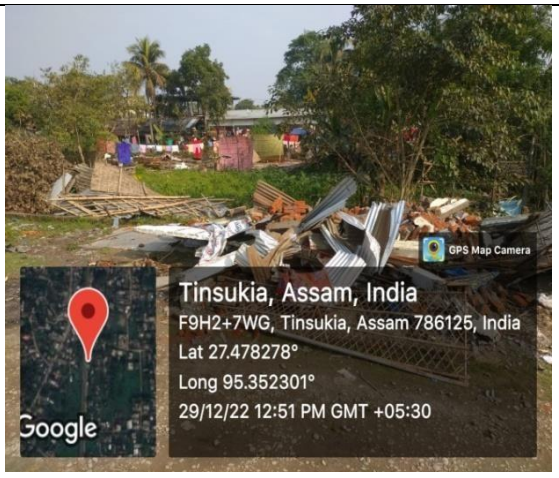


Fig. 3.7: Sripuria Slum Demolished in 2023

3.8 Comparison of Selected Study Areas in proportion to slums and population by Simple Ranking Method Based on Survey Data ranking coefficient:

Generally, Ranking Co-efficient (Composite score) = Summation of individual ranks of different indicators which shows higher the value lower is the development and vice versa which is mainly used for comparison of socio-economic development. In this study to find out the growth of slums in study areas this method is used. The analysis of the data based on the number of slums, household number, slum population, urban population and percentage of slum population to urban population reveals that the lowest value found in Tinsukia that is 8 followed by Dibrugarh, Jorhat and Golaghat towns and the highest value found in Sivasagar town (Table.3.16). Lower the value in simple ranking indicates higher slum growth and higher the value indicates lower slum growth.

Table 3.18: Composite Score of Study Area in Proportion to Number of Slums; Number of Urban and Slum Population and Number of Households:

Name of the towns	Ranking in proportion to No. of slums	Ranking in proportion to No. of Slum Population	Ranking in proportion to No. of households	Ranking in proportion to No. of Urban Population	Ranking in proportion to % of Slum Population to total Urban Population	Composite Score
Jorhat	3	3	3	3	4	17
Golaghat	4	4	4	4	3	20
Dibrugarh	1	2	1	2	2	9
Tinsukia	2	1	2	1	1	8

3.9 Chapter Conclusion:

Population forecasting shows that the population will increase in the study area. This may lead to more advance planning strategies to develop the condition the socio-economic and environmental problems. The growth of slums is notably an eyesore in urban centers but a real foundation for urban planner. Upper Assam has many potentialities of work opportunities in industrial and urban development. Many towns are emerged as transport town and commercial town in the region. As a result of which migration are taking place and the number of slums and slum dwellers are increasing in the area. Inter-state migration mainly found from Bihar and Uttar Pradesh and intra-state migration from Dhubri and Goalpara district of Assam. Intra-state migrants are originally from Bangladesh. The highest

percentage of slum has been found in the Dibrugarh and Tinsukia District. The dwellers of slums are mostly Scheduled Caste people. All the Harijan colonies in the study area are listed as slums. The major reason behind the growth of slum is work opportunities and less social discrimination according to the percentage of responses. Generally, the reason of women migration is marriage.

CHAPTER 4
SLUMS AND GEO-ENVIRONMENTAL IMPACT

4.1 Introduction:

The process of urbanization in many developing countries including India has become a crucial issue for determining the socio-economic development of the country. The unprevented and unpredictable growth of population in the urban centers and metropolitan cities have been the greatest challenge of the urban planners and for the socio-economic-environmental situation as well as for the administration of the urban developmental bodies in India today. Pollution, unhealthy inhabitable areas, low income, diseases such as AIDS, prostitution, domestic violence, high intake of alcohol, drug consumption, high rate of crimes altogether hinders the development of urban environments. The imbalance between socio-economic environment and natural environment affecting each other. The conditions of slums result from the combined effects of natural ageing of buildings, lack of maintenance and neglect, wrong use of the buildings, poor sanitation in the disposal of sewage and solid wastes, and wrong development of land (Olotuah, 2012). Slums are highly populated residential areas in the urban settlements with low incomes (Kondapi et. al., 2019) and rapid growth of population causes a high number of slum settlements in urban areas. The location of slum communities on wetlands continues to threaten the existence of the water bodies in the metropolis (Stephen et. al, 2020). Similarly, the Jalukbari wetland in Guwahati of Assam converted to slum (Barsha, 2021) and also the rapid flow of population is creating a threat to the growth process which is highly sensitive for protection of its physiographic setting (Sharma**,** 2016). Slums are subject to insecure land tenure, lack of access to basic minimum civic services such as safe drinking water, sanitation, storm drainage, solid waste management, internal and approach roads, street lighting, poor education and health care and lacks of quality shelter. Generally, slums are located in environmentally fragile and dangerous zones prone to landslides, floods and other disasters that make the poor residents highly vulnerable. The slum dwellers and informal settlers confront on a daily basis another dimension of poverty which is environmental poverty. The bad living conditions with both economic and environmental poverty in slums impact on health, livelihood and the social fibres. Due to their hazardous location, pollution, poor waste disposal practices and management, weak disaster risk management and limited coping strategies of households etc., effects of urban environmental problems and threats of climate change are the most

pronounced in slums. Thus, bad living environment deepens poverty, increases the vulnerability of both the poor and non-poor living in slums and excludes the slum poor from growth (Ballesteros, 2010). The waste disposal and its segregation practices were poor despite high willingness to participate in initiatives to improve waste management, highlighting a need for authorities to engage residents of slums to improve their practices. Besides, slum settlements whose construction is without careful planning make the environmental impact even more complicated. Non availability of dust bins, irregular visits of municipal vans for household waste collection and lack of knowledge regarding importance of segregation of waste were observed to be the principal problems in the practice of solid waste disposal by urban slum families (Nirgudi et. al., 2014). Due to unhygienic environmental condition or lack of proper sanitization practices slum dwellers are suffered from various health diseases.

Slum resident's health problems included worms in children. Water-borne diseases jaundice and dysentery were a perennial problem, largely because of the lack of adequate potable water supply. Other common health problems are because of congested living conditions and low standards of hygiene included tuberculosis (Ooi and Phua, 2007). The rapid urbanization and the mismatch in the provision and maintenance of housing and infrastructure cause environmental decay in a city. These include exposure to lead, air pollution, traffic hazards, and the "urban heat island" amplification of heat waves (Agrawal, 2014). The basic characteristics of slums are overcrowded with high density, smaller in size, pollution, unhealthy-unhygienic inhabitable areas without proper sanitation facilities, scarcity of pure drinking water, lack of education and housing facilities, lack of awareness etc. The increasing level of human activities along water bodies continues to pose serious threats to the natural habitat of water bodies. The high levels of pollution are caused by anthropogenic factors such as indiscriminate dumping of refuse, channelling of raw sewage, open defecation and indiscriminate dumping of industrial waste into the rivers (Danquah et al. 2011). According to the Zoning Guideline and Planning Standards, 2011, the standard setback average distance for a buffer zone to protect water body ranges from 50 to 100 ft. away from a stream or river. Slums are located along with riverside, railway lines, waste disposable sites or the abundant places of a city or nearby town areas. Therefore, the surrounding environment is unhygienic in slums in general. Due to various reasons, slum dwellers facing several problems every day, which are interlinked with each other as mentioned in Fig.4.1**.** To assess the problems faced of slums demographic characteristics, occupation and income level, educational level, health status, sanitation facilities, drinking

water quality, indoor air quality, garbage output and their disposal methods, clearance of drains, soil quality of waste disposal sites have been studied in this work. Along with these aspects, some other problems were also observed in the slum areas, such as household infrastructure, awareness about government schemes etc.

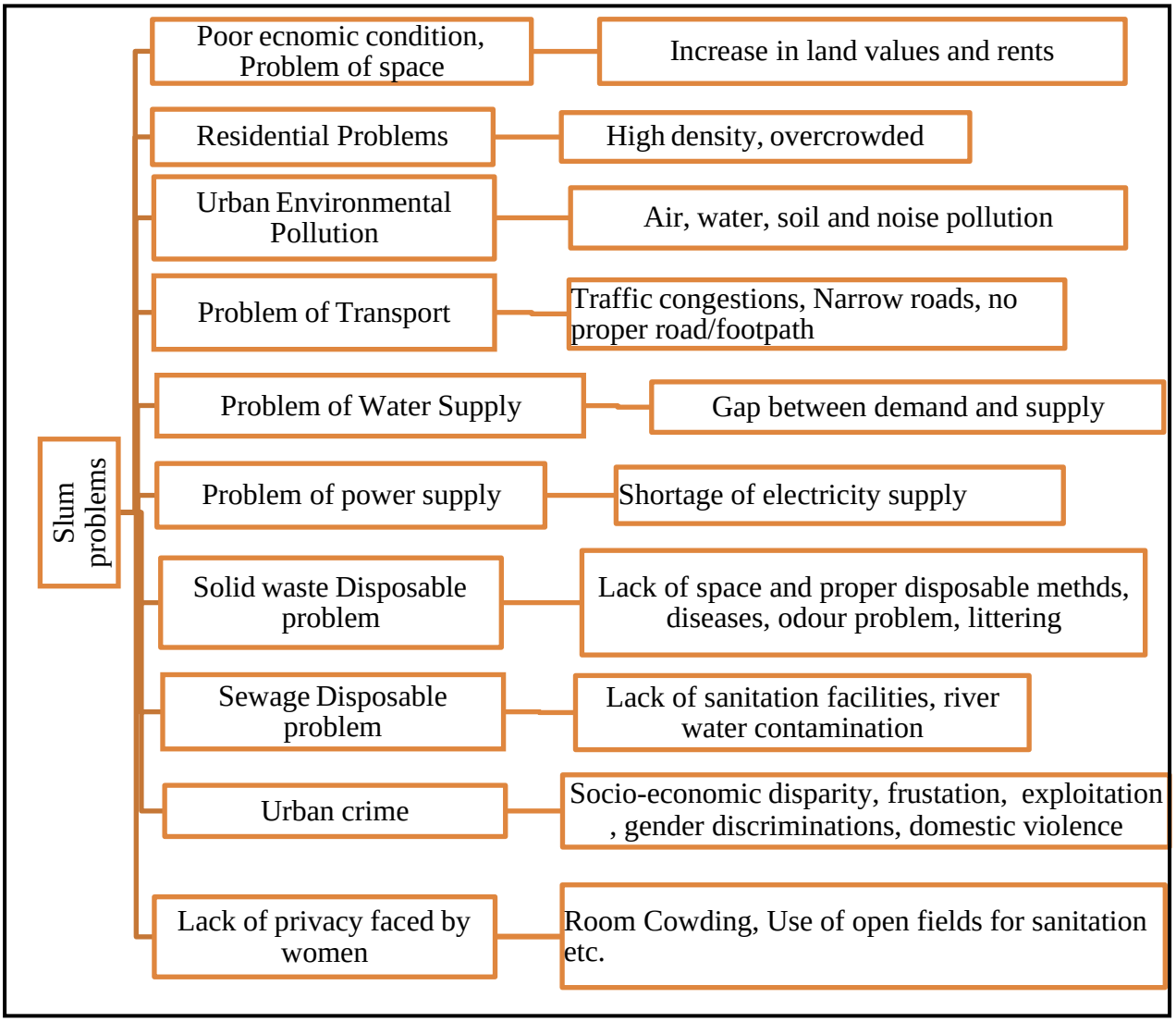


Fig. 4.1: Problems of Slums

4.2 Demographic Characteristics:

Demographic characteristics of slums can differ from place to place widely based on their location, socio-economic conditions, and some other aspects. But there might be exceptions to some general patterns. The common characteristics of slums are overcrowding, poverty, informal housing, lack of access to basic facilities, health challenges, limited education, vulnerable to hazards, ethnic diversity, lack of property rights, a high youthful population etc. High population density, crowded and compact dwelling living condition are common characteristics of slums. Many people reside in small and cramped living spaces. A

single room is shared by three to four or more family members. A common defining feature of slum is poverty, because residents often have not fixed income. They have low incomes and limited access to economic opportunities. Slum dwellers struggle every day to get their basic needs, such as food, clean water, shelter, education, electricity and sanitation facilities etc. Slums are also distinguished by their informal housing structures. With a lack of basic infrastructure, their houses are often constructed from salvaged materials like corrugated metal, cardboard, or tarpaulins etc. Other challenges often faced by slum dwellers are in accessing basic services, such as sanitation and healthcare facilities. Many slums do not have proper sewage systems, leading to open defecation and poor hygiene conditions. Slum residents suffering from health challenges due to poor living conditions, limited access to healthcare and exposure to environmental pollutants. Illiteracy rates are high among slum dwellers. Many children does not attend school regularly and adults, due to this, employment opportunities limited to a large youth population and slums often have a youthful demographic profile. Most of the slums in Dibrugarh district are located in areas prone to natural disasters, such as flooding. Residents in these areas are particularly vulnerable to the effects of such disasters.

Many slum residents are immigrants, who have moved from rural areas to urban centres in search of employment and a better life. This migration contributes to the rapid growth of slum populations. Another problem of slum dwellers is a lack of formal property rights, which can make them vulnerable to eviction and displacement. These traits are a product of complex social, economic, and political circumstances is crucial. Addressing concerns such as poverty, access to education, healthcare, and affordable housing, as well as promoting inclusive urban development policies and community empowerment are common ways to improve the living conditions of slum inhabitants. The percentage of male population is higher than the female population in all studied slum areas, except Guardpara slum in Dibrugarh district. In this slum, the percentage of female to the total population percentage found higher (58%) than the male population percentage (42%). The Jorhat Harijan colony comprises 29 (57%) male and 22 (43%) female. In the Golaghat Harijan Colony, male female Amaraguri male 57 (56%) and female 45 (44%), in South Amolapatti male 15 (63%) and female 9 (38%), Sripuria male 44 (58%) and female 32 (42%), Nepali Mandir male 18 (53%) and female 16 (47%), Dhobi Patti male 20 (50%) and female 18 (47%), Santipara male 73 (52%) and female 68 (48%). In Barbari Dusadpatti slum, the percentage of female was found 30%, which was very low compared to male population that is 70%. The overall male population percentage is higher than female population. The sex ratio indicates number of

females against per 1000 male. The highest sex ratio has been found in Guardpara slum (1400) followed by Santipara (931.50), Dhobi Patti (900), Golaghat Harijan Colony (894.73), Nepali Mandir (888.88), Paltan Bazar (823.07), Amaraguri (789.47), Jorhat Harijan Colony (758.62), South Amolapatti (600) and Barbari Dusadpatti (428.57) respectively (**Table 4.1).**

Table 4.1: Slum wise Population Distribution and Sex-Ratio

Sl. No.	Slums	Male	%	Female	%	Sex-Ratio
1	Paltan bazar	130	55%	107	45%	823.07
2	Santipara HC	73	52%	68	48%	931.50
3	Amaraguri	57	56%	45	44%	789.47
4	Guard Para	20	42%	28	58%	1400
5	Dhobi Patti	20	53%	18	47%	900
6	South Amolapatti	15	63%	9	38%	600
7	Barbari Dusadpatti	14	70%	6	30%	428.57
8	Sripuria	44	58%	32	42%	727.27
9	Nepali-Mandir	18	53%	16	47%	888.88
10	Jorhat HC	29	57%	22	43%	758.62
11	Golaghat HC	19	53%	17	47%	894.73
	Total	439		368		

Source: Field Survey

There are 439 (54%) male and 368 (46%) female respectively, out of the total population in the surveyed slums **(Fig.4.2).** Therefore, the total sex ratio was found 838.27.

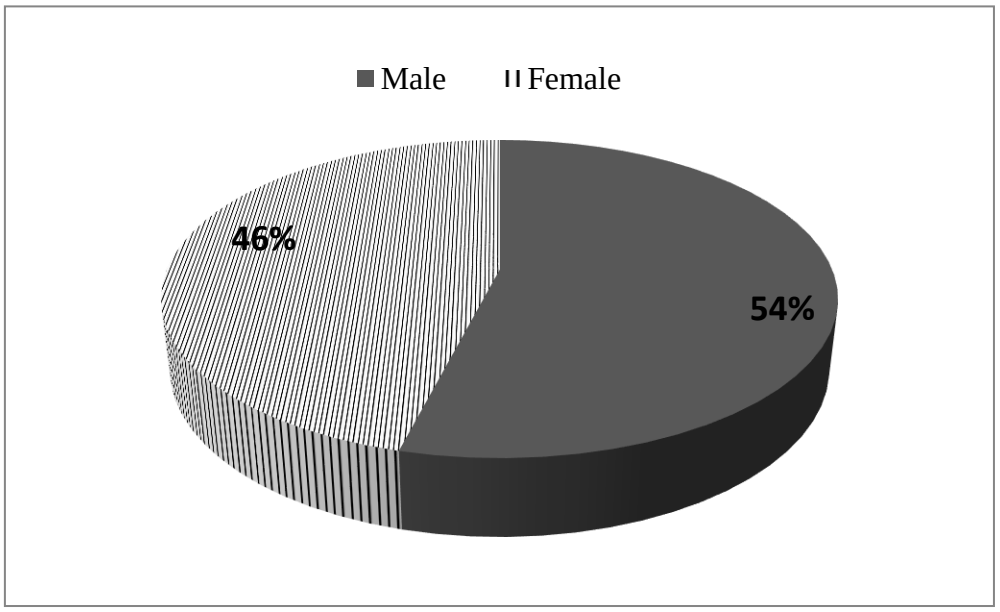


Fig.4.2: Total Percentage of Male and Female in the slums

4.3: Socio-Economic Environment of Slums:

Socioeconomic conditions have a huge influence on the study of any civilization. Social elements such as caste, religion, literacy level, and marital status provide information on a person's goals and methods for achieving those goals. The economic standing of any family is mostly determined by social characteristics such as educational level, family size, and the degree of friendliness present in the family. The economic circumstances of each family shape its members' aspirations, methods of achieving goals, and tangible gains. Economically "better-off" families are more likely to be able to meet their primary and secondary requirements, and they are more likely to achieve their material aspirations. While poor families struggle to meet their basic necessities, they also face emotional pressures and tensions on a daily basis. Migration from rural to urban regions, as well as natural increases in the number of inhabitants, has resulted in significant population expansion in cities. Slow growth in the organised sector, as a result of which an increasing population is unable to find work, is accompanied by a failure to acquire necessary skills. Job seekers' skills have resulted in the absorption of labour in productive informal sector activities that provide low remuneration. Furthermore, the high expense of living in cities forces migrants to settle in low-lying areas with rickety houses or slums. As a result, the pressure on metropolitan regions grows over time, rendering them unable to absorb the population while simultaneously providing basic necessities like housing, drinking water, sanitation, and access to appropriate healthcare. This is especially true for slum dwellers, who are the worst affected. Despite the fact that the government was implementing an increasing number of programmes these areas are living still in deprivation. During rainy season in Santipara slum area the drain water along with garbage enter their houses which create serious trouble to them. They are continuously facing various problems like bad smell, drainage garbage inside the houses, mosquito and insects etc. This situation become as a health hazard to the slum dwellers. Parameters chosen to assess the socio-economic environment in the study area are occupation and income level, housing condition and number of rooms, health facilities and education level.

4.3.1 Occupation and Income Level

Economic profile represents the overall picture of the economic status of any person or community through different indicators. To study the slum dwellers' economic status, the present study adopted some indicators like economic activities, income, expenditure and assets. Occupation is one of the parameters for the study of economic status of the slum dwellers. A number of occupations are reported from the study area, which are manual

scavengers, daily wage labourer in different sectors, Pedi cab driver, milk seller, Statue maker, carpenter, potter, tailors, etc. Their work and income are not fixed. Daily wage labourer works at different fields such as labour in industries, carrying goods in bus stands or truck stands etc. Therefore, their work can be classified as skilled and unskilled activities. Small businesses also run by dwellers. Residents of Amaraguri and Barbari Dusadpatti reported that both woman and man sales jewellery, clothes and plastic items on bicycles. The residents of Golaghat and Jorhat Harijan colony reported that they were running small stalls or vendors. Most of the workers in the study areas are daily wages labourers. The dwellers of Santipara, Sripuria and Jorhat Harijan Colony worked as Manual Scavengers. It has been over nine years since the Parliament enacted the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act 2013. But the breadwinners mainly engaged as manual scavengers and daily wage labourers, especially the dwellers of Santipara Harijan Colony, Jorhat Harijan Colony and Sripuria slum. Government services include all the services from sweeper or cleaner to the high post jobs. Most of the slum dwellers, engaged in government services as a sweeper or cleaner. The highest level of job, such as advocates is also found in this slum. The education level is also high in this slum compared to the other slums. The dominant occupation in the Slums is the daily wage labour. In this category, the nature of works is different. People worked as housemaids, pedi-cab drivers, carpenters, manual scavengers were included. Their working days and wages are also not fixed. In the Paltan Bazar slum, 45.6% engaged as daily wage labour worked as Pedi cab driver, household workers, milkman etc. Government services as cleaner/sweeper in Hospitals. Dominant economic activities: Daily wage labour Pedi cab driver, milkman, street vendor garbage collector, Santipara Daily wage labour Manual scavengers, Amaraguri Daily wage labour, Guardpara Daily wage labour, Dhobi Patti Daily wage labour, Cloth washer, South Amolapatti Daily wage labour, Business, Barbari Dusadpatti Daily wage labourer, garbage collection, Sripuria Daily wage labour, Nepali Mandir Business, Daily wage labourer, Jorhat Harijan Colony Daily wage labourer Manual scavengers, Golaghat Harijan Colony Business, Government services Sweeper and cleaner. Residents of Guardpara and Amaraguri slums also engaged in fishing, because the areas are situated on the Brahmaputra River bank (Table 4.2).

Table 4.2: Occupational Status in the Slums

Slums	Unemployed	%	Govt. Job	%	Small Business	%	Daily Wage Labour	%
Paltan bazar	75	32	20	8	34	14	108	46
Santipara	59	42	1	1	13	9	68	48
Amaraguri	34	33	4	4	8	8	56	55
Guard Para	19	40	2	4	10	21	17	35
Dhobi Patti	13	34	2	5	3	8	20	53
S.Amolapatti	7	29	0	0	6	25	11	46
B.Dusadpatti	2	10	0	0	5	25	13	65
Sripuria	17	22	2	3	9	12	48	63
N.Mandir	11	32	0	0	10	29	13	38
Jorhat HC	18	35	4	8	7	14	22	43
Golaghat HC	4	11	9	25	8	22	15	42

Source: Field Survey

In the occupation category, it was found that the daily wage labour consisting 391 persons (48%), 259 (32%) were found unemployed. In the business category found 113 persons (14%) and government services found as the lowest that is 44 persons (5%) (Fig 4.3).

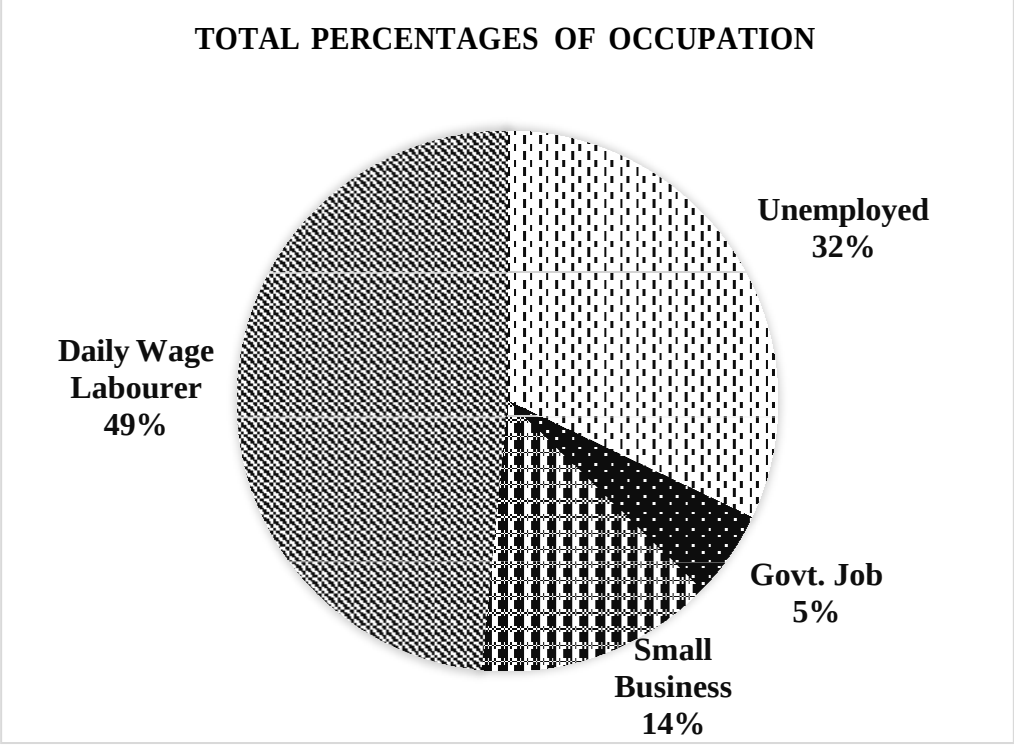


Fig.4.3: Total Percentage of Occupational Status in the Slums

Slum dweller's income is flexible. The income of slum dwellers' can be categorised into high, medium, low and very low-income groups (Barik, 2018). Most dwellers' income ranges between Rs.150 and Rs.200 per day. In the study area, the majority of dwellers' earnings are concentrated in Rs.3000 and Rs.5000. In this research also income groups are classified as very low ranges (below Rs.3000), low group ranges (between Rs.3000 and Rs.5000), medium included Rs.5000 to Rs.10000 and high-income groups Range was more than Rs.10000. In the very low category found the highest in Santipara 52%, followed by Nepali Mandir 47%, Paltan Bazar 41%, Barbari Dusadpatti 35%, Amaraguri 34% Dhobi Patti 34%, Sripuria 26%, Guardpara 23%, Jorhat Harijan colony 22% and Golaghat Harijan Colony 22% and South Amolapatti 21%. The low category found the highest in Sripuria 67% followed by Amaraguri 46%, Jorhat Harijan Colony 45%, Paltan Bazar 43%, Guardpara 42%, South Amolapatti42%, Barbari Dusadpatti 40%, Dhobi Patti 39%, Santipara 36%, Nepali Mandir 29%and Golaghat Harijan Colony 28%. In the medium Category, Golaghat Harijan Colony has the highest frequency 33% followed by South Amolapatti 29%, Guardpara 21%, Dhobi Patti 21%, Barbari Dusadpatti 20%, Jorhat Harijan Colony 20%, Nepali Mandir 18%, Amaraguri 14%, Paltan Bazar 12%, Santipara 9% and Sripuria 4%. Again, in the high category Golaghat Harijan Colony highest 17%, Guardpara 15%, Jorhat Harijan Colony 14%, South Amolapatti 8%, Amaraguri 6%, Nepali Mandir 6%, Dhobi Patti 5%, Barbari Dusadpatti 5%, Paltan Bazar 4%, Sripuria 3% and Santipara 2% (Table: 4.3 and Fig.4.4). The residents of the slum areas must work hard to survive. Expenditure becomes higher than their income level.

The total percentages of each income group found in the studied slums were 36.80% in the very low (Below Rs.3000) category, low-income group (between Rs.3000-5000) found 42.99%, Moderate income groups (between Rs.5000-10000) was 14.37% and high-income group (Above Rs.10000) found only 5.82 %, respectively. The average income of slums is found about Rs.4262.08/Month.

Table 4.3: Household Income Status in the Slums

Slums	Very Low	%	Low	%	Moderate	%	High	%	Total
Paltan bazar	97	41	102	43	29	12	9	4	237
Santipara HC	74	52	51	36	13	9	3	2	141
Amaraguri	35	34	47	46	14	14	6	6	102
Guard Para	11	23	20	42	10	21	7	15	48
Dhobi Patti	13	34	15	39	8	21	2	5	38
S. Amolapatti	5	21	10	42	7	29	2	8	24
B. Dusadpatti	7	35	8	40	4	20	1	5	20
Sripuria	20	26	51	67	3	4	2	3	76
N. Mandir	16	47	10	29	6	18	2	6	34
Jorhat HC	11	22	23	45	10	20	7	14	51
Golaghat HC	8	22	10	28	12	33	6	17	36

Source: Field Survey

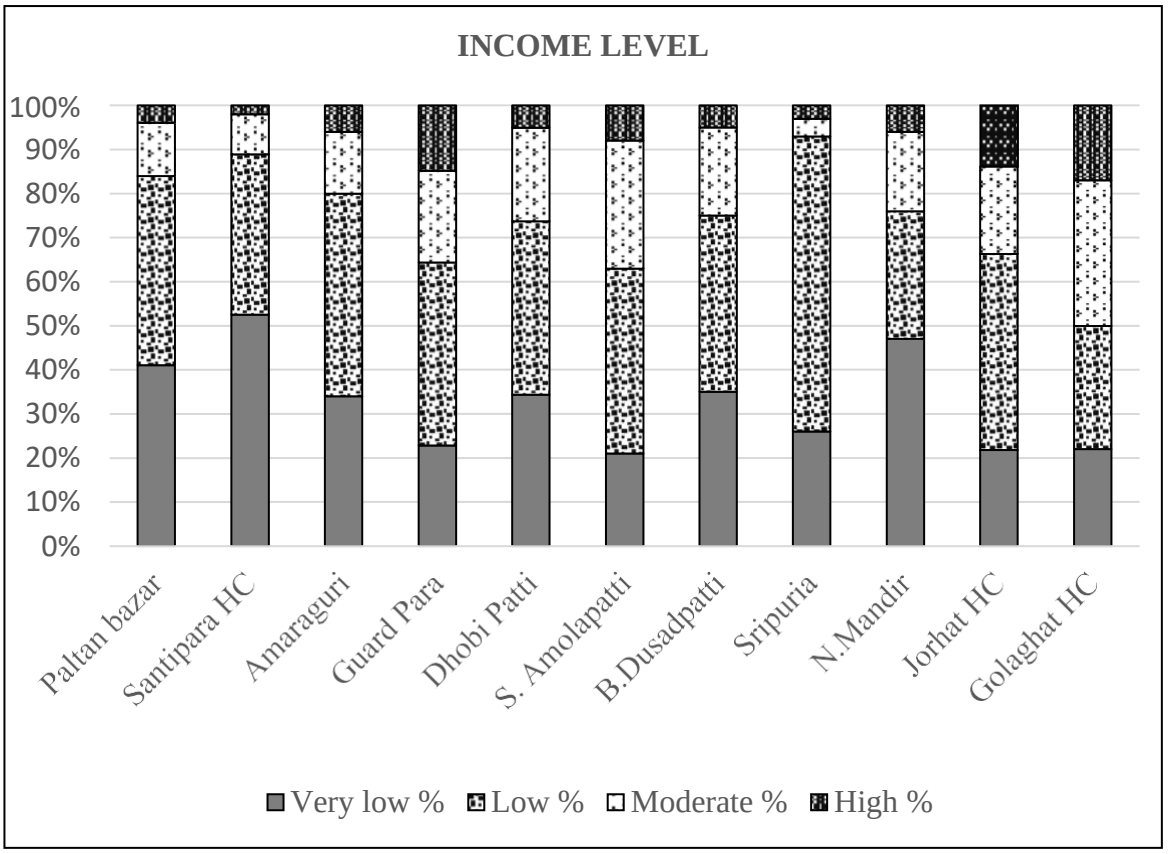


Fig.4.4: Income Level

The income level is high in the Golaghat Harijan Colony compared to other slums, because maximum dwellers are engaged in different government services and small business

sectors. Due to the inadequate educational background of slum residents, they are unable to get employment, due to this, people are unable to change their lives and are also unwilling to occasionally raise their standard of living. Only a few have succeeded in improving their quality of life, others are saving money from their earnings to invest to increase their income.

4.3.2 Education level:

The education levels of slums are poor in general. According to 2011 census, the literacy rate of slum population in Assam was 72 %. This research found maximum illiterate and primary school dropout population in studied slum areas. During the study, it has found that slum people are mostly illiterate, dropouts and currently studied children in primary schools. Due to poor economic condition, children have to do something to support families as soon as possible. Therefore, children drop out of school at early ages to support their families. Most of the slum dwellers are primary school dropouts and illiterate. Only in the Harijan colony of Golaghat district, a higher number of graduates were found. No graduate level residents were found in Santipara, Amaraguri, Dhobi Patti, Barbari Dusadpatti, Sripuria and Nepali Mandir slum areas. The highest percentage in the graduate level category has been found in Golaghat Harijan Colony (13.9%) followed by South Amolapatti (8%), Guardpara (6.3%), Jorhat Harijan Colony (3.9%) and Paltan Bazar Slum (1.7%). The highest percentage of dropouts found in Barbari Dusadpatti (70%) slum followed by Santipara (65.2%), Sripuria (61.8%), South Amolapatti (58%), Dhobi Patti (57.9%), Guardpara (56.3%), Nepali Mandir (55.9%), Amaraguri (54.9%), Jorhat (49%), Paltan Bazar (48.5%) and Golaghat Harijan Colony (27.8%). Again, in the secondary level category the highest percentage have been seen in Golaghat Harijan Colony (16.7%) followed by Paltan Bazar (16%), South Amolapatti (12.5%), Nepali Mandir (11.8%), Amaraguri (10.8%), Guardpara (8.3%), Jorhat Harijan colony (7.8%), Dhobi Patti (5.3%) and Santipara Harijan Colony (1.4%) respectively. No secondary level found in Barbari Dusadpatti and Sripuria slums (Table 4.4 and Fig.4.5).

Table 4.4: Education Level in the Slums

Slums	Illiterate	%	School dropout	%	Primary	%	Secondary Level	%	Graduate	%
Paltan bazar	57	24	115	49	23	10	38	16	4	2
Santipara	21	15	92	65	26	18	2	1	0	0
Amaraguri	17	17	56	55	18	18	11	11	0	0
Guard Para	9	19	27	56	5	10	4	8	3	6
Dhobi Patti	8	21	22	58	6	16	2	5	0	0
S.Amolapatti	4	17	11	46	4	17	3	13	2	8
B.Dusadpatti	4	20	14	70	2	10	0	0	0	0
Sripuria	18	24	47	62	11	14	0	0	0	0
N.Mandir	7	21	19	56	4	12	4	12	0	0
Jorhat HC	16	31	25	49	4	8	4	8	2	4
Golaghat HC	7	19	10	28	8	22	6	17	5	14

Source: Field Survey

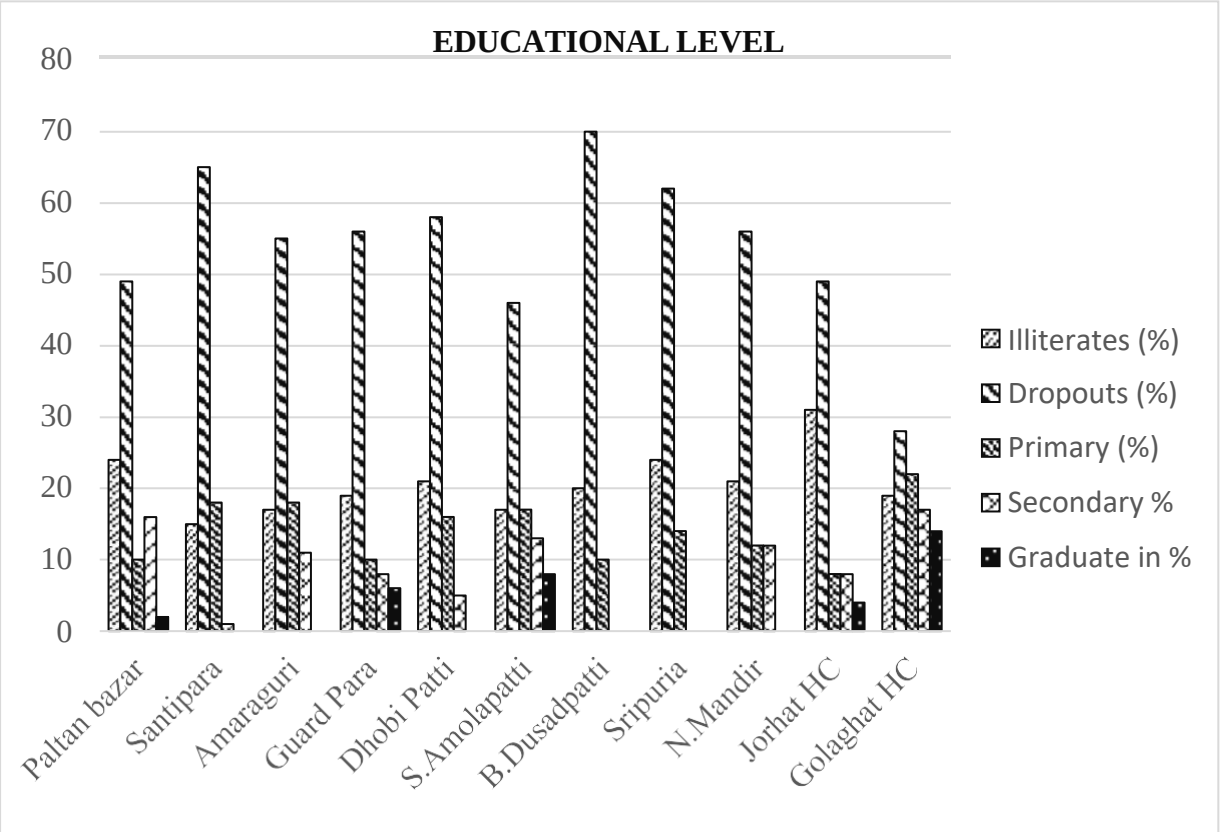


Fig.4.5: Slumwise educational level

For the assessment of education level, options were classified into six categories: Illiterate, dropouts, primary level (from nursery to class eight), Secondary level (from class nine to twelve), graduate (college level) and post graduate (University level). In the slums, it was found that, total 168 (20.81%) were illiterates, 438 (54.27%) were dropouts, 111 (13.75%) were in primary level, 74 (9.19%) in secondary level and 16 (1.98%) were in graduate level respectively. No any residents were found in post graduate level. The percentage in the dropout level was found the highest number (Fig.4.6**).** All dropouts were school level dropout, which indicates that slum dwellers left school at primary level to secondary level (between nursery and class twelve) to fulfill their basic needs.

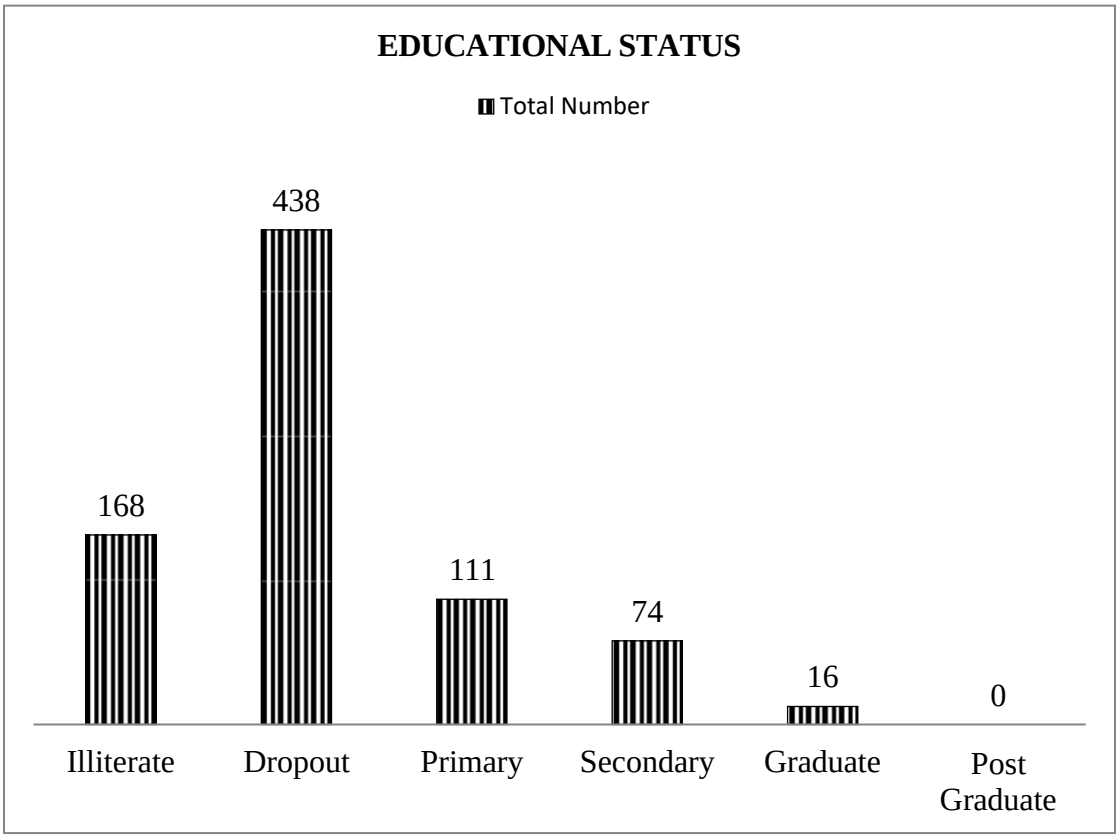


Fig.4.6: Education Level

The education level distribution indicates that the total number of literates in the slums found 639 (79.15%) and 168 (20.82%) illiterates respectively.

4.3.3 Toilet Facilities and Sanitation

According to a report published by Ministry of Statistics and Programme Implementation, Government of India in 2013, stated that at the all-India level 31% of slums had no latrine facility. Out of this 42% for non-notified and 16% for notified slums. Lack of proper sanitation facilities is common in slums. Open fields, shack latrines, common toilets shared by maximum households etc. They sanitize with water after using toilets without soap

or hand wash. Nails are generally cut once in a week by using blades. Fig. 4.7 and table 4.5 shows the toilet facilities in the study areas. Total 11.77% have private kutcha, 15.86% have private pucca, 30.36% uses communal kutcha and 42 % uses communal pucca latrines among the surveyed households. Average 8.64 uses private kutcha, average 11.64 uses private pucca, average 22.27 uses communal kutcha and 30.82 uses communal pucca toilets.

Table 4.5: Toilet Facilities in the Slums

Slums	Number and Percentage of Households							
	Private Kutcha	%	Private Pucca	%	Communal Kutcha	%	Communal Pucca	%
Paltan bazar	21	22.12	27	21.09	97	39.59	92	27.13
Santipara	0	0.00	6	4.69	39	15.92	96	28.32
Amaraguri	19	20.00	7	5.46	25	10.20	51	15.04
Guard Para	11	11.57	23	17.98	10	4.08	4	1.18
Dhobi Patti	5	5.25	7	5.46	8	3.27	18	5.32
S. Amolapatti	4	4.21	5	3.91	3	1.22	12	3.54
B. Dusadpatti	0	0.00	4	3.12	2	0.82	14	4.13
Sripuria	21	22.12	8	6.25	39	15.92	8	2.36
N. Mandir	4	4.21	8	6.25	7	2.86	15	4.43
Jorhat HC	6	6.31	12	9.38	10	4.08	23	6.78
Golaghat HC	4	4.21	21	16.41	5	2.04	6	1.77
Total	95	100.00	128	100	245	100	339	100

Source: Field Survey

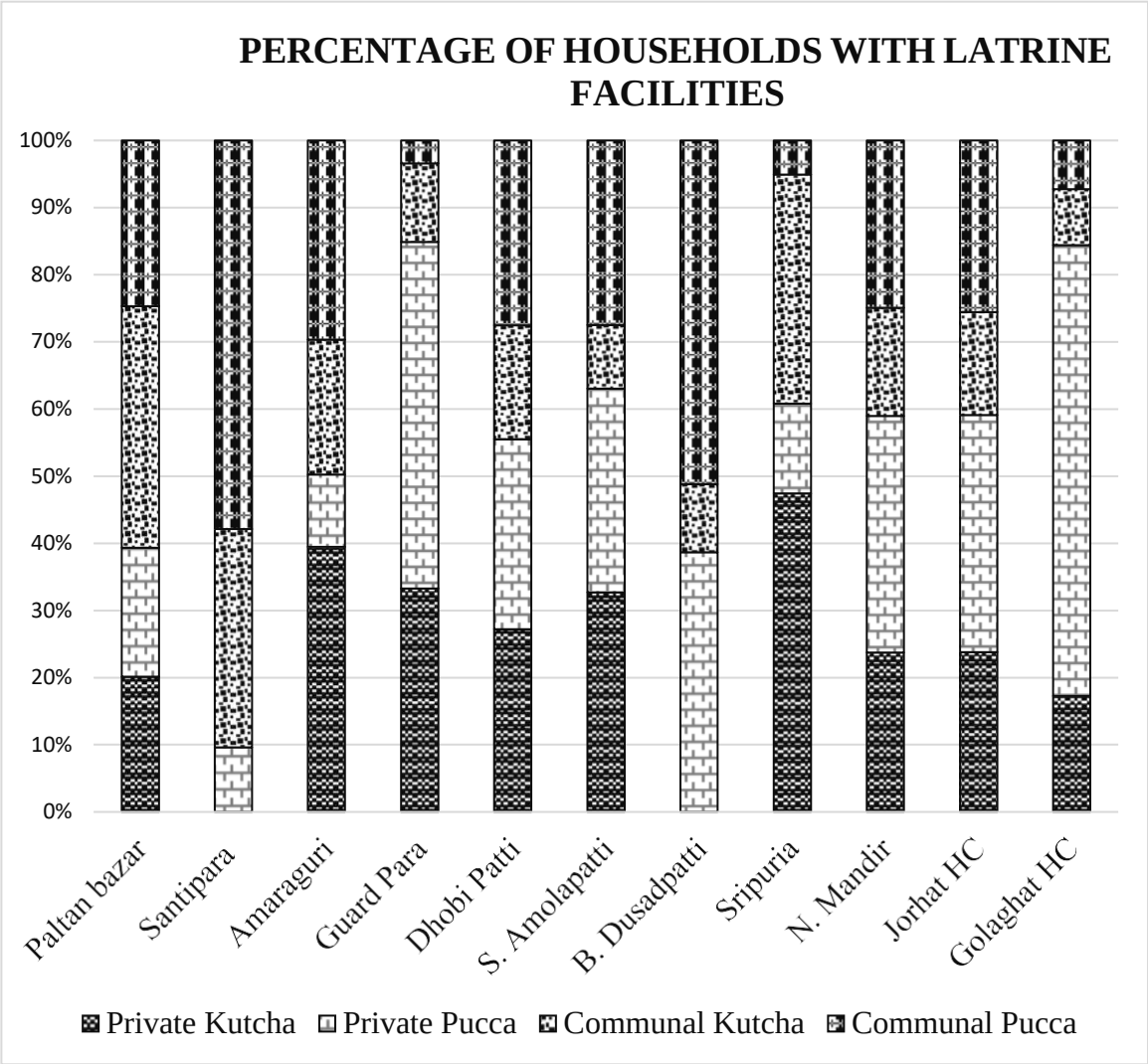


Fig.4.7: Toilet Facilities

During the study, it was observed that a proportion of respondents mentioned utilizing open fields for sanitation purposes. More specifically, there were 14.47% from Sripuria, 10.48% from Guardpara, 11.35% from Santipara, 13.73% from Amaraguri, and 11.67% from the Jorhat Harijan colony slum reported occasional utilization of open fields for this purpose. Lack of toilets and few available has been overuse without regular cleaning causes many problems ranging from social and problem issues on one side and on the other such unserviceable and unhygienic conditions become the breeding ground of all infectious diseases like dysentery, cholera etc. The shortage of latrines and their insufficiency forced the inhabitants to use the open space, wherever available for defecation. Young children defecate in the drain or any available space dirtying the entire environment. The Golaghat Harijan colony about 26% have private pucca toilet (Fig.4.11) and rest of the people uses common kutcha toilet. The toilet condition is very unhygienic in Santipara, Paltan Bazar and Amaraguri slums (Fig.4.8, Fig.4.9 and Fig.4.10). A large number of inhabitants prevailing in

absence of proper system of toilets is the major cause of most of the common diseases. Use of open fields indicates that women in the slums are suffered from lack of privacy and social security problems. In spite of poverty, a substantial number of dwellers do not go to the government or municipal dispensaries for treatment. The main reason reported is the long time spent in getting the treatment provided in these dispensaries. Settlement dwellers are of the view that free medicines given by government hospitals and dispensaries are of poor quality.

Fig. 4.8: Private Pucca toilet facilities, Golaghat Harijan Coloney

Fig.4.9: Pucca Communal toilet, Santipara Slum.

Fig. 4.10: Communal Pucca Toilet, Paltan Bazar, Dibrugarh

Fig.4.11: Private Kutcha Toilet, Amaraguri

4.3.4 Household Condition

House types in slum areas are not in a good condition. The house type has been categorized into shacks, kutcha, semi-pucca and pucca houses (Fig. 4.12 and Fig. 4.13**)**. The shacks included the houses made up of plastic sheets plastic covers *tuff Paulin/tirpals,* small tin houses, where walls and roof covered by tins with kutcha floor and broken mud houses. The semi pucca houses includes the houses which have pucca floors or pucca half wall and tin on roof and Pucca category include the houses which have pucca floor and wall and covered by tin on rooftop. These all kinds of houses are found but maximum kutcha houses are found in a very poor condition. The distances between the houses are generally very low in slums. In Santipara, Jorhat Harijan colony, Dhobi Patti, Paltan Bazar, South Amolapatti, Barbari Dusadpatti houses were distributed in both sides of roads and there was usually no gap between the houses. Houses are connected to each other. The rooms are very small in size. Generally, Number of rooms in slums are low compared to their family size. Most of the houses have only 1-3 rooms including kitchen shared by high number of family members.

Table 4.6: House Types in the Slums

Slums	**Shacks**	%	**Kutcha**	%	**Semi Pucca**	%	**Pucca**	%
Paltan bazar	8	3	103	43	85	36	41	17
Santipara	8	6	65	46	50	35	18	13
Amaraguri	14	14	50	49	31	30	7	7
Guard Para	8	17	22	46	11	23	7	15
Dhobi Patti	4	11	22	58	7	18	5	13
S. Amolapatti	2	8	7	29	8	33	7	29
B. Dusadpatti	4	20	5	25	7	35	4	20
Sripuria	10	13	22	29	39	51	5	7
N. Mandir	6	18	12	35	10	29	6	18
Jorhat HC	6	12	15	29	23	45	7	14
Golaghat HC	0	0	10	28	11	31	15	42

Source: Field Survey

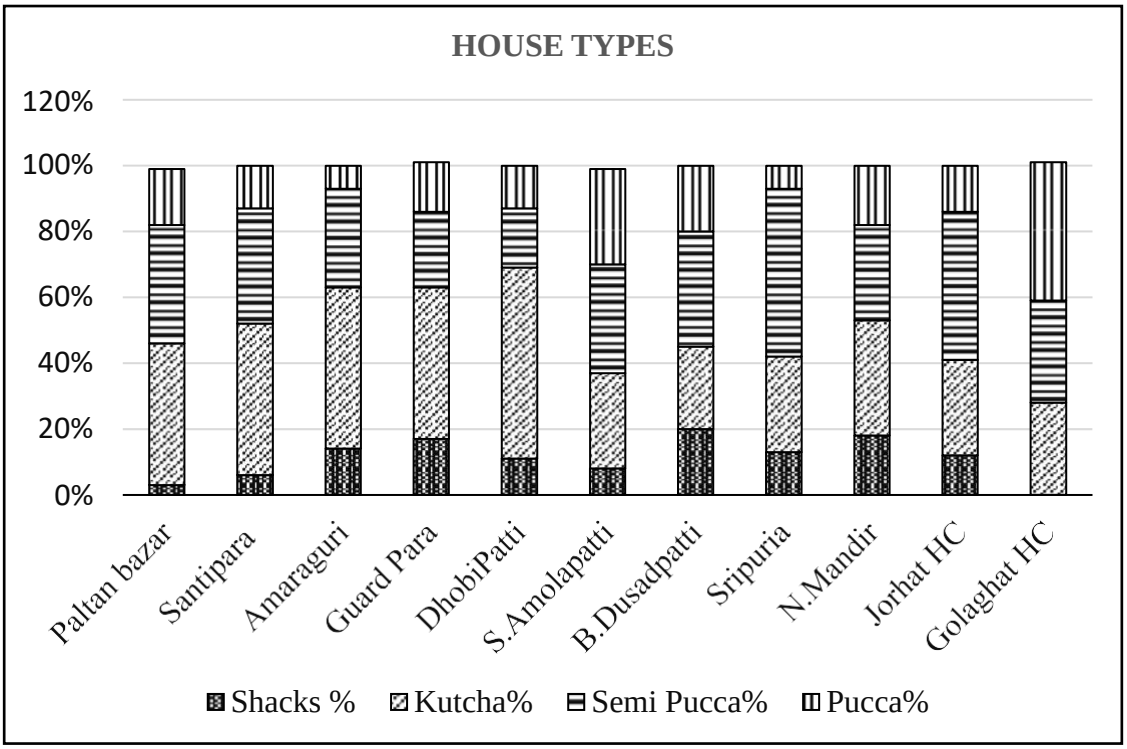


Fig. 4.12: House types

	
a. Shacks	**b. Pucca**

c. Kutcha

d. Semi Pucca

Fig.4.13: House types: a. Shacks; b. Pucca; c. Kutcha; d. Semi Pucca

The report published by Ministry of Statistics and Programme Implementation, Government of India, 2013 mentioned that the phenomenon of absence of electricity in slums appeared to be largely confined to non-notified slums. At all-India level only 6.5% of all the surveyed slums had no electricity and the corresponding figures were 11% for non-notified slums and only 0.1% for notified slums. Shortage or scarce of electricity is a basic characteristics of slum areas in Upper Assam. Inverter connection only found in Golaghat Harijan Colony and rest of the slum areas do not have inverter connections. In the Santipara slum area, dwellers have electricity connection on rent. In this slum area, maximum houses have 1-2 rooms, only Guardpara and Golaghat Harijan Colony slums have houses with 4 households (Table 4.7). In Santipara slum 70 % people lives in houses with single room and used only one to two blubs. They have to pay Rs.400-500 per month, no matter how much they have spent. On the other hand, in Golaghat slum area, all households have domestic electricity connection.

Table 4.7: Number of Rooms in Percentage

Sl. No.	Slums	Number of Rooms in %			
		1	2	3	4
1	Paltan bazar	44.73	40.93	14.93	-
2	Santipara	70	20.57	8.51	-
3	Amaraguri	47.06	49.02	3.92	-
4	Guardpara	29.41	38.24	24.51	7.84
5	Dhobi Patti	55.26	36.84	7.89	-
6	South Amolapatti	33.33	45.83	20.83	-
7	Barbari Dusadpatti	40	50	10	-
8	Sripuria	60.53	32.89	7.89	-
9	Nepali Mandir	29.42	58.82	11.76	-
10	Jorhat Harijan Colony	25.49	41.18	33.33	-
11	Golaghat Harijan Colony	22.22	44.44	19.44	13.88

Source: Field Survey

4.3.5 Road condition

According to the report published by Ministry of Statistics and Programme Implementation, Government of India in 2013, about 66% of among the surveyed slums, the road within the slum used by the dwellers as main thoroughfare was a pucca road. The proportion of pucca road was 83% for notified slums and 55% for non-notified slums. Generally, roads in slums are not very wide. In the Guardpara, Jorhat Harijan colony, Golaghat Harijan Colony, Santipara slum, Guardpara, Barbari Dusadpatti slums; the main roads are metaled but inside the slums, roads are not metaled because they are very narrow. The condition of road at Sirpuria Slum in Tinsukia district is very poor in condition, which is a kutcha narrow road, because this slum is located on the government land, near railway track and the residents do not have property rights. In the Dhobi Patti slum, the open drain is used as road. Similarly, the Amaraguri slum is located on the bank of the Brahmaputra River and waterlogging is a common problem six to eight months. The only road to this slum is the Dibrugarh Town Protection dyke or the embankment.

4.3.6 Crimes and Role of Administration/Police:

Analyzing crime scenes in slum areas are complex which requires the understanding of their socio-economic and environmental characteristics. In general, crime rates are high in slums. The change of socio-economic condition, population growth, poverty, unemployment

and some other related factors driver the crimes. Slum areas can experience higher rates of crimes, including assault and domestic violence. The stressful living conditions and social tensions may contribute to this. This study highlights the crime scenes in the slums. According to the respondents, the common crimes are theft and domestic violences in the studied slums. The highest rates of domestic violence are reported in Santipara slum (63%), followed by Nepali Mandir slum (47%) Sripuria slum (25%) and Paltan Bazar slum (13%). The lowest rates of domestic violence are reported in Golaghat Harijan Colony (18%). The highest incidence of theft is reported in Paltan Bazar slum (78%), followed by Guardpara (49%) Amaraguri slum (31%). Jorhat Harijan Colony (25%), Barbari Dusadpatti slum (23%). Santipara slum (13%). The lowest rates of theft are reported in Golaghat Harijan Colony (30%). Gambling and alcohol consumption appear to be prevalent issues, with varying degrees across different slums. Conflicts are also occurred in the slums during collecting drinking water and uses of latrines, especially among the slum dwellers who used communal toilets. Slum residents do not report any conflicts and violences in the police stations. Slum areas are typically densely populated, which can lead to increased stress and conflict among residents, contributing to higher rates of violence. Inadequate infrastructure, including poor lighting, limited access to sanitation, and subpar housing conditions, can create an environment conducive to criminal activity. Some slum areas may have limited police presence or less effective law enforcement due to resource constraints or challenging terrain. During the survey, the slum residents reported that thieves and domestic violence are common in the slums. Residents' only report to the police stations during an extreme condition. This might be involved into unawareness and perceived ineffectiveness of legal system. It is hard to get information on crimes in the slums. Therefore, responses on common crimes in the slums have been collected by using Yes or No answers. Residents mainly reported that the thieves are very common in the slums.

4.3.7 Other Social Problems:

The dwellers are suffered from lack of privacy especially by women and girls. They have to use open areas or shack bathrooms and latrines for sanitation. Alcohol consumption among slum dwellers is very common. Because of this reason most of the male population is died due to liver diseases. Not only are the males, female also consuming alcohol at a high rate. During the survey it was found that the cause of death of males in the families is the liver enlargement, kidney fail etc. It is also caused to domestic violence in the families. Gamble among the youths is common that increases the crime rates. The slum areas are not secure. Though the areas are near to the city center but road accessibility is not good because

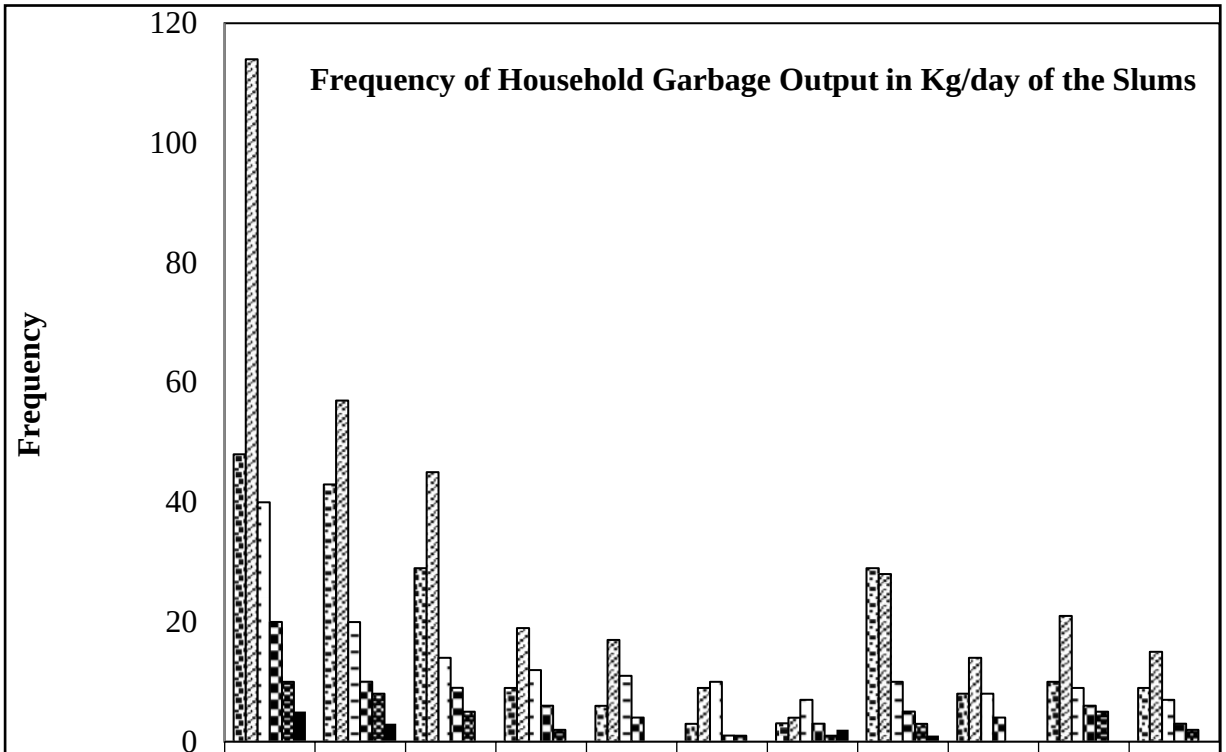
of very narrow road. Therefore, ambulances, fire brigade vehicles are unable to reach to the hazard center. People generally do not have the contact number of the fire brigade offices. Though it is available but they are unaware of these facilities. Therefore, the accessibility of road transport is low during fire emergency or for ambulance facilities.

4.4. Physical Environment and Impact of Slums

The basic characteristics of slums are these areas are overcrowded with high density, smaller in size, pollution, unhealthy-unhygienic inhabitable areas without proper sanitationn facilities, scarce of pure drinking water, education and housing facilities etc. Assam is fall under monsoon climatic region and flood is a common natural hazard every year during rainy season. Both the natural and artificial flood or water logging, bad smell etc. are major environmental problems of the areas. Along with this bad smell, smoke inside the house during cooking, high room temperature etc. are common problems in slum areas.

4.4.1 Household's Garbage Output

Again, as mentioned in the report published by Ministry of Statistics and Programme Implementation, Government of India in 2013, at the all-India level, 27% of all slums had no garbage disposal arrangement. About 38% in non-notified slums and about 11% in notified slums do not have proper garbage disposal arrangements. Garbage disposal and management is a major problem in urban centers especially in slum areas. The separation of degradable and non-degradable waste is negligible in slum areas. The amount of household garbage output is not fixed and the dwellers never measure the weight. According to the respondents, the approximate amount of households' garbage output ranges between 1 to 3 kg per day and above 5 kg per week. Fig.4.14 represents the number of households' responses or the frequencies of households on garbage output kg/day in each slum areas. Responses received on 5 kg/day garbage output in Paltan Bazar, Santipara, Barbari Dusadpatti and Sripuria slums. No responses received on 5 kg/day garbage output in rest of the slums.



	Paltan bazar	Santipara Harijan colony	Amaraguri	Guard Para	Dhobi Patti	South Amolapatti	Barbari Dusadpatti	Sripuria	Nepali-Mandir	Jorhat Harijan Colony	Golaghat Harijan Colony
Below 1 kg	48	43	29	9	6	3	3	29	8	10	9
1-2 kg	114	57	45	19	17	9	4	28	14	21	15
2-3kg	40	20	14	12	11	10	7	10	8	9	7
3-4 kg	20	10	9	6	4	1	3	5	4	6	3
4-5kg	10	8	5	2	0	1	1	3	0	5	2
above 5kg	5	3	0	0	0	0	2	1	0	0	0

Fig.4.14: Frequency of Household Garbage Output Kg/day in the Slums

Based on the responses, the household garbage output in all the surveyed slums found the highest between 1 to 2 kg per day, which was 343 **(**43%**)** households followed by below 1 kg per day category that is 197 **(**24%**).** In the category, 2 to 3Kg/day responses found 148 **(**18%**)**, 3 to 4 Kg/day category 71 responses **(**9%**)**, 4 to 5 Kg/day category 37 responses **(**5%**)** and above 5 Kg/day category 11 responses (1%**)** were received (Table 4.8). The family size, economic condition etc. are responsible factors for garbage output variations. Only 1% households have 5 kg per day, but it is not frequent and their economic activities play an important role in garbage output**.**

Table 4.8: Total Garbage Output (Kg/day)

Garbage output kg/day	Frequency	Percentage	Cumulative%
Below 1	197	24	24
01 to 2	343	43	67
02 to 03	148	18	85
03 to 04	71	9	94
04 to 05	37	5	99
Above 5	11	1	100
Total	807	100	

Source: Field Survey

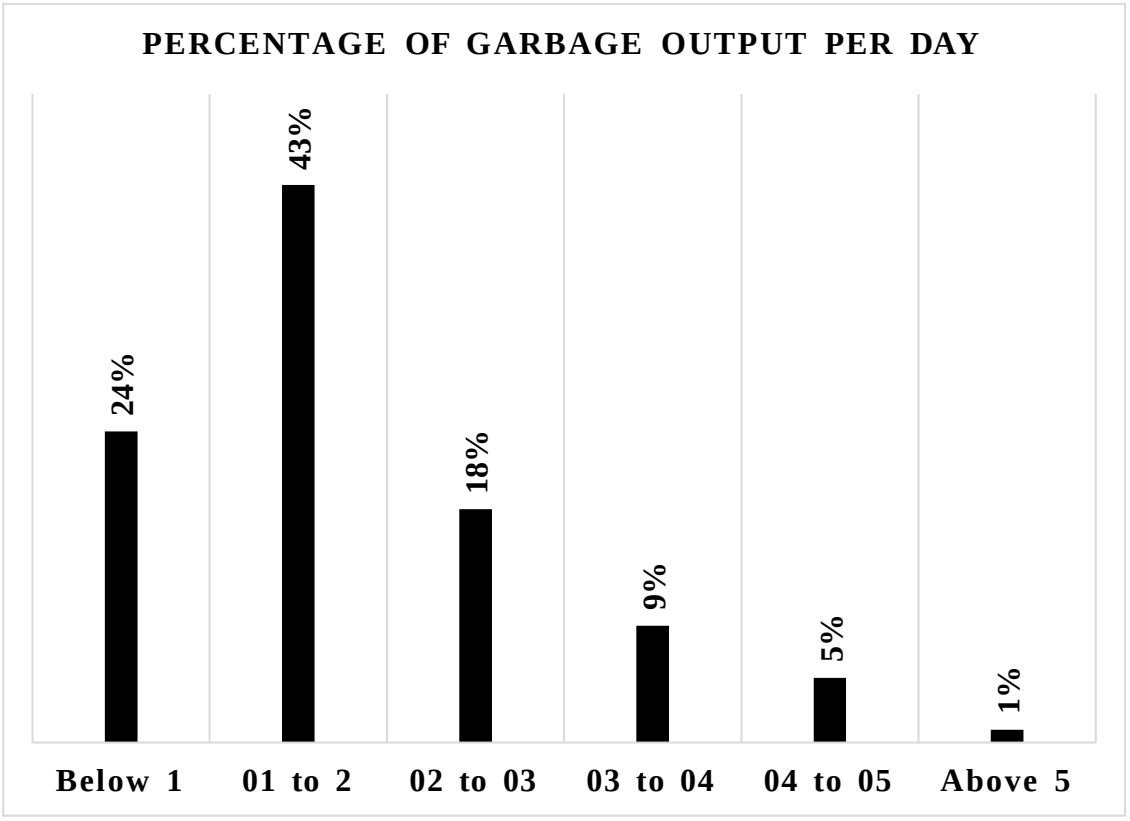


Fig.4.15: Total Percentages of Garbage output/Day

Overall, the average amount of garbage output found 1.08 kg/day. One of the causes of environmental degradation is the domestic waste as well as accumulated wastes by the dwellers. Slums, lack of suitable trash disposal locations and hence no proper waste disposal practices in all the slum areas. The two most common techniques for disposing of trash are throwing it away and burning it. Open dumping is frequent in Upper Assam's slums. Household waste is dumped directly into the Riversides by slum dwellers of the Guardpara and Amaraguri slums. Households' wastes are directly thrown into the drains and open

spaces at Santipara slum and Dhobi Patti slum areas in Dibrugarh town. Similarly, slum dwellers in the Jorhat Rajamaidam new colony and Harijan Colony dump all types of trash into the Tocklai stream. There have been negligible waste separation practices in these slums. Sometimes, they only reuse plastic bags and water bottles once or twice before throwing them away. Out of the total only 27% population response was 'Yes' on waste separation practices and 73% dwellers response was 'No' (Fig 4.16). In the Golaghat Harijan colony slum, the people practice separation of degradable and non-degradable waste but not regularly. They dumped garbage in a communal dustbin outside the slum. Therefore, the condition of this slum is clean and hygienic compared to the other slums in Upper Assam.

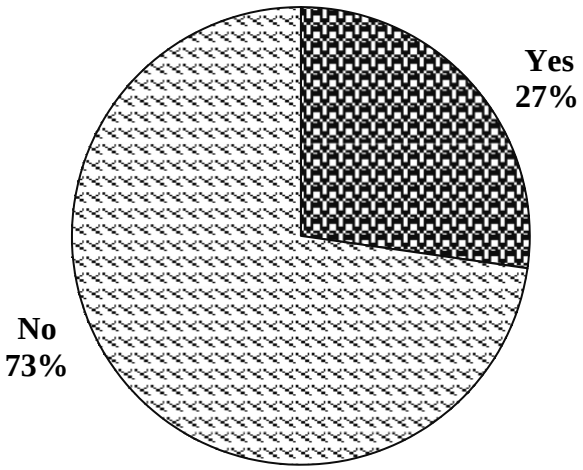


Fig.4.16: Responses on Waste Separation

Improper domestic waste disposal practices continue to prevail due to a lack of awareness and knowledge among households. This study examines the adverse environmental effects of such practices, wherein a significant number of households resort to disposing of their domestic waste in nearby drains, open areas, and embankments. The resultant contamination poses severe threats to both soil and water quality, impacting the overall environment. In case of Guardpara and Amaraguri slums, it was found that the inhabitants utilize empty spaces near the Brahmaputra River embankment for waste disposal. Given the widespread reliance on Brahmaputra River water for various daily activities, the contamination of this vital water source raises concerns about public health and ecological sustainability. Additionally, findings indicate that some households opt to dispose of their

waste behind their residences, exacerbating the environmental challenges. Addressing these practices necessitates a comprehensive approach involving education, awareness campaigns, and improved waste management infrastructure to mitigate the detrimental impact of improper waste disposal on the environment and public health.

4.4.2 Methods of Waste Disposal:

The behavior of the community in treating household waste is one of the reasons for environmental quality degradation. Slums in the study area neither have proper waste disposal sites nor practices proper waste disposal methods. Throwing and burning are the main methods of garbage clearance. Open dumping is common among the slums in Upper Assam. The slum dwellers in the Dibrugarh district especially the people of Guardpara and Amaraguri areas dump household wastes directly into the Brahmaputra River. Similarly in Jorhat town, the slum dwellers dump all kinds of waste on the side of the *Tocklaijan* stream. No separation of waste has been done. They only reuse plastic bags and plastic water bottles one or two times and threw them anywhere. One of the elements for studying the slum environment is the location of trash disposal. Garbage disposal areas are usually classified into two types: unsanitary and sanitary. Rubbish disposal in an open field, near a pond, at the rear and front of a house, or inside the premises might be considered unsanitary; however, using a municipality trashcan and a specially marked spot for dropping garbage can be considered sanitary.

4.4.3 Clerance of Drainage (***Nallah***)

According to the report published by Ministry of Statistics and Programme Implementation, Government of India (2013), about 31% of all slums had no drainage facility and the figure was considerably higher in non-notified slums (45%) than notified slums (11%). There are lacks effective drainage systems in the slums. There is a shallow, small drain located in the Santipara slum and dwellers throw all of their wastes into the drain. This resulted in water logging and mosquito problem in the area. The houses have no distance from the drains. Walls of their houses start from the drain. Drain water with garbage enters their houses during rainy season. Along with the physical aspect of drainage system there is uncountable problems arises, such as increase of mosquito/insects/flies' related problems directly selected to poor drainage systems. In order to mitigate the problem, they burn plastics, old wetted clothes, to get rid of mosquitos, flies and other insects. Therefore, the environmental state of the slum is unhygienic since the majority of the respondents who live there have drains next to their homes. People throw all of their waste in the drains and dumped near the bathing place, which leads to several health issues. During the rainy season,

drain water with garbage enter their houses. It is found that the residents of Harijan colony of Jorhat district dump all kind of waste on the side of Tocklaijan, which is now turned to a small stream drain. There was no drainage system in the Guard Para and Amaraguri slums. Sripuria is situated near an open drain. Similarly Nepali Mandir, Paltan Bazar slums have narrow open kutcha drains. In Dhobi Patti slum, there was an open drain, which the dwellers used as road to the slum. The slums, which are located near the drains have drain clearance problems. The size of the drains is varying from slum to slum. In the Golaghat Harijan Colony slum, drains are small and clean, which are generally used to drain the household's waste water. Dwellers do not throw garbage to the drains. On the other hand, the drains in Santipara slum are larger than the Golaghat, which were not clean and full of garbage. According to the responses, the clearance of the drain is not frequent (Table 4.9 and Fig.4.17).

Table 4.9: Overview of Drainage Condition in the slum areas

Sl. No.	**Slums**	**Presence of Drains *Nallah***	**Type of the drain**	**Clearance of drains**	**Responsibility taken by**
1	Paltan bazar	Yes	Open Kutcha	Once in a month	Municipality
2	Santipara HC	Yes	Open Pucca	No clearance	-
3	Amaraguri	No	-	-	-
4	Guard Para	No	-	-	-
5	Dhobi Patti	Yes	Open Pucca	No clearance	
6	S. Amolapatti	No	-	-	-
7	B. Dusadpatti	Yes	Open Kutcha	No clearance	-
8	Sripuria	Yes	Open Pucca	No clearance	-
9	N. Mandir	Yes	Open Pucca	No clearance	-
10	Jorhat HC	No	-	-	-
11	Golaghat HC	Yes	Open Pucca	Once in two days	Municipality and slum residents

Source: Field Survey

a. Guard Para

b. Dhobi Patti

c. Santipara

d. Golaghat Harijan Colony

Fig.4.17 Drainage Conditions

4.4.4 Drinking Water Sources and its Quality (Lab analysis)

A report published by the Ministry of Statistics and Programme Implementation, Government of India, 2013, At the all-India level 71% of all slums had tap as major source of drinking water. Out of this, 82% in notified slums and 64% in non-notified slum have tap drinking water sources. Water for the slums' various needs comes mainly from tube wells. Apart from this, residents of the Amaraguri and Guard Para Slums utilize river water for bathing, washing clothes, and other activities. However, practically (93%) uses tube wells for drinking water and 7 % have uses Tap water supplied by government. Only in the Jorhat Harijan colony, Nepali Mandir, and Golaghat Harijan colony residents uses tap water for drinking.

The urban poor frequently utilise low-cost pit latrines and may also use neighbouring wells for residential water. Due to slum overcrowding, there is not enough space between pit

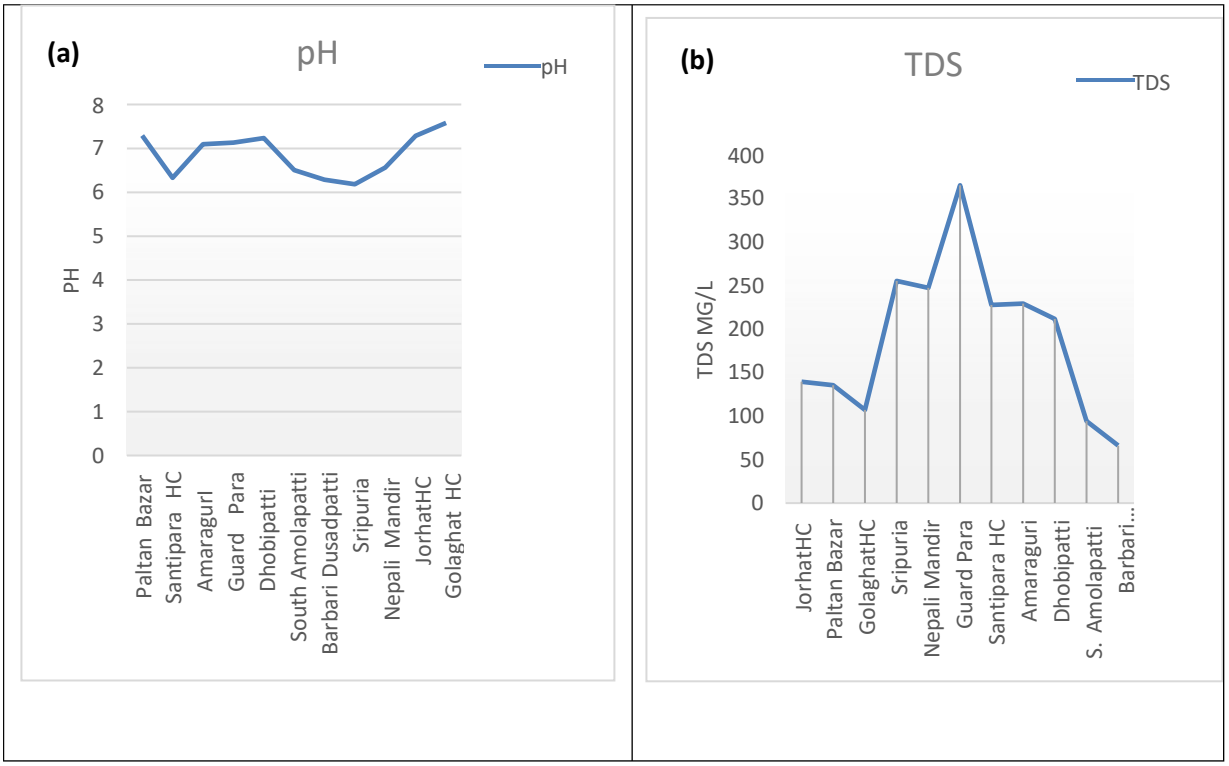
latrines and wells for microorganisms to migrate from latrines to water sources. Poor sanitary conditions in these overcrowded slums contribute to the pollution of the wells (Kimani-Murage, 2007). To assess the suitability of potable water for drinking purposes, physicochemical parameters: pH, TDS, calcium carbonate (CaCo3), Magnesium (Mg), iron (Fe) and Chloride (Cl) of drinking water were assessed in the study areas. The water quality parameters are discussed in this section in comparison to Indian standards (Table 4.10). Water samples' pH value ranges varies from 6.18 to 7.5 (Fig.4.18a). The TDS concentration in the current investigation was found between 66 mg/l and 365.1 mg/l (Fig.4.18b). According to the findings, the slums of Santipara Harijan colony, Jorhat Harijan colony, Guard Para, Dhobi Patti, Golaghat Harijan colony, Barbari Dusad Patti and South Amolapatti had the highest levels of iron (Fe) that were 19.64 and 14.58 (Fig.4.18c). The research area's calcium carbonate (CaCo3) concentrations range from 90 to 356 mg/l, with Guard Para Slum having the highest levels 356.5 mg/l and Nepali Mandir has the lowest CaCo3 level 90 mg/l (Fig.4.18d). Magnesium (Mg) deficiency was observed to vary from 1.9 to 19.64 mg/l (Fig.4.18e). The concentration of chloride (Cl) ranged from 6.7 to 104.4 mg/l, with Sripuria Slum having the greatest concentration and Jorhat having the lowest (Fig.4.18f).

Table 4.10: Lab Analysis of Drinking Water components

Components (mg/l)	**Paltan Bazar**	**Santipara Harijan Colony**	**Amaraguri**	**Gurd para**	**Dhobi Patti**	**Remarks value (IS:10500-2012)**
pH	6.18 at 20.5 ℃	6.33 at 20.3 ℃	7.16 at 20.3℃	7.13 at 20.4 ℃	7.23 at 20.6 ℃	6.5-8.5
Caco3	166.3	152	162.5	356.3	332.5	200
Ca	2	3.4	2.4	11.8	6.6	75
Mg	3	1.8	2.2	1.9	4.5	30
Fe	0.03	3.63	2.9	0.6	0.45	0.3
So4	29.6	38.2	16.3	14.8	11.1	200
Cl	104.4	67.3	7.1	57.3	22.2	250
Alkalinity	12.3	12.3	17.6	36.7	22.1	200
TDS	255.2	227.8	137.2	365.1	211.3	200
TSS	191	203	201	256	291	500

(Cont..)

Components (mg/l)	South Amolapatti	Barbari Dusadpatti	Sripuria	Nepali Mandir	Jorhat HC	Golaghat HC	Remarks value (IS:10500-2012)
pH	6.5 at 15 ℃	5.54 at 15 ℃	6.21 at 20.4 ℃	6.56 at 15 ℃	7.28 at 20.5 ℃	7.58 at 20.4 ℃	6.5-8.5
Caco3	256.3	132.5	331.2	231.2	166.3	137.8	200
Ca	28.02	33.6	10	6.56	2.8	2	75
Mg	14.58	18.95	3.5	14.58	2.6	2.3	30
Fe	0.14	0.35	1.21	0.23	2.8	0.15	0.3
So4	4.04	6.6	56.2	0.57	15.5	26.5	200
Cl	20	33.6	20.5	12.01	6.7	10.1	250
Alkalinity	25	15	15	15	14.7	9.8	200
TDS	94	162	116.2	92	139.5	107.1	200
TSS	203	291	231.1	291	217	302	500



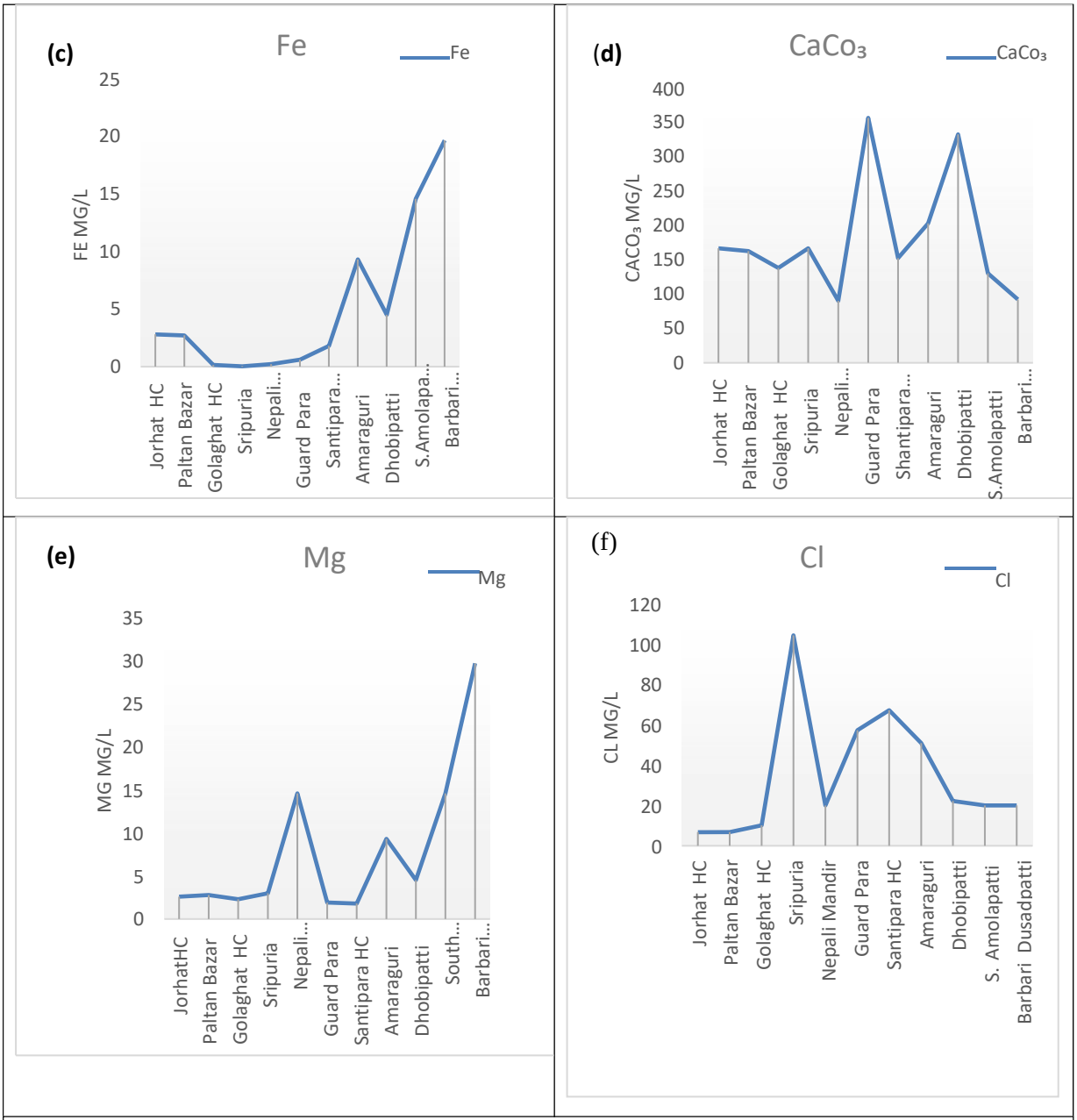


Fig. 4.18: Variation of drinking water parameters **a.** pH, **b.** Total Dissolved Solids (TDS) , **c.**Iron (Fe), **d.** Calcium Carbonate ($CaCo_3$), **e.**Magesium (Mg), **f.** Chloride (Cl)

4.4.5 Indoor Air Quality:

Indoor air quality simply indicates the air quality present in and around residential or official buildings. Degradation of indoor air quality to a certain level by harmful pollutants such as dust, suspended particulate matters (PM 2.5 and PM10), insect repellents, gases such as carbon monoxide and nitric oxides, and biological bacteria, fungi, microbial spores, and animal dander leads to indoor air pollution that may causes headache, redness, and itching of eyes, dry cough, runny nose, and dyspnoea etc. Barik (2018) measured the indoor air quality by studying adequate and non-adequate ventilations in the houses. Indoor air pollution effects

on health. Particles, dust, smoke, ingredients of haze presence cause serious air quality problems in many areas. To measure the indoor air quality which includes PM 2.5, PM10, TVOC and HCHO are measured through SMILEDRIVE air quality monitoring instrument (Table 4.11 and Table 4.12). PM 2.5 indicates fine particles those found in smoke, haze. Its main sources are cars, truck, woodstoves, dusty roads, construction sites, coal and oil burning etc. PM10 are coarse particles includes all particles less than 10 microns in size generally found near road ways and dusty industrial areas. Total volatile organic compound (TVOC) becomes a gas at room temperature, which is the main origin of ground level air pollution. Formaldehyde (HCHO) is a flammable, colourless reactive and polymerised gas at normal room temperature and pressure. This gas naturally formed in the troposphere and the main man-made source is automotive exhaust from engines not fitted with catalytic converters.

Table 4.11: **Air Quality Ranges of SMILEDRIVE Device**

HCHO Range	PM2.5 Range	Colour Bar	Hazard Level
<0.061	<35	Green	Fresh
<0.100	<75	Light Green	Normal
<0.370	<115	Yellow	Poor
<0.775	<150	Light Orange	Harmful
<1.181	<250	Orange	Serious
≥1.181	≥250	Red	Danger

Table 4.12: Air Pollution Level Recorded by SMILEDRIVE pollution meter.

Slums	PM 2.5µg/mt	TVOC mg/m³	HCHO mg/m³	Air quality
Paltan Bazar	54	1.557	0.355	Yellow-Poor
Santipara HC	40	0.658	0.153	Yellow-Poor
Amaraguri	31	1.341	0.278	Yellow-Poor
Guard Para	17	1.332	0.298	Yellow-Poor
Dhobi Patti	22	1.197	0.268	Yellow-Poor
S. Amolapatti	45	1.847	0.235	Yellow-Poor
B. Dusadpatti	23	1.962	0.297	Yellow-Poor
Sripuria	38	1..423	0.194	Yellow-Poor
Nepali Mandir	37	1.332	0.298	Yellow-Poor
Jorhat HC	35	1.542	0.331	Yellow-Poor
Golaghat HC	52	1.530	0.332	Yellow-Poor

Source: Field survey

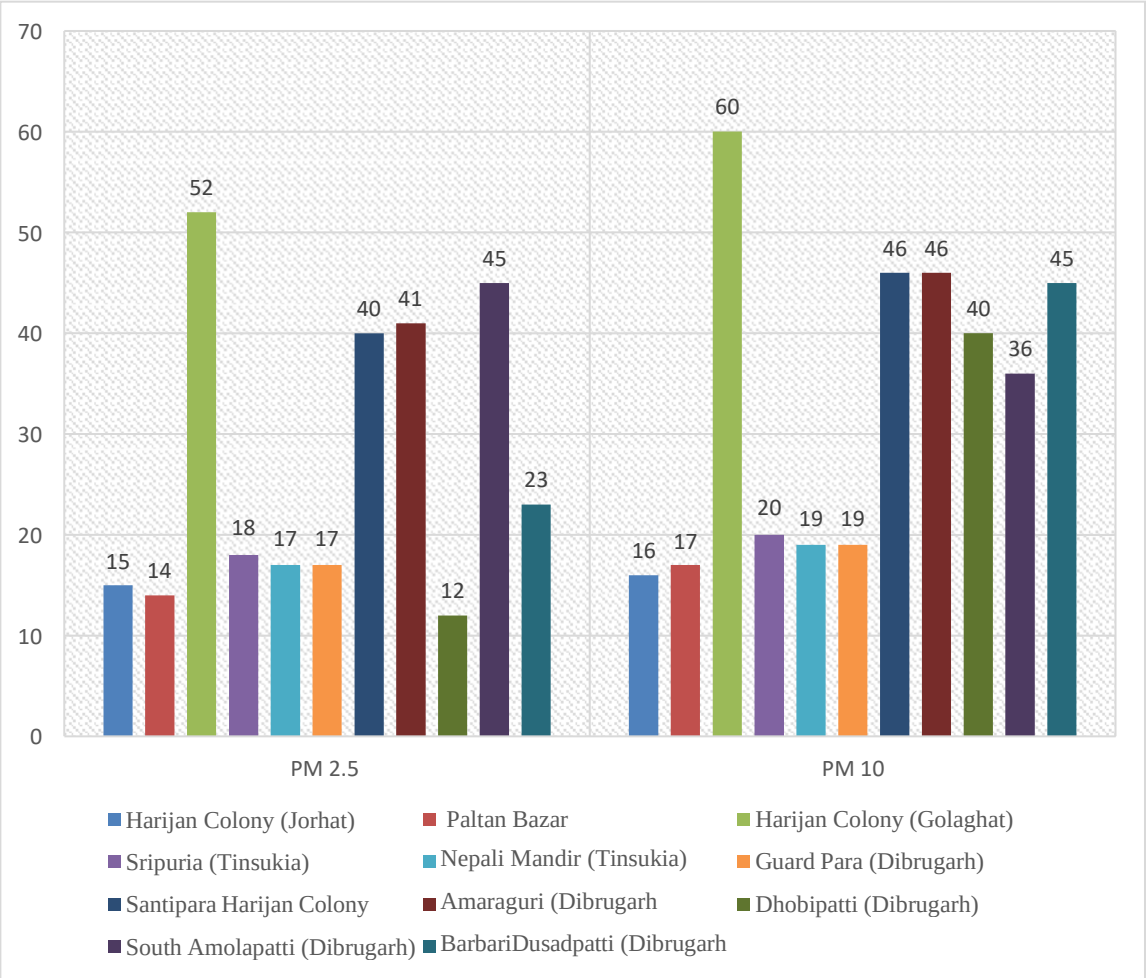


Fig.4.19: PM2.5 and PM10

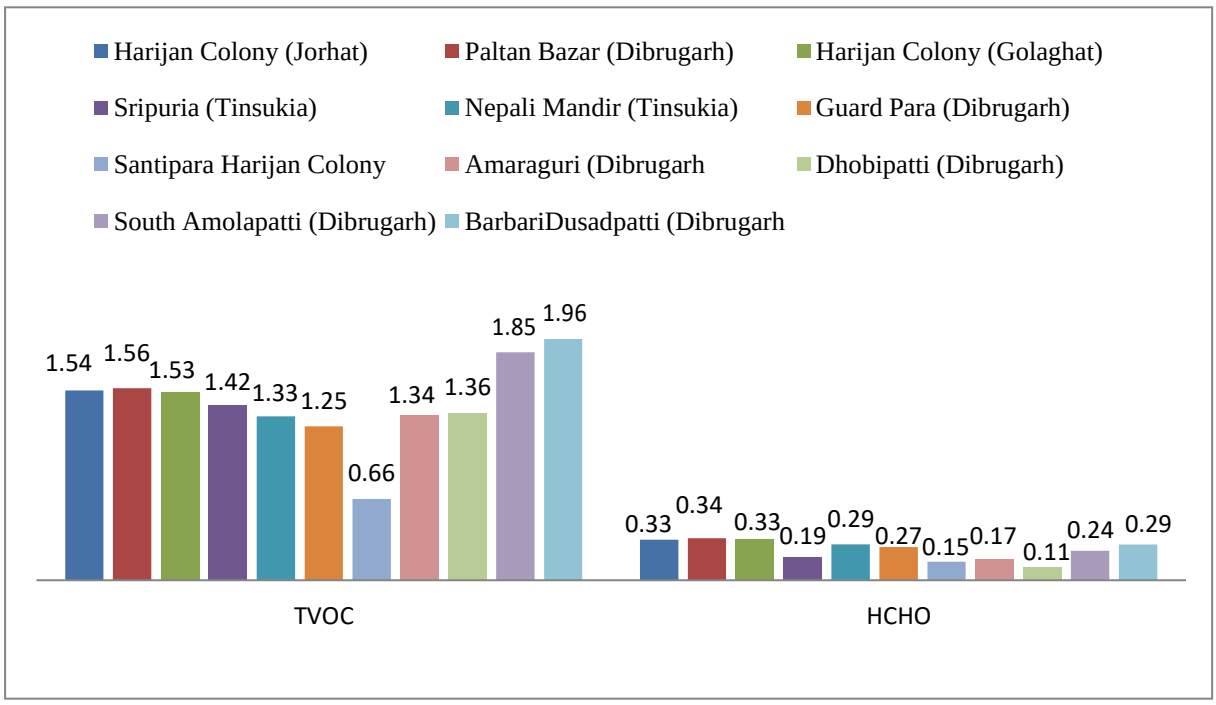


Fig.4.20: TVOC and HCHO

According to the WHO guideline (2021), the recommended levels of PM 2.5 are 15 and PM10 is 45 mg/m³ in air quality. PM 2.5 at or below12 μg/m³ is considered healthy with little to no risk if it goes to or above 35 μg/m³ during 24 hours the air considerably unhealthy and can cause breathing issues such as asthma. Less than 40 PM 10 μg/m³ (averaged over 1 hour) is good air quality and more than 300 range indicate extremely poor air quality. PM 2.5 found the highest in Golaghat Harijan colony area followed by Paltan Bazar slum of Dibrugarh district. TVOC has been recorded the lowest in Paltan Bazar slum and other areas have high concentration. The acceptable range of TVOC is between 0.3 and 0.5 mg/m³. Exposure to high quantities of TVOC human can experience headaches, dizziness, memory loss etc. Similarly, exposure to high concentration of HCHO can cause irritation of eyes, nose and throat, coughing, sneezing etc. sometimes it also leads to death. The overall air quality recorded by the instrument shows that the indoor air quality is poor **(**Fig. 4.19 and Fig.4.20**).** The findings indicate a recurring pattern of poor IAQ in slum dwellings due to room overcrowding and constrained living spaces. A significant number of households, often comprising 4 to 8 family members, share single-room accommodations. Moreover, the majority of these dwellings incorporate the kitchen within the same small room, exacerbating the IAQ concerns. This arrangement leads to heightened exposure to cooking emissions, further deteriorating the air quality. The prevalence of health issues among residents of these slum areas is noteworthy. Common symptoms such as cold, cough, dizziness, headache, and viral fevers are frequently reported. Among low-income households lacking separate kitchens and cross-ventilation, there is a discernible association with respiratory and cardiovascular problems. Furthermore, homes relying on burning practices, such as solid fuels for cooking and heating, exhibit an elevated prevalence of respiratory and cardiovascular conditions. The combustion by products contributes significantly to indoor air pollution, exacerbating the existing health challenges. Many of the households have single rooms with kitchen inside. Another problems face by dwellers are mosquitoes and insect problems for which they are using mosquito coils, old clothes, egg boxes etc. These also impact on the indoor air quality. About 59% households in Jorhat harijan colony utilize burning clothes and egg boxes to combat mosquitoes and rest of the households do not employ any other methods. Similar practices followed by 42% in Rajamaidam new colony, 56% in Golaghat harijan colony, Sripuria 40%, Nepali Mandir 21%, 25% Guard para, 74% in Santipara and Amaraguri, 47% in Dhobi Patti, 42% in South Amolapatti, and 60% in Barbari Dusadpatti (Fig.4.21).

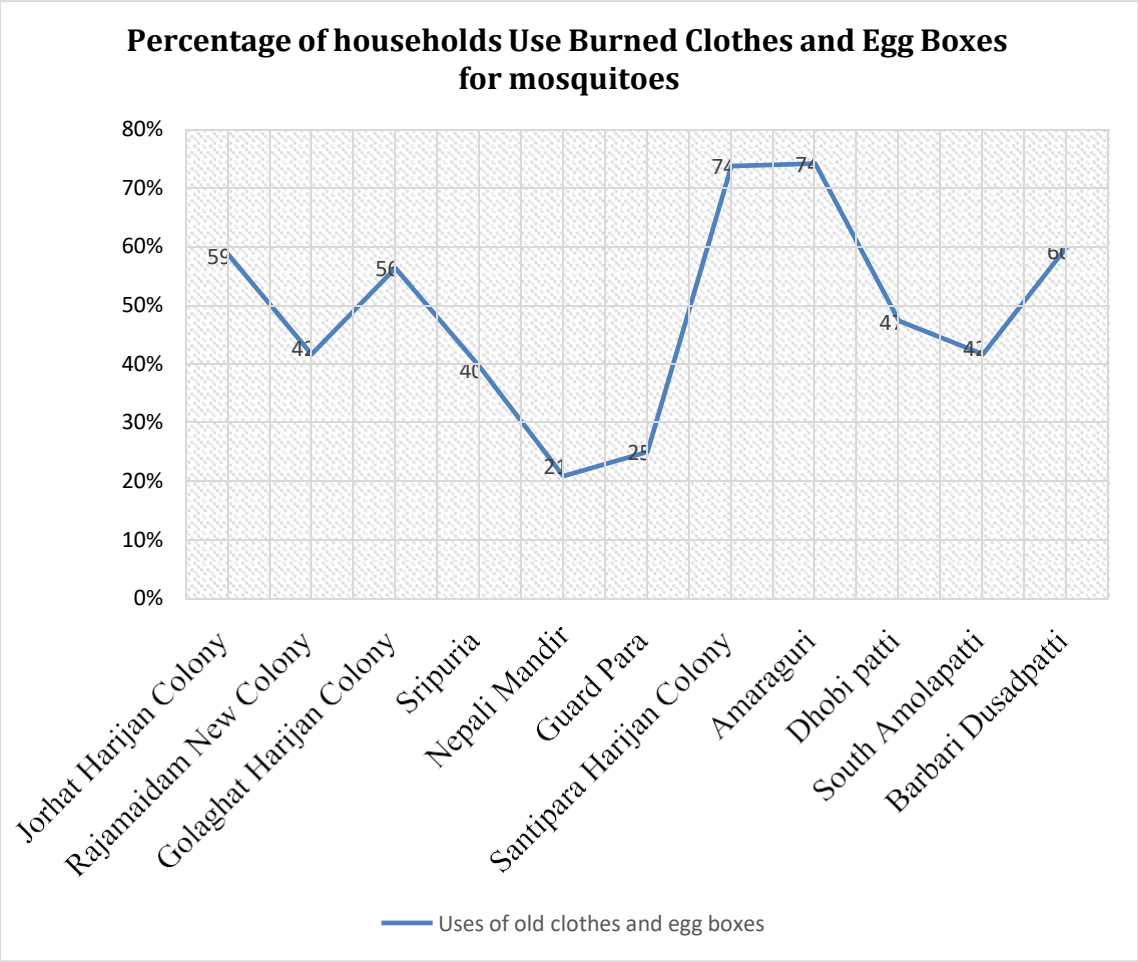


Fig.4.21: Percentage of households Use Burned damped Clothes and Egg Boxes as preventive measures

4.3.3 Health Condition:

Slum dwellers are not aware of communicable diseases, which can spread easily in crowded slum areas. The unhygienic condition of living and unawareness causes diseases breakout and its spreading. Gil et al. (2004), mentioned that a higher risk of diarrheal diseases is associated with open defecation or no removal of human faeces from household area, which he termed as 'risky disposal' and lower risk of diarrheal diseases are associated with "safe" disposal, which means appropriate sanitation facilities. The people of slums are generally not aware of several diseases such as AIDS**.** Zaman (2013) has been discussed about the health awareness among women of Dibrugarh slums and found that a large number of people are lack of basic knowledge about HIV/AIDS etc. Acute diarrhoea causes life-threatening dehydration, while chronic diarrhoea can compromise growth and development by preventing the absorption of nutrients. Chronic diarrhoea can also increase susceptibility to future illness (Buttenheim, 2008). Health condition of slum dwellers is not in an admirable

state. During common fever, cold and cough the dwellers never visited doctors. They only go to the hospitals, when their health condition is reached extreme bad level. Some respondents even do not know about the cause of death of their family members. People generally visited '*Bej*' who gave local herbal medicines at low price. Cold, cough, fever, jaundice, diarrhea, gastric problems, skin rashes are common diseases in the slums. They never visited doctors, when they suffered from these fatal diseases. In Santipara slum, 15 to 20 families approximately 30-35 persons use one tube well and one latrine without roof. Due to the lack of garbage disposal site, the dwellers dump all garbage near the latrine and tube well and threw to the drains, simultaneously they also have to use the place for washing clothes, utensils and for bath **(**Fig 4.22). This unhygienic condition impacts on their health.

Fig 4.22: Unhygienic Sanitary Condition, Santipara Slum

Similarly, the dwellers of Sripuria, Nepali Mandir, Amaraguri, Barbari Dusadpatti and Jorhat Harijan Colony slum areas, washes their cloths and daily useable utensils in unhygienic places. This condition is better in Golaghat Harijan Colony. The number of deaths in the family has been collected during the research. This research highlights a concerning situation in various slums in Upper Assam, in terms of responses on diseases and deaths. Some key observations found that in Golaghat Harijan Colony, Jorhat Harijan Colony, Paltan Bazar, Santipara, Guardpara, and Dhobi Patti slums have reported a relatively high number of deaths in the last 10 years. Responses received on death were: in Golaghat Harijan Colony slum, total 13 deaths, 12 deaths in Jorhat Harijan Colony, Sripuria 7 deaths, Nepali Mandir 8, Santipara 14, Guardpara 13, Dhobi Patti 10, Paltan Bazar 20, South Amolapatti 5, Dusadpatti

6, Amaraguri 9 deaths in last 10 years. According to the respondents, the cancer patients died without treatments. Diarrhea is common in the surveyed slum but no diarrheal deaths were found in the slums. Other causes of deaths were found high fever, Jaundice, kidney failure, accidents. Some were died due to old age problems, which can be termed as natural deaths. The primary causes of death are identified as liver diseases, cancer, asthma, and tuberculosis. Liver diseases are the most common cause of death across all the slums surveyed. These could be attributed to potential factors such as alcohol consumption, improper diet, and unhygienic food.

4.4.7 Soil Quality of Waste Disposal Sites:

Waste has not been separated. Plastic water bottles and bags are only occasionally reused before being discarded. At slum waste disposal sites, the soil's pH, was analysed to check the soil quality. The pH of the soil samples ranges from 4.2 to 5.0 as per IS:2720 (Part 26)/1987 indicating that the study areas' soils are either strongly or extremely strongly acidic (Table 4.13**).** This signifies that the soil is overly rich in soluble forms of aluminium, iron, and manganese. Moreover, it could have hazardous levels of zinc and copper.

Table 4.13: pH ranges of soil as per IS:2720 (Part 26)/1987

Soil pH Ranges	Denomination
< 4.5	Extremely acid
4.5 – 5.0	Very strongly acid
5.1 – 5.5	Strongly acid
5.6 – 6.0	Moderately acid
6.1 – 6.5	Slightly acid
6.6 – 7.3	Neutral
7.4 – 7.8	Slightly alkaline
7.9 – 8.4	Moderately Alkaline
8.5 – 9.0	Strongly Alkaline
> 9.1	Very strongly Alkaline

Table 4.14: Soil pH of Garbage Disposal sites in the study areas (IS:2720(Part 26)/1987)

Sl. No.	Slums	Soil pH of Garbage disposal sites
1	Paltan Bazar	4.96
2	Santipara Harijan Colony	4.23
3	Amaraguri	4.46
4	Guard Para	4.86
5	Dhobi Patti	5.06
6	South Amolapatti	4.76
7	Barbari Dusadpatti	4.73
8	Sripuria	5.02
9	Nepali Mandir	5.82
10	Jorhat Harijan Colony	4.29
11	Golaghat Harijan Colony	4.39

Source: Field study and lab test

The acidic pH could be attributed to the presence of metal scrape, waste materials in the dump sites and other human activities taking place around the dump sites (Srivastava, 2012). The pH level of soils of waste disposal sites found in Paltan Bazar 4.96, Amaraguri 4.46, Santipara 4.23, Guardpara 4.86, Dhobi Patti 5.06, South Amolapatti 4.76, Barbari Dusadpatti 4.73, Sripuria 5.02, Nepali Mandir 5.82, Jorhat Harijan Colony 4.29 and Golaghat Harijan Colony 4.39, respectively (Table 4.14). In Santipara slum there is no specific place to damp wastes. They damped waste near the latrines and drains.

4.4.8 Other Environmental Problems

In 2013, a report published by Ministry of Statistics and Programme Implementation, Government of India, estimated that 32% of all slums, the approach road to the slum usually remained waterlogged due to rainfall. Out of this figure 35% was found in notified slums and 29% in non-notified slums. Assam is highly a flood prone state in India, where water logging is common problem in every city and town. The riverine slums, the Guardpara, Amaraguri and Dhobi Patti slum are highly prone to flood in Dibrugarh.

4.5 Comparative Analysis by using Composite Score

The composite score method is used to determine and compare the socio-economic development of different areas. Although the socio-economic characteristics are generally poor but it is varying from place to place. The z score has been analysed by using three parameters sex ratio, unemployment rate and Literacy rate. The result shows that Dhobi Patti,

Barbari Dusadpatti, Sripuria, Nepali Mandir and Jorhat harijan colony has higher score which indicates that these slum areas are more lacking behind the rest of other slums including Santipara, Amaraguri, Guardpara, South Amolapatti and Golaghat Harijan Colony (Table 4.15).

Table 4.15: Composite Score

Slums	Sex Ratio	R1	Unemployed (%)	R2	Literacy (%)	R3	Shack Houses (%)	R4	Composite Score
1	2	3	4	5	6	7	8	9	10
Paltan Bazar	823.07	6	31.65	5	75.95	10	3	2	23
Santipara	931.5	2	41.84	11	85	1	6	3	17
Amaraguri	789.47	7	33.33	7	83.33	2	14	8	24
Guardpara	1400	1	39.58	10	81.25	4	17	9	24
Dhobi Patti	900	3	34.21	8	78.95	8	11	5	24
S. Amolapatti	600	10	29.17	4	83	3	8	4	21
B. Dusadpatti	428.57	11	10	1	80	6	20	11	29
Sripuria	727.27	9	22.36	3	76.32	9	13	7	28
Nepali Mandir	888.8	5	32.33	6	79.41	7	18	10	28
Jorhat HC	758.62	8	35.29	9	68.62	11	12	6	34
Golaghat HC	894.73	4	11.11	2	80.55	5	0	1	12

NB: Composite Score=Summation of individual ranks of different indicators (higher the score, lower the development and vice versa.

4.6 Chapter Conclusion

In this research, the consequences of slum settlements are explored, focusing on both their positive and negative effects on surrounding urban settlements. The study primarily emphasises the various aspects of slum settlements. The study identifies several environmental problems faced by informal settlers, including overcrowding, waste pollution, and noise pollution. Notably, improper waste disposal is a major concern, affecting

respondents. This work also highlighted drainage congestion due to waste disposal issues. This research paper illustrates the multifaceted impact of slum settlements on their surrounding environment and the broader community. It draws attention to issues with the environment and amenities while highlighting the contribution of slum residents to various services. It also clarifies the multiple viewpoints authorities hold on the existence of informal settlements. This work discusses slum dwellers' opinions on how slum settlements affect commercial activities in the study area. This suggests that slum settlements have a discernible impact on the local economy. The assessment of utility services in the study area indicates that slum dwellers provide services to other urban settlements at a low cost, which indicates that slum dwellers have a significant role in meeting the labour needs of the formal settlements. Slum dwellers offer various services to other formal settlers, including household labour, low-cost labour for industries, and general labour. Additionally, some formal settlers are benefitted from land-related income through house rent. Some slums are situated on private lands in rent houses.

CHAPTER 5
FINDINGS AND STRATEGIES FOR SLUM IMPROVEMENTS

5.1 Discussions of the Findings:

Slum areas are generally characterized by poor living conditions, inadequate infrastructure, limited access to essential services and unhygienic environment. The findings of this work presented the state of slum environment in selected districts of Upper Assam region of North east India. The discussions of this research shed light on several critical issues faced by slum population, such as the absence of demographic characteristics, adequate sanitation, income and educational status, housing facilities including house types and accessories, garbage output and management practices, drainage facilities, drinking water quality, indoor air quality, soil pH of wate disposal sites of the slum areas, recreational facilities in the slums etc. Thus, this study explores the living conditions and their surrounding environmental condition as discussed below:

5.1.1 High Population Density:

Population density refers the ratio between total population and the total area of a country, state district villages or a particular place. Which helps us to understand the region's overcrowding population pressure on that area or region. population density in slum areas is generally very high. The population density in world's 4 largest slums, Orangi (Pakistan), Dharavi (India), Khayelitsha in cape town (South Africa) and Kibera in Nairobi (Kenya) are 42,105, 418,410.04, 10,333.25 and 105,042.01 persons per square kilometre, respectively. Population density was found very high in the surveyed slum areas. In Paltan Bazar 17,358.97, Santipara Harijan Colony 25,886.36, Amaraguri 25,920.63, Guardpara 17,926.83, Dhobi Patti 20,964.29, South Amolapatti 9,179.49, Barbari Dusadpatti 4,387.50, Sripuria and west Sripuria 8,265.00, Nepali Mandir 2,220, Jorhat Harijan Colony 75,000 and Golaghat Harijan Colony 72,033.9 persons per square km. The high density indicates that the slums areas are overcrowded and they have limited space that resulted to inadequate housing and unhygienic environment. Overcrowding living condition increases mental stress, crime rates and most importantly spreading of diseases. During the Covid 19 pandemic, it was nearly impossible to make social distances in slum areas. Therefore, it can be state that slum population is highly vulnerable to epidemics or pandemics and any other communicable diseases. Overcrowding also leads to increase of air, water, soil pollution and noise pollution

at any place. Slums in Dibrugarh is located near the Brahmaputra River bank and the main drain of the town.

5.1.2 Informal Occupation and Low Income:

The data from various slums presents a comprehensive picture of the employment landscape, offering insights into the socio-economic conditions within these communities. The following analysis highlights key patterns and trends observed in the surveyed slums, serving as a valuable resource for understanding urban poverty and labour dynamics. In the Paltan bazar slum, 32% population were unemployed, 8% have Government jobs, 14% have small business and 46% work as daily wage labourers. In the Santipara slum, 42% were unemployed, 1 % engaged in government job sector, 9% have small businesses and 48% were daily wage labourers. In Amaraguri slum found 33% unemployed, 4% government job, 8% small business and daily wage labourers were 55%. In Guradpara slum, 40% were unemployed, 4% have government job, 21% have small business and 35% found daily wage labourers. The Dhobi Patti slum has 34% unemployed, 5% government job, 8% small business and 53% in daily wage labourers' category. In South Amolapatti slum, unemployment found 29%, 25% have small business, 46% work as daily wage labourers and no government job employee has been found in this slum. In Barbari Dusadpatti slum, 10% unemployed, 25% in small business, 65% as daily wage labourers have been found and no government employee has been found in this slum also. In Sripuria slum, 22% were unemployed, 14% in small business, 63% were daily wage labourers with no government employee. In Nepali Mandir slum, unemployment found 32%, 29% have small business and 38% engaged as daily wage labourers and no resident engaged as government employee in this slum also. In Jorhat Harijan Colony slum, 35% were unemployed, 8% engaged as government services, 14% have small business and 43% were daily wage labourers. In Golaghat Harijan Colony, 11% were unemployed, 25% have government jobs, 22% have small business and 42% daily wage labourers were found. The total unemployed found 32%, government job sector 5%, small business 14% and daily wage labourers 49% out of the total surveyed slums. Overall, the total surveyed slums found 32% unemployed population, 5% have employment in the government sector, 14% in small businesses, and 49% work as daily wage labourers. The findings of these data highlighted the occupational pattern in the slum areas. The employment in government services is the lowest in the slums. The population who has government jobs are not high-class job. They were engaged as sweeper, cleaner and other fourth grade employee at government hospitals and other offices. Only in Golaghat Harijan Colony a very few people engaged in third grade government jobs. Most of the

dwellers are engaged as sweeper and cleaner at different government offices. The daily wage labour category includes manual scavengers, loading and unloading of goods in industries, cleaner at hotels, Pedi cab drivers, garage mechanic, Garbage collector and house maid. Small business among the slum dwellers found mainly street vendors, middleman vegetable seller, Jewellery seller. They sales food items on bicycles or mobile stalls. It comes under informal activities. These activities and their income are not fixed. The income level of slum dwellers' is generally low. In this research, their income level categorised into four classes, which were Very Low (below Rs.3000/ month), Low (Rs.3000 -Rs.5000/ month), Medium: (Rs.5000 - Rs.10,000/ month) and High (More than Rs.10,000/ month). The high income and medium income groups are the government job holders. The Santipara slum has the highest percentage of low-income category followed by Nepali mandir, Paltan bazar, Barbari Dusad Patti, Dhobi Patti, Amaraguri, Sripuria, Guard Para, Jorhat harijan colony and Golaghat Harijan colony. On contrast, Golaghat harijan colony has the highest percentage of high-income category, which is 17% followed by Guardpara (15%), Jorhat (14%), South Amolapatti (8%), Amaraguri (6%), Nepali Mandir (6%), Dhobi Patti (5%), Barbari Dusadpatti (5%), Paltan Bazar (5%), Sripuria (3%) and Santipara slum (2%). The highest percentage of daily wage labour rate followed by unemployment category indicates that there are potential disparities in access to employment opportunities which could be poverty, deprivation of education, malnutrition etc. Further research and targeted planning policy are required to address the socio-economic challenges and to promote sustainable development of these areas.

5.1.3 Poor Education Level:

The number of school dropout and illiterate population found high in the slums. In the surveyed slums, a diverse educational landscape has been observed. In the Paltan Bazar slum, the population distribution by education level reveals that 24% are illiterate, 49% are school dropouts, 10% have completed primary education, 16% have reached secondary level and only 2% have attained a graduate level of education. Similarly, in the Santipara slum, 15% of the population are illiterate, 65% are school dropouts, 18% have completed primary education and only 1% have reached the secondary level. Surprisingly, no individuals with a graduate or higher education level were found in this slum. In the Amaraguri slum, the educational distribution consists of 17% illiterates, 55% school dropouts, 18% with primary education, 11% with secondary education and 6% are graduated. No individuals with education beyond the graduate level were identified in this slum. In Guradpara slum, 19% are illiterates, school dropouts 56%, primary level 10% and 8% are in the secondary level.

Notably, there are no individuals with a graduate or higher level of education in this slum. The Dhobi Patti slum exhibits an educational breakdown with 21% illiterate individuals, 58% school dropouts, 16% with primary education and 5% at the secondary level. No individuals with a graduate or higher education level were found in this slum also. In the South Amolapatti slum, 17% are illiterates, 46% are school dropouts, 17% have completed primary education, 13% have reached the secondary level, and 8% have attained a graduate level of education. No individuals with education beyond the graduate level were identified in this slum. Moving on to the Barbari Dusadpatti slum, the educational distribution includes 20% illiterate individuals, 70% school dropouts, and 10% with primary education. However, no individuals with secondary or higher education were found in this slum. In the Sripuria slum, 24% of the population is illiterate, 62% are school dropouts, and 14% have reached the secondary level. No individuals with a higher level of education were identified in this slum. The Nepali Mandir slum comprises 21% illiterates, 56% school dropouts, 14% with primary education, and 12% with secondary education. No individuals with education beyond the secondary level were found in this slum. In the Jorhat Harijan Colony slum, a higher proportion of 31% are illiterate, 49% are school dropouts, 8% have completed primary education, 8% have reached the secondary level, and 4% have graduated. However, no individuals with education beyond the graduate level were identified in this slum. Finally, the Golaghat Harijan Colony displays an educational distribution with 19% illiterate individuals, 28% with primary education, 22% with secondary education, and 14% with a graduate level of education. No individuals with education beyond the graduate level were found in this slum. There was total school dropout 54.28%, illiterate 20.82%, 13.76% Primary, 9.17% secondary level and 1.98% Graduate level found in these slums. The problems of high number of school dropouts, illiteracy and absence of higher education level are complex challenges resulting from a combination of social, economic and educational factors. Even if the national policy of education says about compulsory education to all children, the slum dwellers are not aware and many children start to work at an early age to support family and their focus diverted from education. Due to financial problem struggling with poverty, slum dwellers often face difficulties to afford basic necessities like school uniform, books transportation, school fees etc. No Schools were found within the slum areas but schools are located between 1 to 5 km distances. Hindi medium schools are located near Harijan Colony areas because these people mainly speak Hindi. Lack of proper space within the slums, temporary settlement on government land, missing of certificates or documents, poor health

issues, malnutrition, early marriages, unawareness and illiteracy of parents etc. are some other factors that impact on their education.

5.1.4 Poor Housing Condition:

In the surveyed slums, a poor housing condition has been observed. The house types are classified as shacks, which are made from plastic sheets or any material, Kutcha houses types includes those houses which have kutcha bamboo or walls, doors and windows and floors are kutcha and roof made from tins. Semi pucca houses includes the houses with bamboo or wood walls with pucca floors or the houses have half pucca walls with bamboo walls. The pucca houses include all the houses where floors, walls all made up of bricks and cement. In the Paltan Bazar slum, 8% are shacks, 43% are kutcha, 36% are semi pucca, 17% have pucca houses. In the Santipara slum, 6% houses are shacks, 46% are kutcha, 35% have semi pucca and 18% have pucca houses. In the Amaraguri slum, the shacks consist of 17%, 49% have kutcha, 30% with semi pucca and 7% with pucca houses. In Guradpara slum, 17% are shacks, 46% Kutcha, Semi pucca 23% and 15% have pucca houses. The Dhobi Patti slum, 11% are shacks, 58% kutcha, 18% with semi pucca and 13% have pucca houses. In the South Amolapatti slum, 8% are shacks, 29% are kutcha, 33% have semi pucca, 29% have pucca houses. Similarly, in the Barbari Dusadpatti slum, the shacks include 20%, 25% kutcha, and 35% are semi pucca and 20% have pucca houses. In the Sripuria slum, 13% of the households is shacks, 29% kutcha, 51% semi pucca and 7% pucca houses were identified in the slum. The Nepali Mandir slum comprises 18% shacks, 35% kutcha, 29% semi pucca, and 18% with pucca houses. In the Jorhat Harijan Colony slum, a proportion of 12% are shacks, 29% are kutcha, 45% have semi pucca houses and 14% have pucca houses. The Golaghat Harijan Colony displays with 28% kutcha, 31% Semi pucca and 42% pucca houses. Inverter connection only found in Golaghat Harijan Colony and rest of the slum areas do not have inverter connections. In the Santipara slum area dwellers have electricity connection on rent. They have to pay Rs.400-500 per month. Generally, in this area houses have 1-3 rooms and used one to two blubs.

5.1.5 Shortage of Toilets:

The shortage of proper sanitation facilities like latrines poses a significant challenge to maintaining hygiene and preventing waterborne diseases. Open defecation due to a lack of latrines contaminates water sources and contributes to the spread of diseases, necessitating the implementation of sanitation solutions. The shortage of latrines is a common problem in slum areas. The findings show a significant and widespread shortage of toilets in the study area highlighted on this issue that profoundly affects the living condition of slum residents.

The toilet types were classified as private kutcha, private pucca, communal kutcha and communal pucca. The kutcha toilets are made from plastic sheets or any material, kutcha bamboo walls. Some of these have roofs made from tins and most of these types of toilets are without roofs. The diverse distribution of toilet types has been observed in the slums. In the Paltan Bazar slum, 9% households have private kutcha toilets, 11% have private pucca toilets, 41% uses communal kutcha and 39% households uses communal pucca toilets. In the Santipara slum, private pucca uses by 4% houses, communal kutcha by 28% and 68% uses communal pucca toilets. No private kutcha toilets were found among the surveyed households in this slum, which indicates a potential lack of basic facilities, lack of income and lack of space. In the Amaraguri slum, the private kutcha toilets used by 19%, 7% have private pucca toilets, 25% households use communal kutcha and 50% uses communal pucca toilets. Many of these toilets are constructed on the bank of the Brahmaputra River and directly linked to the river, which can cause river water pollution. In Guradpara slum, 23% have private kutcha, 48% have private pucca toilets, communal kutcha uses by 21% and 8% households uses communal pucca. The Dhobi Patti slum, 13% have private kutcha, 18% have private pucca, 21% uses communal kutcha and 47% uses communal pucca toilets. In the South Amolapatti slum, 17% have private kutcha, 21% have private pucca, 13% uses communal kutcha, 50% uses communal pucca toilets. Similarly, in the Barbari Dusadpatti slum, 20% household with private pucca toilets, 10% uses communal kutcha and 70% uses communal pucca. No households with private kutcha toilets have been found in this slum. In the Sripuria slum, 31% of the household have private kutcha toilets, 12% have private pucca toilets, 45% uses communal kutcha and 12% uses communal pucca toilets in this slum. The Nepali Mandir slum, 12% houses have private kutcha, 24% private pucca, 21% uses communal kutcha and 44% uses communal pucca toilets. In the Jorhat Harijan Colony slum, 12% have private kutcha, 24% have private pucca, 20% uses communal kutcha and 45% communal pucca toilets. The Golaghat Harijan Colony displays with 81% private pucca toilets and 19% uses communal pucca toilets. Overall, 12% uses private kutcha toilets, 13% uses private pucca toilets, 30% uses communal kutcha toilets and 42% uses communal pucca among the total households in surveyed slums. The findings regarding the shortage of toilets in the surveyed slum areas reveal a concerning and prevalent issue that impacts the living conditions and hygiene of the residents. The study area, including Paltan Bazar, Santipara, Amaraguri, Guradpara, Dhobi Patti, South Amolapatti, Barbari Dusadpatti, Sripuria, Nepali Mandir, Jorhat Harijan Colony, and Golaghat Harijan Colony, presents a varied distribution of toilet types and their utilization among households. The communal kutcha or pucca toilets

are in a very poor condition, which have not been repaired since it built. Except Golaghat harijan colony slum no slums have water tap connection in their toilets. In Golaghat harijan colony some houses have flash toilets. The toilets are very unhygienic in condition and the women and girls have to bath in open due to shortage of bathrooms.

5.1.6 Inappropriate Waste Disposal System:

The absence of a proper waste management system results in the accumulation of garbage and waste in slum areas. Improper disposal of waste pollutes the environment, contaminates water sources and poses health risks. This issue demands effective waste collection, segregation, and disposal strategies to mitigate the negative impacts on both residents and the ecosystem. The majority of households (43%) generate 1 to 2 kg of garbage per day, 24% of households produce below 1 kg daily and the percentages decreases as the waste output amount increases with only 1 % households generating above 5 kg of waste per day. Its noteworthy that these responses are based on estimates because residents do not measure their household garbage output per day but rely on their daily food habits and activities to estimate the garbage output per day. A significant concern arises from the fact of waste segregation, 73% of households do not practice waste separation. They disposed garbage without distinguishing between degradable and non-degradable waste. This indicates a lack of awareness and improper waste management system. The two primary method of waste disposal are throwing and burning. Only the residents of Golaghat harijan colony demonstrates a more approachable way by using dustbins arranged by Municipality for waste disposal and also practices waste separation. In contrast to this, residents of other surveyed slums dispose garbage in any available empty places both within and outside the slum. The slum dwellers of Amaraguri, Guardpara and Dhobi Patti slum throw or dump garbage near the Dibrugarh Town Protection (DTP) dyke of the Brahmaputra River and sometimes burn at any place within the slum area. The residents of Jorhat harijan colony dumped all garbage on the bank of a small stream named ‘Tocklai’, which is now become a drain rather than a stream. In the Santipara slum, residents threw households garbage into the open drains, which creates water logging and spreading of bad smell in the area. These practices of waste disposal raise environmental concerns and underscores the need for proper waste management infrastructure.

5.1.7 Absence of adequate Road Network and Drainage Facilities:

One of the primary challenges in slum areas is the lack of proper road networks and drainage facilities. Inadequate roads hinder transportation, emergency response, and economic activities. This lack of infrastructure can isolate communities and limit access to

essential services like healthcare, education, and employment opportunities**.** Poor drainage facilities contribute to waterlogging during rainy seasons, leading to unsanitary conditions and health hazards. Stagnant water becomes a breeding ground for diseases like malaria and dengue. The absence of efficient drainage systems amplifies the vulnerability of slum residents to environmental and health risks. The slums are densely populated unplanned settlement growing in the neglected areas of a city or town. Therefore, construction of roads inside the slums are complex. The roads inside the slums are very narrow and no space for drainage construction. It creates more problems during emergency like fire incidents. In 2020, a massive fire broke out in Jorhat Harijan Colony and 35 houses were burnt down (India Today newspaper, 22 Nov, 2020). Slums are vulnerable areas to different types of incidents and transportation in slums is necessary. In the Guard Para, Jorhat Harijan colony, Golaghat Harijan Colony, Santipara slum, Guard para, Barbari Dusadpatti slums; the main roads are metaled but inside the slums, roads are not metaled. The condition of road at Sirpuria Slum in Tinsukia district is very poor in condition, which is a kutcha narrow road. Because this slum is located on the government land, near railway track and the residents do not have property rights. Non maintenance of proper drainage and sewage systems have created many social and environmental issues. Water logging and overflow of drain water with waste. In the surveyed slums, the Santipara slum have one open drain inside the slum with full of waste and houses are located on the drain side. As mentioned previously during rainy season, drain water with garbage enter into their houses. Bad smell is common in this slum. Mosquito flies or insects' problem is also common in the slum areas. To get rid of mosquitoes, people burn old cloths, egg boxes or corrugated/cardboard boxes and cheap mosquito incense sticks (mosquito *agarbatti*). In the Golaghat harijan colony the drains are clean

5.1.8 Shortage of Drinking water facilities:

Tube well is the main source of drinking water in the slums. Only Jorhat Harijan colony and Golaghat Harijan colony have public tap water supply. One tube well is a source of 10 to 15 households in Santipara Harijan Colony. Same situation has been seen in Paltan Bazar, Sripuria, Nepali Mandir, South Amolapatti and Barbari Dusadpatti slum. In the Amaraguri and Guardpara slum, people use river water also.

5.1.9 Poor Indoor Air Quality:

Living conditions in slum areas often involve overcrowded and poorly ventilated spaces. This can lead to poor indoor air quality, as pollutants become trapped indoors. The close proximity of households and the use of solid fuels for cooking contribute to indoor air

pollution. Addressing these issues requires improving ventilation and transitioning to cleaner cooking technologies. Poor indoor air quality contributes to respiratory illnesses such as chronic obstructive pulmonary disease (COPD), pneumonia and bronchitis. Vulnerable populations, including children and the elderly, are at greater risk. Reducing indoor air pollution by promoting cleaner cooking methods and enhancing ventilation can significantly improve respiratory health in slum areas. Biomass burning often used for cooking and heating in slum areas, releases particulate matter and pollutants into the air. These pollutants can have detrimental effects on respiratory health and contribute to outdoor and indoor air pollution. Encouraging the adoption of cleaner and more efficient cooking technologies, such as clean cook stoves, can mitigate the impact of biomass burning on air quality and health. The rooms are very small in size. Number of rooms generally in slums are low compared to their family size. Most of the houses have only 1-2 rooms including kitchen shared by 3 to 6 persons/rooms.

5.1.10 Acidic Soil Quality:

The soil samples were collected from garbage dumping sites to test soil quality. The pH level has been tested and found that the pH ranges between 4.23 to 5.5 in the slums. According to IS:2720 (Part 26)/1987**,** below 4.5 pH range of soil is extremely acidic and between 4.5 to 5.5 very strongly acidic to strongly acidic. Thus, the soils of the garbage dumping sites of the surveyed slums were found from extremely acidic to strongly acidic type. The acidic pH of soil may due to the presence of metal scrapes, waste materials and other human activities near dumpsites (Srivastava and Singh, 2012; Odhiambo et al., 2015).

5.1.11 Poor Health Condition:

Limited access to healthcare facilities exacerbates health disparities in slum areas. The absence of nearby clinics or hospitals forces residents to travel long distances for medical attention, leading to delayed treatments and poorer health outcomes. Addressing this issue requires the establishment of accessible and affordable healthcare services. Lack of basic amenities such as no medical facilities or dispensary within the slums. The nearest Government dispensary available between 2 to 9 km distances. The distances of government medical hospitals from slums are: Paltan Bazar 2 km, Shantipara 5.4 km, Amaraguri 5.5 km, Guard Para 5.6 km, South Amolapatti 6.1 km, Barbari Dusadpatti 3.5 km, Sripuria 9.3 km, Nepali Mandir 9.2 km, Jorhat Harijan Colony 5.4 km and Golaghat Harijan Colony 5.3 kms away. The government medical hospitals are not very far away from the slums. However, slum residents generally not visited during fever, cough, diarrhoea, any pain etc., they only visit hospitals at extreme condition only. They never visit private hospital because of the high

cost. The residents prefer to visit local herbal doctors (Bej/tantric) during illness. Unhygienic places are used for cleaning utensils, bathing and washing clothes. The women are not aware of sexual diseases like HIV/AIDS.

5.1.12 Other Problems:

Paltan Bazar, Santipara, and Dhobi Patti slums report relatively higher percentages of issues related to gambling and alcohol consumption. There is significant variation in crime rates across different slums, suggesting that the socio-economic and environmental factors of each slum may contribute to the prevalence of different types of crimes. The high prevalence of these crimes may reflect broader socio-economic challenges within these slum communities, including poverty, lack of education, and limited access to resources. These findings underscore the need for targeted interventions and policies addressing the root causes of crime in each slum, taking into account the specific challenges faced by the residents. Efforts should focus on improving living conditions, education, and access to social services to address the underlying issues contributing to crime. Addressing these complex issues of crime in slums requires a multifaceted approach that considers the unique circumstances of each community while addressing broader socio-economic factors.

Slum population facing different problems every day. The Absence of Recreational Facilities is one of the most neglected issues in slum areas. The lack of recreational spaces in slum areas affects the physical and mental well-being of residents. Recreation plays a crucial role in reducing stress and promoting a healthy lifestyle. Creating safe and engaging recreational spaces can contribute to a better quality of life for slum dwellers. But no any recreational facilities within the slum areas have been seen due to lack of space and impropriate planning policies. Only one community hall along with a Mandir have been seen in Golaghat Harijan colony, Jorhat Harijan Colony and Nepali Mandir slum. There are also many social problems like crime issues, which are prevalent within the slums and such problems often spread beyond the slums to other parts of the city/society. Slum residents reported on theft, intake of drugs and alcohol, gambling and domestic violences. Residents do not have the emergency numbers of fire brigade offices, police stations numbers.

5.2 Strategies for Slum Improvement

The slum improvement can be possible by studying the volume of their problems by successful implication of available resources and capabilities (Rankey,2018; Ragheb et al., 2021). There are several important strategies and policies for the developmental planning of slum areas, particularly in India. Some of the government policies are Jawaharlal Nehru National Urban Renewal Mission (JNNURM), Rajib Awas Yojna (RAY). A report published

by Ministry of Statistics and Programme Implementation, Government of India in 2013, stated that at the all-India level 24% of slums benefited from welfare schemes such as JNNURM, RAY and any other scheme run by the Central Government or State Government or any local body. The proportion benefiting from such schemes was 32% among notified and 18% among non-notified slums according to this report. RAY now transform to Pradhan Mantri Awas Yojana Urban (PMAY-U). This program emphasizes "Housing for All" and includes an In-Situ Slum Redevelopment component. It aims to upgrade existing slums by providing better housing and infrastructure while keeping residents in the same location. This approach reduces displacement and maintains social networks. Slum Free City Plan of Action (SFCPoA) is another comprehensive plan consists of two parts: curative and preventive strategies. The curative strategy involves improving or redeveloping existing slums, aiming to enhance living conditions and infrastructure. The preventive strategy focuses on estimating affordable housing needs for the urban poor and revising urban policies to ensure adequate housing provisions. Integrated Housing and Slum Development Programme (IHSDP) for slum development program aims to improve the living conditions of slum dwellers by providing them with basic amenities, housing, and social infrastructure. The program focuses on slum upgrading, including housing improvements and better access to services. Another important plan for development of these areas is Urban Infrastructure Development of Small and Medium Towns (UIDSSMT)**,** this program focuses on enhancing urban infrastructure in small and medium towns. Improved infrastructure benefits slum areas as well, contributing to overall urban development. In addition to these government initiatives, the measures listed below can be used to develop slum areas:

5.2.1 Identification of Vulnerable Slums and Fake Urban Poor Areas

Accurate identification of slums and vulnerable areas is crucial for targeted interventions. This involves mapping and assessing the conditions of informal settlements to prioritize assistance where it's most needed. Additionally, identifying fake claims can ensure that resources are directed to genuine urban poor areas**.**

5.2.2 Study of Slum Topology

Understanding the layout, structure, and spatial organization of slum areas (slum topology) is crucial for effective planning. This includes analysing the arrangement of houses, streets, open spaces, and infrastructure. Such studies help identify areas that need improvement and provide a basis for designing appropriate interventions.

5.2.3 Community Participation

Involving the community in the planning and decision-making processes is essential for sustainable slum development. Community members possess valuable insights into their own needs and preferences. Their participation fosters a sense of ownership and accountability, leading to more successful interventions. Community engagement is one of the best practices for the development of slum areas because they know their problems and challenges more than anyone else. Slum development should be start by engaging with the slum community members to understand their needs, concerns and aspirations. Empower women within the community through training, skill development and educational programs. Association of women with self-help group Establish local committees to ensure participatory decision-making in the development process. Women of slums should be targeted as specific targeted group. Women empowerment through different sectors like micro finance, overall, of prosperities, reformation of education system, local and national level seminars, exhibition and conference on women empowerment along with women education. Regular entrepreneurship awareness programs should be conducted. Capacity building programs can be utilized to reduce unemployment and skill development. Invest in training programs for local leaders and community members to build their capacity in managing various aspects of slum development, including waste management, sanitation, and infrastructure maintenance. A successful slum development requires a holistic and collaborative approach involving government agencies, NGOs, local communities, and various stakeholders. Customizing these strategies to the specific context of Assam and the unique needs of the slum residents will be crucial for achieving sustainable and impactful results.

5.2.4 Understanding Slum Morphology and Re-arrangement:

Analysing the physical layout and arrangement of structures within slums informs strategies for re-arrangement. This can involve better organizing houses, pathways, and common areas to optimize space and improve living conditions. Street lights should be provided by using solar energy.

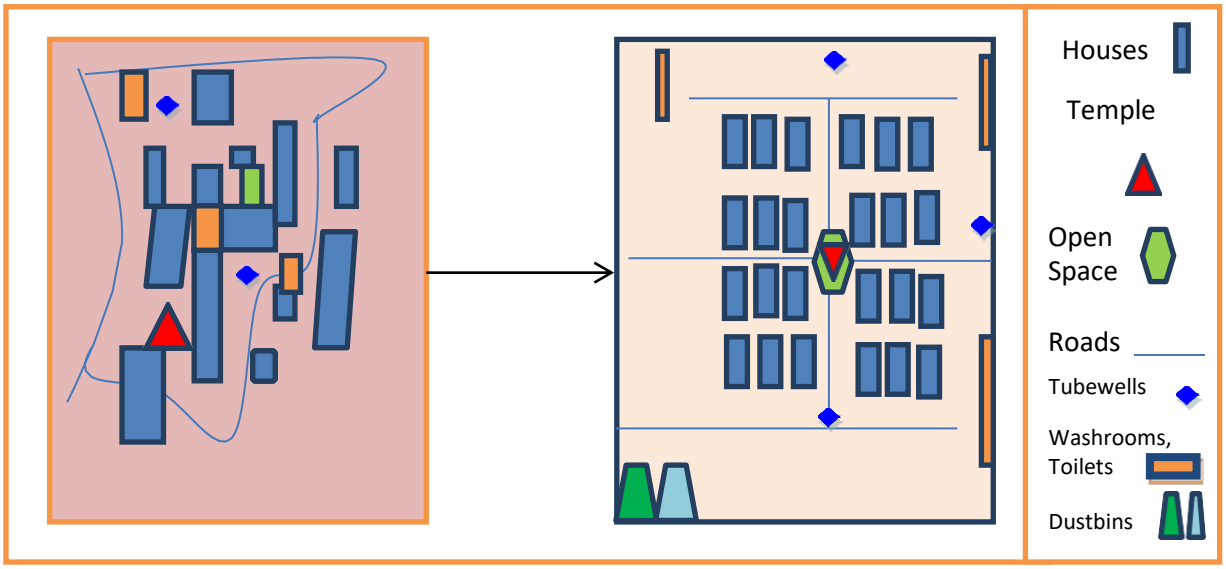


Fig.5.1: Rearrangement of Slum Topology

5.2.5 Housing and Infrastructure:

Collaborate with architects and urban planners to design sustainable and cost-effective housing solutions that consider local materials and building techniques. Plan for adequate roads, drainage systems, and basic amenities such as water and electricity supply. Focus on building multi-story structures to optimize space while providing sufficient ventilation and light**.** Constructing multi-storey housing units can be an effective way to optimize limited land space in urban areas. Vertical construction helps accommodate more families within a smaller footprint. However, the design and implementation need to consider factors like safety, accessibility and the provision of basic amenities.

5.2.6 Livelihood and Income Generation:

Identify vocational training opportunities aligned with local market demands and skills of slum residents. Facilitate access to microfinance and credit schemes to help individuals start small businesses or income-generating activities. Encourage the development of cooperative enterprises to enhance economic opportunities for the community.

5.2.7 Education and Healthcare:

Establish and support educational centres and healthcare facilities within or near the slum. Encourage attendance by providing incentives like free meals for children attending schools. Collaborate with local NGOs and government agencies to ensure access to quality education and healthcare services. The expansion and development of women education has a great impact on society, polity and economy of a country. Education enabled women to take

up jobs and helps in startup of their own business as well as improving awareness about family planning, awareness in health and social activities. Zaman (2013) has been discussed about the health awareness among women of Dibrugarh slums and found that a large number of people are lack of basic knowledge about HIV/AIDS etc. Achieving 100% literacy is not quick fix; it will be a long-term commitment from all development sectors and needs sound public policies, a holistic approach, which will start with women by integrating gender-specific perspectives at the design stage of policy and programming. Improve the condition of women in slum areas can be possible through simple strategies, enable their empowerment through education as central part of programming. Thus, educational policies, skill development trainings, experiences, employment opportunities are need to be improved. Slum dwellers should perceive improved opportunities for employment, considered a transient location Closer to services and perceived to be more accessible, higher immunization coverage, more family planning programs, reducing socio-economic disparities, home ownership relates to greater independence and satisfaction to overcoming living conditions.

5.2.8 Cultural and Religious Spaces:

Design the layout of the slum to accommodate community spaces for worship and cultural activities. Respect local customs and traditions when planning these spaces, ensuring they align with the community's needs and preferences.

5.2.9 Sanitation and Hygiene:

Construct and maintain community toilets and bathing facilities to improve sanitation and hygiene. Educate residents about the importance of proper waste disposal, personal hygiene, and sanitation practices. Implement waste segregation and recycling practices within the community.

5.2.10 Waste Management:

Introduce a waste management system that includes door-to-door collection, proper segregation, and disposal methods. Set up waste processing units for recycling and converting organic waste into compost or biogas. Train community members to run and manage waste-related initiatives, providing them with potential income sources.

5.2.11 Environmental Sustainability:

Incorporate green spaces, parks, and community gardens within the slum to improve air quality and provide recreational areas. Promote the use of renewable energy sources, such as solar panels, to meet energy needs sustainably.

5.2.12 Policy Implementation and Monitoring:

Work closely with local governments and urban development authorities to ensure that policies for slum development are effectively implemented. Regularly monitor progress and gather feedback from the community to make necessary adjustments. Renewal of Planning Policies for Slums is necessary to check the progress and to provide solutions to the barriers timely. Renewal of policies involves updating and improving existing planning policies related to slum areas. As urban areas grow, it's crucial to adapt policies to address the changing needs and challenges of slum populations. Renewed policies can encompass various aspects, such as housing, infrastructure, sanitation and social services.

5.2.13 Application of GIS and Remote Sensing:

GIS (Geographic Information System) and remote sensing play a crucial role in slum studies by providing valuable tools and techniques for monitoring, detecting, and managing slum areas. Object-Based Image Analysis (OBIA) is a method of remote sensing and GIS that involves classifying images based on objects rather than individual pixels. In slum studies, this approach can help distinguish different land cover types within slum areas, such as built-up structures and vegetation. This enables accurate mapping of slum extents and better differentiation between slum and non-slum areas (Cleve et al. 2008; Ebert et al. 2009; Taubenböck and Kraff 2014; Dhanaraj et.al (2020). Similarly, Generic Slum Ontology (GSO) is a structured framework that uses indicators related to the morphology of the built environment to characterize slum areas. It helps standardize the definition and identification of slums across different contexts, making the analysis more consistent and reliable (Weeks et al. 2007). Very High-Resolution (VHR) Satellite imagery provides detailed views of urban areas, allowing for the identification of informal settlements and slum areas. These images capture fine-scale features that might be missed by lower-resolution images, making it easier to analyse and categorize slums accurately (Herold et al. 2003; Stow et al. 2007; Kohli et al. 2016). Spatial Metrics and Change Detection is also a tool to study slum areas or other studies. Spatial metrics, such as the size of segments and proportions of built-up areas and vegetation, can be used to identify and monitor changes in slum areas over time. Change detection techniques, like cross-tabulation, help visualize how slum areas are evolving and expanding, providing valuable insights for urban planning and intervention programs (Sliuzas et al. 2008).

Integration of Expert Knowledge in this field is another important factor for slum development. GIS and remote sensing techniques allow the integration of expert knowledge and local insights into the analysis. This ensures that the interpretation of satellite imagery

and the classification of slum areas take into account the nuanced characteristics of each locality, improving the accuracy of results.

Texture analysis and spatial metrics in GIS and Remote Sensing involves examining patterns and relationships in image data, can be used to identify unique signatures of slum areas. Combining texture analysis with spatial metrics provides a comprehensive approach to detecting and mapping slums accurately. The integration of geo-sensor networks is an important method in this field that collect real-time data from various sensors deployed across an area, can enhance the accuracy and timeliness of slum monitoring. This can help authorities and researchers stay updated on changes in slum areas and respond effectively.

Developing a comprehensive framework for slum detection and mapping involves considering various data sources and technological advancements. By combining different sources of geospatial data and analysing them systematically, researchers can create more accurate and reliable slum maps (Mahabir, 2018**).** The regular updates and accurate information provided by GIS and remote sensing methods aid in guiding policies and intervention programs aimed at improving slum conditions. Decision-makers can use this information to allocate resources effectively and implement targeted development initiatives. The GIS and remote sensing techniques provide a powerful set of tools for slum studies, enabling accurate mapping, monitoring, and intervention in informal settlements. These methods contribute to informed decision-making and sustainable urban development strategies.

From the above discussion, the strategies could be included in the following model:

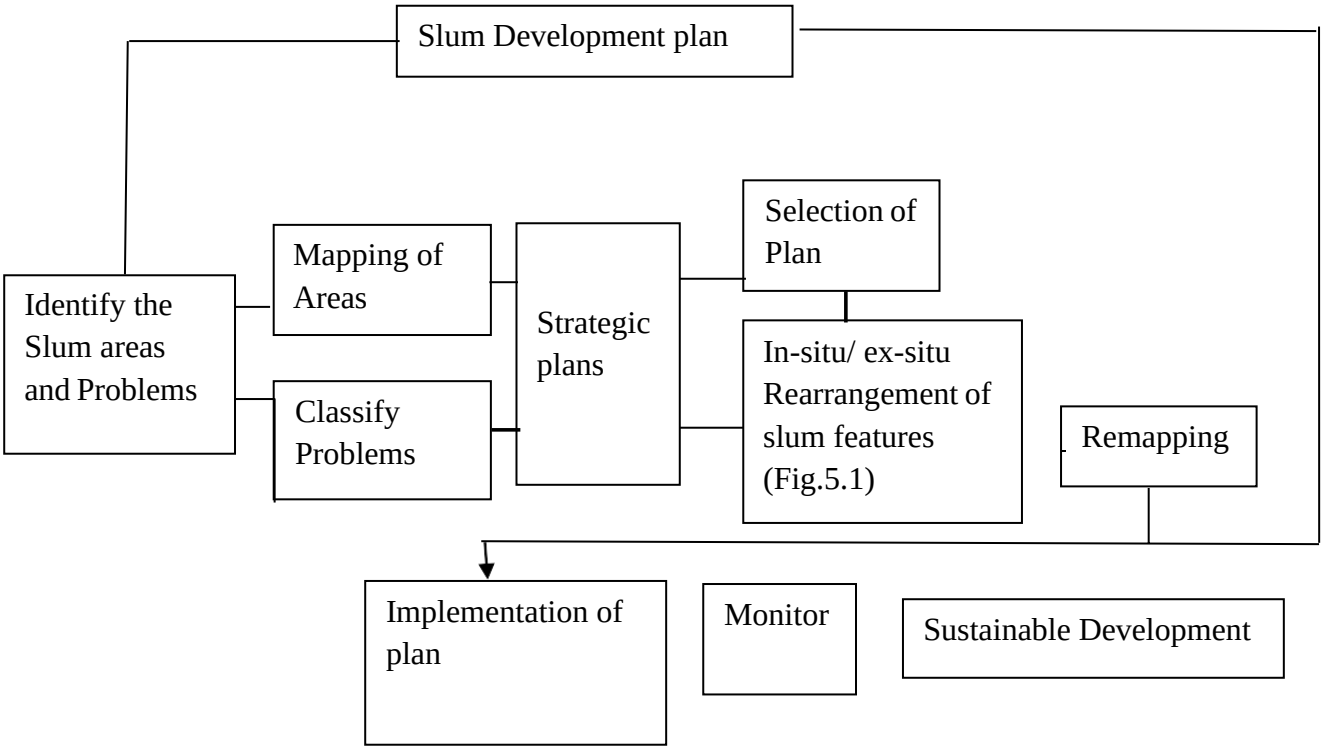


Fig.5.2: **Slum Development strategy**

5.3 Chapter Conclusion:

This chapter highlighted the challenges faced by slum residents in the studied slum areas. The findings highlighted in this discussion underscore the complex challenges faced by slum communities, including inadequate infrastructure, poor sanitation, and compromised indoor air quality. To address these issues, a comprehensive approach is needed, involving urban planning, improved infrastructure development, better waste management strategies, accessible healthcare facilities, and efforts to promote cleaner cooking technologies. By addressing these challenges, we can work towards creating healthier, more sustainable, and equitable living conditions for slum residents. The strategies and policies as mentioned in this chapter reflect a comprehensive approach to slum development in India. They emphasize community involvement, infrastructure improvement, housing provisions, and the prevention of future slums. By integrating these strategies and policies, urban planners and policymakers can work toward creating more liveable and sustainable urban environments for slum dwellers.

CHAPTER 6

SUMMARY AND CONCLUSION

6.1 Summary of Findings:

The undertaken research work on slums and environmental impact, is an attempt to find out the main factors for proliferation of slums in the state of Assam and particularly in the upper Assam region. The study highlights the complexities of defining slum areas, which vary from country to country and region to region, often featuring different local terms for such settlements. Slums are typically characterized by high population density, overcrowding, inadequate sanitation facilities, and unhygienic living conditions. India, in particular, hosts a substantial population of slum dwellers and homeless individuals, with notable examples like Dharavi slum of Mumbai, one of the largest slums in Asia, where about two lakhs population live in 1 to 2 square kilometres. The number of slum dwellers and many slum pockets are increasing day by day. The census reports of India reveals that some states which did not have any slum areas in 2001 reported slum areas in 2011. In Assam number of slums and slum dwellers increased from 2001 to 2011. The Guwahati, Silchar and Nagaon have higher number of slum dwellers in Assam. The easternmost districts Tinsukia and Dibrugarh of Upper Assam have the highest number of slums and slum population.

The four major urban centres in Upper Assam: Jorhat, Golaghat, Dibrugarh, and Tinsukia towns were selected for the study. The work is divided into six chapters to address various aspects of slums, their growth and environmental conditions.

The first chapter describes the theoretical and conceptual framework, significance of the study, outlining the research's objectives, methodology and scope. It also includes a review of relevant literature and defines the area of interest. High numbers of slums in the Upper Assam are mainly distributed in Dibrugarh and Tinsukia districts. These two towns are included in class ii cities. According to the census of India, class cities are those cities where the population ranges between 50,000 to 100,000. Total 24 slums situated in Dibrugarh and 10 slums are located in Tinsukia town. Information of slums were collected from municipality offices of the towns.

The second chapter delves into the geographical context of the study area, covering aspects such as physiography, climate, vegetation, and demographic dimensions. Upper Assam is the eastern part of the Brahmaputra Valley. The historical importance along with

distribution of fertile soil, crude oil and coal resources and their allied industries, labour requirements etc. are can be considered as some pull factors of migration. As a result, several informal slum settlements are growing in the region. This chapter also discussed demographic characteristics of the area including population, infrastructural facilities, economic condition, work participation, literacy rate, religious and caste composition of slum population of the study area. The migration rate found high in the Dibrugarh district.

The third chapter explores the dynamics of slum growth, examining changes in population growth, urbanization patterns, and the evolving nature of slum-related problems. The urbanisation, transportation, industrialisation are growing in the region. In Assam, the number of statutory and census towns increased from 51 to 88 in the period from 1971 to 2011. Total census town were increased from 21 to 126 in the same period, which indicates that the urban population and urbanization rate both are increasing in the study area. Along with the urbanisation, slum population also increasing in the region. This chapter represents the dynamicity of urban areas in Assam and growth of slums.

The fourth chapter provides a comprehensive description of the environmental impact of slums, encompassing both physical and socio-economic aspects within the study area. The socio-economic condition and environmental condition have been analysed in this chapter. Among the 9 districts of upper Assam region the Jorhat, Golaghat, Dibrugarh and Tinsukia have higher number of slums and slum population. The first part of this chapter analysed the state of major socio-economic problems including demographic characteristics and their problems. Major problems analysed in this chapter includes occupation and income level, educational status, housing condition and facilities, sanitation facilities, health conditions. The second part analysed the environmental condition in the slum areas, which included their drinking water quality, indoor air quality, soil quality of garbage disposal sites, methods of garbage disposal. Their indoor quality has been found poor. The soil samples from garbage disposal sites shows pH ranges between below 4.5 to 5.8 which indicated acidic soils. Therefore, the quality is degrading in the garbage disposal sites. A comparison of slums has been done by using composite score and analysed in this chapter. This comparison shows that among the eleven studied slum areas the Golaghat Harijan colony slum has better socio-economic condition compared to the other slums which could be the result of combine engagement of government planning and community participation.

The fifth chapter presents findings, discusses the problems identified and proposes potential solutions for improving slum conditions. It presents an analysis of the research's main objectives across all chapters. It also highlights the government policies and private

sector involvement in alleviating housing problems, ultimately aiming to improve living conditions for slum dwellers**.**

The final chapter offers a summary and conclusion of the entire thesis and provides concluding remarks, emphasizing the importance of defining low-income housing and addressing the needs of the low-income population in the study area.

In this research work slum pockets have been selected from four major urban centres of Upper Assam. The selected urban centres are Jorhat, Golaghat, Dibrugarh and Tinsukia. The research work has been divided into six chapters on the basis of the objectives which cover various aspects of slums, their growth and environmental condition etc. In this research, the consequences of slum settlements are explored, focusing on both their positive and negative effects on surrounding urban settlements. The study primarily emphasises the opinions of formal settlers regarding various aspects of slum settlements. This work discusses slum dwellers' opinions on how slum settlements affect commercial activities in the study area. This suggests that slum settlements have a discernible impact on the local economy. The assessment of utility services in the study area indicates that slum dwellers provide services to other urban settlements at a low cost, which indicates that slum dwellers have a significant role in meeting the labour needs of the formal settlements. Slum dwellers offer various services to other formal settlers, including household labour, low-cost labour for industries, and general labour. Additionally, some formal settlers benefit from land-related income through house rent. Because some slums are situated on lands that belong to private individuals. The study identifies several environmental problems faced by informal settlers, including overcrowding, waste pollution, and noise pollution. Notably, improper waste disposal is a major concern, affecting respondents. This work also highlighted drainage congestion due to waste disposal issues and illustrates the multifaceted impact of slum settlements on their surrounding environment and the broader community. It draws attention to issues with the environment and amenities while highlighting the contribution of slum residents to various services. It also clarifies the multiple viewpoints authorities hold on the existence of informal settlements.

6.2 Conclusions:

The existence and growth of slums in Assam, like many other parts of the world, are multifaceted issues with a complex web of causes and consequences. These slums emerge as a result of rural-urban migration driven by economic disparities, unemployment, and the allure of urban opportunities. They are further exacerbated by factors such as poor urban planning, political influences, natural disasters, and social conflicts. While the scale of slum

areas and populations in Assam may not be as vast as in other regions of India, their presence is still significant, accompanied by numerous challenges affecting various aspects of society, economy, and the environment. This research seeks to shed light on the challenges posed by slum growth in Upper Assam, India, and offers recommendations to enhance the living conditions of low-income communities. Slum dwellers faces many challenges in everyday life such as poor sanitation and water supply facilities, room crowding, unhygienic environmental condition etc. Furthermore, gender inequality and the status of women and children in these slum communities must be a central concern. Lack of basic amenities such as no medical facilities or dispensary within the slums. The nearest Government dispensary available between 2 to 9 kilometers distances. The distances of government medical hospitals from slums are: Paltan Bazar 2 kilometers, Shantipara 5.4 kilometers, Amaraguri 5.5 kilometers, Guard Para 5.6 kilometers, South Amolapatti 6.1 kilometers, Barbari Dusadpatti 3.5 kilometers, Sripuria 9.3 kilometers, Nepali Mandir 9.2 kilometers, Jorhat Harijan Colony 5.4 kilometers and Golaghat Harijan Colony 5.3 kilometers away. Generally, roads in slums are not very wide. In the Guard Para, Jorhat Harijan colony, Golaghat Harijan Colony, Santipara, Guard para and Barbari Dusadpatti slums, the main roads are metaled but inside the slums, roads are not metaled because they are very narrow. The condition of road at Sirpuria Slum in Tinsukia district is very poor in condition, which is a kutcha narrow road. Because this slum is located on the government land, near railway track and the residents do not have property rights. Non maintenance of proper drainage and sewage systems have created many social and environmental issues. Water logging and overflow of drain water with waste during rainy season is a common problem in all the slum areas. In educational condition the number of illiterates and dropouts are very high. Even if the national policy of education says about compulsory education to all children, the slum dwellers are not aware and to support their family children dropout school to do work. There is no single school within the slums. However, near the Harijan Colony slum areas, Hindi Medium schools are located approximately 2 to 3 km away. There are also many social problems like health issues, crime issues, which are prevalent within the slums and such problems often spread beyond the slums to other parts of the city/society. Slum residents reported on theft, intake of drugs and alcohol, gambling and domestic violences. Residents do not have the emergency numbers o fire brigade offices, police stations numbers. Efforts to address these challenges and eradicate slums should begin at the earliest stages, involving comprehensive strategies that encompass monitoring using GIS technology, sound urban planning policies, and government and public intervention. It is essential to recognize that the urban poor, residing

in these slum areas, face numerous hurdles in the physical, mental, social, and political realms. Often, they are manipulated as mere vote banks, highlighting the urgent need for policies aimed at their upliftment. It underscores the significance of urban planning, policy implementation, and collaboration with the private sector to address the pressing issues associated with slum development. This study sheds light on the complex challenges faced by slum dwellers in Assam and offers a roadmap for holistic improvements in their overall development. Innovative approaches and collaborative efforts are imperative to create lasting change and to ensure that poverty, like slums themselves, can be eradicated through concerted human endeavours.

In Assam, every year people losses their agricultural land, their habitat or submergence of land in the Brahmaputra River due to flood and these people move towards cities and towns and starts a settlement in the periphery of the town area. Illegal migration is another major reason of slum growth in Assam, especially from Bangladesh. Using them as vote bank is a major political issue in Assam. In rainy seasons, as a result of flood, the dwellers of slum areas, which are located on the bank of the Brahmaputra River become homeless. During flood they took shelter on the embankment or camps arranged by government. As stated above, the number of slum areas and slum population in Assam are low compared to other parts of India. However, several new small slums are growing in different parts the state Assam and along with that precarities related to society, economy and environment are growing rapidly. It needs an effective way to develop the urban poor at a very large scale and the lowest cost. By taking steps for the prevention of common diseases and development of health conditions, providing access to quality education and promoting women's empowerment can break the cycle of poverty and inequality.

A number of challenges faced during field survey process. Though a number of literatures have been found in global and national level but in regional context the research works are very few in number. Secondly, the data published in different books and the data recorded in different officials are not similar though published in the same year. The population forecasting methods also have few disadvantages such as it shows higher values, which may change in future. Lack of financial support also creates problems during research that impact on testing of high number of samples. Some respondents were not aware of various situations. Therefore, some responses were on the basis of approximation. This work highlighted only indoor air quality condition by measuring day time indoor air quality. But to study deeply on their indoor air quality condition we need to established more instruments at different places to monitor and record 24-hour data at same time. Therefore, there is a scope

for further study on their health condition related to indoor air quality. Lack of high-resolution satellite images also another problem in applying modern slum growth model such as Very High-Resolution (VHR) Satellite Image to promote monitoring of slum growth in the cities. However, despite these limitations, as Nelson Mandela stated that poverty is a man-made issue that can be rectified through human actions. The study would help in further planners in land management and achievement of sustainable development goals in the slum areas. Therefore, this work would beneficial for holistic improvements of the living conditions of slum dwellers.

PLATES

Plate 1: Household Survey, Jorhat Harijan Colony

Plate 2: Household Survey, Santipara slum

Plate 3: Household Survey, Golaghat Harijan Colony

Plate 4: Household Survey, Amaraguri

Plate 5: Single room with kitchen, Guardpara slum

Plate 6: Poor housing condition with narrow road, Jorhat Harijan colony

Plate 7: Tocklai Drain, Jorhat Harijan Colony

Plate 8: Unhygienic bathing place and garbage dump site, Santipara

Plate 9: Road cum Open Drain, Dhobi Patti Slum

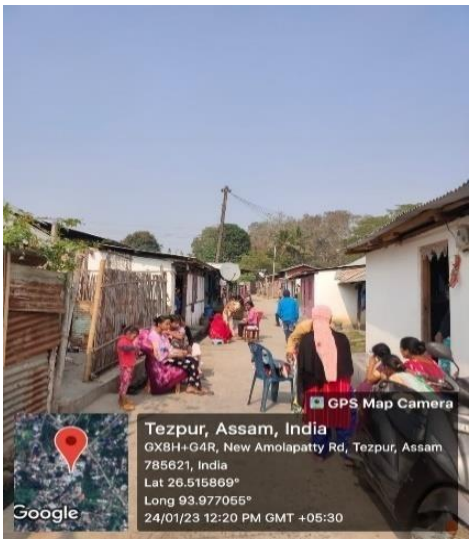


Plate 10: Golaghat Harijan Colony

Plate 11: Soil sample collection, Garbage dumping site

Plate 12: Water sample collection, Guardpara

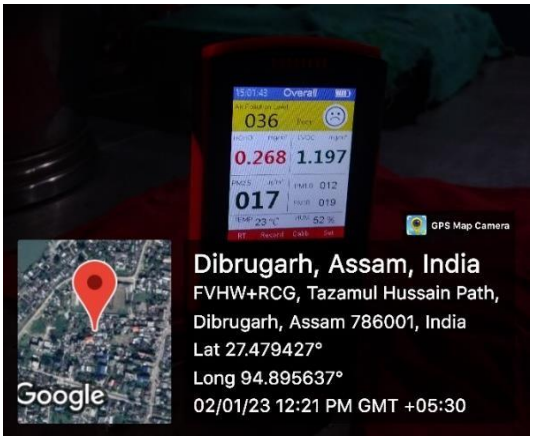


Plate 13: Measuring indoor air quality, Smiledrive instrument

Plate14: Dustbin, Golaghat Harijan Colony

Plate15: Community hall and Mandir, Golaghat Harijan Colony

Plate 16: Supply water collection, Golaghat Harijan Colony

Plate 17: Waterlogging, Amaraguri

Plate 18: Single room condition, Paltan Bazar, Dibrugarh

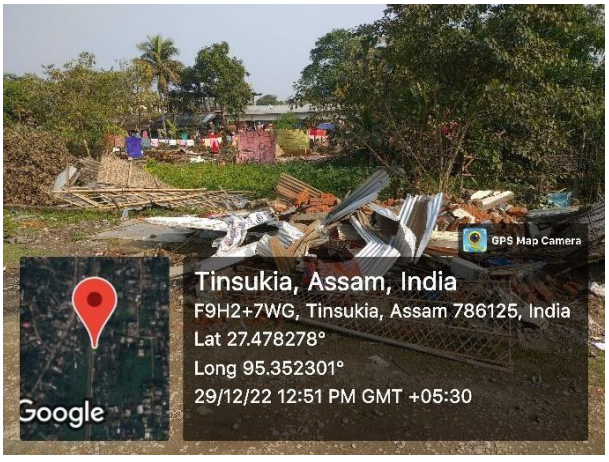


Plate 19: Demolition of Sripuria slum, Tinsukia

Plate 20: Water logging, Dhobi Patti

Plate 21: Rent houses, Dhobi Patti

APPENDIX-1

SURVEY SCHEDULE
DEPARTMENT OF GEOGRAPHY
NAGALAND UNIVERSITY, LUMAMI-798627

Topic title: Slums and Environmental Impact: A Study of Upper Assam

Name of the Researcher: Preeti Barsha Borah

Name of the Supervisor: Prof. Lanusashi Longkumer

Reg no.: Ph.D./GEO/00286

Date of interview:

Serial No:

PART-I

A. General information of the city/town:

1. State: Assam. 2. District:

3. Name of the city/town:

4. Location:

B. Slum Profile:

1. Name of the slum:

2. Notified/ non-notified: Yes/ No, if yes please mention the year:

3. Ward no:

4. Whether located in core city/ town or fringe area.

5. Ownership of land where slum is located:

6. Area in sq. metres:

5. Type of area surrounded by:

Residential	Industrial	Commercial	institutional	Other

6. Location: Physical Location of Slum: Please √

Along Nallah (storm water drain)	
Along other Drains	
Along Railway lines	
Along other transport alignment	
Along River/Water body Bank	
Waste Disposable sites/ Dumping Ground	
Others	

7. Distance from city centre:

8. Total population as per 2011 census:

9. Total households:

PART-II

(Slum Household Survey)

1. Slum HH No.:

2. Name of the respondent:

3. Age:

[i] Below 20 years

[ii] 20-30

[iii] 31-51

[iv] 51 years

4. Caste: ST/SC/OBC/MOBC/Gen/others

5. Religion: Hinduism/Islam/Christian/Others

6. Marital status: Married/Unmarried/Widow/Divorcee

7. Educational qualification: Illiterate/up to 10^{th} /10^{th} to undergraduate/ Graduate/Masters/ Others

8. Employment status: Unemployed/ Farmer/ Business/ Govt servant/ Others

9. Household information: House No (2011 census):

9.1 Ownership of the house: Rental/Own/Relative/Others. If in rent then write the monthly house rent in Rs:

9.2 Household Income per month:

(i) Below 3000 (ii) 3000-5000 (iii) 5000-10000 (iv) Above 10000

9.3. Monthly expenditure:

9.4 Do you have any livestock?

9.5 Since when your family is living here?

Period of staying in the slum: i) 0-5 years ii) 5-10 years iii) 10- 15 years iv) More than 15 years v) whole life

9.6 Whether migrated from other places: Yes/No. If yes, then fill-up the following Migration type and time:

Migrated from		Name of the place			Reason of migration	Year
Village	Town	Country	State	District		

9.7 Family information:

Family members	Sex		Age	Educational qualification							occupation
	M	F		Illiterate	Dropout	HSLC	HS	Graduate	PG	Others	
1											
2											
3											
4											
5											
6											
7											
8											
9											

10. Household facilities:

10.1 House type:

Shacks	Semi pucca	Pucca	Material used			No of Rooms	No of people in one room
			Wall	Roof	Windows		

10.2. Distance from the next neighbours house?

10.3. Household facilities

Source of light			Refrigerator	Computer/ laptops	Car/ Motor bike	Tv	Mobile	Radio	Fuel used for cooking			
Electricity	Solar lamp	Kerosene /candle							Kerosene stove	LPG	Coal	Fire woods

10.4 Sanitation: What type of toilet do you have?

Private				Public				Open field	
Kutcha		Pucca		Kutcha		Pucca			
Please tick √								Yes	No
1	Flush toilet (connected to sewerage system) outside the house								
2	Communal toilet outside the yard								
3	Chemical toilet outside the house								
4	Pit latrine without ventilation								
5	Others								

10.5 Is your public toilet is a paid toilet: Yes/No, if yes then mention how much you have paid for it: (i) Daily paid: Rs: (ii) Monthly paid: Rs: (iii) Annually paid: Rs:

11. Health condition:

11.1. Nearest health care centre distance from the area:

11.2. Do you have any health Id card? Yes/No (if yes write scheme name:

11.3 : Common diseases

Sl. No.	Diseases	Family members suffered			Vaccination	Status		
		Age	Male	Female		Recovered	Under treatment	Died
1	Diarrhoea							
2	Jaundice							
3	Hepatitis							
4	Malaria							
5	Chickenpox							
6	Asthma							
7	Cancer							
8	Dengue							
9	Typhoid							
10	AIDS/HIV							
11	Tapeworms							
12	Tuberculosis							
13	Others (please specify)							

11.4 Do you use sanitizer/masks? Yes/No

12. Number of Death in your family:

Sl. No.	No of persons' Death in the family	Age	Sex		Cause of death
			Male	Female	

13. Drinking water sources:

Ownership	Pond	Well			Water supply			River water
		Tube well	Hand pump	Bore well	tap water	Household tap	Tanker water	
Public								
Private								
Both								

14.1. Do you use water filter: Yes/ No

(i) Sand filter (ii) Candle filter (iii) Drink after boiling

15. Garbage Disposal:

15.1 Do you have Dustbin facilities at home? Yes/No.

15.2If yes, whether the Dustbin is arranged by your own/ or provided by the Govt./NGO?

15.3 Daily output of household garbage in Kg:

15.4 Which method is use to dispose the garbage?

15.5 How do you dispose the non-degradable garbage? Burning/Throwing/others

15.6 Do you renew the renewable/reusable things?

15.7 Arrangement for Garbage Disposal:

Municipal staff	Municipal contractor	Residents themselves	Others	No collection

15.8: Frequency of garbage disposal: Daily/once in week/twice in week/others please mention:

16. Whether the Slum is prone to flooding due to rains:

Not prone	Up to 15 days	15-30 days	More than a month

17. Frequency of Clearance of Open Drains

Daily	Once in 2 days	Once in a week	Once in 15 days	No collection

18. Environmental problems faced by the dwellers:

Sl. No.	**Environmental problems**	**Please tick √**
1	Pollution	
2	Water logging	
3	Flood	
4	Landslide	
5	Slum fire	
6	Chemical explosion	
7	Bad smell	

19. Social problems faced by the dwellers:

Sl. No.	**Social problems**	**Please tick**
1	Caste conflict	
2	Religious conflict	
3	Dowry	
4	Gender discrimination	
5	Domestic violence	
6	Sexual violence	
7	Forceful tax	
8	Ignorance by police/district administration	
9	Malnutrition/ poverty	
10	Others, please specify	

21. What are the crime scenes in your locality?

.....

22. Security scenario:

22.1. Whether the police and administrative presence is felt/known?

22.2. How much affective or just nominal?

23: Consequences of environmental and social problems please explain in brief:

……
……

24. Any welfare scheme done in the past 10 years to improve the slum? If yes then mention below:

25. Any recognized organization in the Slum/by the people of Slum, if so, how effective the organization is?

26. Any plan by the municipal/state/ local authority for the development of the Slum area or to remove the Slum area? Please comment?

27. Is your family the beneficiary of any government programmes? If yes then mention the scheme:

……

28. Any NGO's/ Projects /works for the development of the slum:

29. Slums overhead facilities:

29.1 : Road condition:

29.2 : School:

29.3 : Community playground:

29.4. Library:

29.5. Cremation ground;

29.6: Electricity/ drinking water/ market/ police station

30. Any suggestion to develop of the slum locality at a faster rate:

ANNEXURE -II

RIGHT TO INFORMATION

CSIR-NORTH-EAST INSTITUTE OF SCIENCE & TECHNOLOGY
JORHAT – 785 006, ASSAM

Name of the Division : Analytical Chemistry Group, MSTD	Report No. CSIR-NEIST-Jorhat/QSP/MR/20/AnC/TR- 3484/02-2023	
TEST REPORT OF WATER SAMPLE	DATE 10/02/2023	PAGE 1 of 5

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1. **SCOPE** : **Physical and Chemical analysis of water samples supplied by:**
   Preety Barsha Borah
   Research Scholar
   Department: Geography
   Nagaland University, Lumami

   REFERENCE : **Letter Ref. No.: NIL ; Dated: 25/01/2023**

2. **TEST RESULTS** : **Enclosed.**

3. **CONCLUSION**

TEST CONDUCTED BY	CHECKED BY	APPROVED BY
10/2/23 Dr. M. Gogoi (Tech. Asst.)	10/02/2023 Dr. P. J. Saikia (GL, Analytical Chemistry Group, MSTD)	10/02/2023 Dr. A. M. Das (Chairman, Testing Report Committee)

Released By	
Signature & Date	10/2/2023

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