A MINI PROJECT ON

"IMPACTS OF SAND MINING IN THE KARBI LANGPI RIVER"

Submitted in Partial Fulfillment for the Requirement for the Award of the

Degree of
MASTER OF TECHNOLOGY

CIVIL ENGINEERING
(With specialization in Water Resource Engineering)

Of

Assam Science & Technology University
Session: 2023-2025

Submitted By
CHESONG KIRI TIMUNG

MTECH 3rd SEMESTER

ROLL NO: 230620061008

Under the Guidance of

DR. PULENDRA DUTTA

ASSOCIATE PROFESSOR

DEPARTMENT OF CIVIL ENGINEERING

ASSAM ENGINEERING COLLEGE

JALUKBARI, GUWAHATI-781013

DECLARATION

I hereby declare that the work presented in the dissertation **"IMPACTS OF SAND MINING IN THE KARBI LANGPI RIVER"** in partial fulfillment of the requirement for the award of the degree of **"MASTER OF TECHNOLOGY"** in Civil Engineering (With specialization in Water Resource Engineering), submitted in the Department of Civil Engineering, Assam Engineering College, Jalukbari, Guwahati-13 under Assam Science & Technology University, is a real record of the work carried out under the supervision of **DR. PULENDRA DUTTA**, Associate Professor, Department of Civil Engineering, Assam Engineering College, Jalukbari, Guwahati-13.

I do hereby declare that this project report is solemnly done by me and is my effort and that no part of it has been plagiarized without citation.

Date:

Place:

CHESONG KIRI TIMUNG
M.Tech, 3rd Semester
Department of Civil Engineering
Assam Engineering College Guwahati-781013

CERTIFICATE

This is to certify that the work presented in the project report entitled "**IMPACTS OF SAND MINING IN THE KARBI LANGPI RIVER**" is submitted by Chesong kiri Timung, [Roll no-**230620061008**], a student of M.Tech 3rd semester, Department of Civil Engineering, Assam Engineering College, to the Assam Science & Technology University in partial fulfillment of the requirement for award of the degree of Master of Technology in Civil Engineering with specialization in Water Resource Engineering under my guidance and supervision.

Date:

Place:

DR. PULENDRA DUTTA

Associate Professor Department of Civil Engineering

Assam Engineering College Guwahati-781013

CERTIFICATE FROM HEAD OF THE DEPARTMENT

This is to certify that the project report entitled **"IMPACTS OF SAND MINING IN THE KARBI LANGPI RIVER"** has been submitted by Chesong kiri Timung, [Roll no-**230620061008**], a student of M.Tech 3rd Semester, Civil Engineering (With specialization in Water Resource Engineering), Assam Engineering College, in partial fulfillment of the requirements for the award of the degree of Master of Technology in Water Resource Engineering of Assam Science & Technology University.

Date:

Place

DR. JAYANTA PATHAK
Professor & Head
Civil Engineering Department
Assam Engineering College
Guwahati-781013

ACKNOWLEDGEMENT

The present study on "**IMPACTS OF SAND MINING IN THE KARBI LANGPI RIVER**" has significantly enriched our understanding of this field. It has provided us with valuable insights into distinct theoretical and vocational aspects.

I extend our deepest gratitude to the faculty of the Civil Engineering Department. Their personal initiative and guidance have been instrumental in the successful completion of this dissertation.

I am particularly indebted to Dr. Pulendra Dutta, Associate Professor, Department of Civil Engineering, Assam Engineering College, Guwahati. Her invaluable guidance and personal interest have been crucial in helping us navigate this dissertation.

ROLL NO-230620061008

Water Resource Engineering
Department of Civil
Engineering Assam
Engineering College Jalukbari,
Guwahati-13

Date:

Place:

ABSTRACT

Sand mining, a process of extracting minerals from underground river flows, involves the exploitation of natural resources beneath the earth's surface. While this activity is typically conducted to support development and can have positive effects on communities, it may also lead to environmental degradation if proper impact assessments are not considered. This study aims to evaluate community perceptions regarding the consequences of sand mining operations along the Karbi Langpi River. The research employs a survey methodology, gathering data through observations, documentation, and questionnaires. A total of 30 local residents participated as respondents in this investigation, which was carried out over a five-month period in the vicinity of Karbi Langpi, Baithalangso, West Karbi Anglong, Assam. The collected data underwent descriptive analysis. The findings of this research indicate a significant level of public awareness concerning the impact of sand mining on the Karbi Langpi River, as evidenced by the percentage results from the questionnaire analysis, which categorizes the effects into positive and negative outcomes of sand mining activities on the river.

LIST OF FIGURES

LIST OF TABLES

CONTENTS

CHAPTER 1

INTRODUCTION

1.1 WHAT IS SAND MINING

River sand mining refers to both the process of removal of sand from the river bed or banks for construction activities and the location where this activity occurs. With rising cities, the need for sand has soared, leading us to mine it more vigorously. But these actions happen in relative anonymity and with enormous ecological and social costs. Due to the unprecedented growth and development of urban infrastructure globally, this has made river sand mining one of the most important environmental issues of the 21st century. In this practice, sand deposits are extracted from riverbeds, banks, and floodplains to feed the growing construction industry, where sand is an essential element for concrete.

Sand, which has been nicknamed 'hidden gold', is the second most used natural resource globally, following only water, with an estimated amount of 50 billion tons consumed per year. River systems providing this crucial resource are facing increasing pressure, especially in fast-developing nations where many have been enjoying construction booms in recent years, notably in Asia and Africa. But it complicates the supposedly straightforward practice of taking sand from rivers. Although the practice fosters economic growth and development, it also poses significant threats to river ecosystems, biodiversity, and local communities that rely on these water bodies. This process changes rivers, the water table, increases flood and erosion, and leads to a chain reaction of ecological impacts. Although highly important, river sand mining is still poorly regulated in many places, and illegal mining further hampers sustainable resource management. It is needed to balance these priorities and development necessity with ecological sustainability due to its intersects between environmental sustainability, economics and social impact, while its complexity is increased with ecological sustainability does not have a simple solution that meets multiple development needs. Recognizing these dynamics is very relevant for designing sound policies and for shaping sustainable options to fulfill global construction needs without severely harming key river ecosystems.

The primary purpose of this report is to serve as an overview of river sand mining, its relevance, consequences and regulations.

1.2 BACKGROUND

River sand is favourable natural sand produced by thousands of years weathering and erosion of rocks and is an integral component of economy, environment and ecology. With rounded and smooth grains, uniform grain size, natural sand with low impurity sand belongs to ideal concrete materials, its asphalt nature wherever 35% of required construction industry. River sand forms from the breakdown of rocks and the transporting of those by water currents. The resulting sand grains are rounded, well graded, and low in impurities making them the perfect material for construction. The physical and chemical characteristics of river sand are very compatible with constructions applications, in contrast to the property of desert sand, that is smooth and fine, and marine sand, which has high corrosive salts content. The versatility and quality of this material have made it a key ingredient in many construction processes such as concrete, mortar, and brick laying. The river sand is one of the most preferred choice because the sand making process very quick with cement. This in turn creates a larger surface area for adhesion and allows a better interlocking of sand particles with the cement paste, because of their irregular angular shape. The net effect of this improved bonding is stronger, better, and longer-lasting structures capable of bearing greater loads and environmental stresses.

The coarse nature of river sand is also a major contributor to its effectiveness. The river sand is a coarse aggregate which is different from the smooth type that provides more friction and grip to the concrete or mortar mixture. By incorporating this increased level maintenance causes to direct correlations, friction, forces within the structure become more evenly distributed, therefore decreasing the chance of cracks or weaknesses over time on a structural level.

1.3 IMPORTANCE OF RIVER SAND

1.3.1 Construction Industry

Key in concrete and mortar for many construction projects, including the homes, roads, bridges and other infrastructure we all rely on, river sand has become a target for greedy developers. Environmental issues due to extensive river sand mining in most of the region due to high demand in the construction of dams. Such extractions may change riverine trophic structure – or flow – and local fauna habitat. This has led to some countries looking to alternative materials or sustainable sand mining practices to meet construction needs without compromising the environment. The demand for sand is directly proportional to the growing construction industry.

1.3.2 Economic Significance

River sand mining is also profitable and provides many jobs in many regions. It helps local economies but also may trigger economic inequalities without the right management This sector usually generates a mixed economic environment, spreading advantages and barriers all over local populations. Over exploitation of natural resource through indiscriminate or unregulated sand mining can make development unsustainable in the long-run and known to be detrimental to the environment.

1.4 Purpose and Scope of the Study

In this research we focus to assess the various impacts associated with river sand mining including environmental, socioeconomic, and regulatory perspectives in order to understand the importance of this global phenomenon. While urbanisation across the world is growing rapidly, and the capacity of infrastructure needs to match this, an unsustainable mining of river sand is making it even harder to provide the necessary construction materials, threatening the fragile river ecosystems and the communities that rely on these ecosystems.

This research is focused on the following:

i. Environmental Impacts: This involves assessing the geological modifications in rivers- the shape, water dumping, and sediment transportation. It also reassesses the environmental impacts, like disruption of aquatic ecosystems, and loss of species.
ii. Socioeconomic Impact: The study looks at economic reliance on river sand, job creation in the mining sector, as well as loss of local government revenue. It also examines the social ramifications on riverine communities forced to relocate, health risks, and loss of traditional livelihoods.

1.5 AIM AND OBJECTIVES

The aim of this research is to assess the impacts of sand delivery and mining in the Karbi langpi river. This aim was achieved through the following objectives;

1. To examine the socio-economic impacts of sand mining on the Karbi langpi river.
2. To examine the spatio-temporal patterns of sand mining activities across the study area.

1.6 ORGANISATION OF THE REPORT

This Project comprises five chapters, which are structured as follows:

- **Chapter 2** provides a comprehensive literature review on river sand mining, encompassing research from various scholars.
- **Chapter 3** provides details about the study area, including the data collection methods, data processing techniques, and tools employed in the study.
- **Chapter 4** focuses on methodology. It outlines data collection using Landsat imagery, field observations, questionnaires and other document related to sand mining.This chapter discusses crucial details impacting the investigation's findings.
- **Chapter 5** encompasses the results obtained from field observation, Structured questionnaire and LULC analysis.
- **Chapter 6** concludes the report on Impact of river sand mining to its surrounding environment.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

A literature review is one of the basic components of academic research, being a systematic feature of productive scholarship on a specific theme. This is a systematic process of searching, selecting, and synthesizing all related studies, articles, and books, in an attempt to identify trends, gaps, and key insights. The literature review is a vital part of a research paper, by critique earlier researches it not only puts the current study in a more general academic context but also sheds light on the contributions and limitations of previous works. The importance of carrying out this process is two-fold; it informs the approach of prior research in the field, which helps establish the grounds of credibility for the research itself, as well as the process by which the research questions and methods are formed in order to conduct a well-informed and rigorous study. The following is discussed in a number of papers:

2.2 LITERATURE REVIEW

- **E.S. Rentier, L.H.Cammeraat (2022):** The paper discusses the impact of river sand mining on the environment, focusing on sediment supply, transport, and deposition processes. The paper emphasizes the importance of understanding sediment supply, transport, and deposition processes to assess the impact of river sand mining on the environment.It discusses the effects of river sand mining on different environmental aspects such as physical, biological, chemical, and anthropogenic environments.Recommendations are provided for sustainable sand extraction, including seeking sustainable sources of construction-grade sand, implementing global guidelines, and monitoring sediment mining activities.
- **Adza et al**: This study used a multidimensional approach to assess the socioeconomic and environmental implications of sand and gravel mining in Maroua, Cameroon. The research approach used various data collection methods, such as structured questionnaires, focus group discussions, field observations, interviews,laboratory

analyses. The study, based on original fieldwork and stakeholder engagement, found that the rise in sand mining operations reshaped river morphology at an astonishingly fast time scale of depletion leading to resource depletion and ecosystem degradation. The analysis also found increasing conflicts between mining companies and residents, underlining the intricate web of social relations that resource extraction creates in the region.The combination of qualitative and quantitative methods provided a thorough understanding of both the immediate and long-term effects of mining activities on the local ecosystem.

- **Podila Sankara Pitchaiah (2017):** The paper reviews the impacts of sand mining on the environment, focusing on river channels, physical habitats, food webs, and the velocity of flow in rivers. It discusses how sand mining leads to the destruction of river banks, removal of vegetation, and the decrease in faunal populations. The review also highlights the importance of sand dunes in coastal protection and the threats posed by sand mining to water tables, turbidity, saline water intrusion, and overall environmental quality. The collected data was analyzed to understand the different aspects affected by sand mining, such as water tables, biodiversity, coastal erosion, and societal impacts. The research gathered data from various case studies and academic sources related to sand mining impacts on the environment. Multiple case studies were reviewed to provide real-world examples of the environmental consequences of sand mining in different regions like Kerala, Kenya, and the Caribbean Islands. The research concluded that sand mining has severe negative impacts on the environment, including water table depletion, coastal erosion, loss of biodiversity, and damage to infrastructure.
- **Asabonga Mngeni , Motebang D. V. Nakin(2016):** The paper discusses the impacts of sand mining on rural communities, focusing on community engagement, data collection methods, and the socio-economic effects of sand mining activitiesThe study focused on understanding community perceptions of sand mining activities and their impact on livelihoods. It aimed to determine if there was a consensus among communities regarding the effects of mining operations. Various methods were employed, including focus group discussions, questionnaires, transect walks, and interviews with stakeholders. The findings highlighted profitability through job creation in certain mining sites, emphasizing the need for sustainable management practices and community involvement in resource management.

- **Sadeghi *et al.* (2018):** The paper explores the environmental impacts of river sand and gravel mining in Dagiri, Gwagwalada Area Council. Data was collected through interviews, field observations, and questionnaires. The study revealed that the majority of respondents were traders, and the mining activities led to landscape destruction, deforestation, and pollution.The research employed both descriptive and inferential statistics to analyze the data collected. The results indicated that river sand and gravel mining had detrimental effects on the environment, including erosion, flooding, and loss of biodiversity. The study recommended the implementation of environmental assessment, management, and monitoring programs to mitigate these effects.In conclusion, the paper highlighted the urgent need for alternative construction material sources to reduce the impact of river sand mining in Gwagwalada Area Council and the Federal Capital Territory. The findings underscored the importance of sustainable mining practices to preserve the environment and prevent further degradation
- **Ike Kumala Sari, Sudarti Sudarti (2020):** This research paper aims to analyse the public perception in terms of the effects caused by sand mining on Mujur River and Regoyo River, Pasirian District, Lumajang Regency, East Java Province. This study used a survey research method and collect the data from observations, documentation and questionnaires from 30 respondents in the surrounding community.The study also supports high public perception of sand mining impact on Mujur and Regoyo Rivers, where the results of the questionnaire show between positive and negative impacts are evenly distributed. The positive impacts are about income increase, unemployment decrease, employment generation while on the other side the negative impacts include air pollution erosion and road damage.From the analysis we can conclude that the communities in the Mujur and Regoyo River at a glance have positive and negative perceptions regarding sand mining impact. For the percentage assessments, public perception fell into the high-to-very-high categories: people were widely conscious of sand mining impacts on the environment and livelihoods.
- **Arsyad et al. (2023):** The present study was conducted to assess the social, economic and environmental impacts of sand mining along Saddang River in Pinrang Regency, South Sulawesi Province of Indonesia.Field surveys were the main data collection method to assess production capacity, costs, selling prices and other economic values linked to sand mining.The socio-economic value of sand mining explains the dilemma of local communities and the district government towards this activity in this study, as well

as its environmental impact.If not properly managed, sand mining activities may be excessive, resulting in forms of physical and ecological damage in the region.

- **Sangeeta Choudhary et al. (2023) :** Sand used in infrastructural activities, it plays a crucial role for construction of infrastructure facility but after the definition of the necessary supply chain source, its availability gives an alarming signal to many states such as Rajasthan where sand originates from river mining. This study explains about river sand mining and impact over environment from Ajmer city (road interaction check via satellite images) forecasted to be semi-urbanized within two decades. It points sand mining as an economic blessing, while also making the point that extraction outweighing its rate of replenishment is detrimental and can cause widespread harm to the river system. The study also explores their environmental effects on rivers such as ecological destruction, sediment transport, and supporting plant species.

- **Zia et al. (2022):** The study explores the effects of sand mining along the Odene-Aguleri River and demonstrates the existence of multifaceted impacts intertwining environmental, socioeconomic and land-use conflicts. It was found to be mostly fine sand and environmental impacts were associated, like reduced water quality, loss of fishing habitat, riverbank erosion and changed channel form.Observations of the positive socioeconomic impacts of sand mining, such as youth job provision and increased household income generation, were made alongside conflicts over royalty sharing between individual community members and local authorities to damage infrastructure seekers to disagreements among community-based organization leaders and government officials.
- **Tonia Nkiru Nwobod et al. (2021):** The Ava River in Enugu State, Nigeria, was the specific focus of the study, which examined how sand mining affects land use and land cover in developing nations.The study mentioned a number of sources, such as studies by Abraham et al., Adedeji et al., Atejioye & Odeyemi, and others, emphasizing the significance of keeping a watch on sand mining sites and evaluating the effects on the ecosystem.The study used remote sensing and GIS tools to examine land cover changes caused by sand mining activities, emphasizing the importance of sustainable development practices and environmental conservation.

CHAPTER 3

STUDY AREA, DATA & TOOLS

3.1 STUDY AREA

3.1.1 INTRODUCTION

Karbi Langpi is a tributary river of the Kapili River located in West Karbi Anglong, Assam, north-east India. It has its origin in the capture ground of the Meghalaya and passes through the beautiful landscapes of West Karbi anglong which have importance in the ecology and socio-economic strata of the region. The Karbi langpi River flows from West to East and feeds the neighbouring regions with its lifelines. It traverses the hilly patter of West Karbi anglong, later merging with the Kapili River and creating a healthy environment for wide range of plant and animals.

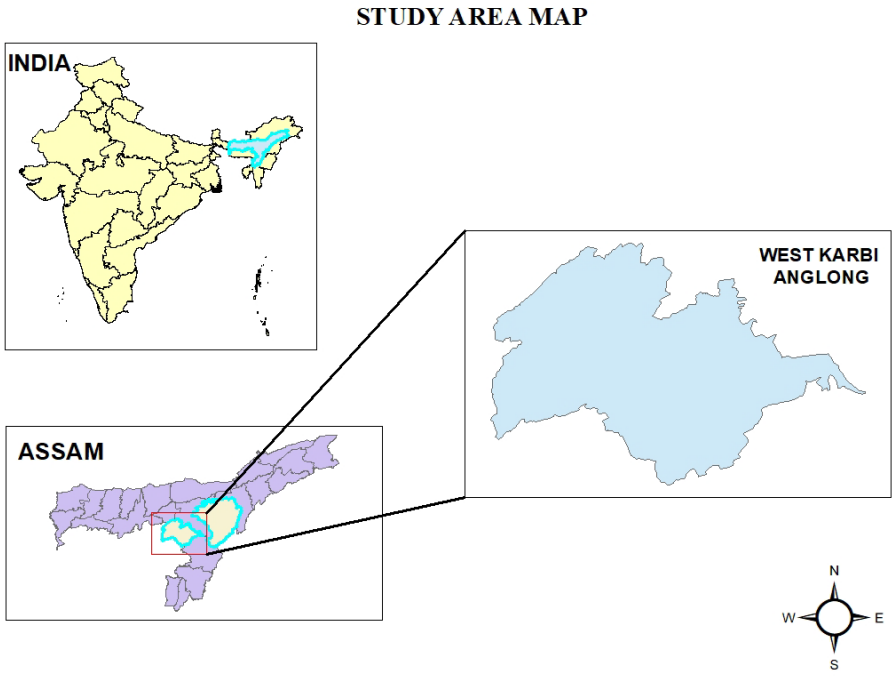

Fig 3.1: Map showing the study area

The Karbi langpi River Basin is settled by a vast population that dependent on rivers for diversified livelihood. Population density is low in the mountain region, agriculture, livestock

and crafts are traditional to a village. The river enters the plains of Assam with higher population density and intensive land use due to large-scale agriculture activities, including paddy cultivation, horticulture, and fishing.

3.2 DATA

In this study, a quantitative and descriptive research design will be applied. The data will be collected from both secondary and primary sources. The secondary data will constitute by academic articles, governmental documents and other web resources that discuss sand mining and its environmental and socio-economic consequences. Direct access to the study area will be used for Primary data collection. Community leaders and sand miners will be interviewed using semi-structured interviews. Residents in communities directly impacted by the sand mining operations will also be administered structured questionnaires. We will conduct field observations and measurements of the riverbank morphology, and sand mining activity levels. Geospatial data to be collected via GPS mapping, satellite imagery analysis and GIS.A purposive sampling technique will be employed alongside systematic random sampling to ensure focused representation. Communities directly impacted by sand mining activities within the designated 5km study area will be targeted. This combined approach ensures a balance between capturing the diversity of experiences and perspectives within the affected population while maintaining a statistically generalizable sample. This multi-faceted data collection strategy will provide a comprehensive understanding of the environmental and socio-economic effects of sand mining practices along the Karbi langpi River.

3.3 TOOLS

3.3.1 ArcGIS - This study primarily used ArcGIS (Geographic Information System) software developed by Esri. ArcGIS is essential for spatial analysis, mapping, and visualization of geographic data needed to investigate river morphology, land-use patterns and environmental changes. It combines multiple data types—satellite imagery, digital elevation models (DEMs), field surveys—to clearly manipulate terrain, hydrology and vegetation. ArcGIS allows users to create maps, identify spatial relationships and produce outputs including flood risk maps or a

habitat suitability model that are integral to informative decision-making for environmental and geographic research.

3.3.2 Google Earth Pro- Google Earth Pro is geospatial software that enables users to visualize the world and generate intricate maps. This application now grants all users access to superior, high-resolution aerial and ground imagery. In addition to providing a top-down perspective of the planet, Google Earth Pro offers various tools and layers for exploring Earth's diverse landscapes. It can be considered a capable and professional program that is readily accessible to the public. For the purposes of this research, we will utilize Google Earth Pro to identify the study area and identify the changes that occurred on the study site in the last few years.

CHAPTER 4

METHODOLOGY

Methodology is a systematic framework for analyzing research methods in a specific field of study. It provides a structured approach to collecting, interpreting, and validating data, guiding researchers in understanding complex phenomena. By establishing principles that ensure research reliability and accuracy, methodology serves as a strategic blueprint for conducting rigorous scientific investigations This systematic approach helps researchers design appropriate experiments, select suitable data collection techniques, and apply appropriate analytical tools to answer their research questions effectively. Methodology also enables scholars to critically evaluate existing research, identify gaps in knowledge, and propose innovative solutions to address complex problems in their respective fields. Furthermore, a well-defined methodology enhances the transparency and reproducibility of research findings, contributing to the overall advancement of scientific knowledge and fostering collaboration among researchers across disciplines.

4.1 INTRODUCTION: The methodology used for preparation and assessment is illustrated through the following FLOW CHART

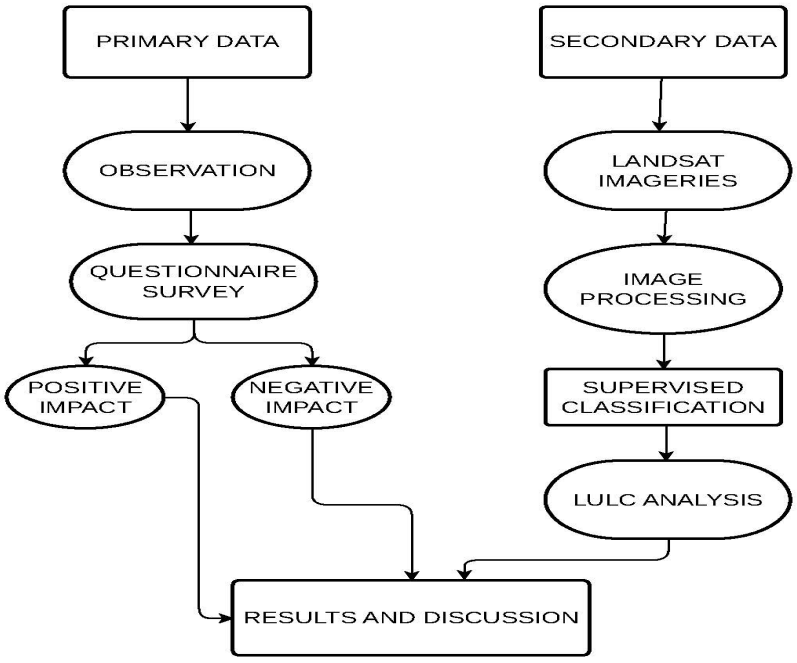

Fig 4.1: Operational Flowchart

4.2 OPERATIONS IN GOOGLE EARTH PRO:

The research area is identified and the geographical alteration is examined using Google Earth Pro software.

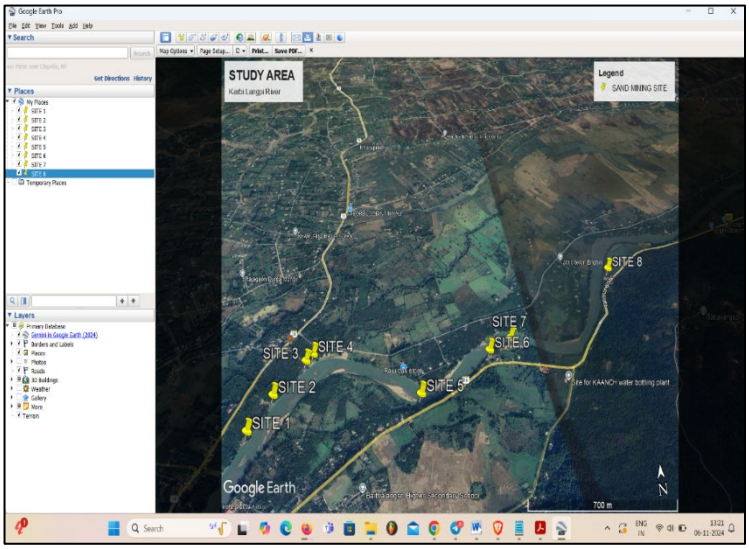

Fig 4.2: Locating the mining site

4.3 COLLECTION OF DATA :

This study employed a qualitative research methodology, which aims to provide narrative descriptions of activities and their impact on life. The investigation took place in the Karbi Langpi areas, specifically in Baithalangso,West Karbi Anglong District, Assam. This site was selected due to ongoing sand mining operations in the river, which have resulted in road deterioration, noise and air pollution, and other detrimental effects. The study involved approximately 30 local residents as respondents. Conducted over a 5-month period from August to December 2024, the research utilized the following types of data and sources:

1. Primary Data

Information gathered directly from the field and community responses constitutes primary data.

2. Secondary Data

Information obtained from various sources, including literature reviews related to the research and Landsat images acquired from the USGS website, is considered secondary data.

The following methods were employed to collect the necessary information for this study:

i. Observation

This technique involves directly gathering data from the field. The observed information encompasses attitudes, behaviors, actions, and interactions. Generally, observation can be described as a method of systematically watching and recording phenomena to gather various information about the objects under study. In this case, direct observations were conducted to assess the impact of sand mining activities on the Karbi Langpi River and its surrounding community. The focus of these observations was on sand mining operations and their effects on the local population near the river.

ii. Questionnaire

A questionnaire is a versatile data collection tool that can be structured in multiple ways. It consists of a set of organized questions with predetermined answer options, allowing respondents to select answers based on their perceptions.

iii. Documents

In this study, the documents used were in the form of photos, notes from field observations and Landsat images from USGS website. Documentation is used to obtain sand mining activities carried out in the Karbi langpi River. Documentation is done using improvised tools, namely mobile phones.

In this study, data analysis was carried out quantitatively with the help of tables explaining the results of the questionnaires for the community around Karbi langpi River,Baithalangso,West karbi angling District. Next, the table will be explained using a description. The calculation of the questionnaire score is as follows:

SA = F x 4;

A = F x 3;

DS = F x 2;

and SD = F x 1.

Where F is the frequency. The maximum score if the respondent chooses to agree is 120. Then the percentage calculation is calculated using the following formula:

(total score) / (maximum score) x 100%

Finally, Geographical Information System (GIS) and remote sensing data were utilized to examine Land Use Land Cover (LULC) changes, providing a visual representation of sand bar alterations. The imagery encompassed the study region for the years 2021 and 2024. Supervised image classification was conducted using ArcGIS 10.4. This classification method was selected based on familiarity with the study area and preliminary survey findings. Subsequently, a classification scheme was developed, offering a broad categorization of the area's LULC. The categories included built-up areas, agricultural land, forest cover, sand bars, and rivers. The process involved training areas, signature files, and image classification. The area of each class was calculated and used to create charts and figures for presentation.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 FIELD OBSERVATION RESULTS

There are quite some mining locations in Baithalangso town area which are in the Karbi langpi River. The results of mining observations can be shown in the images below.

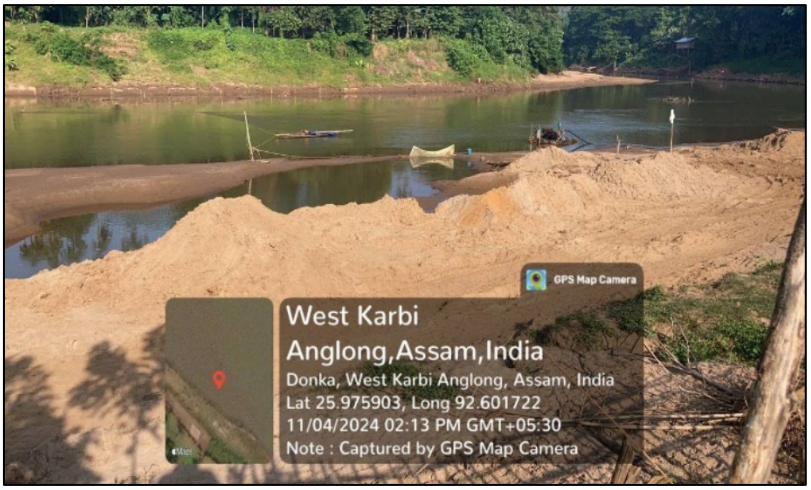

Fig 5.1: Mining site 1

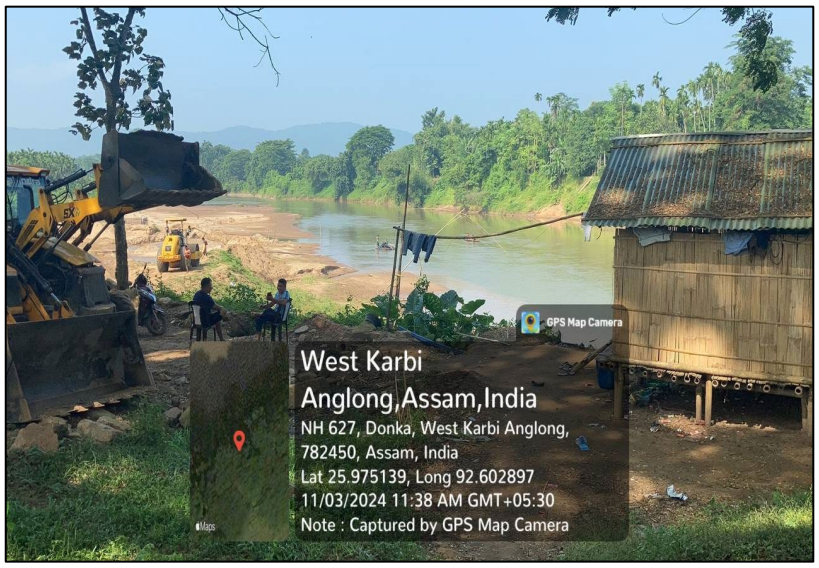

Fig 5.2: Mining site 2

Fig 5.3: Mining site 3

Fig 5.4: Mining site 4

The condition of the sand mining site is concerning, as all extraction areas are situated near the main road. The mining operations at this location rely heavily on manual labour and extensive use of heavy excavators. Not only are sand resources being extracted, but mining operators and workers also disregard environmental impact assessments.

Former mining activities have left numerous excavation pits, resulting in uneven terrain that can lead to environmental degradation. The sand extraction near this river has caused road deterioration due to the frequent passage of sand-laden trucks. This has disrupted local community activities, as the affected road serves as a crucial access route for residents. Additionally, the sand mining operations contribute to air and noise pollution, as well as increased ambient temperatures in the surrounding area. Visual evidence of the mining activities in the river can be observed in the image provided below.

Fig 5.5: Before mining on site 1

Fig 5.6: During mining on site 1

Fig 5.7: Road before mining in 2021

Fig 5.8: Road during mining in 2024

The surrounding community relies on the access road for their daily activities, but potholes and bumps impede their movement. Many in the mining industry fail to consider the consequences of their operations. The use of heavy excavators in mining leaves significant scars on the landscape, resulting in uneven terrain that affects the surrounding environment.

Sand mining activities on the Karbi langpi River, situated near residential areas, cause various disturbances to the local population. These include dust from sand trucks dirtying homes, noise disrupting daily life, damaged roads hindering mobility, and increased ambient temperature. The route used by sand-carrying trucks passes close to several schools, including a Kindergarten and Elementary School. This proximity poses a danger to young students.

The presence of sand mining has created discomfort and unease among community members, as the roads they use for daily activities are dominated by sand mining trucks. Currently, residents remain dissatisfied with the sand trucks using their access road. The continuous movement of heavy sand trucks not only endangers young children but also disrupts the daily lives of local inhabitants. This situation has created tension within the community, with people feeling that their mobility and quality of life have been compromised. Moreover, the ongoing conflict

between mining operations and community needs underscores the necessity of finding a sustainable solution that balances economic interests with public safety and well-being.

In conclusion, it has resulted in excessive degradation of the ecology around the mining sites. In particular, it has been observed that there is a decrease of marine wildlife along with the increase of water pollution with the waste produced from the machinery that is being used for mining. For example, spillage of oil from the excavator, trucks, etc. The other concerns that could be pointed out are the noise pollution from the continuous running of the machines and the damages caused to the public properties, e.g., roads, etc. Due to which the local public has to face "the problem of plenty" or "the Dutch disease," which is the lack of rights to proper public service, including good roads and lack of proper dissolution of funds for the holistic development of the area. Thus, for such mining activities, it is necessary to keep a check on the issuing of licenses and monitor the mining activities on an interval basis.

5.2 QUESTIONNAIRE RESULTS OF NEIGHBORHOOD COMMUNITY

To gauge the community's views on sand mining's effects, questionnaires were distributed to local residents. The survey employed a four-point scale for responses. Participants could select from Strongly Agree (SA), Agree (A), Disagree (DS), or Strongly Disagree (SD). These options were assigned scores of 4, 3, 2, and 1, respectively. The questionnaire was structured into two sections, addressing both the positive and negative impacts of sand mining.

TABLE 5.1

5.2.1 PRESENTATION ASSESSMENT CRITERIA CLASSIFICATION

NO	Percentage	Assesment Criteria
1	0%-25%	Very low
2	25%-50%	Low
3	50%-75%	High
4	75%-100%	Very high

TABLE 5.2

5.2.2 RESULTS OF THE QUESTIONNAIRE ON THE POSITIVE IMPACT ON SAND MINING

Question		SA	A	D	SD	TOTAL	SCORE
Sand mining makes building materials, namely sand, easy to obtain at low prices.	Frequency	8	15	7	0	120	75.83%
	Score	32	45	14	0	91	
Sand mining makes building materials, namely sand, easy to obtain in a short time	Frequency	6	18	6	0	120	75%
	Score	24	54	12	0	90	
Sand mining opens up new jobs	Frequency	4	10	14	2	120	63.33%
	Score	16	30	28	2	76	
Sand mining adds to the income of the community around the river	Frequency	5	8	17	0	120	65%
	Score	20	24	34	0	78	

TABLE 5.3

5.2.3 THE RESULTS OF THE QUESTIONNAIRE ON THE NEGATIVE IMPACT OF SAND MINING

Question		SA	A	D	SD	TOTAL	SCORE
Sand mining causes air pollution	Frequency	16	14	0	0	120	88.33%
	Score	64	42	0	0	106	
Sand mining causes damage to road access	Frequency	25	5	0	0	120	95.83%
	Score	100	15	0	0	115	

Sand mining causes erosion	Frequency	18	12	0	0	120	90%
	Score	72	36	0	0	108	
Sand mining causes river water to be polluted	Frequency	13	17	0	0	120	85.83%
	Score	52	51	0	0	103	
Sand mining causes noise pollution	Frequency	9	15	6	0	120	77.5%
	Score	36	45	12	0	93	
Sand mining causes accidents due to damaged roads to increase	Frequency	8	17	5	0	120	77.5%
	Score	32	51	10	0	93	

Based on the questionnaire results distributed to 30 respondents, it was found that the community's perception of sand mining in the Karbi langpi River was based on a positive impact; namely 75.83% of the community agreed that Sand mining makes building materials, namely sand, easy to obtain at low prices. A total of 75% of people agree that Sand mining makes building materials, namely sand, easy to obtain in a short time, 63.33% of people agree that sand mining creates new jobs, 65% of people agree that Sand mining adds to the income of the community around the Karbi langpi River, The results of the questionnaire showed a percentage of 63.33% to 75.83%. It means that according to the classification of the assessment results, the percentage of the questionnaire results is included in the criteria of high to very high.

The results of the questionnaire based on negative impacts, namely 88.33% of the community agree that sand mining causes air pollution, 90% of the community agree that sand mining causes erosion, 85.83% of the community agrees that sand mining causes polluted river water, 95.83% of the community agree that sand mining causes damage to road access, 77.5% of people agree that sand mining causes the accident rate due to damaged roads to increase, and 77.5% of people agree that Sand mining causes noise pollution. The results of the questionnaire showed a percentage of 77.5% to 95.83%. According to the assessment classification, the percentage of questionnaire results is included in the high to very high criteria.

5.3 LULC ANALYSIS

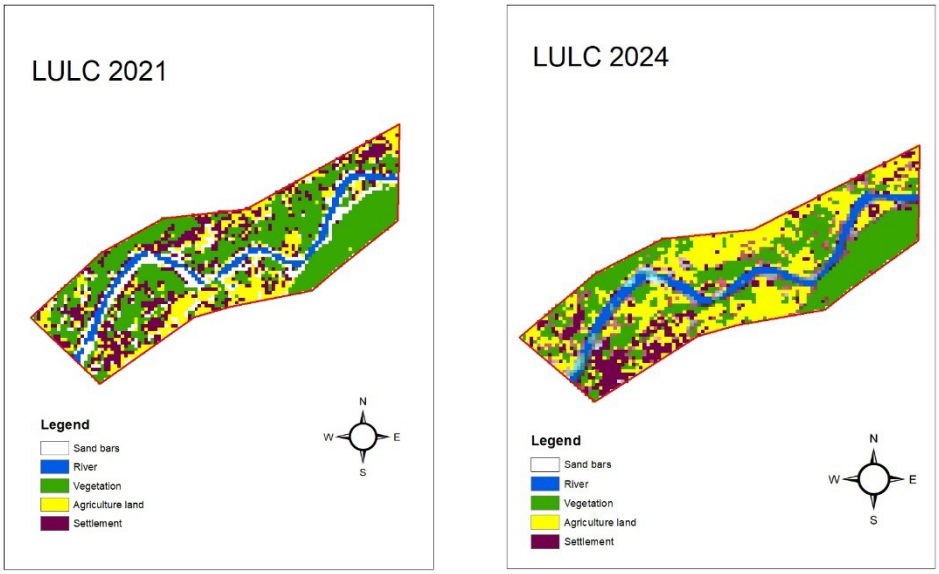

FIG 5.9 - LULC Mapping for year 2021 and 2024

5.4 RESULT OF LULC ANALYSIS:

TABLE 5.4

NAME	2021		2024	
	Sum of Area (Km^2)	Total Area (%)	Sum of Area (Km^2)	Total Area (%)
SAND BARS	0.984114726	33%	0.491798777	17%
RIVER	0.216693797	7%	0.196516862	7%
VEGETATION	0.402864685	14%	0.393761174	13%

AGRICULTURE LAND	0.338035805	11%	0.591511372	20%
SETTLEMENT	1.034376155	35%	1.30304348	44%
TOTAL AREA (Km^2)	2.976085168	100%	2.976631666	100%

In 2021, the region categorized as sand bars saw a significant reduction, measuring at 33%, and further decreased to 17% by 2024. These alterations could be attributed to various causes, including natural occurrences or human activities such as sand extraction.

CHAPTER 6

CONCLUSION

6.1 CONCLUSION

The analysis of public opinions regarding sand mining's impact on the Karbi langpi River reveals a high level of awareness among community members, as evidenced by questionnaire results. The percentage calculations fall within the high to very high range according to the assessment criteria. This indicates that residents near the Karbi langpi River recognize both positive and negative consequences of sand mining activities.

On the positive side, sand mining is seen to boost local income, generate employment opportunities, and provide easier access to affordable building materials in a timely manner. However, the negative effects include air pollution, erosion, river contamination, deterioration of road infrastructure, increased traffic accidents due to damaged roads, and the river becoming more turbid and shallow.

Given these findings, it is crucial for various stakeholders, including government officials, local residents, and sand mining operators, to address the negative impacts. Sand mining companies should conduct thorough environmental impact assessments to minimize or eliminate adverse effects, thereby preventing conflicts with the local community.

REFERENCES

1. E.S. Rentier, L.H. Cammeraat, "The physical and environmental impacts of sand mining", vol. 838, 2022, Article 155877.
2. Mia, M., Karikar, B. A., Mohibul, S., Ali, M. I., Khanam, N., & Siddiqui, L. (2024). Environmental and Socio-economic Impacts of River Sand and Gravel Mining: A Review.
3. Kumar, S., Meena, S., Gupta, P., Sharma, S., & Choudhary, S. (2023). Scope and Impact of River Sand Mining in Ajmer, Rajasthan. 10(7), 287-287. DOI: 10.17148/IARJSET.2023.10740.
4. Sari, I. K., & Sudarti, S. (2021). Analysis of community perception on the impact of sand mining on the Mujur River and Regoyo River, Pasirian District, Lumajang Regency, 2(2), 15-29.
5. Nwobodo, T. N., Ogbuene, B. E., & Nzeadibe, T. C. (2021). Effects of sand mining on land use/land cover on river environment in developing countries: A case study of Ava River in Enugu State, Nigeria., 22(3), 1-25.
6. Yunus, A., Rukmana, D., Salman, D., Alimuddin, I., Arifin, M.A., Jamaluddin, H., Nurdirman, E., Ihsan, M., Bauna, R., & Tinta, Y. (2024). Economic value and environmental impact of Saddang River sand mining, Pinrang Regency, South Sulawesi, Indonesia, 11(2), 5495-5508. doi:10.15243/jdmlm.2024.112.5495.
7. Mngeni, A., Nakin, M. D. V., & Others. (2016). The effects of sand mining on rural communities. WIT Transactions on Ecology and The Environment, Vol 210, 452-453. DOI: 10.2495/SDP160371.
8. Du, L. (2022). Identification and impact analysis of sand mining in Ganges-Brahmaputra-Meghna Delta for the period (2016 to 2021) by using Google Earth satellite imagery and GIS. University of Birmingham. DOI: 10.13140/RG.2.2.18496.55044
9. Ukah, C., David (2024). Environmental Effect of River Sand and Gravel Mining in Dagiri Gwagwalada Area Council of the FCT, 10(5), 37-52.
10. Abdulazeez, A. (2023). Dynamics and Impacts of Sand Mining in the Watari River Basin in Kano State, Nigeria.