

# Socio-economic implication of Yedzeram river bank erosion and floodings on the livelihood of Southern Mubi Community Dwellers, Adamawa, Nigeria

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**ABSTRACT:** Southern Mubi is highly susceptible to flooding and river bank erosion. Understanding the community's vulnerability to these hazards is crucial for implementing effective mitigation measures. The study was conducted in the most vulnerable regions of Mubi along the stretch of the Yedzeram River (Gudu, Duvu/Girburum, Nasarawo and Dirbishi/Gandira communities). The aim and objectives of the study were to determine the effects of river bank erosion in the study area, to examine the causes of erosion, to determine the changing nature of income earning sources and effects on the livelihood of the inhabitants due to river bank erosion and flooding in the study area. To achieve these objectives, 113 households were randomly sampled from the study wards. In addition, 7 key informants were randomly selected from among local leaders: 4 "Maiagwan" and 3 officials responsible for disaster risk reduction and management at the state level. The results indicate that river bank erosion and flooding are the primary hazards affecting the communities in the study area. More than 60,000 families were made homeless, 7 have been reported dead, and damage to crops and properties amounted to several millions of Naira. Agriculture farmlands (66%), schools and small businesses (30%) are the main income sources impacted by these hazards with 48% of respondents heavily dependent on agriculture as their sole source of income. Land use change in the form of large-scale deforestation (41%), floodplain encroachment (42%), increased rainfall intensity (15%), and proximity to rivers were identified as perceived causes of riverbank erosion and consequent significant contributors to community vulnerability. Settlement along the bank should be curtailed to minimise the vulnerability and incur loss of the populace. It is recommended that flood plain zoning be carried out and the limit circulated. This will lessen the impact of this erosion on the populace along the Yedzeram River.

**Keywords:** Bank erosion, flood, livelihood, Southern Mubi, Yedzeram River.

## INTRODUCTION

A well-defined channel of rivers alleged to be stable can shift over time. This is possible through the processes of erosion or sedimentation. This restructuring is called bank erosion. Due to climate change, rainfall patterns are ever changing and it produces abnormal flooding. Landscape degradation, environmental and socio-economic impacts are observed in different countries at different scales due to river bank erosion. River bank erosion is not an issue when no human settlement or infrastructure is present. But this natural phenomenon becomes a disaster when

riparian buffers are not maintained, and human settlements are situated too close to eroding banks (Appendix Plates 1 to 6). The occurrence of environmental hazards such as flooding is not new. However, what is new is the increasing level of damage to lives and properties witnessed as a result of high-magnitude and highly frequent floods experienced in developing countries such as Nigeria (Abubakar *et al.*, 2020). Practically no flooding happens in the nation without the influence and grievous impact on the northeast of Nigeria especially in the study area.

Wherever bank erosion occurs, its existence leaves an indelible impact on lives and livelihoods in most part of the globe. Bank erosion can affect well-being, withdrawal safety and shelter assurance, as well as sources of livelihood of the bank dweller. Displaced people face economic insecurity due to the loss of agricultural land and become unemployed. In Nigeria especially North-east, bank erosion occurrence always imprints socioeconomic hassle and tussle. These include susceptibility to security and physical threats, sexual violence, loss of contact with family members, insecure temporal abode or shelter, shift in group (independent to dependent group), discrimination in palliative distribution, and loss of lives and properties. In the study area, cases of loss of farmlands due to farm flush, break in school calendar due to flooding, and forced migration rendering inhabitants jobless are not uncommon. The factors that contribute to flooding and bank erosion are often complicated and changeable (Haddow *et al.*, 2020; Depicker *et al.*, 2021).

In the study area, in 1994, the dam along river Yedzeram was the cause of flooding in Jere Bowl. A flash flood from the river caused extensive flooding in Maiduguri and in 2012, torrential rainfall caused the Alau Dam to open its evacuation valve, releasing a massive amount of water that caused flooding in Maiduguri and the surrounding areas. On the other hand, the presence of Lagdo dam is a case study in the context of river bank erosion in the study areas. Like other dams, the Lagdo dam contributes positive benefits to the region: obtaining domestic and irrigation water from the stored water, increasing agricultural land, as well as crop intensification, controlling stream regimes consequently preventing floods, etc. (Umar *et al.*, 2020). However, it causes changes in the level, velocity and discharge of the flow in the Upper Benue River Basin downstream of the dam. Leading to waterlogging, and erosion of the river banks and beds. Consequently, landscape degradation (Appendix Plates 1 to 6), mass wasting, environmental and socio-economic impacts are noticeable at different scales along the Yedzeram River. Cases of complete hijacking of school premises for more than a quarter of a session are not uncommon. Also, companies mostly block industry along the area are short down leading to denial of daily income to average inhabitants along this axis. Despite the study area's annual susceptibility to flooding and bank erosion, little documentation is available regarding this issue.

Most of the research work in the literature has been on the effect of anthropogenic activities on the river catchment (Abubakar *et al.* 2020). In the study area, a preliminary study of River Yedszeram Hydropower potential has been assessed (Umar *et al.*, 2020) but quantitative information on the socioeconomic effect of river bank erosion on community dwellers (temporal displacement, loss of occupation, loss of property, impact on health and disruption in education program, etc.) especially along this river are sparse. This study assessed the socio-economic impact of Yedzeram River bank

erosional activities on the inhabitants of the Southern Mubi Local Government Area. This study provides valuable insights for policymakers, underscoring the imperative for robust policies and programs aimed at mitigating the impacts of landslides and floods along the axis.

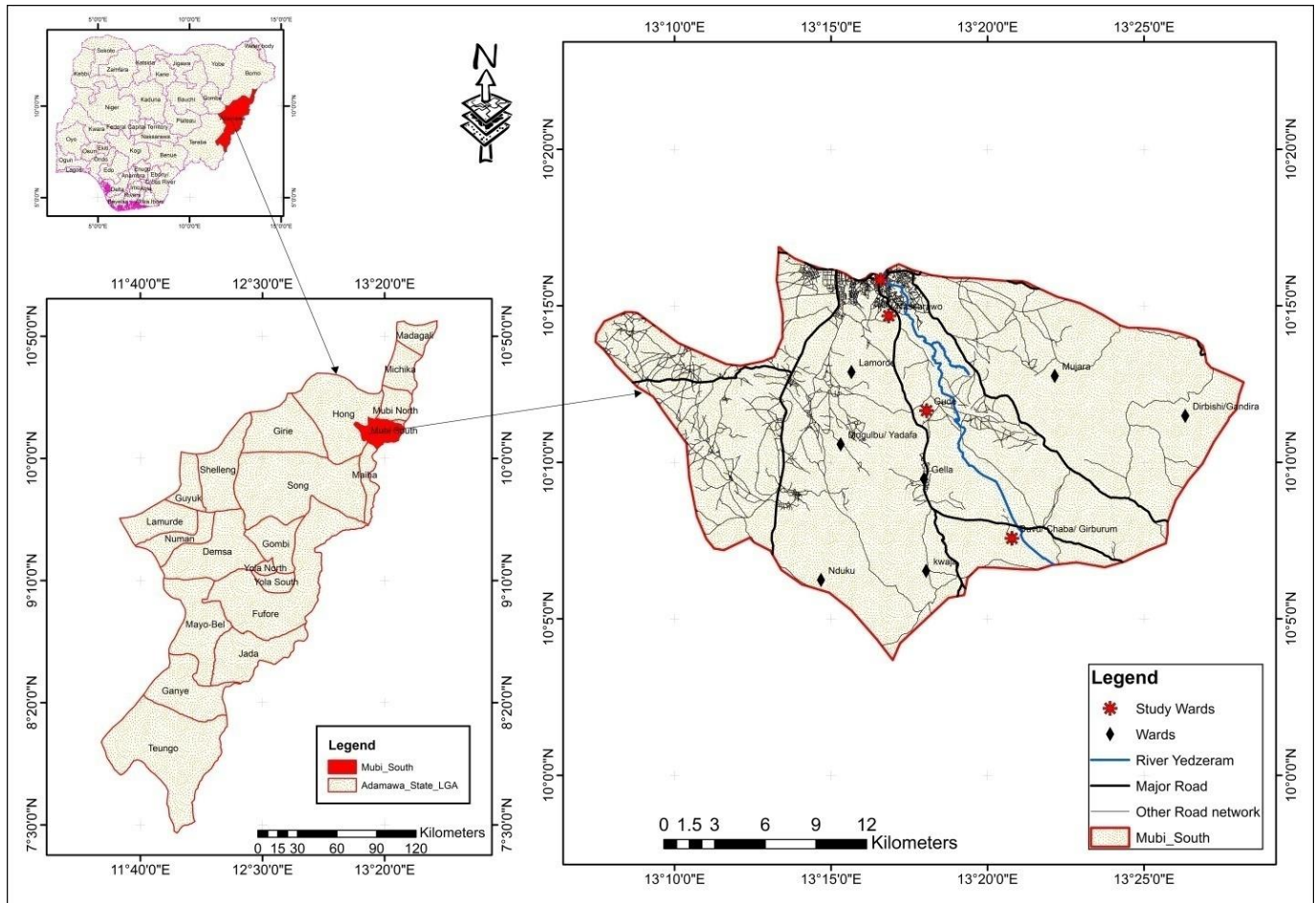
## MATERIALS AND METHODS

### Study area

River Yedzeram navigates and passes through Mubi, dissecting the state into two-Mubi South and Mubi North. It takes its source from the Hudu Hills southeast of Mubi and flows northwards into Lake Chad (Adebayo, 1999). The study area is located between longitude  $13^{\circ} 11' 12'' E$  and  $13^{\circ} 23' 00'' E$  and between latitudes  $10^{\circ} 06' 30''$  and  $10^{\circ} 26' 54''$  covering the whole area drained into the main Yedzeram channel from the river south area to the basin's outlet at Mayo Bani (Figure 1). The area is a mountainous region. Presence of isolated hills, and cliffs terrains, with an average elevation of 540 m high above the sea level (Umar *et al.*, 2020). The climate is tropical with temperatures ranging from  $19-26^{\circ}C$  from October to March, dry and hot with temperatures between  $26-33^{\circ}C$  from April to June while from June to September comes the warm, wet season. The soil of the study area is that of the class of ferruginous tropical soils of granitic parent material. They range from dark red through dark grey and are generally stony, coarse and shallow with almost undefined profiles (Zetter, 2012). The soils are usually poorly drained with textures ranging from sandy to loamy sand throughout the profile. This study focuses on some settlements along the river which are most prone to floods and bank erosion. The major towns around the river are Gude, Duvu/ Nassarawo, and Dirbishi/Gandera. The region is characterized by underdeveloped infrastructure compared to other urban and suburban areas in Adamawa, along with fragile hazard control systems. These communities were selected considering the endemic nature of the areas to bank erosion and flooding.

### Data collection and analysis

The first stage involved the identification of existing wards in the study area in May 2023, namely, Duvu/ Girburum ward, Nassarawo ward, Dirbishi/Gandira ward, Kwaja ward, Gella ward, Mujara ward, Yadafa ward, Lamurde ward, Nuduka ward and Gude ward. Among these 10 wards of the local government, four have been purposively selected as the study area (Figure 1) because this region is the most ravaged in terms of river bank erosion. The selected areas include Duvu/ Girburum ward, Nassarawo ward, Dirbishi/Gandira ward, and Gude ward. These were selected based on their endemic nature to flooding and river bank erosion. The information on the study area was



**Figure 1.** Location of the study area and wards.

collected through field observation, structured questionnaires and an interview schedule was administered to a sample of respondents. Seven (7) key informants were randomly selected from among local leaders for interview: 4 “Maiagwan” and 3 officials responsible for disaster risk reduction and management at the state level.

Regarding primary data collection, households living close to river banks were randomly sampled to be surveyed in each ward. The data was obtained as soon as the rainy season commenced on June 21st 2023. A multi-stage sampling techniques were used in the selection of respondents. The first stage involved the identification of existing wards along the river bank in May 2023, namely, Duvu Ward / Girburum, Nassarawo Ward, Dirbishi/Gandira Ward, and Gude Ward. Altogether a total sample of 113 households was considered. Structured questionnaire together with interview guide questions facilitated the collection of both quantitative and qualitative data. The major questions asked to respondents included: (1) demographic characteristics (age, sex, and occupation), (2) major hazards experienced in the study area and their impact on livelihoods, such as damage to house properties and farmlands, and loss of employment, (3) drivers of flood

vulnerability, (4) income sources affected by flood occurrence, (5) current disaster risk coping mechanisms practised in the study area.

The study targeted key informants through a guided interview process, generating qualitative data. A total of 7 key informants, including “Mai-angwa” and officials from the Adamawa State Ministry of Environment were included in the interview. The extent of the erosion damage in the study area was examined through visual inspection. A pilot test of the questionnaire was carried out to refine questions and ensure clarity. Triangulation was used by cross-referencing data from different sources to enhance data reliability. US Dolla (\$) was used to present the economic value of goods and properties expressed in this paper. The naira conversion used was one thousand six hundred and sixty-seven Naira (₦1667) per Dolla.

## RESULTS AND DISCUSSION

### Socio-economic characteristics of the respondents

The results in Table 1 provide critical insights into the

**Table 1.** Demographic description of the respondents.

Characteristics(N=120)	Categories	Frequency (%)	Value
Male respondents		54	45
Female respondents		66	55
Age Group	Below 18	6	5
	18-39	59	49
	40-59	36	30
	60 and above	19	16
Occupation	Farming	33	28
	Fishing	24	20
	Artisan /Small business	21	18
	Civil Servants	38	32
	Others	4	3
Educational background	Non formal	39	33
	Primary	55	46
	Secondary	19	16
	College	2	1
	University or Above	5	4

**Table 2.** Causes of flood and bank erosion in Mubi South

Causes of flood and bank erosion	Frequency	Percentage (%)
Floodplain Encroachment	51	42.5
Increase Rainfall intensity	18	15.0
Land use change (Deforestation, Constructions etc)	49	40.8
Low land area	2	1.7

Source: Household survey conducted by authors in Southern Mubi Communities, 2023.

demographic, age group, occupation, and educational background characteristics of the sampled population, which are essential for understanding their vulnerability. This study's findings indicate that 81 respondents possess formal education. This suggests that 67% of inhabitants in the study area have basic literacy skills. However, about 39 respondents can neither read nor write. There is a glaring indication of struggling to understand formal written communications, such as early warnings or risk reduction information. This difficulty in the interpretation of advisory service on media of communication, may increase vulnerability and hinder effective preparedness and recovery efforts during storm events. Akinsemolu and Olukoya (2020) reported that education plays a crucial role in reducing vulnerability by raising awareness about various measures to prevent the impacts of landslides and floods. Education can enhance community awareness and preparedness for disasters, promote better farming practices, and encourage diversification of livelihoods (Hoffmann and Blecha, 2020; Asio, 2021). Similarly, Table 1 shows that in terms of gender distribution a slight majority of female respondents (55%). This could be

attributed to men on the lookout for alternative tasks to argument for the family's needs. Table 1 also shows that the majority of respondents (79%) fall within the working-age group (18-59 years) and the older population (above 60 years) is smaller (16%). The same table shows that the majority (46%) of respondents have primary school as their highest level of education, and a remarkable number (48%) rely on agriculture as their occupation. Other occupations represented in small percentages include artisan/small business (welders, automobile mechanics, etc 18%; civil servants constitute 32% while traders/ keke Napep riders constitute 3%).

### **Hazards vulnerability drivers and impacts on the Community**

The study results indicate the factors contributing to flooding leading to river bank erosion in the study area. As depicted in Table 2, floodplain encroachment tops the list (42%). This finding confirmed the assertion of Abubakar *et al.* (2020). According to them, thousands of hectares of

**Table 3.** Nature of river channel, topography, and the type of erosion.

S/N	Communities	Road infrastructure		Terrain			Erosion effects			Remark
		Drains	Culvert	Flat	Sloppy	Steep	Gully	Rill	Crater	
1	Duvu/ Girburum		x		X		X	x		Major
2	Nassarawo	x	x		X		X	x	X	Severe
3	Dirbishi/ Gandira				X		X	x	X	Severe
4	Gude			x				x		Minor

Author Research Work (2023) Note: The symbol “x” represents the nature of river channel, topography, and the type of erosion.

**Table 4.** Livelihood sources affected by flood and river bank erosion.

Livelihood sources affected	Frequency	Percentage (%)
Homestead destroyed	0	0.0
Business/School obstructed	30	25.0
Farm land flushed	66	55.0
Displacement	21	17.5
Others	3	2.5

farmlands and other properties have been destroyed due to floodplain encroachment in Adamawa State. Closely followed is deforestation. 41% of the respondents attest to the fact that heavy dependence on agriculture for livelihood is leading to community vulnerability to floods and consequent river bank erosion. The other causes of river bank erosion identified include increase in rainfall intensity and the low terrain of the study area. This is contrary to the submission of Abubakkor *et al.* (2017). According to them, river bank erosion occurs mainly through sub-aerial weakening and weathering, fluvial erosion, and mass failure mechanisms. Sub-aerial weakening and weathering are considered as preliminary actions that weaken the river bank prior to fluvial erosion in Bangladesh.

#### Impact of river bank erosion and flooding on inhabitants of Southern Mubi communities

Table 3 shows the nature of the channels and the rate of erosion as well as the level of devastation. The areas with severe erosion effects are Nassarawo and Dirbishi/Gandira. These areas largely record the occurrence of flooding with immense impacts on the communities. In the category of major erosion effect on the channel is Duvu/Girburum while at present Gude has a minor effect. From the result presented, 50% of the locations had severe erosion effects, 25% of the locations had major erosion effects and 25% of the locations had minor erosion effects on their channels. This indicates more areas have severe effects. This finding corroborates the submission of Umar *et al.* (2020) and Pham *et al.* (2020). According to them, the area has geographical and geological characteristics conducive to both hazards,

including mountainous regions, with hilly, steep, and cliff terrains, with an average elevation of 540 m high above sea level and significant rainfall.

To understand how floods and river bank erosion affect people's livelihoods, the authors asked respondents to rank the primary livelihood sources affected by the hazards in their neighbourhood. As shown in Table 4, a total of 66 (55%) respondents said that the agriculture business tops the livelihood sources affected by the occurrence of floods and river bank erosion. Poultry and livestock production, farmlands and planted crops were seriously damaged. Most small business owners are also affected 30 (25%). Other livelihoods affected include washing away nearly all personal belongings of striking residents, paved roads being destroyed, and cutting critical communication routes. Floods and bank erosion directly overwhelm buildings in the study area. As of 20th September, at the time of filling this report, more than 60,000 families were made homeless, 7 have been reported dead, and damage to crops and properties amounted to several million Naira (Catherine, 2024).

Table 5 reveals the monetary value of the losses incurred in business due to flooding from single storms in 2023. In these communities where economic activities revolved around salary earned, 11% of the respondents affirmed to have lost nothing less than 30 US Dollar. About 27% of the people indicated incurred losses between 30 to 50 US Dollar. The majority of the respondents are in the category of 70 to 90 US Dollar loss for a single storm ever incurred along River Yedzeram in 2023.

Table 6 shows the changing nature of the main income source due to RBE and flooding. 44 respondents (36.7%) of the surveyed households had changed their income earning source because of losing their homestead, cultivable and kitchen garden lands. It is found that most

**Table 5.** Monetary value of losses due to RBE and flooding in Southern Mubi Communities in 2023.

Monetary values of losses (\$)	Frequency	Percentage
<30.00	13	11
30.00-50.00	32	27
50.00-70.00	29	24
70.00-90.00	41	34
>90.00	5	4
Total	120	100

**Table 6.** RBE and flooding influence on income source in the study area.

Whether source of main earning was changed or not due to flooding of 2023? (n = 120)	Frequency	Percentage
Yes	44	36.7
No	76	63.3

Value inside the bracket shows the %.

**Table 7.** Changing nature of main income source due to RBE in the southern Mubi.

Changing nature of income earning source	Response	
	Frequency	Percentage (%)
Agriculture to Business (Trading, Hawking etc.)	22	18.3
Agriculture to Day labor (Brick laying, mason etc.)	36	30.0
Agriculture to Service (Wheel barrow pusher, water service vendor, Shoe mending etc.)	56	46.6
Full time (Mechanized) to part time Agriculture (Subsistence)	6	5.0

Source: Field Survey, 2023.

of the changes of occupation occurred in agriculture to other sectors, such as from agriculture to services (Wheelbarrow pusher, water service vendor, Shoe mending (43.4 %) followed by agriculture to day labour (Brick laying, mason (31.9 %) and agriculture to business (Trading, Hawking). (19.5 %). About 5% of the inhabitants have changed from mechanized to subsistence farming (Table 7). This implies that the agriculture sector is the main income source affected by the occurrence of floods and river bank erosion in the study area. The high dependence on agriculture makes these households particularly vulnerable. The study results also show that small business owners are also affected. Small businesses are affected by disruptions in infrastructure, supply chains, customer access, and obstruction in the school calendar. Cases of hijacked schools by flood especially in Dirbishi/Gandira and Nassarawo according to respondents are no longer news. This scenario sometimes impedes the children from going to school or sometimes a whole term. This can eventually increase the dropout rate (Zetter, 2012). This indicates that small businesses, while less directly tied to the natural environment than agriculture, still face significant impacts of these hazards

raising community vulnerability (Idukunda *et al.*, 2024).

### Inhabitant's strategies to lessen the impact

Table 8 shows the measures for flood risk prevention strategies. These include (a) building containment walls/embankments. 65% of the total respondents have their buildings well-raised. (b) Use of sandbags. About 17 % of the inhabitants use sandbags. The strategically arrayed sandbags prevent flood water from entering the enclosed properties. However, more than 89% of these respondents scoop water out of their compound immediately after heavy rain that may result in flooding. The preventive measure implies that, though the buildings are walled and sandbags are used, flood water still found its way into most buildings as most people agreed to scoop water out of the building and compound during and immediately after heavy rainfall. (c) Temporal abandonment or relocation of residents from hazardous areas to safer locations. About 11% attested to the fact that they moved temporarily uphill when they saw signs to stay with friends. (d) Others include planting trees and constructing rainwater drainage systems in flood-prone areas.

**Table 8.** Flood risk prevention measures in Southern Mubi.

Prevention measures in Southern Mubi	Response	
	Frequency	Percentage (%)
Use of sand bags	20	16.6
Evacuation/Temporal Abandonment	13	10.8
Erection of wall/Embankment	78	65.0
Others	9	7.5

Source: Household survey, in Southern Mubi Communities, 2023.

## Conclusion

The present study is on the socio-economic implication of the Yedzeram River bank erosion on the livelihood of Southern Mubi community dwellers, in Adamawa. It is clear from the above discussion that the overall scenario of river bank erosions and their impacts can be disturbing. River bank erosion thus has negative impacts on human life. In the study area, 55% of farmland has been reported washed. More than 60,000 families were made homeless, 7 have been reported dead, and damage to crops and properties amounted to several million Naira. It is clear that human activities also have impacts on riverbank erosion. Several causes have been attributed to the case of riverbank erosion. People cultivate on riverbanks because of its fertile land. Less fertilizers are needed. River banks provide better yields than upland farms that are depleted of nutrients. Because of these benefits, there is over-cultivation, poor management of cultivated fields, and indiscriminate cutting down of trees. All these lead to riverbank erosion along with river sedimentation, water pollution and fish habitat alteration. Only 15% of the respondents attribute the menace to climate change. In the study area, the coping strategies range from the use of sandbags and stone, erecting walls and temporary abandonment. It is instructive to note that adaptation planning can limit the damage caused by climate change, as well as the long-term costs of responding to climate-induced flooding that are expected to increase rapidly in level in the decades to come.

## Recommendations

To protect the river bank from further movement and erosion, the following recommendations are proposed;

1. There is a need for increased monitoring, and community education about the flood risk. Infrastructure improvements, such as embankment or better drainage systems, could be necessary to mitigate the risks, especially in Nassarawo and Dirbishi/Gandira where the environmental condition is severe.
2. Settlement along the bank should be curtailed to minimise the vulnerability and incur loss of the populace.

3. Floodplain zoning be carried out along the major drainage channels across Mubi. There should be an enforceable floodplain regulation to regulate future land use within the floodplain. This will lessen the impact of this erosion on the populace along the Yedzeram River.

## CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest.

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**Appendix 1.** Locations and nature of devastation by **RBE and Flooding** in Southern Mubi



**Plate 1.** Construction Company along the riverbank.



**Plate 2.** Mass wasting adjacent a construction company.



**Plate 3.** Foundation under threat along the riverbank of Yedzeram.



**Plate 4.** Block industry along the study riverbank-sand mining.



**Plate 5.** Encroachment along river Yedzeram.



**Plate 6.** Dilapidated embankment along the riverbank.