Abstract – Shiroro dam is one of the three major hydroelectric dams built on River Kaduna in Niger State located in the northwestern part of Nigeria. The river flood plain downstream the dam has rich alluvial soils with great agricultural potentials and this has been the major pull factor for several local communities that settled in the area and engaged in farming as a means of livelihood. However, the downstream communities are exposed to flooding and other hazards related to their livelihood activities and living pattern. A study on rural hazards identification and vulnerability assessment was conducted in Gusoro and Gurmana villages of Shiroro Local Government Area at the downstream sector of Shiroro dam in February, 2012. The study relied on direct field survey using the instruments of oral interview, questionnaire survey and field measurements for data collection. The results form data analysis indicated, among others, that the communities were exposed to floods, erosion and health hazards as well as the risk of building collapse and environmental degradation. The local coping strategies of building concentration on higher grounds, construction of elevated footpaths and embankments were found to be primitive and unsustainable. The problems of high level of illiteracy, poverty and dependent population (about 50%) as well as low or complete lack of access to safe drinking water, health facilities, basic infrastructure and credit facilities (18.1%) make the people highly vulnerable. The level of preparedness was low as there were no disaster management committees, local disaster management institutions and local disaster plan. All these reduced community resilience and increased the vulnerability of the people. The study suggested the provision of basic facilities, vigorous awareness education and the institution of integrated community based disaster risk reduction programmes as practical measures for reducing the risk of disasters in the area.

Keywords – Rural, Hazards, Vulnerability, Assessment, Shiroro Dam

1. Introduction

There is a close relationship among livelihood activities, risk generation and disaster occurrence in all human settlements across the globe. In many low income countries of the world, high level of disaster risk is associated with the livelihood activities of the low income communities. In these countries, hazard prone areas such as the flood plains are attractive areas for human settlements due to the high potentials for agriculture which is the main source of livelihood for the majority. Thus, a significant number of rural settlements in low income countries of Africa, Asia and Latin America are highly vulnerable to disaster as many rural communities occupy risk prone areas for economic reasons.

Several studies have established the link between community exposure to hazards or disasters and access to resources or economic livelihoods (Brooks, 2003; Gwimbi, 2009, p 72). The exposure to hazards and the low coping capacity make rural communities highly vulnerable and less protected against disaster impact. Thus, disasters impact negatively on the people, their assets and their livelihoods. For communities occupying the flood plain, studies of impact of downstream flood disaster have shown the negative effects to include crop losses, soil degradation, home and property destructions, and ill health amongst others (Foster et. al., 2008, p 319 - 320; Gwimbi, 2009, p 73).

The 2009 global assessment report on disaster risk reduction identified vulnerable rural livelihoods as one of the key underlying risk drivers in low income countries (United Nations, 2013, p xiii). Thus, there is a growing advocacy for more disaster risk reduction (DRR) efforts to be focused on rural areas and remote locations because such
areas have less skill and coping capacity than the urban areas and they are more often severely affected by disasters (Manitoba Office of Fire Commission, 2002, p 8). According to Kullig (2000), as cited in Gwimbi (2009, p 75), the DRR efforts in the rural areas should focus on building community resilience rather than mere response to disaster. In order to be resilient, communities must demonstrate the ability to buffer all disturbances, they must be self-organized and be able to adapt to the disturbances arising from disaster events (Trosper, 2002).

Effective DRR in the rural areas requires the understanding of the existing hazards and the underlying risk factors. In order to institute effective rural DRR in Nigeria, this study investigated the common hazards and the disaster risks in Gusoro and Gurmana villages of Niger State and assessed the level of vulnerability of the people and the natural environment. It assessed the capacity of the people to cope with existing hazards and make recommendations for community based DRR for disaster resilience in the settlements.

2. Research setting

Nigeria is a tropical country situated in the West coast of Africa, within Longitudes 3° and 14° East of the Greenwich Meridian and Latitudes 4° and 14° North of the Equator. It occupies an area of 923,768 km² with a population of over 160 million. The two villages studied are situated in Niger State in the north central part of Nigeria (figure 1). The State is particularly prone to flooding disaster. It is traversed by River Niger and River Kaduna on which the Kainji, Jebba and Shiroro dams are built. The flood plains of rivers Niger and Kaduna in the State has become permanent abode for over 350 communities that live in small settlements. Few of such communities include Muregi, Sonlafi, Jiffu, Gusoro, Gbogifu, Lenfa-kuso, ketso, Dutsun, Akare, Wuyakede, Muye, Mawogi, Nupeko and Gurmana. These communities have a long history of flooding and have been affected by series of seasonal flooding arising river bank overflow. The situation became worse after the construction of dams at Jebba, Kainji and Shiroro and the occasional opening of dam sluice gates which normally results in devastating flood and the submergence of hundreds of villages downstream.

Gussoro Village is located on Longitude 06°44.071’ East and Latitude 09°59.113’ North (Figure 2) while Gurmana is located on Longitude 100.5’ East and Latitude 06°37’ North (Figure 3). The two villages lie within the Guinea Savannah region of Nigeria with distinct wet (April – September) and dry (November- March) seasons. The settlements are located downstream of Shiroro hydroelectric dam, on a low lying flood plain of River Kaduna. The area is rich in alluvial deposits with high agricultural potentials, a situation which attracted several rural communities to settle in the areas. The inhabitants are of the Gbagi tribe and the communities are largely agrarian with about 90% of the people engaged in subsistent agriculture.
3. Methodology

The research utilized data field data collected through oral interview, questionnaire and direct field observations. The type and nature of existing hazards in the study areas were identified through field observations and oral interview of community groups. Information on hazard probability, risk level and community preparedness was collected with the aid of a questionnaire which contains variables on population characteristics, livelihood or poverty, health, water and sanitation, accessibility and the environment (sensitivity domains) as well as variables on community asset, infrastructure, economic resources and institutional capacity (coping capacity domains). A total of 90 completed questionnaires (48 for Gusoro and 42 for Gurmana) were used in the analysis. The analysis was done using the simple probability, severity and community preparedness rating or scoring method based on expert judgment. Scoring scales were prepared for hazard probability, risk level and preparedness to determine community vulnerability to hazards. The descriptors and score for probability are: none = 0; low (infrequent occurrence) = 1; medium (may occur or recur every 5 = 7 years) = 2 and high (likely to occur in 5 years or less) = 3. The risk level ranged from low (1), medium (2) and high (3) while the descriptors for level of community preparedness or coping capacity are poor (3), fair (2) and good (1). The scores were multiplied in the three areas of probability, risk level and preparedness to arrive at the vulnerability scores for identifiable hazards in the study areas. A cut-off value (5 per cent of overall score) was set to determine the hazards for attention (those above the cut-off mark) and those for noting (those below the cut-off mark).

4. Hazards identification and vulnerability assessment

4.1. Main hazards in Gusoro and Gurmana

The main types of hazards identified in the study area are flood, disease epidemics, erosion, building collapse and land degradation. Amongst these, flood and epidemic hazards featured prominently in the two villages. With respect to flood hazard, 94.4% of the respondents agreed that the areas experiences flooding once or twice in a year while 66.7% of them confirmed that they have witnessed over six flooding episodes in the last 10 years. For 95.6% of the respondents, loss of farm and crops were the most devastating effect of flooding in the area, a situation that threatens rural food security in the area.

The flooding disasters in the area engendered epidemic hazards as majority of the resident rely on unsafe sources of water which are often polluted during flooding events. The main source of drinking water for 80.0% of residents was streams, pond, shallow boreholes and un-sanitary wells (Figure 4 and Figure 6). About 59.3% of residents used shallow pit latrines while others used the bush for open defecation (Figure 5). The entire area was characterized by poor hygiene and unsanitary environmental condition (Figure 7) a situation that increased the risk of epidemics in the area.
Other hazards such as the risk of building collapse and environmental degradation featured prominently in the villages. Over 60% of the houses were old and dilapidated. There were significant evidences of severe building foundation erosion which constitute the risk of building collapse (Figure 8). The risk of erosion hazard is compounded...
Table 1: Hazard vulnerability analysis scoring. Source: Author’s analysis, 2012

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Probability</th>
<th>Risk level</th>
<th>Preparedness</th>
<th>Vulnerability Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood</td>
<td>3</td>
<td>High</td>
<td>Poor</td>
<td>18</td>
</tr>
<tr>
<td>Erosion</td>
<td>-</td>
<td>Low</td>
<td>Poor</td>
<td>8</td>
</tr>
<tr>
<td>Disease epidemics</td>
<td>3</td>
<td>High</td>
<td>Poor</td>
<td>27</td>
</tr>
<tr>
<td>Building Collapse</td>
<td>2</td>
<td>Medium</td>
<td>Poor</td>
<td>12</td>
</tr>
<tr>
<td>Land degradation</td>
<td>2</td>
<td>Medium</td>
<td>Poor</td>
<td>12</td>
</tr>
<tr>
<td>Total score</td>
<td>77</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Hazard severity, probability and priority ranking. Source: Author’s analysis, 2012.

<table>
<thead>
<tr>
<th>Identified hazards</th>
<th>Risk level</th>
<th>Likelihood and impacts</th>
<th>Priority ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood</td>
<td>Medium</td>
<td>Highly probable \ Significant</td>
<td>2\textsuperscript{nd}</td>
</tr>
<tr>
<td>Erosion</td>
<td>Low</td>
<td>Probable \ Moderate</td>
<td>4\textsuperscript{th}</td>
</tr>
<tr>
<td>Disease epidemics</td>
<td>High</td>
<td>Highly probable \ Significant</td>
<td>1\textsuperscript{st}</td>
</tr>
<tr>
<td>Building Collapse</td>
<td>Medium</td>
<td>Probable \ Moderate</td>
<td>3\textsuperscript{rd}</td>
</tr>
<tr>
<td>Land degradation</td>
<td>Medium</td>
<td>Probable \ Moderate</td>
<td>3\textsuperscript{rd}</td>
</tr>
</tbody>
</table>

4.2. Hazard vulnerability analysis

The existing hazard conditions in the two villages were assessed based on the probability of occurrence, the level of risk posed and the level of community preparedness (available coping capacity). In determining the vulnerability scores, findings from direct field evaluation of the hazards and community coping capacity (available resources and facilities) were combined with the residents’ opinion on hazard probability and risk level. The scoring scales described under methodology were used to derive the vulnerability scores for each of the hazards. The statistics in Table 1 show that Gusoro and Gurmana were highly vulnerable to disease epidemics and flood hazards which have vulnerability scores of 27 and 18 respectively. These hazards ranked first and second respectively as shown on the priority Table 2. The probability of the two hazards is high while the possible impact is considered significant. Although flood hazards recorded a relatively high vulnerability score, the respondents considered the risk level as medium because the Shiroro Dam Authority do issue flood warning signals before the release of excess dam water. The risk of building collapse and land degradation were considered medium while the risk of erosion hazard was rated as low based on the vulnerability scores. However, environmental degradation in the area may worsen in the nearest future due to extensive agricultural practices and primitive excavation of land for building materials.

Irrespective of the individual hazard risk level, 5% of the overall vulnerability score for all hazards (77) calculated yielded a minimum tolerable value of 3.85, approximately 4. All hazard vulnerability scores above this bench mark (cut-off value) are considered not tolerable. As shown in Table 1, all hazards recorded in the two villages score well above the cut-off value. This is an indication that the existing hazards require urgent attention.

as the residents scooped the clay soil to make mud brick for house construction (Figure 9).

The existing hazard conditions combined to make the residents of Gusoro and Gurmana vulnerable to disasters. Further investigation revealed that the residents were poorly prepared for flooding disaster as 77.8% of the respondents confirmed that no mitigation measures were put in place. The communities generally lacked hazard coping capacity and the available resources for coping with hazard situation were inadequate. There is a general low access to credit facilities as 81.9% of the respondents had no access. Thus, the majority were poor with 45% of population living below 1.08 dollar per day.

The existing community facilities were crude and inadequate. There is the problem of poor access to basic healthcare facilities. The two villages were serviced by two non-conventional dispensaries and one clinic (Figure 10) Indices of vulnerability in the communities include:

1. High illiteracy level with 61% of the population having no formal education.
2. High dependency ratio with 49.93% residents in below 10 and over 60 years age categories and large household size (with 68.5% having between 7 and 20 members).
3. Poor accessibility as the villages was serviced by narrow, winding earth roads with rugged terrain and difficult access.
4. The villages had no disaster plan, no village disaster committee and absence of government agency for disaster management.

The presence of hazard conditions, low capacity and lack of preparedness plan combined to increase the level of community vulnerability. Hazard vulnerability analysis was conducted to determine the level of risks posed by the different hazard conditions. The results are presented in section 4.2 of the paper.
5. Conclusion and recommendations

This research presents the rural perspectives of disaster hazards and community vulnerability which is often neglected by many urban biased studies. The study showed that Gusoro and Gurmana villages are vulnerable to hazards and are at the risk of disasters. The existing hazards constitute risks due to low level of coping capacity in the villages. The existing local hazard coping strategies such as concentration of buildings on higher grounds; construction of elevated footpaths and embankments; elevation of building foundations with stones, etc. are primitive and unsustainable.

There is the need to increase the capacity of residents to reduce the risk of disasters through the provision of health care and water facilities; disaster education and initiation of community based DRR; basic hygiene training to improve living pattern; poverty reduction through alternative livelihood programmes and access to credit facilities; amongst others. The study found out that over 60% of the residents had high level of access to radio and Global System for Mobile Communication (GSM). Also, 65.6% of the respondents confirmed the existence of community-based organizations (CBOs) in the villages. These community assets should be used by the Niger State Emergency Management Agency (NSEMA) to mount a vigorous advocacy and disaster education programmes to disseminate disaster information and to create awareness among the rural populace in Niger State. Above all, the focus of disaster management efforts in Nigeria should be broadened to include the poor rural settlements where there are high level disaster risks and low coping capacities.

References


Citation