



Sustainable management of flood disasters in the upper east region, Ghana

Paschal Fang-Viel Gyireh ^{1*}, Abraham Marshall Nunbogu ²

¹ ProNET North, Wa, Upper West Region, Ghana

² University of Groningen, Netherlands

Abstract

In this paper, we discussed how stakeholders and flood victims cope with floods particularly in farming communities in the Builsa district. It contributes to highlighting issues for establishment of a sustainable flood disaster management system to reduce losses of flood-affected households. Results from analysis of data collected using desk study and in-depth interviews show that floods have a multi-scalar effect on every aspect of the lives of the people. The Builsa District experiences flood disasters that displace an annual average of 1,200 persons. The situation is likely to increase in the future due to increasing climate variability. Although almost every district in the region suffers flooding, flood disaster management and mainstreaming is not given the necessary attention. There are institutional lapses on effective coordination and collaboration, which have led to mass suffering, and fallen living standards. This paper therefore recommends an integrated governance strategy for flood management in the Builsa District with emphasis on coordination and bottom-up initiatives.

Keywords: Flood disaster; Emergency response; Flood management; Integrated approach; Builsa District

Published by ISDS LLC, Japan | Copyright © 2015 by the Author(s) | This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



* Corresponding author. E-mail address: nunbogu@gmail.com

1. Introduction

Flood disasters take enormous toll on human lives and property as no country is totally insulated against their occurrence and impact (Wisner et al., 2004). Natural hazards and the disasters they trigger hit all countries, rich and poor but the already underprivileged suffer most (UNDP, 2004; UNISDR, 2002, 2004, 2009). More than 700 major natural catastrophic events occur each year, and direct economic losses have increased 14-fold since the 1950s (IIASA, 2000).

According to UNISDR (2009), extensive catastrophes such as floods are responsible for a small proportion of disaster related deaths. Nevertheless, they account for a significant chunk of damage to public assets, such as health and education facilities, as well as livelihoods, homes and assets of poor people. Disasters can wipe out years of development in minutes and consume precious resources that could be better used for development (Chan, 1997; Abbott, 2006; IFRC, 2007). They damage infrastructure, reduce productivity, generate social tensions and confine vulnerable communities to cycles of disaster and response. There is no such thing as natural disaster. Events such as earthquakes, cyclones, tsunamis, volcanic eruptions, landslides, storms, fires, droughts and floods by themselves, are not considered disasters. Rather, they become disasters when they adversely and seriously affect human life, livelihoods and property (IFRC, 2007; White, 1945; Sinnakaudan et al., 2003).

Disaster is unnatural and risk reduction measures reduce the odds of it occurring and by putting in place adequate response and prevention measures to protect life, limit the damage and strengthen a vulnerable community's ability to bounce back quickly from adversity. The solutions may lie in simple strategies like educating people on what to do during emergencies, development of early warning systems, and preparedness planning. Currently, there has been a shift from strong reliance on flood defence and prevention towards a more integrated approach to flood hazards (Smith and Ward, 1998). The integrated approach seeks to blend the structural and non-structural methods within a socio-economic context which increasingly recognises that complete prevention or protection from floods is impossible and that some level of risk has to be accepted and borne by humanity.

2. Geographical scope

The Builsa District has Sandema as its administrative capital which lies between longitudes 1° 05' West and 1° 35' West and latitudes 10° 20' North and 10° 50' North. The District covers an area of 2,220 km² and constitutes 25.1% of the total land area of the Upper East Region. Builsa district shares border to the North and East with Kassena-Nankana West and Kassena-Nankana East respectively, to the West with Sissala East in the Upper West region, and to the South by West Mamprusi district in the Northern Region. The District has 155 communities bunched into eight area councils with no urban settlement (where urban settlement is community with 5000 or more inhabitants). The settlements are as indicated on Figure 1. The District is wholly rural. The ten (10) study communities are marked with black dots on the map.

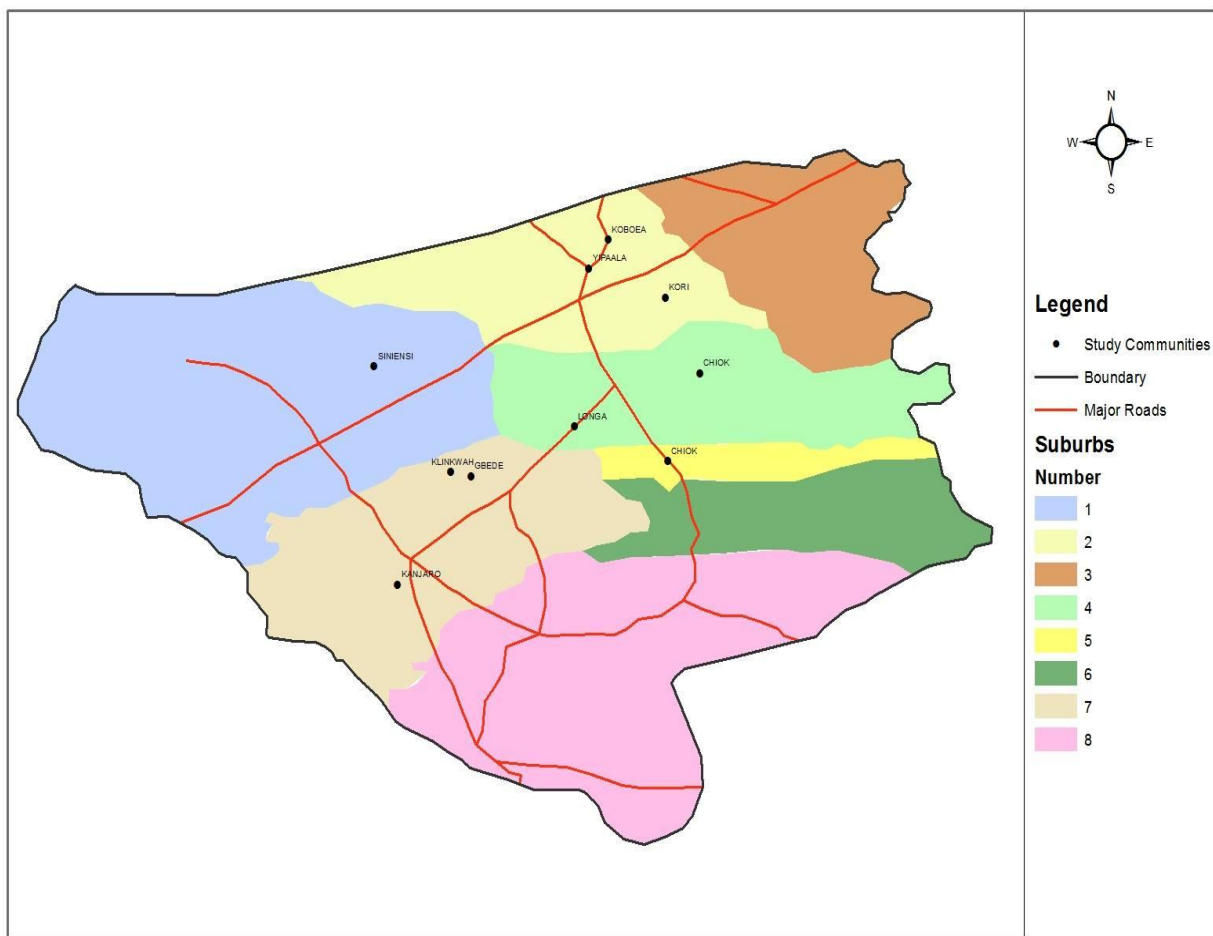


Figure 1. District Map of Builsa (Adopted from DMTDP, 2011)

2.1. Floods in the Builsa District

Builsa district is prone to flooding due to its location on the tributaries of the White Volta and the Cecily River in the Upper East region of Ghana. The terrain is mainly flat, and can be considered to be a primarily low-lying riverine area. Flash flooding caused by convectional rainfall related with the overflowing of Tono irrigation and Tono riverbanks is common and a significant cause of floods every year.

Flood disasters usually cover 18 per cent of the upper East Region destroying homes, farms and other infrastructural facilities. This directly impacts on the livelihood of those affected, with a replica effect on the already poor regional capacity to cope. For instance, the 2007 floods destroyed 1,725 farmlands, which deprived most farmers of their harvest and subsequently resulted in low agricultural production. The flash floods over the years have resulted in growing food insecurity and hunger, worsening poverty levels, and high out migration among the youth in these affected regions and localities. The above impacts highlight the

multi-scalar effects of the flood on society and the economy making it a national worry. Flood disasters play a substantial role in inhibiting economic development and create greater difficulties for many of the regions' poor (UNDP/NADMO, 2009; ISDR, 2009).

However, small scale flooding in Builsa is required to sustain the rice industry in the Fumbisi valleys as sediment deposited by floodwaters fertilizes fields. Natural flooding replaces the requirement of artificial irrigation, which is time consuming and costly to build. This therefore raises certain practical dilemmas and varied interest among the different stakeholders involved.

The government of Ghana tried to manage floods with non-structural measures. In the mid-2007, systematic measures like flood forecasting and warning were introduced. Though these measures were supposed to contribute to the improvement of the capacity of flood preparedness and mitigation of flood losses, poor institutional collaboration coupled with the weak involvement and participation of stakeholders hindered their implementation.

The governance of flood disaster and response strategy in Ghana is reactive and takes the object-oriented approach. Flood management plans; programmes and projects are planned at the central levelled by National Disaster Management Organization (NADMO).

Currently, there is great public concern about the perennial floods that ravage the region, and the social and economic consequences. The relevant institutions and partners seem overwhelmed by magnitude and regularity of the flood incident. Consequently to efficiently and effectively manage flash floods, the research was conducted to generate the required information, and knowledge to enhance decision-making, policy planning and implementation in an attempt to reduce the effect of floods on the populations.

3. Method

Data from secondary and primary sources were employed in the study. The secondary data were sourced from the records of NADMO on flood disasters in the District over the last 3years. To ascertain the general flood disaster situation, primary data were collected through interviews on key actors in disaster management and local developers including communities (households), and institutions such as NADMO, Regional Planning and Coordinating Unit (RPCU), Builsa District Assembly (DPCU), Meteorological Services Agency (MSA), Ministry of Food and Agriculture (MoFA), Town and Country Planning Department (TCPD), the Hydrological Services Department (HSD), and Water Resources Commission/Volta Basin Authority (WRC/VBA) and Environmental Protection Agency (EPA).

A population size of 2,261 was used in 10 selected communities. The communities are: Sandema, Fiisa, Korii, Nyaansa, Kanjarga-Jiningsa, Kobdema, Siniensi-Kaasa, Chiok-Anpa yeri, Gbedema and Gbendem Kunkwa. Community selection was done purposively (most and severely affected by floods in the District). Out of this number, 146 households were selected based on Slovin's method of determining a sample size; with a margin of error of 0.08 and a confidence level of 92%. The sample size of 146 households was

proportionally distributed among the selected settlements. The main sampling techniques was systematic and convenience sampling.

The data collection process was through direct administration of structured and unstructured questionnaire to a sample of households and some public institutions to solicit. An interview guide was used as instruments for discussing with other relevant bodies on the subject matter. Observation was used to survey the vestiges of the flood disaster in the abundance of critical evidence like videos, pictures, damaged and unrepaired physical infrastructure and the reconstruction efforts that were on-going.

3.1. Analyses

Manuel identification of themes was used. Frequencies and other simple statistics were used to represent the various themes. The issues examined in the analysis were: the impact of floods on affected people, households response to flood disasters, the kind of support services given to victims, capacity of the National Disaster Management Organisation and other collaborators in managing flood disasters and the role of stakeholders in mainstreaming disaster planning and management at the District level.

4. Findings and discussion

4.1. Impact of floods on affected people

Though flooding may have some positives in terms of agricultural production, the negative impact is of priority to development actors in disaster management. Floods affect every aspect of the lives of the people. As a predominantly agrarian district, the flood disaster causes extensive damage to crops and animals alike. Often, crops are submerged or washed off and animals drowned. In some cases, animals die due to inadequate food and diseases such as foot rot and mouth diseases. Birds are especially drowned, as the coops get flooded. The effect of the flash floods on livelihoods is indicated on the Table 1.

Table 1. Impact of flood on household livelihood

Effect of flood	Frequency	Percent (%)
Loss of farm crops	10	6.8
Loss of animals	7	4.8
Trade/businesses	2	1.4
all the above	127	87
Total	146	100

Source: Field survey, 2011

From Table 1, majority of the households (87%) consented that floods destroy their farms, and animals annually. What this means is that greater number of the population of farm families vulnerability increases as these flood flash continually ravage their farms. Since family assets in peasant farm families consist mainly of farm crops and animals, once destroyed the entire household is impoverished and this explain why a lot of youth out movement is noticeable in the district. The above finding corroborates the IFRC conclusion that flood disaster posses' serious challenges to livelihood security among victims. On the average, 5000ha of farms are inundated and or destroyed in the district annually affecting food security (Figure 2).



Figure 2. Flooded farms in study District (MoFA, 2010)

Though the flood waters when they inundates rice farms could be beneficial in terms of yield, it often leads to massive crop failure and/poor yields with crops like yam, cereals and legumes which are widely cultivated by all households. The incident is threatening food security of majority of households in the region.

4.2. Household response to floods

Knowledge on flood management is very limited among the respondents. From the responses only about 7.3% of respondents had knowledge on some steps to minimize flood effect though it appear they were simply theory. The measures mentioned included constructing run channels to carry excess water away from built environment. These channels upon observation are simply a sand block raised to redirect water away from main entrances to homes as a result the flood waters still leads to destruction of built environs due to poor channel construction.

Siltation and over flows of river banks is another major cause of the flash floods in the district. A total of 6% of the sampled population had knowledge of this challenge. Through the Integrated Water Resource Management project by Water Resources Commission (WRC) a few farmers were given pumps to lift water from the rivers to distant places about 30metres away from the riverine to prevent flooding on farms. The initiative was to deal with silting of rivers and runways, however the number is negligible. Dry season gardens are also established closer to river boundaries especially for tomato farming.

A more worrying factor was the fact that majority of the victims of the flash floods believe floods are natural happenings that no one can change or prevent. Of the total respondents, 86.7% of the households in the communities hold this view and therefore think its time wasting to be discussing the matter. The indication is that knowledge on flood disaster management is clearly lacking among the victims of this perennial occurrence.

4.3. Support services to victims

Various support services are being offered to victims of flood disaster. The support services included distribution of food items, student mattresses, blankets, and plastic products in very limited scale and selective in nature. From the field survey, although 88 % of the respondents had experienced flooding, only 32 % confirmed ever-receiving disaster aid.



Figure 3. Typical relief items delivery to flood victims (NADMO UER, 2010)

The role of NADMO as facilitator and manager of disasters in the district is heavily criticised by victims. In all 84% of victim respondents criticized the operations of NADMO has been shrouded with politics, favouritism and above all massive failure to meet any promises often made to victims. The respondents lamented how they are either late in responding, the poor assessment of damage, and supplying items that really do not meet the needs of the victims. Normally, what was available was served regardless of what one had lost in the process. Since the impact varies from one household to another, the absence of a standard procedure for distributing aid leaves some victims worse off in the process. Another key issue is the victims are viewed as needing bread forgetting the next seasons farming activities when one losses farm produce and seed.

Staff of the local government agency responsible for disaster mitigation and response-NADMO lamented the inadequacy of relief items saying; the only time relief support services were near adequacy throughout the district was in 2007 when the flood disaster assumed a national dimension and attracted international support. It led to the establishment of the Northern Ghana Floods Disaster Management Fund to assist perennial victims of flash flood disaster in the north. This re-emphasises the fact that NADMO is generally incapacitated in responding to disaster victims and deserve national attention.

4.4. Mainstreaming disaster management into local development plans

The National Development Planning (System) Act, 1994, (Act 480), the Local Government Act, 1994 (Act 462) and the Civil Service Law, 1993, PNDC Law 327, prescribed the planning functions for the Regional/District Planning and Coordinating Units. Besides preparing detailed work plans covering activities to be carried out, the District Assemblies and planning units also assist in the preparation of community development plans. According to the Ghana Shared Growth and Development Agenda (2010-2013), cross cutting issues such as gender, environment, HIV and AIDS, vulnerability and exclusion are critical with respect to development. These issues can contribute to accelerating or derailing the progress of development at all levels.

On the environment, the Medium Term Development Framework concluded that “the development activities of the District may tend to aim mainly at achieving the District objectives (e.g. increasing crop production), while neglecting the nature, stability and resilience of the environment (socio-cultural, economic and natural resources), upon which the long term sustainability of the District’s activities depend. The GSGDA required the Districts to indicate the mitigation measures to embark on to address the effect of their programmes on the environment using the Strategic Environmental Assessment tool, climate change strategies as well as ensuring sustainable production and consumption” GSGDA (2010-2013). However, the requisite capacity to act in accordance with this framework at the local level is very much inadequate.

As leaders in the development of the local economy, the RCC, and NADMO had no strategy locally to ensure that the assemblies incorporates disaster and emergency preparedness plans into the Medium Term Development Plans. For instance the Medium Term Development Plan of the Builsa district assembly (2010-2013) identified flood as a threat to sustainable development yet no specific activity or concrete strategy was designed to tackle the phenomena by the assembly.

The National Disaster Management Organisation, which is always under resourced in terms of personnel, funding, and logistics to deal with the situation often relied heavily on donor agencies and the central government for support without local commitment. The implication is that in the unlikely event of disaster, without external support the assembly takes ad hoc and non-sustainable measures.

Though Regional Coordinating Council headed by an appointee of government who chairs the committee uses the regional disaster management committee meetings to engage various agencies and demand the District Assemblies to consider disaster management as urgent matter and plan for any eventuality, there is no enforcement except mere mentioning of the issue in documents such as MTDPs.

4.5. NADMO and other stakeholders in managing flood disaster

In times of flash flood crisis, NADMO undertakes rescue missions together with other stakeholders to save lives, assess the impact and organise aid for victims. In the 2009, the organisation constituted and inaugurated a forty-member District Emergency Preparedness Team (DEPT) charged with the responsibility to plan mitigation measures on the perennial flood susceptibility in the district. The DEPT had staff from Ghana Health Service (GHS), Ministry of Food and Agriculture (MoFA), Ghana Fire Service (GFS), Ghana Police Service (GPS), District Assemblies (DAs), and Non-Governmental Organisations (NGOs).

NADMO facilitated the formation of an eighty-number community/Area Council Emergency Preparedness Teams (CEPT) of 10 members each from Area Councils however; these CEPT were not functional at the time. Based on the above challenges it is argued that the management of floods require an integrative approach even more so in harnessing the strengths and potentials of all sector actors and managers.

4.6. Governance strategy

The general response to floods is reactive and takes the object-oriented approach where flood management plans, programmes and projects are planned at the central level. Due to the geography of the Builsa District, flash floods will continue to occur especially in the face of climate variability. The problem of floods cannot be solved with the current top-down approach assumed by government because floods occur within a complex socio-economic and geophysical context.

It is basic to strengthen participation especially among marginalized stakeholders who are mostly victims. Bottom-up initiatives are germane so as to enable vulnerable communities adopt mitigation measures that would fit with their current socio-economic landscape. Therefore a hybrid of working together with state and market parties and the active involvement of communities in flood management with emphasis on bottom up initiatives are crucial.

Again, when initiatives are built upon the qualities of their environment, they tend to be less sensitive to changed conditions and more sustainable (De Boer and Zuidema, 2013). Also, market parties brought on board in a form of Public-Private-Partnership would provide a partnership arrangements and financial agreements around local initiatives.

It is critical for the district assembly to integrate the local initiatives into MTDPs in accordance with the guidelines established by the central-governing units and to facilitate the implementation of these initiatives. The regional bodies should coordinate and collate the individual district plans into a regional plan of action for mitigation.

The central governing body should formulate national development frameworks on floods disaster response and management, which would serve as scope of reference for flood mitigation nation wide. The framework should stimulate and support district assemblies in dealing with their responsibilities whilst aiding them to coordinate individual efforts in the face of multi-scalar issues and social dilemmas on flood hazard.

4.7. Towards sustainable flood management: Working together with stakeholders in a Participatory Integrated Assessment (PIA)

To trigger bottom up initiatives for flood management, the active involvement and cooperation of the many stakeholders is desirable. One way to ensure cooperation is through Participatory Integrated Assessment (PIA). The PIA is a structured process of dealing with complex issues using knowledge from various scientific disciplines and/or stakeholders such that integrated insights are made available to decision-makers on the approach and a variety of tools and methods. The main objective of PIA is to get a deeper and more active involvement of the stakeholders in the planning process which guarantee transparency, consideration and negotiation between the stakeholders for the best possible solution in relation with their existing socio-economic interests (Alhorn, 2009).

At present, the major barrier to participation is the lack of awareness of government policies on flood management by the local communities. Therefore the principle of free, prior and informed consent (FPIC) should be considered. The FPIC principle treats communities with respect; allows them to consider development proposals and policies without pressure (free); allows them sufficient time to consider the proposal/policy and its implications for them (prior); ensures that they have adequate information about the programme, project and/ or activity and that they are in a position to understand the implications thereof (informed); and gives them the power to say yes or no and/or propose alternative course of action (consent) (Vanclay and Esteves, 2011; Esteves et al., 2012).

4.8. Structure of governance strategy

The governance strategy should reflect a multi-scalar and/or hybrid form of governance intended to counteract the current fragmentation that characterized the sector based decision-making in disaster response. The concept of hybrid is based on the recognition of the strengths and weaknesses of the actors that can complement each other (Lemos and Agrawal, 2006). The relationship between governance at the international, national and local levels as well as with non-governmental organizations is shown in Figure 2.

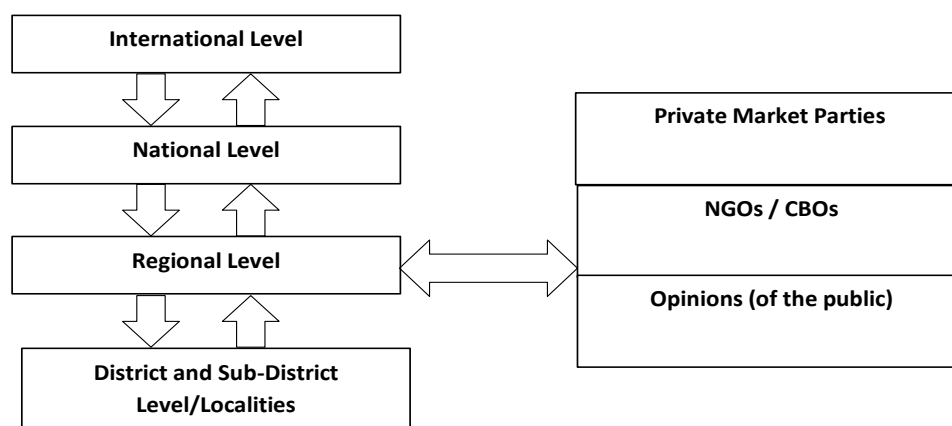


Figure 2. Governance Strategy (adopted from Lemos and Agrawal, 2006)

Since no single actor is capable of handling the multiple facets and interdependent scales of the problem, it is appropriate to include market actors or private institutions and the local communities. The involvement of the local communities would provide the benefit of 'time-and-place- specific' information and context specific initiatives that may help address the problem. Moreover, private organizations involvement would promote the representation of the diversity of interests that are affected and also foster social learning while enabling greater transparency. The hybrid focus is not solely on the coordinative model of governance (state control), but also the competitive and the communicative side of governance (Lemos and Agrawal, 2006), which should form the thrust of the governance strategy.

4.8.1. National government

Building a flood disaster risk management and institutional framework should be an utmost priority to government. Basically, disaster risk management includes formulating policies, setting up strategic action plans and establishing a multi-sector body to be responsible for flood management. The institutional framework should encompass guidelines for implementing actions for disaster relief and management. The government strategy should move towards a participatory approach in developing strategies for flood management, improvement of communication channels between the levels of governance in addition to a system of transparency and accountability in the implementation of plans to enhance the process of deliberation, coordinated actions, effective implementation and stronger monitoring and evaluation.

4.8.2. Inter-governmental

The decoupling across scales of the causes and consequences of the problem, and with the geographical location of Builsa District, a regional cooperation involving Ghana and Burkina Faso is necessary. For instance, in 2007, the spillage of the Bagri Dam in Southern Burkina Faso – though was not the sole factor – contributed to floods in the Builsa District. Thus, a framework of multilateral cooperation is needed to promote an external trans-boundary policy, co-developed and co managed with the governments of Burkina Faso. The possible challenge to such trans-boundary policies might be conflicts of interests in the use of rivers. This could be resolved through diplomatic dialogues.

4.8.3. The private sector

A partnership with private market parties (Public –Private Partnership) is vital due to their investment activities. Private sector agents such as builders, business entrepreneurs, infrastructure developers, insurance agents, and farmers and should be involved in the decision-making and implementation through constant interactions on a regular basis. The private sector can enter into a Public Private Partnerships (PPP) with the Builsa district assembly and contribute knowledge and funding through corporate-social responsibility to support not only water infrastructure development, but also reconstruction and recovery efforts to advance flood management. A Public-Private Partnership to adopt building schemes in flood prone areas would therefore be a good step towards a sustainable spatial planning and flood adaptation in the future.

4.8.4. Communities

The communities act as niches for innovations and bottom-up initiatives for flood management. Communities play an important role by contributing local and specific knowledge, setting up grassroots initiatives through their active involvement in monitoring and evaluation processes and ensuring accountability.

Community based initiatives are often based on overlapping interest, which gives the initiatives a multifunctional purpose. Indigenous solutions such as changing the housing structures, and shifting cultivation, establishment and strengthening of community disaster management teams desilting of choked or silted rivers and run ways, reduction in the cultivation of river banks, less use of heavy agricultural machinery at low lying areas which loosen the top soils and growing of trees and raising of water barriers in flood prone areas will help reduce flood damage and enable communities adopt a life style that is more conformable to their natural environment.

Moreover, the fact that these initiatives are embedded in the local economy makes them sustainable and may open up possibilities for other extra innovations. Though involving communities enable them to take charge of their own livelihoods and security, there are major barriers that could be encountered in the quest for community participation such as; unwillingness to participate, illiteracy and lack of awareness. In this case, the FPIC principle and robust government policy measures should be used to stimulate participation.

4.8.5. Non-Governmental Organizations (NGOs) and Community Based Organizations (CBOs)

The relevant NGOs and CBOs in addition to their provisions of social services especially during flood disasters should provide Advocacy campaigns, public education, and training programs for various personnel involved in flood management from national to the community level. These NGOs and CBOs should collaborate with local government agencies in the planning and implementation of flood management projects. The involvement of NGOs and CBOs would exert effective pressure on government agencies while ensuring the incorporation of the views of the grass root. Besides, these non-governmental organizations can stimulate local self-organization processes in terms of flood management by serving as funding sources for local flood resilience projects.

5. Conclusion

Disasters whether natural or man-made can strike at any time. The general response to disasters in the Builsa District is in terms of relief and rescue operations usually after the event. However, adequate preparation can aid in reducing the impact of a disaster through a good understanding of mitigation action as well as good knowledge of certain life-saving techniques. The occurrence and management of natural disasters is often difficult and requires the pooling of both human and material resources of all stakeholders so as to reinforce each other in the pursuit of a sustainable solution to the dilemma.

Flood disaster triggers precarious situations of food insecurity and poverty, as NADMO and stakeholders often appear overwhelmed by the risk. The critical element in the set of activities associated with flood-loss

reduction in the short to medium term is advance preparedness. Central government, regional and district assemblies should have mechanisms in place to allocate, reserve and bring in the needed resources whenever disaster strikes.

Constructional measures in flood disaster management are expensive engineering techniques of checking the flow of water that causes flood; deepening of water basins or channel improvement, construction of defence walls, and dykes however they are worth trying in the long run given the resources. Flood disaster should be tackled to rescue the masses from the undesirable and ultimate effect of displacement, disruption of social and economic activities, loss of lives and diversion and dissipation of development funds. Failure to arrest and manage floods and other related disasters will lead to an entrenchment of inefficiencies; poor service delivery, high cost /fallen standards of living, and deepening of poverty.

A sustainable flood adaptation management strategy or coping mechanism should be integrative and informed by iterative learning about the ecosystems and the earlier management success and failures. It should create linkages across scales professions, local, regional, national and international thereby selling local problems to wider audience for appropriate redress.

References

- Abbott, P.L. (2006), *Natural Disasters* (5th Edition), McGraw-Hill, USA.
- Ahlhorn, F. (2009), *Long-term perspectives in coastal zone development – multifunctional coastal protection zones*, Springer Verlag, pp. 89-94.
- Builsa District Assembly (2010), *2010-2013 Medium Term Development Plan*, Sandema, Upper East Region, Ghana.
- Chan, N.W. (1997), *Increasing flood risk in Malaysia: causes and solutions. Disaster Prevention and Management*, MCB University Press, Vol. 6 No. 2, pp. 72-86.
- De Boer, J. and Zuidema, C. (2013), "Towards and Integrated Energy Landscape", paper presented at Association of European Schools of Planning (AESOP) – Annual Conference on Spatial Planning, 15-19 July 2013, Dublin, available at: <http://www.icevirtuallibrary.com> (accessed 20 February 2014).
- Ghana Statistical Service (2005), "Population and Housing Census 2000: special report on Localities by District" Ghana Statistical Service, Accra, Ghana, available at: www.statsghana.gov.gh (accessed 23 March 2011).
- International Federation of Red Cross and Red Crescent Societies (IFRC) (2007), *Defusing Disaster Reducing the risk: Calamity is unnatural*, International Federation, Geneva, Switzerland.
- International Institute for Applied Systems Analysis (IIASA), (2000), *Disasters Adaptation and Development*, IIASA, Laxenburg, Austria.
- International Strategy for Disaster Reduction, (ISDR) and World Bank, (2009), "Disaster Risk Management Programmes for Priority Countries", *Global facility for disaster reduction and recovery*. The World Bank

- Development Research Group, available at: <http://www.undp.org/cpr/disred/documents/publications/rdr/english/glossary.pdf> (accessed 1 March 2011).
- Lemos, M.C. and Agrawal, A. (2006), "Environmental Governance", *Journal Annual Review of Environment and Resources* Vol. 31, pp. 297-325
- National Development Planning Commission (NDPC), (2010), "*Ghana Shared Growth and Development Agenda (GSGDA)*", Accra, Ghana, available at: <http://www.ndpc.gov.gh>(accessed 7 January 2011).
- Ministry of Food and Agriculture (MoFA), (2007), *Report on the Effect of Flood Disaster on Agriculture in the Upper East region*, MoFA, Bolgatanga, Ghana.
- Sinnakaudan, S.K., Ghani, A.A., Ahmad, M.S.S. and Zakaria, N.A. (2003), "Flood Risk Mapping for Pari River incorporating sediment transport", *Journal of Environmental Modeling and Software*, Vol.18 No. 2, pp. 119-130.
- Smith, K. and Ward, R. (1998), *Floods Physical Processes and Human Impacts*, John Wiley and Sons Ltd, USA.
- UNDP/NADMO (2009), "Enhancing National Strategies for Effective Disaster Risk Reduction in Ghana", UNDP, Ghana, available at: www.undp.org/.../disaster/.../Ghana(accessed 4 April 2011).
- United Nations Development Programme (2004), *Reducing disaster Risk, A Challenge for Development*, A Global Report, John S. Swift & Co., USA.
- United Nations International Strategy for Disaster Reduction (UNISDR) (2002), "Living with risk: A global review of disaster reduction initiatives", United Nations, available at: <http://www.unisdr.org> (accessed 18 November 2010).
- United Nations International Strategy for Disaster Reduction (UNISDR) (2004), "Living with risk: a global review of disaster reduction initiatives", United Nations, available at: <http://www.unisdr.org> (accessed 18 November 2010).
- UNISDR (2009), "Global Assessment Report on Disaster Risk Reduction", United Nations, available at: www.preventionweb.net (accessed 18 November 2010).
- Vanclay, F. and Esteves, A.M. (2011), "Current issues and trends in social impact assessment", in Vanclay, F. and Esteves, A.M. (Eds), *New directions in social impact assessment: conceptual and methodological advances*, Edward Elgar, Cheltenham, pp. 3-19.
- White, G.F. (1945), "Human adjustment to floods: a geographical approach to floods problem in the United States", Department of Geography, University of Chicago, Research Paper, No. 29, 1945.
- Wisner, B., Blaikie, P., Cannon, T. and Davis, I. (2004), *At risk. Natural hazards, peoples' vulnerability and disasters*, Routledge, London.