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Vikash Kumar

Queen Margaret University, Edinburgh, UK

Suk Yin Caroline Cheng

Queen Margaret University, Edinburgh, UK

Ajit Kumar Singh

Indira Gandhi National Open University, New Delhi, India

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Impact of Floods on Rural Populations and Strategies for Mitigation: A Case Study of Darbhanga District, Bihar State, India

Vikash Kumar and Suk Yin Caroline Cheng
Queen Margaret University, Edinburgh, UK

Ajit Kumar Singh
Indira Gandhi National Open University, New Delhi, India

Abstract. Floods are one of the most disastrous acts of nature and impact human life in multiple ways. Damages by floods in rural areas are more severe compared to urban counterparts due to poverty, limited infrastructures and access to resources and health care services. The Province of Bihar in India, with a population of 104.1 million, has 76 per cent of the population living under recurring threat of floods. In 2008, Bihar experienced severe floods in the northern region that affected more than 2.3 million people; and in 2013, they affected more than 5.9 million in 3768 villages across 20 rural districts. Floods damage property, infrastructure and further decreases access to health care and social services. This paper draws from the data collected for the primary author's master's thesis, along with his personal experience on floods as an inhabitant of a flooded community. It outlines the impact of floods in the rural areas of Bihar and highlights the continuous marginalization and exclusion of flood-affected communities. This paper will raise awareness of the issue and call for global support to advocate for more effective flood mitigation strategies.

Keywords: flood mitigation, health, migration, livelihood

Natural and manmade disasters pose great threats to human life. Disasters include earthquakes, volcanic eruptions, landslides, tsunamis, floods, and drought. Natural disasters have serious health, social, and economic consequences. The number as well as the magnitude of the damage caused by natural calamities has been increasing all over the world in the recent decades. Each year more than 255 million people are affected by natural disasters. In the last decade, on average, natural disasters caused damages of an estimated US \$67 billion every year (Guha-Sapir, Hargitt, & Hoyois, 2004). Since 1900, more than 9,000 natural disasters have been registered in EM-DAT and 80% of these have occurred over the last 30 years (Guha-Sapir, Hargitt, & Hoyois, 2004). Previous studies show different patterns of damage across the world. Natural disaster damages more infrastructures in industrial countries, whereas developing countries lose more lives.

Literature Review

Floods are among the most disastrous natural calamities. The Intergovernmental Panel on Climate Change (IPCC) predicts that climate change is likely to cause an increase in flood hazards in many areas of the world (McCarthy, 2001). According to World Disaster Report-2014, floods remain the most frequent natural disasters. Floods accounted for 44% of deaths caused by natural disasters and for windstorms 41% (International Federation of Red Cross and Red Crescent Societies, 2014). Worldwide flood damage to agriculture, households, livelihood systems, infrastructure and public utilities amount to billions of US dollars each year, in addition to the loss of precious human and cattle life. Flood impacts human life in complicated and subtle ways, and creates vulnerable conditions, which put human lives at stake. Floods can

Vikash Kumar, Institute of Global Health and Development, Queen Margaret University; Suk Yin Caroline Cheng, Institute of Global Health and Development, Queen Margaret University; Ajit Kumar Singh, Indira Gandhi National Open University. Correspondence concerning this article should be addressed to: Vikash Kumar, Institute for Global Health and Development, Queen Margaret University, Queen Margaret University Drive, Edinburgh, United Kingdom, EH21 6UU; Email: vkumar@qmu.ac.uk

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destroy field crops and cause food scarcity, destroy infrastructure and create barriers to access to services, affect business activities, and exacerbate health risks in the community (Blaikie, Cannon, Davis, & Wisner, 2014; Parker, 1999; Smith, 1996).

Floods can have significant impacts on the provision of health services. Floods reduce access to health service and can cause changes in the demand in health services (Axelrod, Killam, Gaston, & Stinson, 1994; Schatz, 2008). During floods, patients generally suffer from loss of medical services and find it difficult to access health care (Curry, Larsen, Mansfield, & Leonardo, 2001). Floods not only reduce access to health care, but also increase mortality and morbidity in the affected area. In one study, 43% of people reported health-related problems following a flood (Kunii, Nakamura, Abdur, & Wakai, 2002). Floodwater often brings debris and waste products close to the community and further contaminates the local water and food supply. This could further increase the risk of communicable diseases. Contaminated water sources result in waterborne diseases such as *escherichia coli*, diarrhoea and other diseases and increases the risk for communities and farm workers (Pianetti, Sabatini, Bruscolini, Chiaverini, & Cecchetti, 2004). Faecal contamination of livestock and crops can also lead to the spread of infectious diseases (Casteel, Sobsey, & Mueller, 2006).

India is the second most flood-affected country after Bangladesh. India accounted for one-fifth of the global death count due to flooding from the 1960s to the 1980s. The annual flood damage increased nearly 40 times from the 1950s to the 1980s. In India, about 40 million hectares, or one-eighth of the country's geographical area, is flood prone (Gupta, Javed, & Datt, 2003). Each year, an average of 7.35 million hectares of land is affected, 1793 human lives are lost, 85,599 cattle are killed, and 1,452,904 houses damaged. The total loss caused by flood amounts to US \$575 million (Dutta & Watts, 2010). Bihar, which shares a border with Nepal, is the most flood prone state in northern India. Bihar has 104.1 million people and approximately 88.7% of them reside in rural areas. About 76% (79.11 million) of the population in Bihar lives under the threat of flood, and over 73% (68800 square km) of the geographical area in Bihar is classified as flood affected region (WRD, 2015). Flood in north Bihar is mainly due to heavy water flow brought by the Himalayan ranges of rivers that originate in Nepal such as the Kosi, Gandak, Burhi Gandak, Bagmati, Kamla Balan, Mahananda and Adhwara. During the rainy season, these rivers carry a high discharge and heavy sediment that drops onto the plains area of Bihar that inevitably floods North Bihar. The major flood-impacted districts in Bihar are Saharsa, Khagaria, Gopalganj, Katihar, Darbhanga, Madhubani, Supaul, East Champaran, West Champaran, Begusarai, and other districts which fall in the catchment area of these rivers (WRD, 2015). In the last 30 years, north Bihar has recorded the highest number of floods with an increase in the total area affected by the flood in Bihar. Darbhanga is a district of North Bihar that is severely affected by the annual flood. The population of the Darbhanga district is 3.93 million with over 90% of the population living in rural areas (DHSD, 2012). Biraul, Kusheshwar Asthan (East and West), Ghanshayampur, Singhwara, Keoti, Jale are the most flood affected areas in the district by the Himalaya range of rivers. The flooding typically impacts the region for 3-5 months at a time and severely affects human life and living conditions, especially in marginalised communities (DHSD, 2012).

In 2008, the primary author was part of a humanitarian assistance program and worked in the flood-affected area of Biraul and the Kusheshwar Asthan block of Darbhanga district in Bihar. The humanitarian assistance program was focused on agriculture, water and sanitation, gender-based violence, and shelter in 30 villages. In 2010, the first author conducted a study on health care accessibility in flood-affected area of Biraul block, Darbhanga district as part of his master's thesis. This paper draws on the findings from the thesis, highlights the impact of

the flood on rural communities and describes how flood perpetuates poverty and continuous marginalisation of the flood affected area from mainstream development. In this paper, the authors attempt to explain how the flood contributes to poor health, food insecurity, and a culture of poverty in the rural areas of Bihar.

Methodology

This paper analyzes data collected for the master's thesis that set out to understand the healthcare accessibility in the flood affected area of the Biraul block of the Darbhanga district, Bihar (Kumar, 2011). The study adopted a mixed method approach and was conducted in two phases. The first phase of the study was conducted between April and May 2010, with the focus of understanding the impact of flood on the community in the flood-affected area through using qualitative research methods. The second phase, which was conducted from October to November 2010, focused on understanding the health seeking behaviour of the population in the area using quantitative research methods. Due to the scope of this paper, quantitative analyses will not be discussed here. Instead, the paper mainly draws on the qualitative data collected in the first phase of the study to highlight the impact of the flood on the rural community.

Participatory Rural Appraisal (PRA), observation and interview were adopted as data collection methods in the first phase to understand the impact of the flood. Participatory Rural Appraisal is a bottom up approach that enables local people to participate, share, and analyse their knowledge of life and conditions; to plan and to act (Chambers, 1994). First, PRA method was employed to bring community together and explain the impact of flood on the community. Initially, community members were invited to participate in a PRA exercise, and 23 community members agreed to participate. The PRA exercise began with a transect walk in the community, followed by a focus group discussion with participants. Transect walk is a systematic walk on a well-defined path in the community with a group of community members to explore the geography of community issues by observing, asking, listening, looking, and producing a transect diagram (Intercooperation, 2005). The purpose of the transect walk was to determine the vulnerabilities and their impact on the community associated with annual flood. During PRA exercise (including transect walk and focused group discussion), participants discussed and highlighted issues related to health care accessibility, water and sanitation, poverty, livelihood, and migration and security issues, which will be discussed in the next section.

In order to collect more data from the perspectives of agency and front line workers, key informants were interviewed to collect wider perspective on impact of flood on the family and community. A total of 14 key informants were interviewed including 3 senior program managers from two international agencies, 1 medical doctor from a local health facility, 2 front line workers (auxiliary nurse midwife and accredited social health activist), 2 community health workers and 4 community members. PRA, observation, and interviews conducted by the primary author in Hindi (local language) were manually written (verbatim) in a field journal. Verbal informed consent was taken from each research participant and confidentiality was maintained. All data gathered were anonymized, and all identifying information was removed from the transcript.

Based upon the author's personal experiences as an inhabitant of the area, data collected through the PRA exercise, transect walk, observations, and interviews were used to generate the key themes that will be presented in the next section. The synthesis of multiple data sources such as interview transcripts, field journals, observation notes, and site visits allowed the author to reduce the effect of biases from one source and improve the validity of the study.

Findings

Health Service Delivery

The annual flood in the Darbhanga district affects health service delivery that has a severe impact on population's health and wellbeing. In the flood-affected region of the Biraul block of Darbhanga district, waterlogging lasts 3-5 months damaging roads and impeding transportation of essential medical supplies and services. Continuous water logging in villages creates physical barriers to travel to a health facility. Irrespective of the distance of villages from a block primary health centre in Biraul, almost all of the villages face a physical barrier that decreases access to healthcare in the community. All of the public transportation services in the area linking urban area and rural areas, such as buses, auto rickshaws, and manual rickshaws were closed for service. These services are only available in the urban areas where road conditions are better. Almost every village gets cut off from the main roads and communities and families in this area are largely dependent on small boats. These small boats are generally very old and do not have safety features such as safety jackets, buckets, ropes, etc. These small boats have a limited capacity of 5-6 people at a time. However, often it was observed that the boats were unsafely transporting 10-12 people at a time. It often takes more time to reach the destination than average normal walking pace. During the PRA exercise, community members reported that these boats are often not available for marginalised communities; and during an emergency, patients often cannot reach health facilities in time to get proper treatment, which often causes unnecessary loss of life.

The unavailability of a transportation system in the flood area also affects the delivery of essential health services such as routine immunization services, antenatal and postnatal check-ups of pregnant women and lactating mothers, and family planning services. Frontline workers reported that they were unable to reach villages to delivery essential healthcare services due to water logging in the villages. They also reported that during flood season, women are unable to reach health facilities and often delivered their babies at home without any medical support and assistance. Delivering babies under supervision of a trained medical professional at a health facility has been considered safe for both mother and child. Nonetheless, women often give birth in unhygienic conditions, which puts both the mother and the child at risk of infection that could lead to other health issues and even death in extreme cases. In most of the cases, women and newborn babies do not receive home visits by health workers within 24 hours, which is recommended by national health programs.

Due to water logging in the area and unavailability of public transport, community members mainly depend on local unqualified medical practitioners during a flood. These are individuals who have been working with medical professionals for a period of time and start their own private practice. They have no formal medical training, but take on the roles of medical professionals who diagnose, prescribe medicine, and provide treatment. This can lead to misdiagnosis and pose a risk to people seeking treatment. Nonetheless, the availability of these persons in the remote and flood-affected area could have a positive impact under some circumstances. Often they are the first contact point for health care and provide first aid services based on their experiences. They also decide when to refer patients to an appropriate health facility or a hospital for proper treatment in severe medical cases.

Water and Sanitation

Water and sanitation are another problem in flood-affected areas, and are often ignored by local authorities in the villages of the Biraul block. Flood and water logging in the area also influence the water and sanitation practices in the community. Floodwater and water logging in the villages contaminate the local water supply. In Darbhanga, hand pumps are the main source of water for drinking and domestic purposes. In this area, almost every hand pump is installed at ground level rather than on raised platforms. During a flood, many hand pumps get submerged in floodwater and become contaminated. Communities are often solely dependent on these water sources, which regularly cause the incidence of waterborne diseases such as diarrhoea, cholera, skin diseases and eye infections during times of flood.

The community often defecates in the floodwater due to the unavailability of a household toilet or dry land for defecation, creating further risk for waterborne disease and related infections. Floods also bring a lot of debris and waste in the water, especially dead animals, as well as animal and human waste near human habitation. According to health workers and local medical practitioners working in the flood affected region of Darbhanga, the number of cases of illness related to waterborne and vector-borne diseases increases rapidly when a flood hits. Treatment is delayed due to poor health care service delivery and limited health service access. In flood and post-flood conditions, the burden on health facilities is exceptionally heavy due to the high number of patients affected by water-borne and vector-borne diseases.

Livelihood

Flooding indirectly reduces economic and agricultural production, thus decreasing social-economic welfare (Appleton, 2002). Rural Bihar has a mainly agriculture based economy and has very few secondary industries. Agriculture, fisheries and daily wage labour are the main occupations of most people in Darbhanga district. Agricultural and economic activities are largely hindered in the flood-affected region of Darbhanga, which limits agricultural productivity. Annual flood and regular loss of agricultural production of wheat, rice, corn and mango continuously impact the food supply as well as employment opportunities in the region. Reoccurrence of the annual flood also deters investment for the establishment of industries and business in the region. Lack of employment opportunities creates challenges for families to survive and brings forth the issue of cheap labour due to limited job opportunities. Daily workers often receive wages equivalent to 1.5 US dollars per day, less than the national minimum wage of 2.75 US dollars. Livestock are considered a good source of income and social security for landless families and community. Selling of livestock, such as goats and chickens, is considered a source of income to cope with the financial situation during an emergency, especially in flood. In the Biraul blocks, we observe that families often sell their livestock when they are in need of money to buy food or pay for medical expenses. During the flood, livestock often die because of flood or water borne diseases and infections, which further causes financial loss for the family.

To remedy the situation, government and stakeholders have to come up with strategies to ensure proper implementation of existing programs and schemes, which are often poorly implemented in the flood-affected region. Strategies to improve livelihood and generate steady income for marginalised communities are important for ensuring social justice and equity in rural neighbourhoods. Formulating a new program and policy for flood-affected regions involving community participation are of utmost importance.

Food Insecurity

Reduced agricultural productivity and poor transportation systems during floods affect the food supply in the flood-affected region of Darbhanga. Additionally, lack of employment opportunity and income reduces the household income of the families and further affects their purchasing power. According to women (aged 38), in most of the marginalised communities especially, schedule caste (groups recognized by Indian government as historically disadvantaged people in India), live in a Kachha house (made of wood, non-concrete) that provides very limited space for families. These houses lack storage space for food grains during a flood. They are totally dependent on market and cash purchases during a flood. Physical barriers and the lack of transportation during flood severely affect the food supply and its network in the Darbhanga region. This causes prices of food and essential household supplies to rise in the local market. Families and communities have no option but to buy food and essential goods at very high prices, benefitting local traders. Families who cannot afford high food prices often must change their diet.

In the Biraul block, villagers in marginalised communities switch to dry food such as flattened rice, sattu etc. during the flood because of the unavailability of fuel and the high price of fresh food in the market. Lack of fuel is another reason for changes in food consumption patterns. The community generally uses wood, paddy waste, and dry plants as fuel to cook their meals, which they collect from the local area and agricultural fields. During the flood, all the dry plants get submerged in floodwater and subsequently cause fuel unavailability in the area. This increases fuel prices in the market, especially for dry wood, which is essential for cooking. These factors jointly alter the food consumption pattern and nutritional intake in the flood affected regions, especially among children and pregnant and lactating mothers. These changes in consumption patterns can have a negative impact on the health of mothers and children and could be one of the reasons for high malnutrition and anaemia in the region.

Ensuring food security is one of the prime goals of the government and there are multiple campaigns going on in the country demanding the right to food security. Various schemes and programs that aim at providing welfare and reducing poverty are underway. Employment guarantee schemes, income generation programs such as MGNAREGA (national program that guarantees minimum 100 days of work in the rural area for marginalised communities), JEEViKA (Bihar government program that promotes self-help groups for income generation activities and women empowerment), and PDS (food security system run by Government of India that provides food at very low cost to families living under poverty line) focus on providing employment and income generation to the community and marginalised populations and are becoming more evident. The program manager of an international agency reported there is poor implementation and management of government programs mainly due to corruption in the system. The lack of a flood prevention system and its implementation along with the occurrence of floods on a yearly basis are major factors that affect management and implementation of such welfare programs and entitlement schemes. Ensuring proper implementation of these programs could help marginalised communities to cope better during flood seasons.

Migration

Food insecurity and lack of employment opportunity in the flood affected region of the Biraul block often force members of the community to seek employment in nearby states and districts. Migration is a common feature in a flood affected rural area. Nearly 14 percent of the youth population migrates to metropolitan areas and industrial cities for employment (DHSD,

2012). Most of the migration occurs in marginalised and lower income communities. Male migration is a common phenomenon in these communities. Male family members aged 16 and above often migrate to other northern and western Indian states such as Gujarat, Punjab, Maharashtra, and Uttar Pradesh for employment during flood season. Migrant male workers often work in factories, industries, and the agricultural sectors in other states. They work in hazardous conditions at very low wages. The unhygienic living conditions also impact their health, thus defeating the purpose of leaving home and seeking relief for the whole family back in the village during flood time. The migration of adolescents disturbs the educational attainment as young people stop going to school to search for jobs in other states. Young people often discontinue their education once they start migrating for work to urban cities, reducing their opportunity to get decent or more professional jobs.

Migration due to flood continually affects social and economic factors that are associated with quality of life and/or family status, in the aspects of health, education and income. Women from the marginalised community (schedule caste) reported that they often take a loan from a moneylender for expenses related to rural-urban migration such as buying train tickets, food, and covering initial settlement costs at a very high interest rate as local banks refuse to lend money to them. The average interest rate from moneylenders is from 5-10 per cent per month, which is 8-10 times higher than the local banks. The role of microfinance institutions and banks are important to ensure access to personal finance assistance. This could also prevent communities from being exploited by moneylenders if implemented properly.

Vulnerability to Women, Children and the Elderly Population

Floods, like other natural disasters, have a more adverse impact on women compared to men across the world (Massey, 1994; Rashid, 2000; Rose, 1993). Women are generally invisible during disaster as they are often confined to their “feminine space” and private domain of the home (Fordham, 1998). They suffer more inconvenience when their routine gets disturbed at home as primary caregiver and chief homemaker. In Indian society, women are primarily responsible for providing care to the family, whereas the primary role of men is to earn for the family and ensure their safety. Male migration adds vulnerability to the family and decreases family support. Due to the patriarchal nature of Indian society, the absence of males or head of the family could make family members feel less secure. Also, female members of the family become responsible for managing the family, taking on various roles including providing care to children and elderly, and ensuring their health and safety. Thus, women compromise their own health conditions for those they care for, often playing multiple roles and taking on the sole responsibility for their family. That, in turn, affects their health and wellbeing, which leads to further complications for the entire family. Like women, young children and elderly are vulnerable during flooding. Many studies have highlighted the psychological impact of flood and disaster and reported that the young, elderly and women frequently experience high levels of anxiety and Post Traumatic Stress Disorder (PTSD). These psychological stresses on vulnerable populations can have a severe impact on their physical health and also influence long-term mortality (Jonkman, 2003).

Recommendations: Strategies for Mitigation in a Flood-Affected Area

To minimize the negative consequences and ill effects of flooding on the rural communities, a multi-sector approach is needed to restore the life of the people to normal. This involves joint planning, monitoring and execution of policy with community and government departments. Based on discussion with NGO workers, frontline health workers, and local health officials, some of the key strategies to mitigate impact of flood on communities are as follows:

Provision of Clean water for Domestic Purposes

Some of the local organisations have provided training to local communities on how to clean water for drinking purposes by using chlorine tablets. However, these strategies were largely unsuccessful due to unavailability and inconsistent supply of chlorine tablets in the areas. Regular supply of chlorine tablets for water treatment and its proper use by the community could potentially improve water conditions in the area. Additionally, the installation of hand pumps on high raised platforms instead of at ground level could help alleviate the problem as long as hand pumps remain above the water level during floods. This could potentially improve health status by decreasing water related diseases in rural areas.

Improving Availability of Health Care and Social Service Workers

Properly trained personnel are crucial to deal with any crisis situations. The Darbhanga region suffers from a severe shortage of trained healthcare staff, which in turn badly affects health care delivery system. Developing and recruiting trained human resources should be a strategic priority for the government to increase coverage for the provision of health care. Filling various positions such as doctors, axillary nurse midwives (ANMs), paramedics and other health workers could help communities to restore their health and wellbeing. Additionally, to deal with crises like floods, volunteers, social workers, relief workers, and emergency teams are encouraged to work together and assess the need of the population and to provide essential health and social services. Currently, university curriculum in Bihar lacks a specialised module on social work, disaster management, and other academic disciplines that could help alleviate this problem (Thomas, 2015). These subjects need to be incorporated into the current academic curriculum. In the absence of trained human resources, it is very challenging for the state to provide effective and reliable services. Providing trained human resources are essential for social development and to decrease regional inequity.

Financial Protection and Employment Opportunity

Flood affected communities are largely dependent upon loans from moneylenders to meet their on-going health care costs and living expenses. Loans at high interest rate often push families into extreme poverty that creates further vulnerability for the family. In this situation, flood affected communities require financial protection from the government to restore their lives and prevent themselves from falling into extreme poverty. Easy access to micro credit at low interest rates would allow families and communities to manage on-going expenses and living costs. This will prevent communities from paying high interest rates to moneylenders and help them to contribute towards saving for emergencies and future needs. Many local organizations help communities to form women's self-help groups to engage them in saving and micro finance related activities. This strategy has a limited impact on their lives in relation financial protection, especially for flood-affected communities. During flooding conditions, all families have similar needs and self-help groups are not a solution to the problem. However, the involvement of regulated financial institutions could have a huge impact by providing families with secured loans.

Flooding continuously affects agricultural and economic activities in the Darbhanga region. This further leads to unemployment in the region; and as a result, many people migrate to cities for employment. Migration has very negative consequences on family, especially women and children. It affects the stability and structure of the family. Financial investment, establishing new industries and creating job opportunities for the affected population could help restore their economic status up to a certain level. Migrant workers often work in very

harsh and vulnerable conditions that lead to death and injuries. Job opportunities in the local area will allow them to live with their family and community, which will help them to nurture their family and social relationships. The parent-child relationship is important for children to learn social values and provide a sense of safety and security to children. Due to migration, the family relationship is disrupted and often creates personal and social problems.

Designing Special Educational Curriculum for Affected Communities

Level of education has a close correlation with the economic status and income of the family. Flood affects educational services severely, which causes interruption in educational service to children. Both teachers and students are unable to attend school due to the waterlogging situation. As a result, these children form a pool of unskilled labour, which can be exploited by the urban counterparts. Most dropouts continue to work in agricultural fields to supplement income for their family. Overall, children from a flood-affected area require special educational modules and curricula, which should be flexible and tailor-made for the circumstances. This will help retain and continue education for children and youth without any interruption. In this regard, further research on pedagogy and learning is required to develop the educational curriculum and modules.

Community Empowerment and Local Planning

Various authors have highlighted the importance of community participation in immediate response during crises (Chambers, 1994; Pandey & Okazaki, 2005; Thomas, 2015). Building local resilience and adopting the strength-based and empowerment approach can help lift families and communities from the risks and vulnerable conditions in multiple ways. Building community capacity to develop and execute a community contingency plan, together with disaster preparedness plans, could save human lives and injuries. Training, such as an early warning system, evacuation, search and rescue, first aid, relief and coordination, and a temporary housing relief plan could help deal with immediate and urgent needs more effectively (Krzyszczanovskaya et al., 2011). In this context, the help and support of local community based organization (CBOs) and voluntary organizations become very important to local communities. Developing local organizations and building their capacity and skills could be another strategy towards community empowerment for mitigations (Allen, 2006).

Infrastructure Development

Recurrence of floods has severely affected the infrastructure development in the region, which has continuously hampered the development process. A strong infrastructure development is necessary to tackle some of the issues rural, vulnerable, and marginalised communities are facing. Building a flood resistant infrastructure such as connecting roads, health facilities, schools and other institutions on high raised platforms could help communities and villagers to access health and social services. Besides, constructing health facilities on a raised platform or high-rise area could be a good strategy to keep health infrastructure or facilities safe from floods. New construction technologies and designs can be utilised to build a stronger health infrastructure that can withstand a flood and minimize the damage done.

Additionally, utilizing motorboats in rural areas can ensure that doctors and health care workers are able to reach difficult areas during a flood. Improving health care access is very challenging in the flood-affected area. Social services, especially healthcare and family-based services are very much essential services that help communities to run their day-to-day life, and infrastructure is essential for guaranteeing service delivery. Building reliable roads and

deploying motor boats would certainly be very helpful for a community to access essential services and carry out daily activities in times of a flood.

Political Mobilization

The development of a flood-affected area has been largely ignored and does not get enough attention. Re-occurrence of floods and the continuous loss of infrastructure and property have diverted the business and industries to other regions. One of the major reasons for underdevelopment of the Kosi regions (i.e., Kosi River area) including the Darbhanga district was the lack of political interest in the development of the flood-affected region. Representatives of the Darbhanga region failed to mobilise the necessary political support to improve the condition of the population. Lack of leadership and political mobilization towards development in the flood-affected community could further promote rural backwardness. The issue of the flood-affected community has never been a priority of the state, and one of the main reasons is the lack of capable and experienced leadership.

Political mobilization is essential to mobilise political support from the government and advocate for the rights of people. There is need of political mobilization and social action to push disaster prevention into the state's agenda. It is important to include the development agenda of flood regions in state and national policy. In this regard, it would be important to organise and mobilise academic institutions, as well as local and regional organisations to come forward and advocate for the rights of the marginalised and flood affected communities to improve their life conditions.

Conclusion

Annual flooding in the Darbhanga region has slowed down the development process and pushed marginalized communities into extreme poverty and exclusion. Water logging in the area of the Biraul block, which usually lasts 3-5 months, adversely impacts the social and economic life of the communities. It also negatively affects health care delivery service and access to healthcare. The on-going loss of infrastructure, property, human life, crops, agricultural land, and livestock during floods results in huge personal and economic loss. Continuous damage to infrastructure and reduced access to health and social services makes it difficult for rural communities to get out of extreme poverty or have a new start. They continue to suffer and cope with extremely difficult living conditions in the Darbhanga region. Vulnerable communities witness women, children, elderly people, individuals with mental health issues, and individuals with disabilities struggling with minimal support from their government. Mobilizing political support and empowering communities is essential to accelerate the development process in the region. It is high time that we advocate for the urgent needs of these rural communities and explore practical and feasible solutions to flood related problems in these areas.

References

- Allen, K. M. (2006). Community- based disaster preparedness and climate adaptation: Local capacity-building in the Philippines. *Disasters*, 30(1), 81-101.
- Appleton, B. (2002). *Climate changes the water rules, dialogue on water and climate*. Liverpool, United Kingdom: Prinfine, Ltd.

- Axelrod, C., Killam, P. P., Gaston, M. H., & Stinson, N. (1994). Primary health care and the midwest flood disaster. *Public Health Reports (Washington, D.C.: 1974)*, 109(5), 601-605.
- Blaikie, P., Cannon, T., Davis, I., & Wisner, B. (2014). *At risk: Natural hazards, people's vulnerability and disasters*. New York, New York: Routledge.
- Casteel, M. J., Sobsey, M. D., & Mueller, J. P. (2006). Fecal contamination of agricultural soils before and after hurricane-associated flooding in north carolina. *Journal of Environmental Science and Health, Part A*, 41(2), 173-184.
- Chambers, R. (1994). Participatory rural appraisal (PRA): Analysis of experience. *World Development*, 22(9), 1253-1268.
- Curry, M. D., Larsen, P. G., Mansfield, C. J., & Leonardo, K. D. (2001). Impacts of a flood disaster on an ambulatory pediatric clinic population. *Clinical Pediatrics*, 40(10), 571.
- DHSD. (2012). District health action plan 2012-13 Darbhanaga. *District Health Society Darbhanaga*. Darbhanaga, Bihar, India.
- Dutta, R., & Watts, H. (2010). FACTBOX - annual loss from floods in India. *Reuters India*. Retrieved from <http://in.reuters.com/article/2010/05/21/idINIndia-48687120100521>
- Fordham, M. H. (1998). Making women visible in disasters: Problematizing the private domain. *Disasters*, 22(2), 126-143.
- Guha-Sapir, D., Hargitt, D., & Hoyois, P. (2004). *Thirty years of natural disasters 1974-2003: The numbers*. Louvain-la-Neuve, Brussels, Belgium: Presses universitaires de Louvain.
- Gupta, S., Javed, A., & Datt, D. (2003). Economics of flood protection in India. *Natural Hazards*, 28(1), 199-210.
- Intercooperation. (2005). *Participatory monitoring and evaluation: Field experiences NGO programme Karnataka-Tamil Nadu Series I*. Hyderabad, India: Intercooperation Delegation.
- Jonkman, S. (2003). *Loss of life caused by floods: An overview of mortality statistics for worldwide floods*. (No. DC1-233-6). Delft Cluster, Delft: The Netherlands.
- Krzhizhanovskaya, V. V., Shirshov, G. S., Melnikova, N. B., Belleman, R. G., Rusadi, F. I., Broekhuijsen, B. J., & Pyayt, A. L. (2011). Flood early warning system: Design, implementation and computational modules. *Procedia Computer Science*, 4, 106-115.
- Kumar, V. (2011). *Health care accessibility in flood affected area: A study of Biraul block of Darbhanga district, Bihar*. Unpublished manuscript, Tata Institute of Social Sciences, Mumbai, India.
- Kunii, O., Nakamura, S., Abdur, R., & Wakai, S. (2002). The impact on health and risk factors of the diarrhoea epidemics in the 1998 bangladesh floods. *Public Health*, 116(2), 68-74.

- Massey, D. (1994). *Space, place and gender*. Minneapolis, Minnesota: University of Minnesota Press.
- McCarthy, J. J. (2001). *Climate change 2001: Impacts, adaptation, and vulnerability: Contribution of working group II to the third assessment report of the intergovernmental panel on climate change*. Cambridge, United Kingdom: Cambridge University Press.
- Pandey, B., & Okazaki, K. (2005). Community-based disaster management: Empowering communities to cope with disaster risks. *Regional Development Dialogue*, 26(2), 52.
- Parker, D. (1999). Criteria for evaluating the condition of a tropical cyclone warning system. *Disasters*, 23(3), 193-216.
- Pianetti, A., Sabatini, L., Bruscolini, F., Chiaverini, F., & Cecchetti, G. (2004). Faecal contamination indicators, salmonella, vibrio and aeromonas in water used for the irrigation of agricultural products. *Epidemiology and Infection*, 132(02), 231-238.
- Rashid, S. F. (2000). The urban poor in dhaka city: Their struggles and coping strategies during the floods of 1998. *Disasters*, 24(3), 240-253.
- Rose, G. (1993). *Feminism & geography: The limits of geographical knowledge*. Minneapolis, Minnesota: University of Minnesota Press.
- Schatz, J. J. (2008). Floods hamper health-care delivery in southern Africa. *The Lancet*, 371(9615), 799-800.
- Smith, B. W. (1996). Coping as a predictor of outcomes following the 1993 midwest flood. *Journal of Social Behavior & Personality*, 11(2), 225-239.
- The International Federation of Red Cross and Red Crescent Societies. (2014). *World Disasters Report 2014*. Geneva, Switzerland. Retrieved from <http://www.ifrc.org/Global/Documents/Secretariat/2014/WDR%202014.pdf>
- Thomas, R. L. (2015). Exploring community based disaster risk reduction as a community practice model: A case study of disaster affected villages in Bihar, India. *Society for Social Work and Research 19th Annual Conference: The Social and Behavioral Importance of Increased Longevity*. New Orleans, Louisiana.
- Wind, T. R., Joshi, P. C., Kleber, R. J., & Komproe, I. H. (2013). The impact of recurrent disasters on mental health: A study on seasonal floods in northern India. *Prehospital and Disaster Medicine*, 28(03), 279-285.
- WRD. (2015). History of flood in Bihar. *FMIS Bihar, India*. Retrieved 22 November 2015, from <http://fmis.bih.nic.in/history.html>