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Full Length Research Paper

Rural Flood Resilience Strategies: Examining Community Measures in Narayani River Basin, Nepal

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When it comes to the amount of fatalities, livestock losses, and damages to livelihoods, floods are the most catastrophic natural event in Nepal. Flood risks can be decreased through nonstructural, soft structural, and structural means. In addition to these strategies, rural communities have been using community efforts to lessen, respond to, and recover from the effects of floods for a number of years. The primary goal of the study is to analyze these community efforts in the context of livelihood capitals, the Early Warning System (EWS), and the Disaster Risk Reduction (DRR) cycle before summarizing the findings. As a result, two communities in the Narayani river basin—Kudiya and Paklihawa—in the Susta Rural Municipality, Nawalparashi-west, Nepal, were the sites of the research. The article provides examples of general rural coping, resilience, and recovery tactics used by local residents in the wake of floods. An effective and efficient holistic strategy to explaining empirical findings at the community level is also included in the article. The article presents the general conclusions on community activities that enhance flood resilience, and these empirical findings are deemed pertinent, realistic, workable, and long-lasting ways to lower the dangers of flooding in Nepal's rural areas.

Key words: Flood, Resilience, Community, Actions, Livelihoods, Capitals.

INTRODUCTION

The most common catastrophic calamity is flooding. According to T. Luo, Robert S. Young, and P. Reig (2015), river flooding impacts the lives of 21 million people on average, reduces GDP by $521 billion, and results in internal displacement of thousands of people each year (Willner, S.N., Otto, C. & Levermann, A, 2018). An integrated strategy that tackles social protection, disaster risk reduction, and climate change adaptation is required since flood-led disasters have become more frequent and severe in recent decades due to the global warming effect. Floods are more common worldwide than other natural disasters, and they have the power to "wash away" in an instant the progress and development that communities have made over many years.

Floods are predicted to impact 156,600 people annually in Nepal (WRI, 2011). Communities and households experienced increased poverty and marginalization as a result of the yearly flooding (Myron B. Fiering, 1982). The governments of Nepal view the losses resulting from the yearly flooding as a major issue. It becomes a heated topic of conversation among victims, security personnel, and the government every year. Floods in Nepal have deteriorated the agricultural land in the Terai region. One of Nepal's largest rivers, the Narayani, destroys rural residents' lives and means of subsistence through flooding that occurs virtually annually. From the northern Himalayas, the Narayani river basin descends down Susta Nawalparshi, Nepal, and ends at the Ganges River in Bihar, India. People with extremely poor socioeconomic features are among those who live along the banks of this river basin. Floods, particularly during the monsoon season, which lasts from June to September, are to blame for their poor living conditions. Following the conclusion of the monsoon rains, other disasters, such as drought conditions, also occur.

THEORETICAL UNDERPINNING

The article focuses on the community's efforts to become more resilient and save lives and livelihoods during floods. In the guise of modernization and science, rural flood risk control measures are largely disregarded. The following basic theoretical foundations form the basis of the paper.

Defining resilience

The ability to withstand shocks and stressors that don't have long-term negative effects on development is referred to in this research as resilience (Frankenberger, Timothy R., Constas, Mark A., Neson, Suzanne, Starr, Laurie, 2014). The ability of a household to adapt, endure, recover, and alleviate natural stresses and shocks is known as household resilience. Resilience, or the capacity to recover or cope with the effects of calamities, is a means, not an aim. In order to empower households to achieve resilience during shocks and pressures, resilience is a comprehensive approach that encompasses capacities, skills, a set of traits, and situations. Flood resilience in Nepal's rural areas is covered in the article.

Resilience to floods in communities

"A community is resilient to flood when it can maintain its essential functions and systems under flood stress caused by adaptation to changes in the physical, social, and economic environment; additionally, it can be self-sufficient in the event that external resources are limited or cut off." Mueller M., Spangler T., Alexander S., and Frankenberger, T. (2013). The degree to which communities can effectively integrate social capital and group efforts in response to flood shocks and pressures is known as resilience.

One of the major household-level capabilities that directly affects flood resilience is social capital. A community is a collection of houses that share a common language, culture, and economic means of subsistence. In order to mitigate, respond, and recover from any type of disaster, including floods, the households communicate, engage, and cooperate in a bonding, connecting, and networking manner.

Community-based initiatives to increase flood resistance

The locals have been residing on the riverbanks for many generations. They are able to accurately forecast when floods will occur, which areas will be most affected, and where people should flee. In order to deal with, endure, and recover from the flood, the communities use their unique rural tactics and behaviors. They regularly participate in risk mitigation activities and do cause-and-effect analysis. In order to reduce the risk of flooding, they mostly use structural solutions including gabion and earthen embankments, creating shelter homes, spurs, and river training. Although policymakers and researchers have not given enough credit to the community's recent efforts to maintain water reservoirs (ponds, waterways, etc.), upstream-downstream communication, and nature-based solutions like plantations, local watershed management, etc., these community actions help to manage flood risk in a sustainable way.

METHODOLOGY

Agriculture and Forestry University (AFU), Rampur, Chitwan, Nepal, is now doing Ph.D. research, which includes the study data and findings reported in this publication. The Susta rural municipality in the Nawalparasi district of Lumbini Province's Paklihawa and Kudiya settlements were selected to collect and analyze empirical data as rural flood resilience management measures. The Nawalaparshi-West district's most flood-prone settlements are Kudiya and Paklihawa, which are particularly susceptible to monsoonal floods virtually every year. Communities that frequently experience and respond to flood occurrences were deemed appropriate for the study because it would offer community-based flood resilience initiatives. Both qualitative and quantitative data were gathered for the study using a mixed research approach. 402 households in each community participated in household surveys to obtain primary data, which were then complemented by data from four Key Informant Interviews (KII) and four Focus Group Discussions (FGD) conducted in the two communities. Books, papers, published materials, and literature reviews were all part of the secondary data collection process. This chapter's investigative study involved a thorough examination of the government of Nepal's public papers and DRR regulations, followed by the collection of primary field data.

RESULTS AND FINDINGS

The results and findings are discussed in the following categories:

Respondent’s demographic characteristics

Out of 402 respondents, 227 (56%) were female and 175 (44%) were male. Higher respondent’s age groups (n=286, 71%) fall under 26-50 years categories (Table 1)

Table 2 includes the ethnic composition of those who participated in the survey from of Kudiya and Paklihawa sites. Chaudhari, Pahadi, Kannu/Kalawar were the major ethnic groups in the Kudiya, while Mushar/Dalit, Muslim, and Yadav were major ethnic groups in Paklihawa.

Techniques for managing flood danger in rural areas

Although rural communities have a number of challenges, they also offer solutions. They are familiar with the local context, can accurately comprehend community issues, and can help design support measures that increase local capacity and develop rural flood risk management adaption methods. In particular, rural techniques assist flood catastrophe victims in identifying appropriate

actions, preventing illnesses, conserving property, and reestablishing their standard of living. The following categories and discussions highlight some significant community efforts that were seen in the study sites to lower flood risk management.

A scheme to mitigate floods in Kudiya and Paklihawa

Measures taken to lessen the extent of material and human damage brought on by floods are known as flood mitigation. They should also ensure that natural or human-caused events do not generate emergencies or disasters. In order to lower the dangers of flooding, the community has its own local mitigation strategy. Table 3 demonstrates that Kudiya and Paklihawa have varied community mitigation action priorities. As a mitigation strategy, 113 (28%) of the 402 respondents increase the plinth of their homes. Only five (23%) of the 22 respondents from the Paklihawa group use diversion as a mitigation strategy, compared to 17 (77%) of the Kudiya respondents who prefer to use diversion routes. In a similar vein, out of 35 respondents, 25 (71%) from Paklihawa said they grow trees as a flood mitigation strategy, compared to just 10 (29%) from Kudiya. In essence, these societies use various ways. Additionally, the p-value from the Chi-square test is much lower than 0.05 (p=0.006284236). It demonstrates how Paklihawa's mitigation strategy differs greatly from Kudiya's.

The same is shown in Table 4, which also contains qualitative data. Depending on the DRRM cycle, Kudiya and Paklihawa have distinct community initiatives. Compared to Kudiya, Paklihawa's communal initiatives appear more realistic and useful, which increases resilience. Paklihawa has an active Community Disaster Management Committee (CDMC) and more regular DRRM training and orientation, which are the causes of this. The degree of focus, method, and ownership varies between Kudia and Paklihawa, but the community actions in other DRRM cycle phases, such as readiness, response, and recovery, are essentially the same. According to the FGD and KII, the community is taking adequate preparation and reaction measures, however there aren't many mitigation and recovery efforts. This is due to the fact that mitigation and recovery measures require additional resources and support from governments and external stakeholders, both of which are deficient in both communities. Detailed community actions according to the DRRM Cycle are shown in Table 4.

Flood livelihoods recovery

Economic capitals such as income, assets, and resources are examples of livelihood possibilities. Having more diverse livelihood options aids in coping with, surviving, and recovering from flood risk early on, according to a frequent thumb rule in the assessment of flood resilience. Table 5 reveals that, of the 402 respondents, 92 (23%) depend on manual labor as a source of income following the flood, while 80 (20%) have no plan because of the dire economic situation. There are differences between the community actions for livelihood recovery in Kudiya and Pakliha, as indicated by the p=0.025878, which is less than 0.05. There is a significant difference (p=0.025878) between Kudiya and Paklihawa in the focus and intensity of community efforts.

Likewise, table 6 confirms the facts mentioned previously regarding the insufficiency of community actions in economic capitals. Although there are few actions in the areas of economic, physical, and natural capitals, community actions are beneficial in the areas of social and human capital. This is a result of the community's limited resources and those of government and external players. For comprehensive community action based on the five livelihood capitals, please see table 6.

Flood monitoring and warning services

EWS is essential to managing the risk of flooding. One component of EWS is flood monitoring and warning services. According to Table 7, 116 (29%) and 105 (26%) of the 402 respondents, respectively, in Kudiya and Paklihawa, are receiving flood early warning alerts from sirens through early warning task forces and community relatives. Only 20 respondents in Paklihawa receive EWS from government stakeholders, compared to 35 respondents in Kudiya who receive it from local government stakeholders. Despite the apparent differences in community behaviors between Kudiya and Paklihawa, the p-value (p=0.135615664) is higher than the p-value at 0.05. Therefore, Kudiya and Paklihawa's communal behaviors are not that distinct from one another. In contrast to Paklihawa, it indicates that Kudiya has stronger ties to the local government. Additionally, 30 of the 51 responders in Paklihawa receive the EWS via a flood gauge reader. Due to the installation of a flood gauge in the river close to their village, Paklihawa has a greater rate of early warning receiving respondents.

In a similar vein, table 8 demonstrates that sirens and interpersonal communication within the community are the primary means of receiving flood monitoring and warning services. The government sends out flood alert SMS to a small number of people. Compared to those in Kudiya, folks in Paklihawa appear to be more prepared. Though there are few community actions in response to a flood alert, both communities have some pertinent community activity in risk understanding and dissemination. For a complete list of community initiatives in Kudiya and Paklihawa according to the EWS factor, see the table below.

Role of local government

Community actions also involve the municipality, or local government. Floods cause major damage and losses to lives and livelihoods in communities almost every year. Flooding not only destroys the framework of livelihoods but also causes a variety of issues that make life very difficult. For instance, it ruins homes and interferes with

the health and educational systems. Since local governments are more familiar with the local context and have stronger ties to the community, they play a more important role in flood response than do the federal or provincial governments. The Disaster Risk Reduction and Management (DRRM) Act of 2017 gives local governments, particularly those in rural areas and municipalities, more authority to carry out DRRM plans on a local level. Below are few examples observed during the key informant interview with the Susta Municipality representative:

- Hazards, risks and vulnerability assessments and plans.
- Creating flood risk awareness, simulation exercise, and learning events
- Carrying out disaster-resilient construction works for preventing floods such as dam, spur, embankments etc. forestation, and bioengineering.
- Organizing training for the local peoples and helps in an early warning system operation.
- Providing temporary shelter to the people who are displaced by floods.
- Providing safe drinking water and food to the people who are affected during and after the flood.
- Provide rescue operations during the flood and provide health services to the wounded people in the primary health care center.
- Provide livelihood opportunities to the people who have suffered from the disaster
- Provision for DRR fund and local resource allocation for DRR.
- Localization of DRRM Act, formation of Local Disaster Management Committee, Local Emergency Operation Center etc. for effective early warning, preparedness, response and recovery.

How social capital matters in flood resilience

In the rural context, community efforts are one of the social capitals that are essential to lowering flood risk management. The strength and complexity of the connections between individuals both inside and outside of their communities is referred to as social capital. In the context of community catastrophe resilience, social capital exemplifies social cooperation or community connectedness, which offers unofficial safety during emergencies and facilitates resource access. In addition to helping individuals who are most impacted and in need of assistance, bridging, bonding, and linking among people lowers barriers to collective action. However, compared to those with a political connection or a higher social standing, poor and marginalized groups, women, and Dalits have difficulties in receiving resources and help during the relief and funding period. Since local government assistance does not always reach promptly, community involvement is essential during floods in rural areas. There are a few examples observed in Kudiya and Paklihawa during FGD and KII:

- Helping people in finding goods or materials lost during the floods.
- Sharing of the shelters and food amongst the people who are affected by flood
- Helping each other in re-building/renovating the houses and much more construction- related work
- Supporting immediate relief of food, clothing, shelter and medication during emergency to the needy.
- Further, plans are made within community people for the prevention of flood and preparing the plans regarding the steps which should be taken during the flood
- Counseling to the people who are highly affected due to flood and further motivating and supporting them in each sector
- Providing loan to the people who are affected due to flood without any interest rate
- Working together in agricultural lands for enhancing the production of crops

Remaining community gaps and needs

Recurrent flooding in Nepal has caused significant damage and fatalities, demonstrating the ineffectiveness of the remedies implemented both during and after the flood. The death toll also indicates that several gaps need to be addressed in order to lessen the effects of floods. Some remaining gaps and challenges observed at the time of FGD and KII at Kudiya and Paklihawa are:

- Community engagement in hazards, risks, vulnerability assessments and DRR plans and policies preparation.
- Access and dissemination of flood early warning to the most vulnerable and disadvantaged groups in the community.
- Limited knowledge and skills about the flood risk management activities such as EWS, structural and natural solutions like bioengineering, plantation, watershed planning, etc.
- There is no strategy focused to flood risk management in Nepal. The DRRM Act mostly emphasizes on emergency management and does not emphasize risk management and preparedness.
- Limited education and training about flood risk management among the community people, and local government for the prevention of flood, response during and after the flood
- Lack of vibrant DRR community institutions (CDMCs, task forces etc.) who are primary responders during the disasters.
- Lack of diverse livelihood opportunities and resilient livelihoods schemes for the ral people living in these areas.
- The public and private sectors' willingness to support these rural communities was found limited.

RESEARCH AND PRACTICE IMPLICATIONS

The study fills in the knowledge gaps in academic and development research on rural flood adaptation, resilience, and recovery. The research and results demonstrate how important, pertinent, and helpful community initiatives are in lowering the risks of flooding. The significance of rural flood risk management techniques in development practices related to mitigation,

readiness, response, and recovery is emphasized in the article. Stronger and more capable communities with pertinent community actions are better able to function as resilient communities. According to the comparison analysis, the Paklihawa community is more engaged than the Kudiya community and has taken pertinent community actions both during and after the flood, which has helped them develop a more resilient community. The aforementioned research's implications lend credence to a more general notion that community efforts that are beneficial, creative, and sustainable should be respected. These actions also offer high-level guidance and pathways to potential academic and development stakeholders. Community initiatives also include social capitals and the participation of local governments, which can be very important during floods. Although there are still a number of gaps in flood resilience, rural methods are pertinent and helpful in reducing the hazards of flooding. In a similar vein, community initiatives assist lower the risk of flooding by maintaining milestones that can be expanded upon throughout time.

DISCUSSIONS

The main and initial responders to any disaster are local DRR organizations that are rooted in the community. In Nepal, flooding is regarded as one of the most significant and common natural disasters, resulting in the loss and destruction of thousands of lives and livelihoods every year. In this situation, community members play a critical role in coping with, enduring, and recovering from the negative effects of floods. At various levels, the role of the community and its activities are discussed, viewed, and observed in different ways in rural areas. According to the research findings in this paper, the community has been playing highly beneficial roles, and community efforts in several areas such as livelihood capitals, the DRR cycle, and EWS are found to be realistic, practicable, and long-lasting in lowering the danger of flooding. Actions and interventions cannot be disregarded, even though they are not flawless or sufficient to lower the risks to a safe level. These serve as the cornerstones, and the customs and abilities must be projected and preserved. By expanding on the measures that families now take and creating treatments that can adapt to changing circumstances, the rural community can offer workable ways to lessen the detrimental social effects of flooding (Dixit A. et al., 2007). On the other hand, the traditional approach to risk reduction mostly uses structural measures and does not examine the cause-and-effect scenario (Dhakal, 2013). Although the background is unclear, the study in the aforementioned research revealed that communities lack the resources to implement structural remedies; instead, they rely on soft structures like plants, bioengineering, sandbags, and pilling to lower the risk of flooding in rural areas.

The research emphasizes that a community can be more flood resilient to deal with, tolerate, and recover from the flood if it has more options for livelihood, such as economic capital and variety. While having wealth in all five capitals is desirable, physical, economic, and natural capitals have a greater impact on lowering the danger of flooding and its negative effects on the society. Another study supports this, showing that access to natural and economic capitals is a major factor in a household's ability to adapt to high flooding (M.R. MotsItolaplte, Donald L. Kgathi, Cornelis Vanderpost, 2014). In a similar vein, community actions and interventions in accordance with the DRR cycle are extremely important since they address every stage of the disaster and enable the community to cope with floods. In order to lower the risk of flooding, an effective early warning system must be integrated with community initiatives. Low capacity and knowledge of information on warning, communication devices, transportation, and the use of advanced forecasting tools and models are also linked to barriers to information dissemination, which must be addressed to strengthen community-based EWS (Rishiraj Dutta, Senaka Basnayake, Atiq Kainan Ahmed, 2015). Flood resilience measures in rural areas are vital and significant. Although the community's efforts to lower the risks of flooding are very beneficial, they require additional technical assistance and resources, and they should be reinforced with a comprehensive strategy that incorporates the DRR cycle, livelihood capitals, and efficient EWS. Involving the local community in risk, hazard, and vulnerability assessments as well as DRR plans and policies to increase resilience is essential to enabling the community to respond, mitigate, and recover from floods in sustainable ways.

CONCLUSIONS

There are no hard-core methods or tactics to mitigate the negative social and economic effects of flooding. It is possible to practically transfer and capacitate rural tactics with community actions that families have already been conducting, as well as by creating interventions that can adapt to changing circumstances and the community's context. Such measures ought to address the strains and shocks caused by flooding as well as their effects. In the event of flooding in the aforementioned communities, community actions like locals seeking refuge frequently by relocating to higher ground, communicating with one another upstream and downstream, planting flood-resistant crops or early-ripening crops, storing some emergency food and supplies, and setting up a DRR fund locally all greatly aid in the mitigation, response, and recovery from the effects of the floods. Through ongoing institutional local innovations, such as increasing hand pump platforms, boiling the water with local medicinal neem plant, using water filters, etc., community initiatives also help to improve access to clean drinking water during floods. More proactive solutions than focusing just on strict structural measures to lower flood risks are local community plans that assist rural residents in developing a variety of livelihoods to lessen flooding dangers and vulnerabilities. As a suitable method for constructing homes on high points or stilts to provide respite during flooding, the traditional and new rural plan is implemented. Activities such as community forestry can help to create buffer zones and biological shields along

the flood plains. Compared to Kudia, Paklihawa's community efforts are more pertinent and successful, and its residents are also more involved in managing flood threats. Paklihawa appears to be more flood resilient than Kudia thanks to these proactive community efforts and active engagement.

Increasing capacity and building community actions of the current mitigation, readiness, response, and recovery plan—all of which have been found to be extremely effective in Paklihawa—are the general strategies that seek to improve resilience and reduce people's susceptibility to flood hazards. Without significant institutional change, people in their communities can implement the advantages of these approaches. Focus must be placed on both the creation and application of suitable legislation as well as adherence to municipal ordinances. In order to increase flood resilience, local government stakeholders and social capitals must engage the community. The aforementioned community initiatives in livelihood capitals, EWS, and the DRR cycle are deemed pertinent, long-lasting, workable, and sustainable; they only require more financial and technical assistance to improve their ability to prepare for, respond to, and recover from the effects of floods.

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