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Research Article

## Mountains and Rivers: Impacts of and Responses to Flash Flood in the Seti River in Nepal

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### Abstract

On 5 May 2012, a flash flood originating in the Seti river swept away Kharapani, a settlement also known as Tatopani in Sardikhola Village Development Committee (VDC), killing people and destroying the lives and livelihoods of people living and working along the river. This paper explores the perceptions and responses of flood affected people. It also looks at the impacts of the flood on people's livelihoods and their short-term and long-term strategies for coping with and adapting to the destruction caused by the flash flood. Using data based on a qualitative survey, the study recognized the pro-active and effective contributions of social networks and nongovernmental institutions in the post-disaster situation. Although the disaster response required a lengthy process, the flood affected people still felt that the government intervention was slower than expected. This paper outlines the need for the government to have practical strategies and plans to address and respond to localized disasters like the Seti flash flood immediately. At the community level, it also illustrates the role of awareness and preparedness in minimizing the adverse effects of flash floods. The paper concluded that collaborative efforts between governmental and nongovernmental institutions prove instrumental in dealing with the post-disaster situation.

### Introduction

Flash floods are unpredictable and one of the most hazardous weather-related natural events that can cause large losses of life and property [1-3]. Flash floods possess a high destructive capacity in a very short period [4] that can even occur in small rivers and pose great challenges to the communities [5]. In addition, posttraumatic stress disorder is a highly likely consequence for surviving people if no social support is provided [6,7].

Many studies have been conducted to assess the technical aspects of flash floods and explore prediction and warning systems [3,8], including a methodology to collect data for analyzing specific issues and reducing the risk of errors [9]; this has increased our ability to forecast and warn such events in many areas [10, 11]. Nonetheless, flash flood impacts and their intensities are on the rise [11]. Recently, the inclusion of social science perspectives in the study of flash floods and risk management through warning systems is gaining atten-

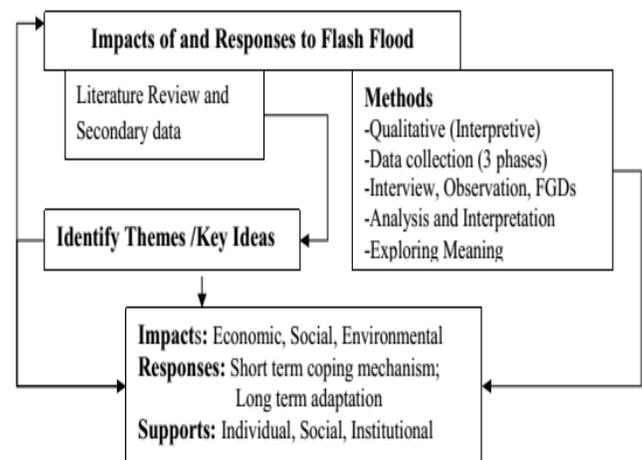
tion [12-14]. This perspective can provide a more comprehensive and clear understanding of the impacts of flash floods, especially in flood-prone areas [15] where it is beneficial to build coping and adaptive strategies. Analyzing the short-term coping mechanisms and long-term adaptation strategies of at-risk communities is key to understanding what kinds of responses occur and what conditions influence these responses and can contribute to enhancing their adaptive capacity. Indeed, both the coping and adaptive capacities of people are shaped by social, economic, and political processes [16]. Social vulnerability may pre-exist a flood and decrease people's capacity to cope [17]. In addition, the destruction of assets during flash floods makes affected people more vulnerable; therefore preparedness at the household level and the empowerment of families in disaster-prone areas in terms of raising awareness and developing new plans are good strategies for reducing losses in the future [18]. In doing so, institutions play a vital role in enhancing the adaptive capacity of vulnerable communities by delivering external resources to facilitate adaptation and, thus, govern access to such resources. Because of this, partnerships between public/governmental and civic/non-governmental institutions are crucial to fulfill adaptation needs [19].

A study conducted in the Philippines by Palmino-Reganit [20] showed that viable coping mechanisms were regular processes in communities where flash floods occur frequently. However, in places where flash floods are uncommon, local people may not be well prepared to deal with such hazards. Destructive flash flood events are a common occurrence in the Hindu Kush Himalayan (HKH) region including Nepal; and such events are increasing in frequency and intensity in the recent years [21,22]. Recently a similar incident with massive landslide occurred in Sunkoshi River killing 12 people, 120 km northeast of the capital city Kathmandu, blocking the river causing a fear of flash flood downstream [23]. Although Nepal is susceptible to various natural disasters, especially flash floods [24,25], such a hazard was not witnessed for a long time in Seti River. Studies on coping and adaptation strategies of local people and on the roles that governmental and non-governmental organizations play in supporting affected communities during recovery are lacking in this part of the world.

The aims of this study were to identify short-term coping and long-term adaptation strategies adopted by the households affected by a flash flood event that took place on 5 May 2012 at around 09:30 hours in the Seti River; we also analyzed the perceived effectiveness of institutions in supporting affected people dealing with the impacts of the flash flood. This study would be beneficial for the academia as well as governments of the mountainous countries to prepare short-term coping mechanisms and long-term adaptive strategies after unexpected natural hazards such as flash floods.

## Research Methods

The study approach was mainly qualitative with some quantitative analysis of affected people's perceptions. Perception is the reflection of existing knowledge and experiences Otara [26] suggests that perception is a sensory experience about the world around us involving both recognition and response. The main philosophical stand point was 'interpretivism' that focuses on the subjective meaning of social action [27]. Accordingly this study was guided by a set of beliefs, feelings and perceptions of research participants [28]. As part of a relief intervention, the households affected by the flash flood were categorized by the Sayapatri Youth Club (SYC), a local community-based organization, according to the degree of impact they suffered (Table 1), in order to organize relief distribution. This study considered the people most affected by casualties, i.e. in the categories 'A' ('human casualty and property losses') and 'B' ('more than one casualty') as key respondents. It was difficult to trace people from all the categories for the comparison because many businessmen were from outside the study area and they had alternative to move away in safe areas. The data from the field were collected through observations, interviews, and focus group discussions (FGDs) to explore the 'multiple realities' on the coping and adaptation strategies after flash floods (Figure. 1; modified after [29,30]).



**Figure 1:** Conceptual Framework of the study [conceptualized after Mwape (2009) and Sharma et al (2013)].

The primary data was collected in three phases, with the main focus on 14 household members who lost all their properties and at least one family member (category 'A'). During the first phase, the research team identified the location of flash flood-affected people and recorded people's views and perceptions in the post-disaster situation. The qualitative research examined people's attitudes by focusing their lived experiences and their perception towards hardships during the recovery phase. At the same time, rapport building with the affected people/households was also done so as to make comfortable situation and share their feelings without any

hesitation. In the second phase, as suggested by Kumar [31], a rigorous field data collection was carried out. A total of 14 in-depth interviews, including both male (5) and female (9) participants, were conducted. Six focus group discussions were held with flash flood-affected people as well as members of the mothers' group and local youth club and representatives from the media and civil society. The third phase focused on member checking and the reconfirmation of the qualitative information.

To maintain the quality and integrity of the research, data were collected applying standard tools suggested by Denzin and Lincoln [28]. During the field visit, the affected area was mapped with support of the local community and government officials. The qualitative data were transcribed and coded thematically. These themes were further sub-categorized according to the objectives in different sectors and sub-sectors for data processing, analysis and results [27,32].

As the subject of the research could be sensitive, ethical principles were maintained during fieldwork to respect the pride, rights, well-being, and safety of the informants [33,34]. The research teams received permission from VDC offices and notified the District Administration Office (DAO). As suggested by Denzin and Lincoln [28], every informant was given equal opportunity to participate during discussions. Personal and confidential issues were respected and the confidentiality was maintained.

### Terminology used in this study:

Coping is the ability of people/systems to avoid exposure to flood hazards and avoid, tolerate or recover from harm [35].

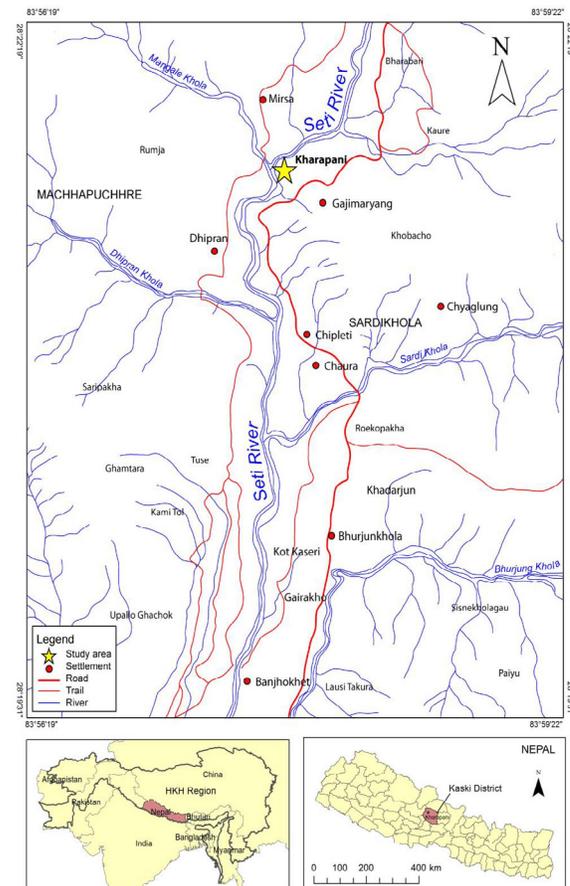
Adaptation refers to an adjustment in natural or human systems by changing processes, practices, or structures to offset potential damages [36].

Institutions refer to many different types of entities, including both organizations and the rules used to structure patterns of interaction within and across organizations [37]. In this research, the word institution refers to organizations and man-made formal and informal mechanisms that shape social and individual expectations, interactions, and behaviors [19].

### Research Area

Kharapani is a village located on the bank of the Seti River in the Sardikhola Village Development Committee (VDC) of Kaski District in western Nepal. This is a narrow river valley where people are practicing terrace agriculture. The Seti River originates from the southern aspect of Annapurna IV peak. Geographically, the study area lies between 28°21'36" N, 83°57'37" E, nearly 40 km north of the second largest city in Nepal, Pokhara (Figure. 2). The total number of household in the village was 879 with a population of 3,442. The male population was 1614

and female was 1828 [38]. The study was mainly focused on those households (14 households) who were victimized by the flash flood in Kharapani.



**Figure 2:** Location of the study area

## Results and Discussion

### Impacts of the Seti Flash Flood

Flash floods can have numerous and pronounced impacts on society, including fatalities [2], economic (property) loss, physical injury, and psychological trauma [7,24]. According to the three broad categories characterized as “representative specific effects” of flash floods [39] –social, economic, and environmental – and interpreted them according to an analytical framework that shows the links between impacts, responses and institutions (Figure. 3).

The Seti flood was a heavy debris-mixed flood that resulted in massive losses of both human lives and physical properties [40,41]. The flood swept away an entire settlement and led to the death of 40 people; 31 people were still missing at the time of study. Most of the deceased were pilgrims, picnickers, locals, tourists, and laborers working in a sand/stone quarry on the riverbank [42]. In addition to human casualties, 20 houses,

shops/restaurants, two temples, and a community building were completely swept away [43]. A hot spring, playground, and picnic area were also destroyed (Figure. 4), displacing the local community.

### Social Impacts

Human endangerment, personal injury, loss of life, displacement, and the emotional and psychological trauma associated with the loss of personal property and memorabilia, homes, communities, etc. are common social impacts of flash floods [39]. Some survivors of the Seti flood took refuge with their relatives while others lived in tents under very poor conditions built with the locally available materials (Figure.5). The flood wreaked havoc on the social lives of local people. Children from poor families, after losing almost all of their properties, discontinued their education. One female respondent mentioned:

‘I lost two family members, my sister-in-law and mother-in-law, which itself is a great loss that cannot be compensated. Our entire family was totally dependent on labor wages. Because of economic problems after the flood, my children had to withdraw from school and are now working as stone loaders.’

The psychological and emotional trauma associated with personal injury and the loss of family members, property, homes, and employment were other notable impacts in this study as has also been reported in other studies (e.g., [6,7]). Most of the people who had experienced the brutality of flash flood directly remained haunted by the fear of flood and suffered deep psychological effects (Figure. 3). One of the respondents who lost his wife said:

‘I am suffering from mental trauma and often haunted by the fear of the reoccurrence of flash floods while working with stones and sand in the river.’

**Figure 3:** Linkages between flash flood impacts on different sectors and the responses of affected communities.

### Economic Impacts

In addition to fatalities and the social impacts, flash floods result in huge economic losses in different parts of the world each year [24,44,45]. Likewise, the Seti flash flood wiped out the entire economic activities of Kharapani. People lost their businesses, employment, and physical assets. Most of the survivors were left jobless (Figure. 3). Before the incident, Kharapani was a small business hub for tourists and people from nearby villages. The hot spring, open ground, and beautiful landscape attracted many domestic and international tourists for hot baths, sports, picnicking, and sightseeing; and local shopkeepers were able to earn a good income. The preliminary estimated monetary damage from the Seti flash flood was NPR 49,628,000 (Exchange rate 1 US\$ = 99.06 NPR)[43]. One of the respondents who owned a hotel in Kharapani said:

‘On average, I used to make cash income up to NPR 30,000 per day during the tourist season.’

After the incident, most economic activities such as manual stone/sand collection were halted, which affected the livelihoods of many poor people. One of the respondents elaborated:

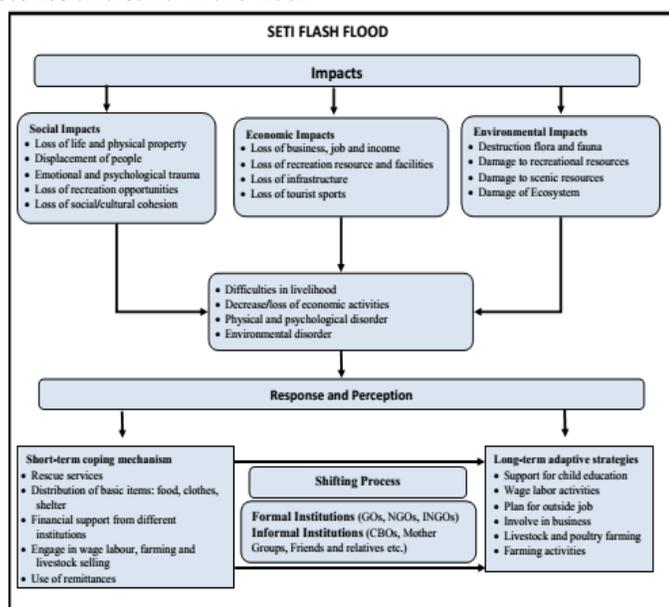
‘I originally came from Gorkha. I used to work along the riverside with my family [husband and son] collecting sand and stones for my livelihood. My husband passed away in the flood. After the incident, I haven’t continued my work. I fear that a flood might happen again.’

### Environmental Impacts

Flash floods can influence an area’s ecosystems, and recovery sometimes takes longer as the system has to go through succession [46]. However, such changes in ecosystems are regarded as secondary impacts when compared with fatalities and health impacts [47]. In the present investigation, environmental impacts, such as destruction of recreational resources, were observed in addition to human casualties and property loss (Figure.3 and 4). The land and road were buried under deposits of silt, sand, and gravel. The flood eroded and widened the riverbanks and spurred landslides. It damaged the habitat of aquatic species, agricultural land, and a large area of community forests. Similar damages were experienced previously in other parts of Nepal [24].

### Perception of the Flash Flood

People’s perception of disaster can differ from community to community depending on the level of understanding, experience, education, cultural beliefs, and socioeconomic conditions; and perception influences coping and adaptation



strategies [20].

In the case of the Seti flash flood, almost all of the respondents believed that the flood was a curse of God, because the study population is dominated by Hindu people who believe nature as a god. One respondent said:

'Whatever our fate is, we have to face it. The incident was terrible. It was beyond people's imagination that the flood could occur on a sunny day in Baishak (May). The flood should not have occurred, but such incidents are not under the control of people. It was God's will.'

The statement explicitly shows that some of the local people were unaware of flash floods and their causes. A similar situation was reported in France in 1988 where interviewees did not notice risk of flooding in their locality [48]. A study by Hopkins [49] indicated that a tendency to link prior exposure to flash floods with higher perception of flood risk can sometimes be unhelpful because it may not be predicted easily. In the case of the Seti flood, though some people claimed that they noticed the decreased and muddy water flow before the flash flood took place, nobody was cautious or sought an explanation. If people had been made aware of such kinds of phenomena, the losses could probably have been minimized. However, the nature of people in developing countries such as Nepal might be different from developed nations where they have to struggle for basic needs and might show less importance towards the preparedness against natural hazards.



**Figure 4:** Study area before (above) and after (below) the flash flood event

## Short-term Coping Strategies and Institutional Support

The support provided from individual, governmental and non-governmental agencies is a crucial part of coping and adopting mechanisms after flash floods [7]. In the present context, various institutions provided emergency and short-term support to the flood-affected people and helped them to cope immediately. The flash flood hit in the morning, but rescues were delayed due to a lack of a nearby emergency team. According to local witnesses, Nepal Army and Nepal Police arrived at the site of incident after several hours. Later, various institutions played a significant role in supporting people as indicated in (Figure. 6). It is an indication that the government lagged behind in immediate rescue process and needs to increase the preparedness for such remote and hazard-prone areas.

Later, the Government of Nepal provided monetary support to flash flood-affected people in two phases. At first, the support was provided for conducting death rituals to the family of the deceased. Then money from a relief fund was also distributed. Although the immediate rescue process was delayed, Nepalese Army, Nepal Police, Armed Police Force, District Disaster Rescue Committee (DDRC), DAO, District Development Committee (DDC), and VDC officials were actively involved in the rescue and relief mission afterwards.

International organizations such as Nepal Red Cross Society (NRCS) and UN agencies helped flood-affected people considerably. In particular, the NRCS helped by providing basic essentials such as rice, salt, lentils, cooking oil, tents, blankets, and some financial support, which was appreciated by all respondents. It is an indication of the fair distribution of support materials by an organization. Similarly, the Annapurna Conservation Area Project (ACAP) provided temporary space for displaced people and some financial support. Additionally, community-based organizations played a significant role in rescuing people during the flood and channeling relief funds received from different networks. Social networks, including contributions from Nepalese students and employees residing abroad, contributed monetary support through the relief funds (Figure. 6). The SYC played a significant role in coordinating, collecting, and distributing the relief funds, particularly from abroad (Figure. 6). A similar situation has been reported in a study by Feng et al [7], where support from social networks included both financial and material assistance such as clothes, medicine, tents, food, and drinking water. This was a noteworthy contribution to help flash flood-affected people to cope with the aftermath situation.



**Figure 5:** Present living conditions of some of the displaced families

According to interviewees, the media played a key role in supporting the affected, including the collection and distribution of relief funds. They were actively involved in fund collection and distribution and frequently broadcasted information regarding the need for financial support. Led by Annapurna FM, various non-governmental institutions collectively formed a joint bank account in support of flood-affected people. Local mothers’ groups were also involved in coordinating and providing support. All respondents noted that the support they received from social networks and non-governmental institutions exceeded their expectations.

Responses of 14 respondents regarding the question on ‘Which organization do you receive support from?’ are presented in Fig.6. The figure clearly shows that in addition to the government, many non-governmental institutions supported the flood-affected people. In addition to tangible support, the most flood affected-people reported that they received sympathy and consolation from relatives, neighbors, and immediate community. Most of the respondents appreciated the moral and emotional support. However, some people expressed dissatisfaction toward the negative attitude of some community members. One respondent from Sardikhola who lost her 16-year-old son said:

‘Society has not been supportive. They often backbite and don’t have good feelings toward our loss and misery. Some of the people have accused us of enjoying the money received from different organizations. The people who have not suffered from the flood often say that the flood was profitable for families that were affected.’

This response indicates that relief aid for flood-affected people can lead to social resentment; this must be handled carefully in distributing aid.

Category	Description	No. of households affected	Per household support received from SYC (in NPR)*
A	Human casualty and property loss	4	50,000
B	More than one human casualty	4	40,000
B	Only one human casualty	14	35,000
C	Loss in business	3	35,000
D	Houses submerged or swept away	5	15,000

**Table 1:** Categorization of flood-affected families by Sayapatri Youth Club

Interestingly, rather than wait for aid, local people whose economic activities had been completely destroyed by the flash floods initiated their own coping strategies for subsistence. Some of the respondents changed their livelihoods whereas others continued their previous occupation. Out of the nine respondents engaged with wage labor job before the flash flood, seven reported that they continued their previous job, one respondent changed his occupations into small scale poultry farming and the other respondent relied on remittance. Similarly, two shop owners totally lost their business and both of them relied on remittance sent by other household members and relatives from abroad. The remaining two households were engaged in farming practice as they engaged previously (Table 2). Thus a high proportion (more than 64%) of the flood-affected respondents’ previous occupation influenced their choice of coping strategy.

Activities/Strategies	Occupation before flood	Coping Activities	Adaptation strategies	Expectations
Wage labor	9	7	3	
Farming	2	2	4	
Livestock and poultry	1	2	2	
Remittance		3		
Business/Shop	2		1	
Jobs			1	4
Education			2	
Relief fund				6
Scholarship to children				5
Land				1
Loan				2
No plan			1	

**Table 2:** The response of the flood affected people regarding coping activities, long term adaptive strategies and expectations

### Long-term Adaptation Strategies

Long-term support and livelihood strategies are crucial for disaster-hit communities. In present study, although government and non-governmental institutions provided short-term relief, flood-affected families felt a lack of long-term support. Nevertheless, some of the children were provided educational scholarships by local schools and NGOs, particularly for those

children who had lost one or both parents. Some children were provided bank balances as educational saving funds. It was observed that education for children was an issue of high concern for the flood-affected families. One of the respondents from Sardikhola who lost his wife was very concerned about his children's education. He mentioned:

'I will continue my previous job of collecting stones and sand. I do not have any plan to increase my income. I would rather focus on scholarships for my children. I have deposited NPR 200,000 in the bank for the education of my two children.'

Flood-affected people had many expectations from the government (Table 2). Their primary expectation was the provision of relief funds. The government announced that it would provide relief money to the families of the deceased only after getting evidences. During interviews, only six of the 14 households reported that they received relief money; two households reported that they received funds for only one of two deceased members, and six households responded that they did not get any kind of government relief because they were unable to find the dead bodies. One of the respondents said,

'I did not get any kind of financial support from the government because I wasn't able to find the dead bodies of my three family members.'

The respondents who did not receive any kind of government support mentioned that neither the criteria for the distribution of relief were practical/just nor the government support was adequate. In addition to the relief funds, flood-affected people also expected the provision of scholarships for children, job placements, loans for farming and businesses, and land for house construction (Table 2).

It was observed that people had unique long-term plans and strategies in place to sustain their livelihoods. Out of the 14 respondents, four reported that they were planning to engage

in farming activities, three were seeking wage labor, two were planning to provide a good education to their children, and two were planning for poultry farming (Table 2).

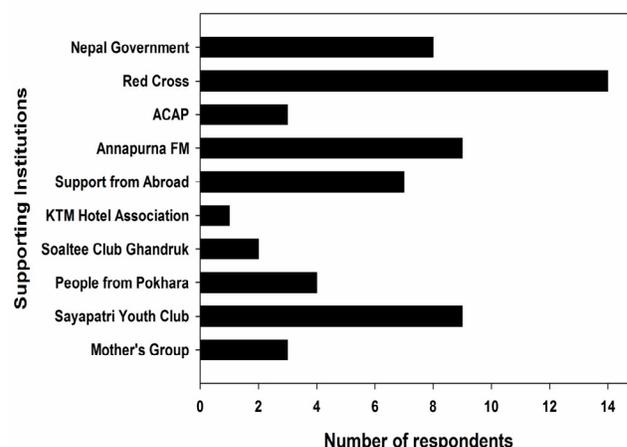


Figure 6: Responses for 14 respondents regarding the question on 'which organization do you receive support from?' Recommendations

### Linkages between Impacts and Responses

The study shows that the flash flood had severe social, economic, and environmental impacts. It was also reported that the help and support extended from governmental and non-governmental organizations and local people were crucial and helped affected people shift from short-term coping to long-term adaptation. While the support extended by various agencies only provided temporary relief, it was effective for the immediate needs of those affected. But feelings of injustice and inadequate help were expressed; these should be considered carefully in shaping aid because they may reduce the effectiveness of support. The high rated organizations providing the support for immediate coping were INGOs, local social clubs and media houses (Table 3).

Parameters	Names of Organizations	Most effective organizations	Effectiveness* (1 – 5) with highest percentage
Governmental organization	District Development Committee (DDC), Village Development Committee (VDC), and Forest Committee	DDC (21.4%) and VDC (21.4%)	3 (44.4%)
Community-based organization	Mothers' groups, Sayapatri Yuwa Club, UK-Kaski Samaj, UK-Hong Kong Samaj, Kathmandu Hotel Association, Soalte Club	Mothers' Group (72%), Sayapatri Yuwa Club (52.5%)	4 (21.4%), 3 (21.4%)
Non-governmental organization	Annapurna FM, National Social Welfare System (NSWS), SOS, ACAP, NDR	Annapurna FM (42.9%), NSWS (14.3%)	3 (35.7%), 4 and 2 (14.3%)
International non-governmental organization	Red Cross	Red Cross (78.6%)	3 (35.7%), 4 (21.4%)

\* The effectiveness was measured at 1-5 scales from lowest to highest.

Table 3: Organizations providing support to flash flood-affected people and their effectiveness based on the perceptions of people directly affected by the flood (n=14)

Based on the findings and people's responses, the research identified some recommendations for preparedness and short-term coping mechanisms as well as long-term adaptive strategies:

### Preparedness and Short-term Coping Mechanism

- Information about the flash flood should be provided to the locals through phones, radio and television. On top of that, door-to-door awareness campaign should be organized immediately.
- Basket fund for hazard affected people for the immediate support is urgent with a provision of supplying basic needs such as food, clothes and shelter for the flash flood victims. Moreover, temporary health posts need to be established for the people injured in the flash flood.
- Mobilization and monitoring of local organizations for providing services to the flash flood affected people is necessary. In this context, active and effective role of the local government is necessary.
- Educational support should be provided as early as possible for the flash flood affected children so that their education will be continued.

### Long-term adaptive strategies

- Increase the awareness campaigns in local level so as to make them aware of the hydrological changes in the river water.
- Flash flood preparedness should be addressed adequately by setting and monitoring the early warning and alert systems while designing and implementing flood management policies and disaster risk management plans.
- The government should make provision of job for the flash flood affected people based on their capabilities.
- Long-term educational support should be provided for the flash flood affected people.

### Conclusion

The Seti flash flood caused unexpected and immense social, economic and environmental impacts owing to the lack of preparedness. Additionally, local people perceived that the event was due to a supernatural power, indicating lack of proper knowledge or information on reasons for flash floods. This should be taken into account in preparedness measures. Non-governmental organizations and community-based organizations were very effective and vital in dealing with the post-disaster situation. The financial support provided by national and international institutions was efficient and timely;

however, people affected by the flood expressed some dissatisfaction with the distribution process and transparency. Their expectations were high and could not easily be met through the support provided by the government; moreover, aid distribution led to social resentment, which should be taken into consideration in interventions. The locals adopted their own coping and adaptation strategies, which can easily be strengthened if they get government support. Recommendations should be tailored according to the findings, differentiating between issues concerning preparedness, short-term coping strategies and long-term adaptation measures, and taking into account the institutional possibilities that already exist on location.

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