During a drill, CDMC members walk through their community warning people of an impending flood.

SIX PILLARS OF A TRANSBOUNDARY FLOOD RESILIENT COMMUNITY

This document presents a model of what a community in a development context needs to be resilient to floods. It includes careful consideration of flood-prone communities in transboundary settings as well as examples of the model's implementation from Lutheran World Relief's Transboundary Flood Resilience (TBR) Project. This document is intended to provide a high-level framework that government and development actors can use to build the flood resilience of communities where they are pursuing sustainable development.

This document was made possible by the support of the Z Zurich Foundation. The contents are the responsibility of Lutheran World Relief and do not necessarily reflect the views of the Z Zurich Foundation.

As part of our holistic approach to development, Lutheran World Relief (LWR) has been striving for decades to build the resilience of vulnerable communities throughout the world to shocks, such as droughts and floods, and stressors, such as food insecurity and climate change. In the Ganges-Brahmaputra-Meghna (GBM) river basin, specifically along the flood-prone Gandak/Narayani and Koshi rivers, LWR and our local partners have been focused on strengthening the flood resilience of transboundary river basin communities since 2013.

The GBM river basin, which spans Nepal, India, Bangladesh, Bhutan and China, is the most populated river basin in the world with over 630 million people and has "the largest number of the world's poor in any one region."[1] It is also one of the most flood-affected areas, with nearly 16,700 people killed, 203 million displaced and more than $19 billion in economic damages sustained as a result of 67 large floods that occurred between 2000 - 2010 alone.[2] With the continued intensification of the effects of climate change such as glacier melting

1 The Food and Agriculture Organization of the United Nations (FAO). (2011). "Ganges-Brahmaputra-Meghna river basin", *AQUASTAT Survey*, p.3.Retrieved from: http://www.fao.org/nr/water/aquastat/basins/gbm/gbm-CP_eng.pdf

2 Priya, S., Young W., Hopson, T., Avasthi, A. (2017). *Flood Risk Assessment and Forecasting for the Ganges-Brahmaputra-Meghna River,* World Bank Group's Water Global Practice, p. 5. Retrieved from: https://reliefweb.int/sites/reliefweb.int/files/resources/120482-WP-P156643-PUBLIC-108p-WBFloodReportOct.pdf.

and unpredictable and severe monsoons, it is likely that the vulnerable communities in this region will suffer an increasing number and magnitude of flood events in the coming years.[3] The GBM countries and the international development community are starting to turn their attentions to the importance of effective transboundary water management and flood resilience in this region but much work has yet to be done to adequately build the resilience of these largely agrarian communities to the worsening floods they face.

To contribute to the ongoing efforts to build transboundary flood resilience in the region, LWR has reviewed our experiences and those of our partners as well as extensive peer and academic research into flood resilience and developed a comprehensive model that answers the fundamental question of "What does a community need to be resilient to floods?" This simple question has an enormously complex answer. However, LWR's six pillars model of a flood resilient community can give governments and development practitioners helpful high-level categorizations of the answers from which they can drill down, contextualize and implement the elements that most directly meet the needs of any particular flood-affected community they are working with.

WHAT DOES IT MEAN TO BE RESILIENT?

Before addressing what a community needs to be resilient to floods, we must first understand what it means to be resilient and why it is important. LWR defines resilience as the capacity of a system (e.g. a community) to **absorb** the impacts of shocks and stressors, **adapt** to change and potentially **transform** in a manner that **enables the achievement of development results** (e.g. sustainable livelihoods, well-being, poverty alleviation; Figure 1).[4] In our resilience programming, we work to increase a community's absorptive, adaptive and transformative capacities (Box 1)[5] through strengthening their livelihood capitals (social, economic, human, physical and natural; Annex 1) and their resilience attributes (robustness, self-organization, learning, redundancy, scale, rapidity, flexibility, and diversity and equity; Box 2).[6]

BOX 1. RESILIENCE CAPACITIES

- **Absorptive capacity** is the ability of a system to mitigate the impacts of shocks on their livelihoods and basic needs.
- **Adaptive capacity** is the ability of a system to adjust to the impacts of shocks and stressors, moderate potential damages and take advantage of opportunities that may emerge with change.
- **Transformative capacity** is the ability of a system to achieve a new state through a combination of technological innovations, institutional reforms, behavioral shifts and cultural changes, among others.

Recent resilience studies indicate that of all livelihood capitals, social capital plays a particularly crucial role in resilience programming.[7] LWR defines **social capital** as "networks, together with shared norms, values and understandings that enable individuals and groups to trust each other, collaborate and work together in pursuit of their livelihood objectives."[8] There are three types of social capital: **bonding capital**, which describes the bonds between individuals or households within a community; **bridging capital**, which describes bonds between members of one community/group to members of another community/group, sometimes in other geographic areas; and **linking capital**, which describes the network between individuals and groups "across explicit, institutionalized and formal boundaries in society."[9] Social capital is fundamental to LWR's resilience programming since, as will be discussed in further detail later, its presence is necessary in order for many of the other livelihood capitals and resilience attributes to be strengthened. Communities unable to use and build social capital will be unable to achieve their full resilience potential.

3 Priya, S., Young W., Hopson, T., Avasthi, A. (2017). *Flood Risk Assessment and Forecasting for the Ganges-Brahmaputra-Meghna River*, World Bank Group's Water Global Practice, p. 7. Retrieved from: https://reliefweb.int/sites/reliefweb.int/files/resources/120482-WP-P156643-PUBLIC-108p-WBFloodReportOct.pdf.

4 Read more about LWR's approach to resilience at https://lwr.org/what-we-do/resilience.

5 IPCC Working Group II. (2007). *Climate Change 2007 – Impacts, Adaptation and Vulnerability*, Cambridge University Press. Retrieved from: https://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4_wg2_full_report.pdf.

6 Ospina, A.V. (2013). "Climate Change Adaptation and Developing Country Livelihoods: The Role of Information and Communication Technologies". PhD dissertation, IDPM, University of Manchester, UK.

7 Woodson, L., Frankenberger, T., Smith, L., Langworthy, L., Presnall, C. (2016). "The Effects of Social Capital on Resilience Capacity: Evidence from Ethiopia, Kenya, Uganda, Niger and Burkina Faso". *Technical Report Series No 2: Strengthening the Evidence Base for Resilience in the Horn of Africa. Nairobi, Kenya*, International Livestock Research Institute (ILRI) and TANGO International. Retrieved from: http://www.technicalconsortium.org/wp-content/uploads/2016/02/Report-4-The-effects-pf-social-capital_18FEb2016.pdf

8 Ospina, A.V., ibid

9 Woodson, L., Frankenberger, T., Smith, L., Langworthy, L., Presnall, C. (2016). "The Effects of Social Capital on Resilience Capacity: Evidence from Ethiopia, Kenya, Uganda, Niger and Burkina Faso", p.5.

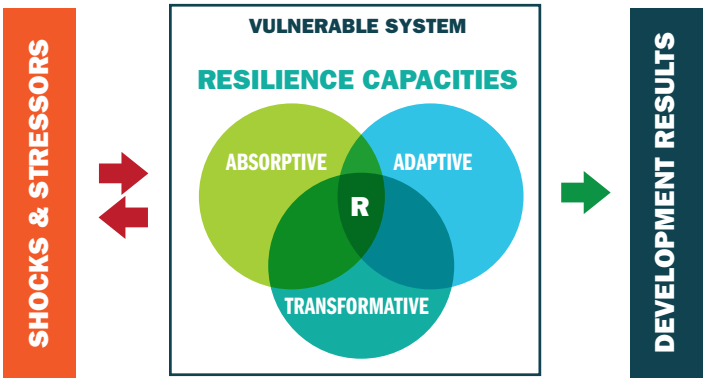


Figure 1. Resilience Capacities of a Vulnerable System

BOX 2. RESILIENCE ATTRIBUTES

COMMUNITIES WHO ARE RESILIENT TO FLOODS ARE

- **ROBUST:** They have the ability to maintain their characteristics and continue to function despite the impacts of shocks and stressors.
- **SELF-ORGANIZED**: They have the ability to independently re-arrange their functions and processes.
- **LEARNING:** They have the capacity to gain or create knowledge and strengthen the skills and capacities of their members.
- **DIVERSE AND FLEXIBLE:** They have the ability to undertake different courses of actions with available resources, enabling them to explore different options, innovate and benefit from emerging opportunities.
- **EQUITABLE:** They provide equal access to rights, resources and opportunities to their members.

COMMUNITIES WHO ARE RESILIENT TO FLOODS HAVE

- **REDUNDANCY:** They have additional sustainable resources available that can be accessed to respond to floods.
- **RAPIDITY:** They have the speed necessary to access or mobilize assets to achieve goals in an efficient manner.
- **SCALE:** They can access a breadth of resources (e.g. at regional, national or international levels) to effectively overcome or adapt to the effects of floods.

WHAT DOES A COMMUNITY NEED TO BE RESILIENT TO FLOODS?

Floods destroy livelihoods, property and lives and exacerbate problems in already struggling communities. Without the means to be prepared for and recover from such loss, reoccurring floods can keep people entrenched in poverty, forcing them to continuously start over from scratch.

Ultimately, flood resilient communities have the means to **absorb** the impacts of floods because they are prepared beforehand and equipped to recoup any losses afterwards. Should a flood take away their means of making a living or feeding their families, they are able to **adapt** their ways and resources to make ends meet. In some cases, these communities **transform**, adopting fundamental changes to their lives and institutions that significantly and sustainably reduce their vulnerabilities to floods.

In order to build these attributes and enhance their absorptive, adaptive and transformative capacities, a flood resilient community depends on six things.

To ABSORB the impacts of a flood in the immediate term, a community needs...

1. **An Early Warning System (EWS)**
2. **Community-based Disaster Risk Reduction (CB DRR) Institutions**
3. **Disaster Resilient (DR) Infrastructure**
4. **Safety Nets**

To ADAPT to the impacts of annual flooding that continuously impedes their customary means of earning a living, a community needs...

5. **Flood Resilient (FR) Livelihoods**

To TRANSFORM so they are no longer vulnerable to the impacts of flooding, a community needs...

6. **Public - Private Support**

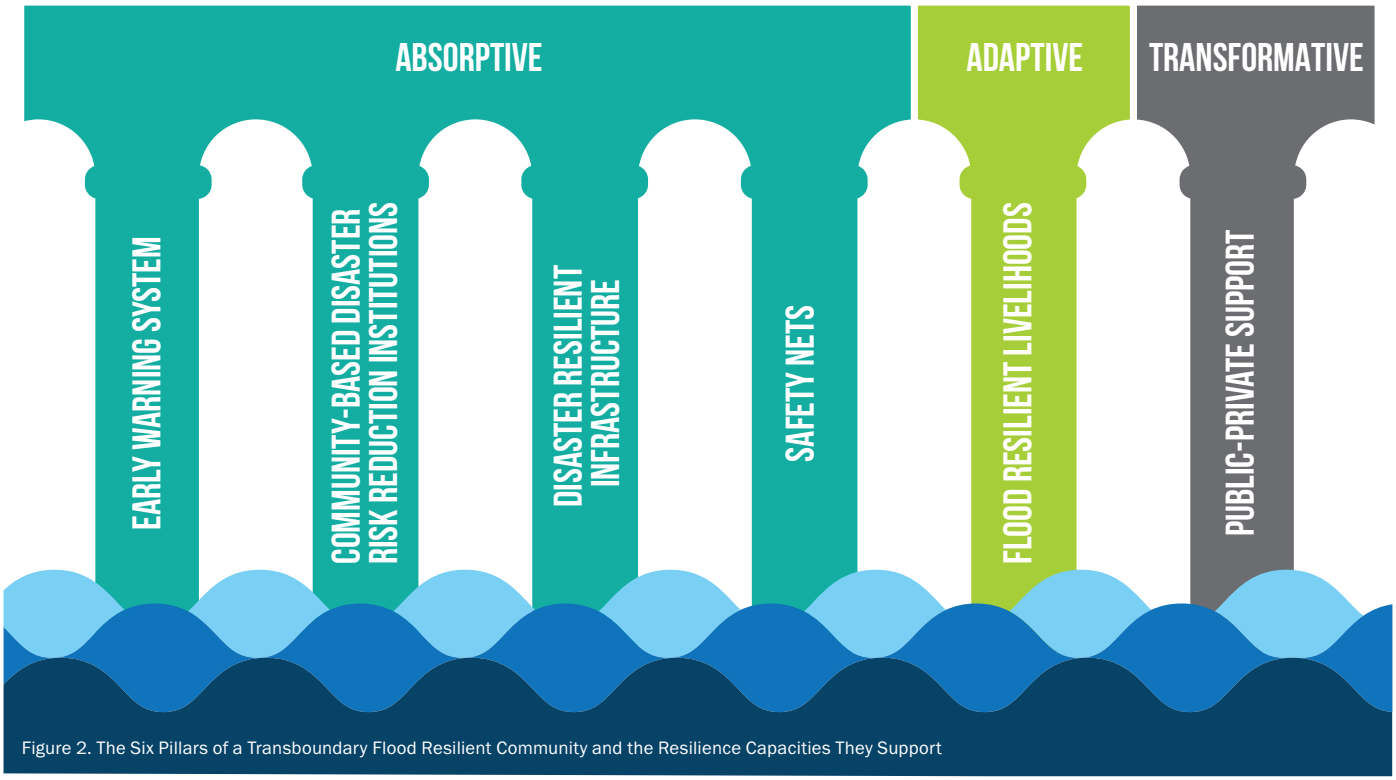


Figure 2. The Six Pillars of a Transboundary Flood Resilient Community and the Resilience Capacities They Support

THE SIX PILLARS

EARLY WARNING SYSTEM (EWS)

Time is of the essence when a flood approaches. Ensuring rapid and clear communication of flood information is key to saving lives and protecting homes and possessions as the more forewarning people have, the longer they will have to secure their belongings, erect additional flood barriers around their homes and reach higher ground. A 2015 United Nations survey on EWS across the globe highlighted its importance in saving lives, stating that in the last three decades, "deaths from disasters have been declining, in part thanks to the role of early warning systems and associated preparedness and response systems."[10] The establishment of an EWS in flood-prone areas is essential to afford people the time and information they need to be proactive and well-prepared to absorb the impacts of a flood.

Countries that experience frequent floods often find it difficult enough to internally coordinate all of the elements of an EWS despite operating within the same languages, resources and government and civil sector support agencies. Numerous flood-prone rivers wind through several countries before reaching their ends, however. When an impending flood is predicted to impact multiple countries, efficiently and effectively warning all potentially affected communities becomes nearly impossible as the process is hindered by different languages, varying degrees of capacities and resources and disconnected bureaucracies. With the world's 263 lake and river basins that cross international borders, including the GBM basin,[11] there is a need for a model transboundary EWS that can provide the mechanisms for inter-government and community-driven communication and mobilization when significant flooding occurs.

A transboundary flood EWS should be institutionalized within the governments of the river basin countries as well as supported by their communities. These two integrated tracks ensure that accurate, real-time flood information reaches as many people as quickly as possible, including those in less technologically connected communities. It also creates system redundancies that help continue the flow of information and services even if parts in one track of the system fail.

To ensure the inter-government track of the EWS runs smoothly, river basin governments must have official cooperation agreements with clearly articulated processes for sharing information between the appropriate agencies and with the public. The river basin governments should have similar weather and flood forecasting and communication technologies. If a government's capacity in this area is weak, it must be addressed in the cooperation agreements as well.

10 Centre for Research on the Epidemiology of Disasters (CRED). (2004). "Thirty Years of Natural Disasters 1974-2003: The Numbers," Presses Universitaires de Louvain, as cited in United Nations. (2006). *Global Survey of Early Warning Systems*. Retrieved from: https://reliefweb.int/sites/reliefweb.int/files/resources/B29FA16DF05E6C62C125722700470B15-UNISDR-Sep2006.pdf.

11 United Nations Department of Economic and Social Affairs (UNDESA). "International Decade for Action 'WATER FOR LIFE' 2005-2015". Retrieved from: http://www.un.org/waterforlifedecade/transboundary_waters.shtml.

To ensure that the community-based track of the EWS is effective and sustainable, task forces made up of community members must be organized, trained and equipped to perform EWS services such as flood gauge and telemetry reading and intra- and inter-community notification. While the importance of community participation in Early Warning task forces will be discussed in more depth under the CB DRR Institutions pillar, the purposes of their tasks will be explained here.

An EWS task force must be trained and equipped to read flood measurement tools, which range from rudimentary (e.g. a stationary measuring pole, or flood gauge, erected alongside the river) to sophisticated (e.g. a telemetric system[12]) and are based in or near the community. Employing both types of tools is recommended since the telemetric system does not require a person to physically check on its deployed receptors and can provide important details earlier and faster, whereas the flood gauge is inexpensive and can indicate the height of the water without electricity, which is especially important when severe weather is the cause of flooding. The redundancy of using both types of tools in an EWS is key since any number of things could impede the use of one or the other type of early warning tool during a flood.

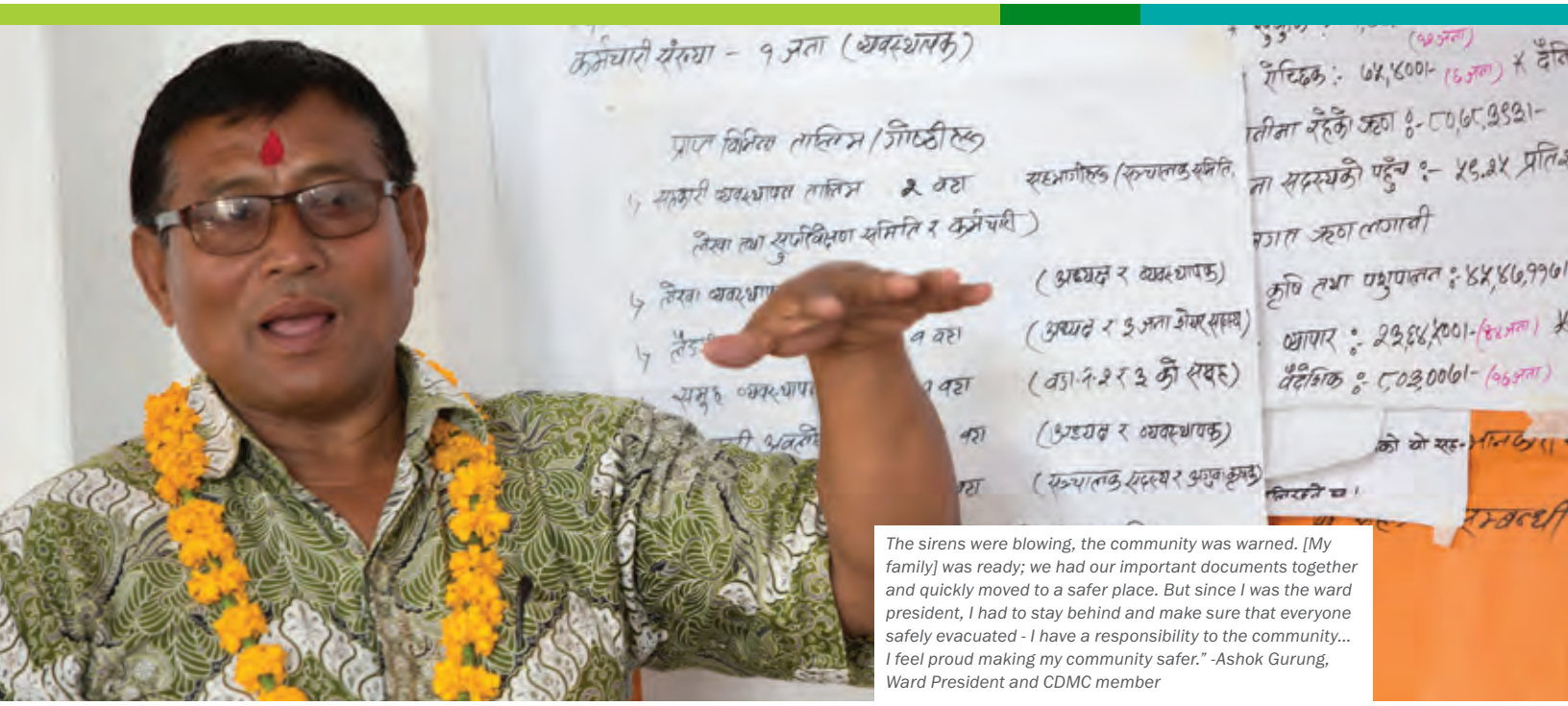
When EWS task forces in upstream communities pick up flood readings from their measuring equipment, they must immediately begin notifying everyone within their community as well as the next community downstream. For the same reasons as with the measuring equipment, the communication equipment that EWS task forces have at their disposal should range from rudimentary (e.g. walking through the streets relaying information via megaphone) to sophisticated (e.g. SMS). In contexts where the river crosses international borders, EWS task forces on both sides of the border must have multiple established communication channels with one another, as this is the point in the system where breakdowns are most likely to occur. For example, should telecommunication systems be down, using a display board to convey flood information across the river may be an adequate substitute warning mechanism. The importance of social capital between these groups will be discussed in the following section.

Ram Kisun Koiri shows the flood gauge in Narsahi, Nepal that his CDMC monitors. When water reaches the red zone, dangerous flooding is imminent, and the communities must be evacuated immediately.

OUR EXPERIENCE

LWR has been implementing this approach to flood EWS in Nepal and India along the Gandak/Narayani and Koshi rivers since 2013. With continuing support from the Global Resilience Partnership, Z Zurich Foundation, and the TBR Consortium, 47 EWS task forces in Nepal and 60 in India have been formed and trained in communities that experience severe annual flooding. The project has also installed 20 flood display boards and five flood gauges as well as contributed to the improvement of the Government of Nepal's telemetry and SMS EWS. When an alert from an upstream community is received, the members of the downstream community's EWS task force spread the information throughout the village while also passing the alert on to the next downstream community via SMS and flood warning display boards. Communities have reported that this more direct cross-border village-to-village EWS mechanism has more than tripled the speed of flood warnings, cutting the process from a 48-hour relay to 15 hours. LWR has coordinated these community EWS efforts with the Department of Hydrology and Meteorology in Nepal and the Government of Bihar's Flood Management Information System in India.

12 A telemetric system uses deployed, automated receptors to collect data and send it back to monitoring equipment.



The sirens were blowing, the community was warned. [My family] was ready; we had our important documents together and quickly moved to a safer place. But since I was the ward president, I had to stay behind and make sure that everyone safely evacuated - I have a responsibility to the community... I feel proud making my community safer." -Ashok Gurung, Ward President and CDMC member

COMMUNITY-BASED DISASTER RISK REDUCTION (CB DRR) INSTITUTIONS

Prevention is half the battle in building flood resilience. There are many things communities can do prior to a flood to reduce their risks and address their vulnerabilities in order to prevent significant damage to their homes, property and livelihoods.

The first is to draw upon their bonding social capital to facilitate their **self-organization** (Annex 1) into community disaster management committees (CDMCs). The role of CDMCs is to take the lead in preparing the community for floods and responding when floods hit. CDMC members must be trained on how to identify and address community vulnerabilities and risks as well as on how to provide early warnings, first aid, search and rescue services, evacuation point management and CDMC leadership/coordination. Once properly trained, members can divide themselves into task forces such as the EWS task force discussed in the previous section, which will allow the committee members to perform their duties simultaneously when called upon. Due to time, capacity and resource constraints, not every CDMC member may be thoroughly trained in all elements of disaster risk reduction. However, if possible, at least several members should be trained in multiple skill sets in case they need to replace someone from another task force who is unable to fulfill his or her role at any given time.

In addition to having the appropriate skill sets, the task forces must have access to the appropriate equipment to carry out their duties. The first aid task force requires access to basic medication and wound dressings and the search and rescue task force must have boats, life jackets, ropes, megaphones, flashlights, radios, etc. The EWS task force needs mobile phones and megaphones. All task forces should hone their skills as well as help familiarize their communities with disaster risk reduction procedures through routine simulation exercises that utilize relevant equipment.

They can further advance the communities' understanding of DRR procedures through simple communication materials such as public posters or pocket notebooks that contain useful information, including maps of evacuation routes and phone numbers of CDMC members, alongside a calendar and note-taking space.

Since CDMC members are from the community they serve, they are not only able to help faster than official first responders when a flood comes (especially in remote areas), their awareness of their community's specific contexts makes them better able to anticipate and meet the needs of their neighbors in times of crisis.[13] Their immediate and appropriate responses can save lives.

To be as prepared as possible before a flood, CDMCs must routinely undertake community Hazard, Vulnerability and Capacity Assessments (HVCAs), or vulnerability[14] and risk[15] mapping. This task is necessary for a community to understand

13 Simpson, D.M. (1992). "Risk and Disaster: Arguments for a Community-Based Planning Approach", *Berkeley Planning Journal*, 7(1), p.111. Retrieved from: https://escholarship.org/uc/item/8zv0b5gz.

14 The United Nations defines "vulnerability" as "the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards" (Source: United Nations Office for Disaster Risk Reduction. "Terminology". Retrieved from: https://www.unisdr.org/we/inform/terminology#letter-v)

15 According to ODI, "risk can be understood in relation to the concept of future harm, the probability of a harmful event or hazard occurring and the likely severity of the impact of that event or hazard." (Source: Metcalfe, V., Martin, E. and Pantuliano, S. (2011). "Risk in humanitarian action: towards a common approach?" HPG, p.2. Retrieved from: https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/6764.pdf)

where their capacities and assets already exist and where improvements and additional resources are needed so they can focus on filling those gaps. In assessing their own vulnerabilities, communities should be examining their **social, economic, human, physical and natural capital** as well as their resilience attributes (Annex 1) with particularly close attention dedicated to the **attribute of equity**. CDMCs must be trained in how to conduct inclusive, participatory mapping to ensure their assessment captures the perspectives of women, youth and marginalized members of the community who face specific socioeconomic challenges that affect their resilience.

HVCAs inform community DRR plans, which CDMCs must also develop to prepare for and mitigate the immediate impacts of floods in their community. DRR plans should contain, at a minimum, the roles of the various task forces, instructions for receiving early warning information, evacuation routes, shelter locations and emergency contact information. Local governments should conduct their own vulnerability and risk mapping and devise DRR plans as well, especially to guide the allocation of resources to where they will be most influential in building community flood resilience. Ideally, the governments' and the communities' mapping and DRR plans should be complementary, but recognizing the difficulty of achieving this level of collaboration in some contexts, it is enough that both the government and local communities complete their own maps and plans. In contexts where CDMCs are strong and widely trusted, they can serve as the government's main point of contact for disaster risk reduction and response collaboration.

In transboundary river basin contexts, there is a need for another type of CB DRR institution – Transboundary Citizen Forums (TBCFs). These groups are federations of CDMCs from both sides of the border in a transboundary river basin and serve three explicit functions: to ensure the early warning alerts make it across borders; to share resources, skills and knowledge to improve flood resilience in the region; and to lobby their respective governments for more transboundary flood early warning, preparedness and recovery collaboration. TBCFs provide individuals from different countries who otherwise may have never met a unique opportunity to build bridging social capital through forming relationships and collaborating to better prepare their communities for floods. When trained in advocacy tactics and government systems, TBCFs can bring their collective ideas for improving community flood resilience to their governments in the most effective ways possible with the aim of showing officials where state resources could fill gaps and strengthen preparedness, ultimately lowering government costs for flood recovery and increasing local development in the long run.

The effectiveness and success of these CB DRR institutions depends on the strength of the bonding social capital between the communities and their institutions, the strength of the bridging social capital between the CDMCs within an EWS chain and within the TBCFs and finally, the strength of the linking capital between the TBCFs and public and private institutions. In many societies, past conflicts, social hierarchies and gender constraints may prove difficult to overcome to build the level of social trust needed for CB DRR institutions to be successful. That is why it is imperative that every possible effort is made during their inception to ensure these institutions are inclusive, participatory and transparent. In certain situations where there is low social trust, it may be helpful for a mutually respected outsider to aid in the establishment of these groups and act as a mediator. What is needed to build social trust will vary from context to context, but inclusivity, participation and transparency are essential in all cases because only when an entire community is invested and supportive can a CB DRR institution — and community flood resilience, by extension — be sustainable.

OUR EXPERIENCE

In LWR's transboundary flood resilience work in Nepal and India to date, LWR and our local partners have organized (or strengthened those that already existed) 178 CDMCs and two transboundary citizen forums (one in the Gandak/Narayani river basin and one in the Koshi river basin) to prepare and provide early warning, first aid, search and rescue and rehabilitation services to their communities. Members of these groups are trained in DRR and EWS as well as group management and leadership. As of May 2018, 25 CDMCs have been provided with lifesaving tools such as sirens, mobile phones, megaphones, radios, flags, ropes, life jackets, boats, flashlights and temporary stretchers. CDMCs have also been trained in the practical application of LWR's Dynamic Resilience Wheel[16] analysis model, which they can use to strengthen their ability to analyze local issues and develop local solutions to address issues affecting their capacity to cope with annual flooding. The TBCFs meet on a quarterly basis and have mobilized some funding for specific DR infrastructure projects. They have also devised action plans on EWS and advocacy issues they intend to work on, and their next steps are to begin engaging government stakeholders at their local level.

16 The Dynamic Resilience Wheel (DReW) provides a dynamic snapshot of the key components of resilience thinking in development environments. Composed of multiple rotating layers, DReW offers a dynamic lens to help learn about and apply the main factors that play a role in resilience building. For more information, visit https://lwr.org/what-we-do/resilience/wheel

DISASTER RESILIENT (DR) INFRASTRUCTURE

Just as people in the community need to be prepared for floods, so too must a community's infrastructure be prepared. DR infrastructure, in this context, is any physical structure within a community that due to its construction and placement is able to absorb or help mitigate the impacts of a natural disaster. In flood-prone under-developed river basin communities, essential DR infrastructure includes emergency shelters, embankments and raised housing and platforms. There are more types of DR infrastructure that could be discussed in this section such as raised and paved roads and enclosed sewage systems, but in areas where there is already little to no permanent infrastructure and limited resources for construction, focusing on these four types has the potential to adequately increase flood resilience with more modest investments.

Having a safe designated space to retreat to when a flood arrives saves lives. All communities should have at least one emergency shelter that is accessible and large enough to accommodate all residents, including disabled individuals. Communication around the operation of the shelter is important as all must feel welcome and safe to use it. If possible, a community should use multipurpose buildings like markets or town halls as shelters[17] in order to make the best use of space and resources as well as to improve the likelihood of upkeep. Any building intended to serve as an emergency shelter during flooding should be located on high ground far away from the river and should have multiple exits and clear views of the surrounding area to avoid entrapment by the flood waters.

Wherever possible along a flood-prone river, embankments or sloped walls should be constructed to contain and redirect the water. Strong embankments can buy time during a flood and reduce the amount of water that reaches the local communities. In areas with minimal resources, embankments can be made with natural materials including clay, soil, bamboo and rooted plants. However, earthen embankments are easily erodible and need constant upkeep to ensure their effectiveness during a flood. When a community or local governments can afford it, concrete embankments should be constructed to provide stronger and longer lasting flood protection.

Where homes have been previously destroyed by floods and in new settlements in flood-prone areas, houses should be built on raised foundations of either concrete or wood. Community members who have the resources to raise their existing houses or build a second floor in their home should be encouraged do so. Those unable to make such improvements should construct simple raised platforms upon which they can safely store their belongings and food supplies during a flood. These raised platforms can be individually owned or shared within a community. If adequately raised, homes and the belongings inside of them are less likely to be damaged by flood waters. Raised and covered platforms can keep food, grains and seeds dry and useable after the waters recede as well as protect essential equipment and tools needed for the continuation of livelihoods.

17 The use of schools as emergency shelters should be avoided if possible in order for children to return to their education and a sense of routine quickly after a disaster. If a flood renders homes inhabitable, people may need to remain at the school shelter for a long period of time, preventing children from resuming their lessons in the space.

OUR EXPERIENCE

In the Narayani river basin, LWR and our local partners constructed an emergency shelter in an isolated community that was assessed to be the most vulnerable of the ones we were working in at the time. In addition to being an emergency shelter, the space now serves as a social gathering place where community meetings are held. In both river basins, we have also bio-engineered dams in strategic locations using bamboo, sacks of sand and planted trees as well as installed cement embankments along swaths of riverbank prone to greater erosion. We also repaired existing culverts, roads and dams that had sustained damage from previous floods and normal wear and tear.

A CDMC member in Susta, Nepal demonstrates how to sound the alarm when a flood is imminent.

This digital display board in Narsahi, Nepal provides CDMC members with real-time updates on water levels as part of the community's early-warning system.

SAFETY NETS

A safety net in the context of resilience building is a mechanism that replaces something lost or provides additional financial or material support during times of shocks or stress. Safety nets can be formal mechanisms such as government or private insurance schemes or informal mechanisms such as a savings and credit fund within a farmers' association. Access to both increases a community's ability to absorb any losses caused by a flood and recover their normal standard of living quicker. Safety nets play a significant role in keeping families in low-income communities, especially ones that experience reoccurring floods, from sinking even further into poverty and food insecurity when they incur flood damage.[18]

Since floods can cause tremendous losses, it is imperative that people living in flood-prone areas protect themselves as fully as possible with a range of different safety nets. Government and private insurance schemes can offer coverage for anything from houses and belongings to crops and loss of income, but it is typically the costliest option. In rural river basin communities, lack of financial literacy and economic capital often become barriers to accessing these insurance schemes. Efforts must be made to introduce people in these communities to what insurance is, the types of plans available and the procedures for obtaining coverage. Additionally, barriers to access can be reduced by fostering linking social capital between the people in these communities and formal insurance providers who traditionally have not made overtures into these low-income areas. The same must be done to help communities secure loans and other financial services from local banks.

In order to promote the resilience attribute of **redundancy** (Annex 1) and given that the barriers to bank loans and insurance can be prohibitively high, it is important that community organizations offer similar but more accessible financial services as well. Community Self Help Groups (SHGs)[19] or farmer associations, for example, can be trained to manage savings accounts and extend credit to community members. Since these services require social trust, strong bonding social capital must exist or be strengthened within a community in order for them to be successful. Though such financial services are typically modest, they can be significantly beneficial for the improvement of livelihoods and daily life in general and are especially useful at times of emergency since they can often provide more immediate access to funds.

Another safety net needed in flood-prone communities is grain and seed banks, which simply are stored supplies of grain for future consumption and seeds for future planting. While grain and seed banks can improve the quality of life and livelihoods in general, following a disaster, such banks in a community can respectively provide food and ensure agriculture livelihoods continue in the following planting cycle if damage to crops is sustained. Grain and seed banks as well as any other storage facilities in a community should be constructed as high up and far away from the river as possible.

OUR EXPERIENCE

In the Gandak/Narayani and Koshi river basins, LWR and our local partners coordinated with government line agencies like the District Agriculture Development Office and the District Livestock Service Office in Nepal to educate nearly 1,000 individuals about what insurance is and help more than 300 community members purchase insurance coverage (as of November 2017). We have trained farmers cooperatives and SHGs on providing financial services and to date, nearly 3,000 people have gained access to savings and loan services through these groups. We also constructed a grain bank in a community that did not already have one and improved other banks in the area. In India, we coordinated with the government's National Rural Livelihood Program (NRLM), also known as JEEVIKA, to successfully organize 3,370 women into SHGs. Through these SHGs, 922 people purchased insurance, secured nearly $50,000 in bank loans and obtained nearly $15,000 in government funding for sanitation and agriculture support.

18 Ousmane Niang, Véronique Mistycki and Soukeynatou Fall, "The impact of safety nets on the resilience of vulnerable households in Niger," Humanitarian Practice Network (October 2012), https://odihpn.org/magazine/the-impact-of-safety-nets-on-the-resilience-of-vulnerable-households-in-niger/.

19 An SHG is a locally organized group, typically of women, who pull resources together and use their collective influence and social capital to create benefits for their members.

Kumari Gurung manages her community's women's savings and credit cooperative. She volunteered to organize the group at first, but now the government pays for her services

FLOOD RESILIENT (FR) LIVELIHOODS

Stable income is a necessity in everyday life, and it is an important factor in resilience since those with adequate economic capital are better able to mitigate the impacts of floods on their lives and bounce back quicker. In resilience building, it is therefore critical that livelihoods are adapted in such ways that afford people the ability to spend more on their own risk reduction and to continue earning a living after a flood.

Since many river basin communities around the world, including those in the GBM basin, depend on agriculture for their livelihoods, given the fertileness of the land and lack of other opportunities, this section will focus on making agriculture livelihoods flood resilient and sustainable. When considering which aspects of livelihoods, agriculture or otherwise, to adapt and strengthen to improve resilience, capital must be analyzed.

An agricultural community's social capital can be harnessed to build resilience through the creation and capacity building of existing farmers cooperatives, associations or SHGs. What they specifically can offer to improve a community's livelihood capitals will be detailed below, but first, in order to function at their best, they must maximize the utility of their own bonding, bridging, and linking social capital.

These community organizations can be comprised of a single homogeneous social group or multiple different social groups. The former type of community organization has a higher degree of social trust intrinsic to its operations.[20] In most cases, the inclusivity of bonding social capital within these types of organizations needs to be expanded to ensure all members are equally able to benefit from its services, especially women, the elderly and disabled individuals. The latter type of organization may have existing bridging social capital that will need to be strengthened or created where it does not exist in order to ensure that all have equal opportunity to build their resilience with the help of the organization's services. These groups must also foster strong linking social capital with stakeholders in their agricultural commodity's value chain and the government to expand business and receive support they can use to then help their members build resilience. Ultimately, these groups can only be a sustainable positive force for a community's resilience when they can rely on strong social capital.

Farmers groups or SHGs can strengthen a community's physical capital as it pertains to livelihoods through the collective acquisition and use of improved agriculture tools and flood-tolerant seed varieties of crops as well as through the establishment of seed banks as was detailed under the Safety Nets pillar. These physical inputs into agriculture can help farmers improve and maintain their crop production even if a flood hits.

In addition to affecting people, floods can take significant tolls on the natural capital that rural communities depend on for their livelihoods. Farmer groups and SHGs can help their members make the necessary adaptations to their agriculture practices to make their natural capital more flood resilient and thus more productive and sustainable in the long-term. Such adaptations include diversifying and rotating crops and employing conservation tillage. Diversifying and rotating crops helps improve soil nutrients while also increasing the number of income streams on which a farmer can rely. Conservation tillage forgoes tilling and keeps the remnants of the previous harvest in the fields to boost soil cover and water absorption, lessening soil erosion and even flooding. In many cases, trainings in these practices will need to be passed down from agriculture specialists to the farmers groups and SHGs whose leadership can then pass down the trainings to individual group members.

All efforts stated above are designed to contribute to the increase and sustainability of agriculture production to ensure farmers' economic capital improves and is not impeded significantly when a flood hits. However, farmers' livelihoods need **diversity** and **flexibility** (Annex 1) as well in order to be resilient, which requires an investment in human capital. By undergoing training in skills like sewing, bicycle or motorcycle repair and DR infrastructure construction, farmers can diversify their own skill sets and take up alternative livelihoods that are less vulnerable to floods than agriculture to further diversify their income streams so that money can still be earned if one stream is disrupted by flooding.

20 Myeong, S. and Seo, H. (2016). "Which Type of Social Capital Matters for Building Trust in Government? Looking for a New Type of Social Capital in the Governance Era," *Sustainability*, 8(4), p. 322. Retrieved from: https://doi.org/10.3390/su8040322

OUR EXPERIENCE

To help the river basin communities we work with in India and Nepal adapt their livelihoods and increase their economic capital, LWR and our local partners provided alternative skills trainings in embroidery, bicycle and motorcycle repair, mobile phone repair, bamboo stool making and flood resilient home construction. We also promoted diversifying crops with sugarcane, bananas, vegetables and mushrooms as well as planting flood- and drought-tolerant paddy seeds since paddy is the main cash crop for these communities. We offered sugarcane since it can withstand some flooding well and help prevent soil erosion and vegetables since they can be used for household consumption and easily grown on small plots of land. We purchased the flood-tolerant seeds from the local private sector and planted them in 64 demo plots to showcase their effectiveness to farmers and promote their adoption. The survival rate of the flood-tolerant paddy submerged for less than 15 days was 100 percent. In situations where the paddy was submerged between 22-25 days, only eight farmers lost their crops, which is impressive when compared to when regular seeds were used and all paddy farmers lost their crop after just three days of submergence. As a result of our livelihood adaptation interventions, approximately 30 percent of our project participants have experienced an increase in their income.

Members of the Susta CDMC in Nepal demonstrate how to perform first aid on a person who has been rescued from floodwaters.

PUBLIC-PRIVATE SUPPORT

Achieving sustainable flood resilience is complex and iterative over long spans of time, especially in transboundary settings. It requires a multi-sector approach with different actors and their context-specific resources and knowledge to adequately build all of the pillars. The most important actors in this endeavor are the communities themselves as the adaptations they make now will have the most immediate and direct effect on strengthening their flood resilience over time. In most cases, their resources are considerably limited however, and they need the assets as well as the financial and policy support of the public and private sectors to help them holistically transform into flood resilient communities.

First, both the government and the private sector must have an awareness of what flood resilience is, how it is achieved and how it aligns with their objectives. Flood resilient communities that stay on positive development trajectories expand markets, grow economies and need less assistance in the future. This awareness must also translate into willingness to support flood-prone communities. Where awareness and willingness to act do not already exist in these sectors, non-governmental and community actors (via the TBCFs) must drive efforts to build linking social capital and advocate for government and private sector support. Typically, the first step is to connect with local government agencies that can provide DRR and EWS services to the communities and work up the chain of command from there.

As challenging as that can be, connecting with the private sector can be even more difficult. One option may be for non-governmental actors to approach businesses that are either social enterprises or have a social welfare element to their business model, like a linked foundation or a stated commitment to sustainability, and bring flood-vulnerable communities to their attention. These types of companies often already fund development programming or offer products and services that are affordable and geared to serve low-income communities, like flood tolerant seeds or microinsurance. Another option may be to approach businesses that utilize local natural resources or labor or are seeking to expand their consumer base in the region. In most scenarios, when seeking private sector support for development, the government should be looped into the efforts to promote accountability and sustainability for it is not uncommon to see government investment immediately precede or follow private sector investment in an area to prime it for further economic development.

It is important to acknowledge that building awareness and motivating public and private sectors to act may take years of advocacy and institutional reforms. However, once community connections with the public and private sector are made and their awareness has translated into willingness to act in support of flood-prone communities, collaborative short- and

long-term plans for DRR and EWS policies, practices and resource allocation must be created and funding to enact those plans secured. When a government has fully integrated DRR and transboundary EWS into sustainable public policy, a transformation of the system has truly taken place. The government has accepted the responsibility to proactively work with communities to offer (or facilitate access to) the early warning systems, DRR and livelihood trainings, infrastructure, safety nets and private sector opportunities that communities need to build their resilience to floods and ultimately achieve their development goals.

OUR EXPERIENCE

LWR has developed linking social capital with various agencies within the Governments of Nepal and India over the decades we have worked in the region. Using this capital and experience, we sought out new relationships with the line agencies and government-funded programs most directly connected to flood resilience work, such as the Department of Hydrology and Meteorology, the District Agriculture Development Offices and the District Livestock Service Offices in Nepal and the Government of Bihar's Flood Management Information System and JEEVIKA in India. Both governments already had existing EWS, but we collaborated with them to improve their systems and connected them with the CDMCs with whom we were training on DRR and EWS to facilitate the provision of formal safety nets such as insurance.

We further engaged public-private support in our seed provision interventions. In India, we secured flood-tolerant paddy seeds from the Government Agriculture University and Block (local government) Agriculture Offices. We also purchased vegetable seeds for interested farmers to try from a local agribusiness with the intent that the farmers could continue to purchase the seeds from local private sellers, thereby contributing to the local economy, ensuring sustainability of the intervention and potentially driving supply of more types of seeds in the local market through farmer demand.

ENVISIONING FLOOD RESILIENT COMMUNITIES

In our work in the GBM river basin, LWR has envisioned what a successful end goal – namely, flood resilient communities – looks like. These flood resilient communities have an EWS, CB DRR institutions, DR infrastructure and safety nets to help them absorb the impacts of a flood through well-planned, well-trained and well-resourced preparation and recovery efforts. Their community members can adapt their livelihoods in ways that allow them to continue earning a living after a flood as well as to increase their food security and incomes to be better prepared for the next flood. Their relationships with the public and private sectors have transformed to afford them the long-term support they need to sustain their absorptive and adaptive capacities as well as the freedom to make progress towards improving their quality of life.

It is our hope that with proper contextualization, the six pillar model will help governments, development practitioners and flood-vulnerable communities plan and design new initiatives as well as reassess past or ongoing ones to build flood resilience in development contexts. By envisioning these six pillars at work in a well-functioning flood resilient community, these stakeholders can work collaboratively to address gaps and systematically map out the logical courses of action they need to take to achieve that end goal.

By Kat Fiske, Lutheran World Relief
With generous support and input from Angelica Ospina, Garrett Schiche, Narayan Gyawali, Santosh Dahal, Deepanita Biswas, Patrick Bell, Nicole Hark, Holli Jordan, Elizabeth Cuellar, Bruce Ravesloot, Greg Kresslein, and Viktorija Grant and LWR's local partners GDS, IDF, KVS, and SAHAMATI.

ANNEX 1: LIVELIHOOD CAPITALS & ATTRIBUTES OF RESILIENT COMMUNITIES

LIVELIHOOD CAPITALS	DEFINITION
Social Capital	Networks, together with shared norms, values and understandings, that enable individuals and groups to trust each other, collaborate and work together in pursuit of their livelihood objectives.
Economic Capital	"The financial resources that people use to achieve their livelihood objectives."
Human Capital	"The skills, knowledge, ability to labor and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives."
Natural Capital	"The natural resource stocks from which resource flows and services (e.g. nutrient cycling, erosion protection) useful for livelihoods are derived."
Physical Capital	"The basic infrastructure and producer goods needed to support livelihoods."

Source: Keeley, B. (2007). *OECD Insights: Human Capital--How what you know shapes your life*. Paris: OECD Publishing, 2007. pg. 102-105 http://www.oecd.org/insights/37966934.pdf.

DFID (1999) 'Framework: Social Capital,' *Sustainable Livelihoods Guidance Sheets*, 2.3.1.-2.3.5, DFID, London. http://www.eldis.org/vfile/upload/1/document/0901/section2.pdf

RESILIENCE ATTRIBUTE	DEFINITION
Robustness	Ability of the community to maintain its characteristics and continue to function despite the impact of shocks and stressors.
Self-Organization	Ability of the community to independently re-arrange its functions and processes.
Learning	Capacity of the community to gain or create knowledge, and strengthen the skills and capacities of its members.
Redundancy	Availability of additional resources that can be accessed to respond to shocks and stressors and that are substitutable.
Rapidity	Speed at which assets can be accessed or mobilized by the community to achieve goals in an efficient manner.
Scale	Breadth of resources (e.g. at the regional, national or international levels) that a community can access to effectively overcome or adapt to the effects of shocks and stressors.
Diversity and Flexibility	Ability of the community to undertake different courses of actions with available resources, enabling them to explore different options, innovate, and benefit from emerging opportunities.
Equity	Extent to which the community provides equal access to rights, resources and opportunities to its members.

Source: Ospina, A.V. (2013). "Climate Change Adaptation and Developing Country Livelihoods: The Role of Information and Communication Technologies". PhD dissertation, IDPM, University of Manchester, UK.

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Gangasagar Khatik helps his parents sell their vegetables in Narsahi, Nepal to bring in extra income.

Members of the Susta CDMC search and rescue task force in Nepal demonstrate how to safely rescue a drowning person from floodwaters.

The TBR consortium is a partnership of development and academic organizations responsible for the implementation of the Transboundary Flood Resilience Project in India and Nepal. The consortium consists of Lutheran World Relief (LWR), Asian Disaster Preparedness Center (ADPC), DanChurchAid (DCA), Grameen Development Services (GDS), Integrated Development Foundation (IDF), Koshi Victim Society (KVS), SAHAMATI, and Yale University Himalaya Initiative.

This document was made possible by the support of the Z Zurich Foundation. The contents are the responsibility of Lutheran World Relief and do not necessarily reflect the views of the Z Zurich Foundation.

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