Improved tools to enhance resilience

SHEAR research outcome

Tools are important for gathering, processing and communicating information to strengthen resilience. This brief outlines how SHEAR projects have generated knowledge through the development and use of new co-designed tools.

Introduction

A key goal of the Science for Humanitarian Emergencies and Resilience (SHEAR) programme was to put research into practice, channelling the new learning generated by the different projects about hazard risk, preparedness and response into meaningful, sustainable action that strengthens resilience. SHEAR projects have designed, tested and delivered a wide range of tools to achieve this, capturing and communicating knowledge about risk as well as putting processes in place to continue monitoring risk conditions in the long-term, while adapting policies, plans and practices as new information comes in. Through co-producing tools for decision-making with key stakeholders, SHEAR projects have applied the findings of innovative research to practically address the hazard, exposure and vulnerability aspects of risk.

Co-designing tools

For disaster preparedness and response to be effective, policies, processes and plans must be grounded in and led by the needs, perspectives, priorities and capacities of communities affected by hazards. Participatory approaches are central to developing risk management and response which is relevant, accessible and useful for the different people, groups and institutions who need them. For example, IPACE-Malawi (Improving Preparedness to Agro-Climatic Extremes in Malawi) worked closely with farmers in three districts of the country to jointly identify agro-climatic indices of severe weather events and their impacts. These indices, once clearly identified as relevant and useful, in turn can be used to improve the effectiveness of forecasts in meeting the farmers’ information needs.

SHEAR research also emphasized a balance in developing new, cutting-edge tools and developing the capacity of local stakeholders to use and adapt existing tools. The role of scientific projects in developing the meaningful participation of stakeholders is central to creating higher quality and usable tools – ensuring a longer-term legacy beyond the lifetime of the projects. The National-scale Impact-based Forecasting of Flood Risk in Uganda (NIMFRU) project developed Farmer Agri-Met Village Advisory Clinics (FAMVACs) to bring together the traditions and practices of indigenous groups with scientific-model data. This tool has contributed to a greater understanding of farmers’ realities and needs in relation to flood response. Two clinic participants also spoke at Uganda’s Parliamentary Forum on Climate Change about their experiences, which resulted in the construction of a valley dam and in the acquisition of new tractors for the Katakwi District.
Tools for decision-making

Tools are necessary for decision-making for disaster risk reduction. SHEAR worked on three types of tools: thresholds, maps and data collection.

Thresholds

A variety of different tools can be used to make disaster risk management decisions. Notably, determining the conditions under which hazard events are likely to occur is vital to effective planning and monitoring. From this, calculating warning thresholds of certain weather or environmental conditions mean that, when these levels are crossed, decision-makers in disaster preparedness and response can act decisively and quickly before the hazard hits. These thresholds can be based on a number of indicators depending on the targeted hazards and can include levels or rainfall, soil moisture or water surfaces, or temperatures reached over a given time period.

Several SHEAR projects have been working to identify thresholds for conditions relating to floods and landslides, providing a range of key stakeholders with the tools to identify high-risk situations:

• On landslides, the LANDSLIP project has developed a statistical model to identify rainfall thresholds linked with landslide occurrences in two study sites in India. This threshold-based model was then used by the Geological Survey of India to monitor conditions and inform local disaster management officials, through a daily landslide forecast bulletin, when rainfall reaches levels of intensity and duration likely to trigger landslides.

• The Forecasts for Anticipatory Humanitarian Action (FATHUM) project worked in Uganda and Mozambique to strengthen flood forecasting with improved thresholds for decision-making. The project has been addressing the limitations of existing approaches to defining flood thresholds, which use a single threshold across all lead times (from four months to a week). This new research has calculated flood thresholds using river flow ensemble forecasts, providing the likelihood of flood events occurring, increasing the reliability and skill of flood forecasts for humanitarian and civil protection stakeholders.

Maps

SHEAR projects have also been developing and strengthening a number of maps and mapping tools to support stakeholders in hazard-prone contexts in understanding what areas are at risk. These are critical tools for disaster risk management in both the long- and short-term. In the long-term, stakeholders involved in planning and development – for example, in land use management – can make informed decisions about the safe location of housing, infrastructure and other investments. In Nepal, SHEAR-funded landslide mapping and modelling, undertaken after the 2015 Gorkha Earthquake, has been used to inform landslide risk management at national-scale with the development of high-resolution and openly accessible online maps through the National Disaster Risk Reduction and Management Authority’s online portal. The data were also used specifically in the support of households facing geohazards in the aftermath of the 2015 earthquake, helping to assess whether settlements were unsafe and to identify sites for relocation.
In the shorter term, disaster risk managers can identify which risks and locations to prioritize for effective, appropriate preparedness and response measures:

- For example, in Kenya, the Forecast-based Preparedness and Action (ForPAC) project developed a Global Hazard Map for East Africa. This presents forecasts of extreme weather events in the region, which were applied by government agencies to severe weather advisories during a period of flooding in 2018.
- The COSMA project (understanding the overheating risk and heatwaves in Colombo, Sri Lanka) has developed high-resolution overheating risk maps for the city’s authorities to identify hotspots vulnerable to heatwaves and connect with urban planners to mitigate overheating risks.

SHEAR projects have developed hazard maps in coordination with local agencies to assist with the development of severe weather advisories, better urban planning and understanding risk.

Data collection

SHEAR projects have developed several online and hardware tools to aid data collection. Gaps in data on vulnerability as well as physical dynamics can be major challenges to effective decision-making. For example, the CONNECT4 Water Resilience project has trained technical staff and researchers from ARA-Sul and Universidade Eduardo Mondlane in Mozambique in dam sediment sampling using a new gravity corer – a tool that allows researchers to sample and study sediment layers. This means that stakeholders will be able to effectively monitor the impacts of floods and droughts on water quality, supporting water resource management. Developing, supplying and training stakeholders in the use of such new tools supports long-term monitoring and decision-making.

Tools also play a crucial role throughout the project cycles in data collection, decision-making, planning and communication. The Towards Resilience project worked with key stakeholders to install five weather stations around Kampala, Uganda to measure rainfall, temperature and wind speed. The stations are hosted by the Uganda Red Cross Society, a school, residential organizations and Makerere University. Partners received training in downloading and monitoring the data and a reporting app was developed for basic data analysis. In addition, outputs from modelling flood risk have been made available for a range of different rainfall events, overlaid on different background maps.

Conclusion

Throughout SHEAR projects, tools – such as algorithms, apps, hardware and maps – have been instrumental in generating advances in knowledge and enabling users to act. Tools are necessary for decision-making for disaster risk reduction. Collaboration on the co-design of tools between academic researchers, service providers and local stakeholders is essential in optimizing resilience efforts around the world. The co-design of tools and solutions should be a top priority in future risk reduction and resilience programming.

In SHEAR, these collaborations have resulted in scientifically rigorous, cutting-edge tool development that is also user-friendly and decision relevant. It also allows for empirically effective tools that are tailored to the reality that different stakeholders face in their local contexts. These practical tools have enabled the production of new knowledge and transformed this into action to address critical hazard risk and resilience needs in some of the most hazard-prone parts of the world.

For further details on all SHEAR projects and outputs see [www.shear.org.uk](http://www.shear.org.uk)