Tanzania Red Cross

![Finnish Red Cross logo]

Why early warnings are not leading to early action?

Solutions to ensure people can act in advance of hazards.
Based on hazard perception studies conducted in East Africa.

Finnish Red Cross, in collaboration with Kenya Red Cross Society, Rwanda Red Cross and Tanzania Red Cross Society

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Contents

Executive Summary

The frequency and intensity of extreme weather events such as floods and landslides are increasing due to climate change. More accurate information is available from scientific sources, including through meteorological agencies, on weather events and potential future hazards. This information is vital for early warning systems, which are effective ways to protect people, livelihoods and assets from hazards. But only if warnings lead to early action.

National Red Cross and Red Crescent Societies and a wide community of organisations and governments are committed to developing people-centred early warning systems. The key is to ensure that actionable information flows in time to the affected communities, and that people have capacities to act early and effectively.

National Societies support their respective authorities in reducing and managing disaster risks and preparing for and responding to disasters when they happen. Their volunteers witness the devastating local impacts of climate crisis at first hand. **National Red Cross and Red Crescent Societies strive to strengthen communities' resilience to disasters and scale up their capacities to act early based on forecasts and local observations.**

In 2022, the Finnish Red Cross started a new project with the Kenya Red Cross Society, the Rwanda Red Cross and the Tanzania Red Cross Society focusing on the information flow between meteorological and disaster management agencies and local communities to enable early action. As a foundation for the project, the Finnish Red Cross commissioned four case studies to understand how people perceive hazards and how early warning systems can be improved from the local perspective in the target areas in Kenya, Rwanda and Tanzania. This policy paper draws from these studies, and presents findings and recommendations that can be useful for actors working to ensure that early warning systems are people-centred and warnings lead to life-saving action.

The studies found that due to past experiences, community members are aware of the causes of flooding but lack knowledge, capacities or resources to increase their resilience to flooding in the long term. When actions are taken, they are mostly protective measures to cope with the immediate impacts of flooding.

Even though weather forecast information and warnings may be available, they do not necessarily lead to early action. The studies found several reasons why people may not take heed of warnings, from ignorance to trust issues, not receiving or understanding the information, or not being able to act due to poverty or ownership matters. Overall, more awareness is needed on early warning systems, alerts and their dissemination, and on actions that can be taken in anticipation of a hazard based on a warning. Dedicated awareness raising efforts would also counter people's attitudes and negative perceptions about the reliability of existing warning systems.

Based on discussions held with communities and stakeholders when conducting the studies, early warning systems need to be further strengthened by relevant authorities with a multistakeholder collaboration. **Systems must generate more accessible, timelier, easier to understand and more area-specific weather alerts, which would provide adequate time for at risk populations to take actions.** An inclusive approach is important to ensure that weather forecasts and warnings are accessible to everyone and that inequalities in receiving, understanding and acting on forecasts and warnings are addressed.

Knowing the target audience, the end users, and understanding which the most effective and preferred communication channels for them are makes a difference. Community meetings are among the most important and effective information sources in communities in all three areas. Radio and mobile phones are good tools to reach those people who have access to them. The studies noticed that multiple communication channels must be used, and information must be repeated and received from several sources for it to lead to action.

In many risk-prone locations, especially in remote areas, communities have established their own community early warning systems and mechanisms to ensure they are informed and prepared for hazards. These should be enhanced and linked more systematically to meteorological knowledge. The community can be more involved in monitoring local indicators for floods and landslides, and in the dissemination of forecasts and warnings. Investing into these roles and **empowering local actors as part of early warning systems and in the development of early actions can make a life-saving difference when there is time to act based on a warning.**

Key recommendations

- Support communities in strengthening their own early warning systems and preparedness capacities to take early action based on warnings, in developing prioritised anticipatory actions and in scaling up local disaster risk reduction solutions.

- Increase public awareness of and trust in weather forecasts, alerts and early warning systems.

- Build trust and enhance the effectiveness of early warning systems by utilising local observations and knowledge about hazards and their impacts, and communicating through existing channels and structures preferred by people.

- Invest in preventing and controlling floods and in ensuring that the national early warning system is well connected to the local level.

- Identify the needs and capacities of people in particularly vulnerable situations, such as persons with disabilities, and ensure that they are meaningfully engaged in the development of early warning systems, have access to warnings, and receive support.

1. Introduction

An effective early warning system has four components: risk knowledge, monitoring and warning service, dissemination and communication, and response capability. This policy paper focuses on the communication and dissemination of actionable warnings and preparedness to respond to the warnings from the local perspective. Advance information of potential hazards enables people and communities to take appropriate measures to minimise the impact of disasters.

All four components are closely connected to each other, as parts of an early warning early action value chain, and equally vital for the success of the system. There are also several cross-cutting elements and enabling environments, such as governance mechanisms and institutional, policy and legal frameworks, that are important to the functioning of the system.
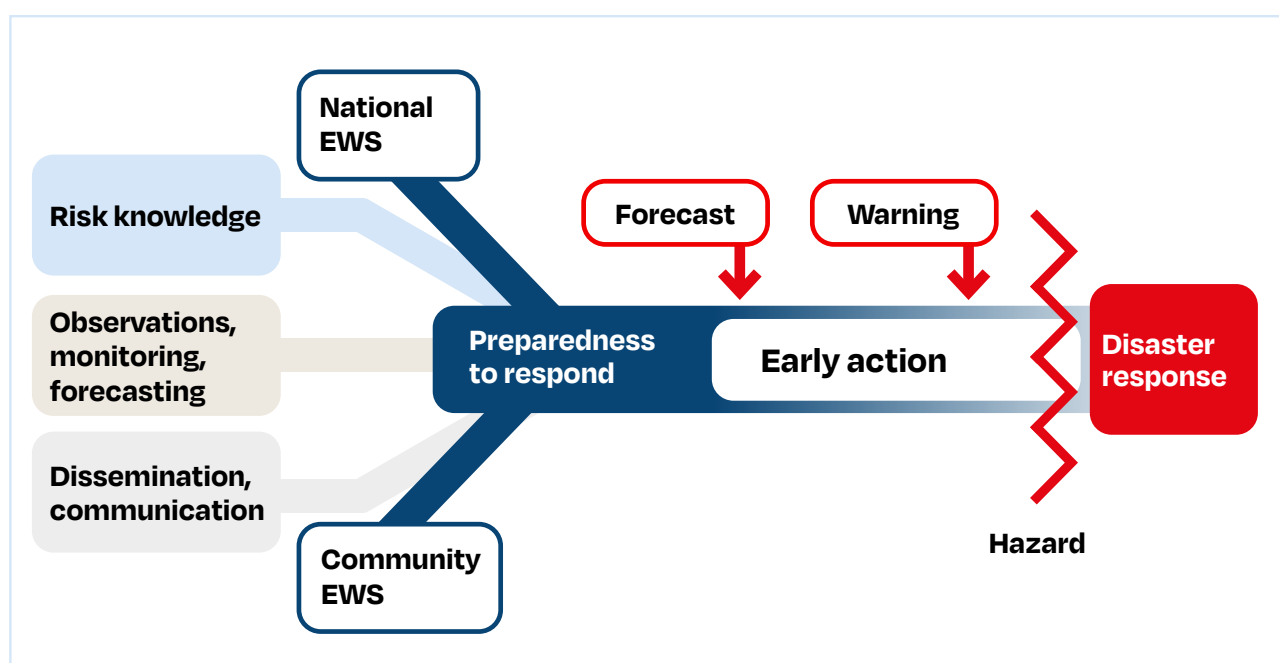
When early warning system (EWS) works from national to local level and preparedness capacities are in place, early action can be taken based on a forecast or a warning reducing the impacts of a hazard.

Collaboration between meteorological agencies, authorities and relevant stakeholders is increasing to enhance early warning systems with a more people-centred, multi-hazard and inclusive approach. When warnings generated from observation data are accurate, timely and accessible to everyone, they can lead to early action at the local level. This is also central to the UN's Early Warnings for All initiative, the overall objective of which is to ensure that reliable weather forecasts and warnings are available to everyone by 2027. Despite the proven effectiveness of early warning early action in reducing disaster impacts and saving lives, around one-third of the global population is not covered by early warning systems.

Four studies bring new knowledge on access to warnings

With a new project in East Africa, the Finnish Red Cross commissioned four hazard perception studies (See References for details), one in Kenya and Tanzania and two in

Rwanda, to form a basis for the co-creation of community-led, accessible, and usable early warning services. The studies focused on the understanding of the perceptions of people on weather-based hazards, forecasts and warnings, and the impacts on their communities. The studies looked at existing weather observation, forecast and early warning systems, sources of information and communication methods, and what action was taken to mitigate flood impacts based on forecasts and warnings.

The studies were conducted in the Morogoro region in Tanzania, in Turkana County in Kenya, and in Rubavu District in Rwanda. A follow-up study was conducted in Rwanda to complement the findings due to the flooding in May 2023. For exact locations and methodology, please see Annex.

This report builds on the key findings and recommendations from the studies.

Higher flood and landslide risks call for better resilience

While the geographical areas differ from each other, the targeted areas face similar weather-related hazards. The major hazards experienced are drought and floods in Turkana, flooding and landslides in Rubavu, and flooding in Morogoro.

Turkana in Kenya has an arid climate with low and erratic rainfall, with flooding every three years.

Rubavu in Rwanda and Morogoro in Tanzania are wet areas with rich agricultural productivity, and regular flooding occurs yearly. In Rwanda and Tanzania, the soil gets saturated due to frequent rainfall throughout the year and rainfall results in excess water finding its way into the Sebeya River in Rwanda and the Mkondoa River in Tanzania, with a possibility of causing flooding downstream.

The major causes of floods are heavy rains in the upper areas or in arid areas. Deforestation is considered as one factor worsening flood risk. Heavy rainfall is also a key factor in generating landslides.

The major causes of floods are heavy rains, which have become more erratic and unpredictable.

Climate change has resulted in the distortion of the normal rain calendar. Weather patterns and rainfall have become more erratic and unpredictable. Both floods and droughts occur in close succession in relation to the seasonal rainfall performance. Rains may be late, short and torrential, causing flooding, and they may be followed by prolonged droughts.

The studies showed that people are not ready for the hazards and there is a clear need to boost flood resilience and overall disaster preparedness in the areas. For example in Turkana, the combination of factors such as poor settlement planning, weak makeshift shelters due to a nomadic lifestyle, and limited capacities and resources to implement mitigation measures make people vulnerable. The county disaster risk management directorate has long-term mitigation measures in place, such as enforcing river bank management regulations and planning codes for rural and urban settlements. Despite these, communities continue to be affected when flood waters flow along seasonal river channels that criss-cross the road network and grazing areas.

In Rubavu, hilly topography, heavy rainfall, deforestation, farming on steep slopes, and climate change accelerate disaster risks. The government of Rwanda has undertaken a hydrologic assessment of the Sebeya Basin and identified disaster-prone communities by using flood hazard maps. It is aiming at tackling severe flooding in north-west Rwanda, especially in the Sebeya River Basin, through improved capacity for flood forecasting and early warning, risk reduction, and disaster preparedness.

Spotlight ⊕

A project links meteorological knowledge to the local level

The Finnish Red Cross has partnered with the Kenya Red Cross Society, the Rwanda Red Cross and the Tanzania Red Cross Society in the development and implementation of an Early Warning Early Action multi-country project since 2022.

The project links with a separate FINKERAT project implemented by the Finnish Meteorological Institute (FMI) with the Kenya Meteorological Department (KMD), Rwanda Meteorology Agency (Meteo Rwanda) and Tanzania Meteorological Authority (TMA) with an objective of improving the capacity of meteorological agencies to provide enhanced weather forecasts and early warning and air quality services to communities and critical government institutions engaged in disaster risk reduction. Both projects are funded by the Ministry for Foreign Affairs of Finland, through civil society development cooperation funding and the Institutional Cooperation Instrument.

The meteorological agencies in Kenya, Rwanda and Tanzania have a common purpose to provide weather, water and climate information services for the safety of life and property for various users. They issue forecasts, advisories, alerts and warnings at different time scales to give advance information. The projects link the meteorological agencies with disaster-prone communities.

In the Red Cross project, forecast needs of the communities are identified and forecast products co-created together with the communities, with the objective of leading to improved early warning and early action processes. These products are tested with a two-way feedback mechanism. The aim is to increase community risk awareness and the reach and use of the early warning alerts. The projects combine the respective areas of expertise of the Red Cross and the meteorological agencies.

Public awareness good on floods, insufficient on early warning early action

The studies conducted in the three countries found that due to past experiences, community members were aware of the causes of flooding. The people living in the lowlands were known to be most exposed to flood events. People were also aware of the interplay between heavy rainfall, low-lying topography, and major land use changes and agricultural practices which had resulted in soil erosion.

Also, floods were not always seen as a negative thing. Less intense flooding brings opportunities: there is more accessible water for both households and livestock, and soil fertility also improves.

In Tanzania, the community perceived floods as natural annual phenomena. Living in the flood risk area is a livelihood strategy to access fertile land and water for agriculture. Many families have their homes away from the river, and they only come to the farm for cultivation. Once the flood water subsides, people get back to normal life. Some community members indicated they would like to permanently relocate to safer locations but they lack financial means to acquire land in safer areas.

While the government and partners have supported sentisation through early warning information, the communities acknowledged that dissemination was very low. They were not familiar with the anticipatory action approach and what early actions could be taken proactively and ahead of a forecast hazard.

National Red Cross Societies can play a role in early warning systems

While the efforts to reduce and manage disaster risks and enhance an early warning system involve a variety of governmental actors, public authorities can also get support through multistakeholder collaboration. They can facilitate the involvement of civil society organisations and representatives of vulnerable groups, the media, the private sector and research institutions.

The Kenya Red Cross Society, the Rwanda Red Cross and the Tanzania Red Cross Society are auxiliaries to the public authorities in the humanitarian field in their respective countries. Similar to other National Red Cross and Red Crescent Socities worldwide, they are uniquely mandated to support the authorities in reducing and managing disaster risks and preparing for and responding to disasters when they happen.

National Societies are present at the local communities before, during and after disasters. They strengthen communities´ resilience to disasters and capacities to act early based on forecasts and local observations. In their partnership with public authorities, including emergency management authorities and meteorological agencies, they agree in each country on the areas in which the National Society supplements or substitutes public services.

Specific to early warning early action, the responsibilities can include, for example, tasks related to raising community awareness on early warning systems, the forecasts and warnings issued, proper early actions to take when warnings are received, or training and capacity building to strengthen community preparedness. They can also develop people-centred and inclusive early warning messages and improved communications, identify people in vulnerable situations in communities, mobilise volunteers in response to warnings, or provide resource persons and knowledge support for understanding and interpretation of weather monitoring and forecast information.

Tanzania Red Cross conducted household assessments after severe flooding in Pwani and Morogoro.

2. Access to actionable forecasts and warnings should be improved

Information about weather and early warnings is available from many sources: meteorological agencies and local authorities, indigenous knowledge and local sources. People receive information through weather forecast reports and early warning alerts, verbally, by observing nature, by monitoring the river, and through expert advice. The studies found that the more awareness and experiences people have of flooding, the more willing they are to receive forecasts and warnings.

In many risk-prone locations, communities have established their own ways of surviving, community early warning systems. These community-led systems use local sources, observations and communications in developing warnings that are useful and accessible, and in identifying the most feasible and relevant early actions for people to take. With the facilitation of authorities, the Red Cross and other actors, as needed, these local systems and mechanisms could be strengthened, made more structured and linked to meteorological agencies. In doing so, it would be important to ensure that the actions engage women and include vulnerable groups, such as persons with disabilities.

One good practice is collaboration between communities residing in the upper catchment area and in the downstream. It is common for community members in the lower areas to have friends and relatives in the higher areas who alert them by phone when upper areas receive high rainfall, potentially causing landslides or flooding downstream. In the areas targeted in the studies, such collaboration exists between the upper areas of the Mkondoa River in Tanzania and the Sebeya River in Rwanda and respective flood-prone lower areas. This collaboration is an example of local systems that can be strengthened further.

Spotlight ⊕

Tanzania & Rwanda: Using local weather stations in producing localised weather information

The community in Kilosa in Tanzania has three local weather stations; two located in primary schools and one in the Ilonga Agriculture Institute. These measure and record real-time weather data. Community members and Red Cross volunteers are trained to collect the information. The Tanzania Meteorology Agency (TMA) processes, analyses, interpretes and shares it with the community through TV, radio, websites, bulk SMSs, and social media.

In addition to local information, the TMA disseminates weather forecast information with sub-stations, which share them with their respective local government authorities for planning purposes and communicate them to the community in various ways.

In Rwanda, Meteo Rwanda has installed automated Flood Metering and Observation Stations that constantly record and send data on water level via mobile devices. Once the data is analysed, it is used to warn people and village heads through advisories sent via radio, television, mobile phone messages, and through members of Disaster Management Committees via WhatsApp groups.

Radio and mobile phones are good tools to reach people who have access to them. Radio can be effective as it is possible to share alerts timely, not just using allocated slots, and radio stations often use local languages or dialects. The study found that in Tanzania and Rwanda, mobile phones and radio were among the main sources of information. In the project areas in Kenya, with less access to mobile phones and radios and limited network and public services in general, traditional experts, government officers and NGOs

were among the main sources. TV was not available for the majority of people, and the internet even less in the three areas studied. As a significant proportion of people also do not have access to radio or mobile phones, these communication methods have to be complemented by other means.

Local meetings, structures and leaders are crucial information sources

Community meetings held by chiefs, village elders and local resource persons are considered important information sources for communities in all three areas. While other topics are also covered, weather forecast and warning information from meteorological agencies is communicated through the meetings.

In addition to community meetings, existing community structures and groups can play a crucial role in community early warning systems. In Rwanda, communities are organised into small groups of 10–15 households locally known as 'Isibo'. The groups meet every Tuesday evening to discuss early warning alerts and measures which community members should take. Through these groups, community members also provide assistance to flood-affected households to build dykes around houses and reconstruct damaged houses. Additional community gatherings take place, for example, during the rainy season to discuss landslide risk.

Community meetings are important sources for forecast and warning information.

Community leaders and local resource persons, for example religious leaders, chiefs, assistant chiefs, village leaders, tribal chiefs, teachers and educated persons, interpret weather alerts from the media and various other sources to ensure that all at risk community members are aware of impending disasters and take appropriate mitigation actions. The communities have a high level of satisfaction towards these persons and thus trust the information disseminated.

Also, local security groups, farmer promoters who are members of the community, and local volunteers, such as those from the Red Cross, can be actively engaged in monitoring and communicating flood warning alerts, and in disaster preparedness and response. Improved access to information through mobile phones, including WhatsApp, is one way to facilitate that. To play these roles, the study showed that there is a need to enhance the capacities of different community members to participate more actively in weather monitoring and dissemination of weather forecasts and alerts. Meteorological agencies could work more with local administrative bodies in the formation and strengthening of local weather monitoring systems, such as committees or forums.

With a high probability of flooding during certain months, it is recommended to conduct more frequent monitoring of both indigenous indicators and scientific parameters of weather forecasts at those times to facilitate the timely creation of alerts and dissemination for early action.

There is potential with regard to schools, which can be utilised by creating linkages between teachers, meteorological agencies and communities on weather forecasting and alerts and by integrating local school children into the weather forecasting and alert system through the guidance and mentorship of their teachers. Pupils could get information on appropriate flood mitigation measures at school and convey alert messages from school to their caregivers.

Flood markers showing flood risk areas were painted during a simulation exercise in Kenya.

Timely and accessible communication creates trust

The study found that previous experience on correctly forecast and communicated floods had a positive influence on attitudes towards weather forecasts. This was evident in Rwanda after the May 2023 flooding that was preceded by a Meteo Rwanda forecast. As a result, the perception the communities had on early warning alerts from Meteo Rwanda has improved.

The way of life in the communities influences access to information. In Turkana, the nomadic lifestyle influences community perceptions and the effectiveness of alerts. Due to the low level of access to early warning alerts, the language of communications, and the vastness of the area, community members prefer information from indigenous sources, local leaders and other resource persons.

People are eager to understand early warning systems and forecasts better.

In Turkana, 38% of the respondents confirmed that there is a local person in the community who uses indigenous knowledge to provide people with warnings of impending hazards or disasters. "Modern ways of alerts are mostly used by those who are educated" as cited by a key informant, with most of the community members preferring the indigenous ways of weather information. Only 12.3% of the respondents perceived that a modern early warning system was reliable. This was influenced to a great extent by the level of education and literacy of community members, their poverty status and nomadic lifestyle.

Traditional knowledge (incl. indigenous knowledge and local knowledge) has existed in the target areas for generations. Traditional methods of generating and sharing early warning alerts are passed from the older generation to the younger generation at home and during community festivities and initiations. Local early warning alert systems, including the physical observation of rainfall and the environment, are used and generally trusted in communities.

However, it has been observed that due to climate change the traditional indicators are not working as they used to, and the trust in them has started to erode. Thus, there is increasing awareness of the need to combine indigenous knowledge and local observations with scientific forecasts. People are eager to understand early warning systems and forecasts better. From the Red Cross point of view, this should be approached as a behavioural change process, in which awareness is raised and trust is built through trainings and repeated sessions in communities. People should also be explained about uncertainties in weather forecasting, and why false alarms and near misses occur, to improve their trust in warnings.

Spotlight ⊕

Kenya: Main sources of early warning information for people in vulnerable situations

In Kenya, the key channels to reach the most vulnerable people are local resource persons and chiefs, village administrators and elders, and radio. Children get information and alerts from teachers and other pupils at school and at home from their parents/caregivers. Older people also observe weather signs using traditional knowledge. Red Cross SMSs were received widely, but considered as key sources only among persons with disabilities.

Vulnerable Group	Sources of Early Warning Alerts
Children	• Teachers at school during school assemblies • Peers at school and at home • Parents/caregivers as communicated by the local resource persons • Listening to radio at home • Parents' or caregivers' mobile phones
Older people	• Local resource persons/traditional seers • Area chiefs/village elders/ward administrators • Looking at common weather signs such as heavy clouds, flying direction of particular birds
Persons with disabilities	• Local resource persons • Area chief through community barazas (meetings) • Village administrator/village elders • Radio, television • SMSs from Kenya Red Cross
Poor people	• Local resource persons • Area chief through community barazas • Village administrator/Village elders • Radio

Information does not automatically lead to action

Even though information may be available, it does not automatically lead people to act upon it. There are several reasons for this, from lacking awareness due to illiteracy or low education, or preference to indigenous knowledge and verifying the weather phenomena by personal observation. The reason can also be as simple as lacking access to information. For all key factors emphasised by local communities, see page 19.

Spotlight ⊕

Rwanda: Learning from the Sebeya River floods

Heavy rainfall in the mountainous areas of Rutsiro district in Rwanda where the Sebeya River originates caused flooding in May 2023. Flood waters carried debris, including trees, grass and mud which clogged drainage channels and the river itself, causing water to overflow the river banks, destroying protective walls that had been constructed and sweeping into farmlands and settlement areas. This happened despite recent efforts by the government to mitigate the flood risk by constructing a retaining wall, a retention dam and water channels. Fortunately, these measures did reduce the intensity of flooding and helped to protect the communities from even worse impacts.

Flood alerts were also issued, mainly through radio, television, phone and community meetings. These communication channels served different purposes. While TV, radio and telephones provided general

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awareness on the impending floods, community meetings ensured everyone had understood the warnings.

Radio was the first medium to alert people about the expected heavy rains. The alerts were aired at 6:00 a.m., 12:00 a.m. and 18:00 p.m. on the day that the floods occurred, 2 May. Obviously, only the people owning a radio and listening to it at the time received these alerts first hand.

Response to warnings was very low. 58% did not receive the alert.

On TV, weather forecasts were aired on 1 and 2 May, showing visual charts on the screen. This was additional information that could not be communicated through radio. TV also showed flooding as it was taking place, and people in other flood-prone areas within the district were able to move to safer grounds. This was only accessible to those community members with TV sets.

The forecast released on 13 April was discussed in the community meeting held on 25 April, in which the community members were informed about the expected heavy rains that might lead to floods. The alerts released on 1 May were discussed in the evening of Tuesday 2 May, as the community Isibo meetings take place every Tuesday evening. At the meeting, the village head explained the weather forecast to the community members, who asked for further clarifications. The meeting was open to all community members but was not attended by all. Absentees did not receive the information unless they happened to hear it from other community members. There was no system in place to inform those unable to attend. This is considered something that could be arranged for the future.
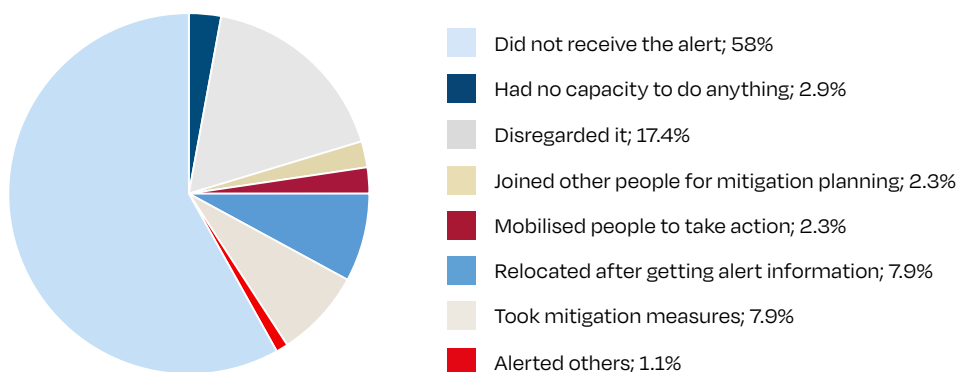
The flooding started seven hours after the meeting took place, at 1:00 a.m.

Community members with smartphones and airtime were able to access the alerts from social media and use the phone to inform others about the floods. Mobile phones were also a real-time mode of communication during the floods as electricity was disrupted, rendering radio and TV inaccessible.

Pre-positioned whistles and megaphones were used to alert the community about imminent flooding. The use of these devices not only warns residents of the danger as it unfolds but also prompts them to relocate to safer areas.

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How the alert information was used

- Did not receive the alert; 58%
- Had no capacity to do anything; 2.9%
- Disregarded it; 17.4%
- Joined other people for mitigation planning; 2.3%
- Mobilised people to take action; 2.3%
- Relocated after getting alert information; 7.9%
- Took mitigation measures; 7.9%
- Alerted others; 1.1%

Most people did not receive the alert, and many disregarded it.

Why early warnings are not leading to early action?

Just before and during the flooding, an Umumotsi, or 'smoker'—a person authorised by the sector executive to alert the community during emergencies—travelled through the affected villages blowing whistles and informing residents about the flooding and necessary actions to take: "Amazi yaje! Amazi yaje! Sebeya yuzuyea!" translated as "Water is coming! Water is coming! Sebeya is overflowing!"

The Rwanda Red Cross volunteers also utilised megaphones to broadcast urgent warnings in the communities and advised community members to evacuate from the affected areas. Megaphones are cost-effective and ensure that crucial information is immediately accessible to everyone within earshot.

Those villagers who had disregarded the earlier evacuation alerts were at this time helped to evacuate by the Irondo, the local level security team, to safer areas.

The study concluded that response to warnings was very low. Even though early warning alerts were available and accessible through various sources, 58% of the people did not receive them, and 17.4% disregarded them. This meant that people missed a chance to act early and minimise losses and damages.

One major issue was that area-specific information was not adequate, as climatic conditions vary within the district. In the past, community members had experienced that rain forecasts given for the whole district of Rubavu were often locally inaccurate as they covered a broad area. This had led to losing motivation to check weather forecasts and other communications, such as the 6-hour alerts. Some people had moved to safer places on 2 May but returned to their homes as rains had not started at the time forecast. The updated rain forecast should have reached people, taking note of heavy rainfall in the catchment area of the Sebeya River. Afterwards, it was noted that the flood emergency had to some extent improved the perception the communities of early warning alerts.

Flood retention wall was rebuilt after May 2023 floods in Mahoko cell, Kanama sector, Rwanda.

Finnish Red Cross

Spotlight ⊕

Traditional knowledge on weather-based hazards is important

Traditional knowledge has had an important role in predicting early appearance of the rainy season, heavy rains, or a prolonged rainy season potentially leading to flooding. The use of weather forecasts or alerts from indigenous experts and reliance on this information depends on the community and the availability of other information sources. While income improves access to other information through mobile phones, TV and radio, households with higher income levels are also keen to get forecasts and alerts from indigenous sources. This is due to the integrated nature of indigenous knowledge, including security alerts.

While people prefer scientific methods, indigenous ways remain easily affordable and accessible.

The below table shows key indicators monitored in communities. Climate change has resulted in the distortion of the normal rain calendar with the rains becoming more erratic and unpredictable, which has affected the accuracy of some of the predictions made by the indigenous experts.

In Tanzania, people observe the behaviour of animals and insects as well as clouds, and the position of the sun, moon and stars to predict weather including rainfall. Thunder, lightning and heavy clouds are considered so visible that they cannot be ignored in forecasting weather. While preferring scientific and modern methods, people consider that indigenous ways of generating warnings and alerts have worked for them in forecasting and still remain easily affordable and accessible. Traditionally people used trumpets (cow horns) and whistles to alert about flooding. Once people heard the sirens, they were expected to move to safe places.

Also in Kenya some of the local signs alerting on impending heavy rains are well known in the community. These include the flowering of the acacia tree and some evergreen plants, birds flying together towards one direction, and cattle and camels making a specific sound and having their calves jumpy.

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Ecological	Meteorological	Riverine	Ethology	Celestial
Nature phenomena and patterns.	*Wind movements, rain patterns, temperature and clouds.*	*Behavior of water in the river.*	*Animal behaviour.*	*Behaviour of celestial bodies.*
• Increased numbers of local bird species • Migratory birds fly towards certain direction • Flowering of specific plants and trees • Drying of trees predicts heavy rain • Increased amount of bird nests ahead of floods and less when rainy season is poor	• Occurrence of dark clouds (the darker the sky the more intensity in rain) • Extremely hot temperature, hot nights, or unusual increase in temperature predicts rainfall • Rainfall intensity • Heavy winds • Thunder/Lightning	• Colour of water (darker, muddier) • Increased debris • Increased volume of water • Increased sound from water moving in the river • Ammonia-like smell of the river indicates that rain is near	• Different animals produce a distinct sound (e.g. cattle, camels) • Calves appear to be jumpy/restless • Amount of frogs croaking for prolonged time • Prediction based on armadillo's selection over a maize, water, knife or arrow (food, flood, conflict)	• Position of the moon • Position of the sun • Movement of stars. When the brightest star sets, it is believed the area will receive rains • A ring around the moon

Key indicators observed in the communities.

Kenya Red Cross volunteers wade through flood waters to reach out to communities marooned by the El Niño floods in the Tana River Delta in Kenya.

In Kenya, indigenous experts provide predictions for a wide range of issues that affect the community, including calamities, drought, war or insecurity, availability of pasture and water, availability of rainfall as well as livestock and human disease outbreaks. Indigenous experts (ngimurok akiru or traditional rainmakers or seers) are advanced in age, have an ability to link and talk with spirits, and skills to predict various phenomena. Their main data collection method is talking to the spirits while observing physical signs in the environment such as in the vegetation, behaviour of animals and insects, flying patterns of birds, footprints, and the position of the sun, the moon and stars. They can also read goat or sheep intestines to predict rain, drought, conflict, and other calamities.

In Rwanda, indigenous experts known as 'Umuvubyi' have an ability to link and talk with spirits, make predictions and weather forecasts, such as heavy rains, floods and earthquakes. They are recognised by the government through the Ministry of Emergency Management (MINEMA), and sensitised by the Ministry to work together with the village head in communicating the forecasts. According to the old practice, when heavy rainfall is forecast, the expert first informs the head of the village and then ties a piece of red cloth along the bridge on the Sebeya River to alert the community of the impending heavy rains. Nowadays, forecasts from the Meteo Rwanda are increasingly followed.

3. Flood resilience and preparedness to respond to warnings must be improved

The communities in Kenya, Rwanda and Tanzania do take some actions to mitigate the impact of floods. The local knowledge and disaster reduction measures are crucial in enhancing resilience towards flood disasters but they could be utilised further.

The study findings show that the measures taken are mostly protective coping strategies during the flooding to reduce its impacts, not preventative measures taken ahead of a hazard, which could help in increasing resilience to flooding in the longer term. Approximately 35% of the respondents have built their houses on safe surface or elevated land, and some have reinforced their houses with concrete foundations and raised doors. 35% of the respondents have engaged in constructing flood steps or dykes to prevent homes from getting flooded.

Local knowledge is effective in building resilience.

Due to the semi-urban environment in Rwanda, the importance of cleaning the gutters and water canals was recognised, while in Tanzania drainage canals are cleared in farms to create ways for flood waters to get out. In Kenya, community members highlighted that they build dykes using sand bags to divert flood water from entering their houses. This is possible due to the availability of sand in the area. They also dig trenches and make gabion walls to manage flood waters.

In Tanzania, mitigation measures include nature-based solutions, such as planting trees and native vegetation like reeds and bamboos, along the Mkodoa River to prevent water from eroding and breaking river banks, as well as planting elephant grass and sugar cane in farmlands along hill contours to divert water to the sides of steep slopes. Traditional techniques also include making sand-and-stone ridges and embankments, called 'tuta'. These create a plateau-like feature that acts as a barrier. People also make contours and terraces, called 'makinga maji', to control water passage through accumulated top layer of soil at the steep slopes. Similar to Rwanda, Tanzanians also make gabion walls and use sandbags as barriers.

Spotlight ⊕

Kenya: Distinct roles of family members in mitigating and responding to floods in pastoralist communities

In pastoralist communities in Kenya, women and girls run households and carry the main responsibility for mitigating and responding to floods. Women share early warning alerts with other community members and build raised houses. During floods, they build temporary shelters on raised grounds, move children and family assets to higher grounds, and fetch food, water and firewood.

Children assist parents in reading weather information shared via their phones, relay information to parents on weather alerts received at school, and share warning alerts with their peers. During floods, they help in moving household items to safer grounds and can swim to salvage animals that are being swept away by floods. Girls assist in building shelters on higher ground and look after younger siblings.

Men are responsible for taking care of livestock, and during flooding they move livestock to higher grounds. They build dykes along riverbanks and dig furrows to divert floods with the help of young persons. They also build gabions, terraces and dams to store water. They protect family and house belongings as they move to higher grounds and help moving older people and persons with disabilities to safety. Older people use traditional knowledge in forecasting weather and issuing alerts and provide advice on flood response. Persons with disabilities pass on alert information to other household members.

Several barriers to implementing disaster risk reduction

Many factors influence whether preparedness and mitigation actions are taken at the household level. The following factors emerged from the studies:

- **Education:** Level of education influences preparedness: more education leads to more mitigation measures taken.

- **Income/poverty status:** Limited financial means are a barrier to taking preventive action.

- **Physical location:** The closer to the riverbank, the more the community members considered the weather forecast important, and took action to mitigate any foreseen hazard.

- **Accepting the risk:** Agricultural livelihoods are dependent on irrigation water from the river and therefore farmers prefer to be close to the water source, accepting the risk. Land fertility is also better close to the river, which reduces the interest to relocate even if government would provide land and building materials.

- **Frequency of hazards:** The frequency and severity of the hazard prompts mitigation measures. The frequency of floods in Rubavu and their impacts on communities increased flood mitigation actions in Rwanda. In Kenya, the unpredictablity of flooding and its infrequency had caused farmers to only consider floods to be a risk when their farms were completely flooded. In Tanzania, flooding was considered an annual event during the rainy season, a natural part of life.

- **Ownership of property:** Tenants were not able to make structural changes to the houses or farms and felt that they can always move to another house in case they were threatened by floods in the current residence.

Flood retention dam for the Sebeya River in the Kanama sector in Rubavu district, Rwanda.

Early warnings are not effective in leading to early action

The studies, conducted at the early stages of the project, found that early warnings were thus far not effective in leading to early action. The proportion of people disregarding alert information and ending up facing the consequences of the flooding or landslides was high.

In all areas, a large part of community members (37–61%, depending on the area) took actions to avoid the hazard just after receiving information. 24–39% of people took action after the hazard showed signs of increasing or after the situation became unbearable and they had to act. After the flooding in Rwanda, the second study results showed a significant increase (from 41 to 60%) in the number of people taking action after receiving the information.

Appropriate response to forecasts and warnings is subject to the resilience capacity of the communities. The study found that resilience capacity is significantly dependent on the availability of resources (household income level), awareness level of the communities (access to accurate and timely early warning alerts, skills on disaster mitigation/response), and socio-cultural factors (including livelihood opportunities and cultural factors), among others. There is a need to identify context-specific strategies to deal with the attitude of disregarding alert information and to strengthen capacities.

The main factors influencing the lack of anticipatory or early action based on warnings included:

- **Low awareness** at the community level with regard to understanding of weather services, forecasts and warnings, leading to limited confidence in taking action.

- **Attitudes, reliability, trust:**
  - Ignorance attributed to high illiteracy and low education levels.
  - Past experiences on inaccurate or untimely alerts, or false alarms, contribute towards the lack of trust in warnings. People referred to occasions when weather forecasts had predicted heavy rains with a high likelihood of flooding/landslides which had not occurred.
  - Preference to verify the information with own observations: A high percentage of people indicated that they would consider flooding to be a risk only after personally observing and confirming the warning signs, for example heavy clouds, prolonged rain or increase in river water levels.
  - Inaccuracy owing to the wide area covered by the forecast (entire district or province). Forecasts are not considered reliable as they are not specific enough to the area.
  - Strong belief in indigenous knowledge. Local forecasters are well-respected opinion leaders in the community. They are often older people, considered wise and known to communicate with the spirits. People have preferred getting early warning alerts from local forecasters because the information is understandable and considered reliable, and it also covers other critical matters, such as security concerns.

- **Not understanding the information:**
  - Due to language: The weather forecast reports and alerts are produced in English or Swahili for Kenya (while local communities prefer Ng'Turkana), French and Kinyarwanda in Rwanda and English/Swahili in Tanzania.
  - Due to technical language: The reports and alerts are too technical in nature and therefore complicated to understand.
  - Reliance on the chief or village administrator to explain the forecasts/warnings.

- **Timeliness** of alerts is critical for the reach and uptake of warnings. If forecasts are given too far ahead or at the wrong time, e.g. when people are busy with their livelihoods, they may not be able to process the information and take action.

  Timely access to warnings can be increased by:
    - The involvement of local leaders in disseminating alert information: In cases where local leaders were heavily engaged in disseminating alert information, it enabled the information to reach the communities timely, and the information was also perceived as more reliable. For example in Morogoro, leaders, including religious ones, are involved in sharing warning and alerts from scientific sources, thus significantly contributing to timeliness of the alerts.
    - Using multiple communication channels: When the alert information is accessible through multiple sources, such as social media, radio or phone, it enhances timely access to it. Poverty affects the affordability of communication equipment, for example smartphones and TVs. A cross-tabulation of household income level with access to weather forecast and early warning alerts indicated that the higher the income level, the better access the households had to weather forecast and early warning alerts.
    - Repetition: Perception of flood risk and understanding of its magnitude increases when alerts are repeated several times.

- **Unpredictability and infrequency of flooding:** The unpredictablity of flooding and its infrequency has caused farmers in Kenya to only consider floods to be a risk when their farms are completely flooded.

- **Livelihood:** Specific to Kenya, the nomadic lifestyle necessitates moving from one location to another for which the practice has been to seek advice from local forecasters. Warnings have not been followed due to fear of losing irrigable land near the flooding rivers.

- **False sense of security:** People living in houses with reinforced and elevated foundations did not feel threatened by the occurrence of floods and therefore did not take the weather forecast seriously. In Rwanda, community members were no longer worried about the floods due to the construction of the retaining wall along the Sebeya River, several drainage and diversion channels, and the terracing on the farm lands and steep slopes.

- **Not allowed to take action:** Specific to Rwanda, many people living in flood risk areas have rented the properties. Due to the ownership conditions, it is not possible to make structural changes or build dykes.

Spotlight ⊕

Persons most affected by floods have varying coping mechanisms

The effects of flooding on the most vulnerable community members and their coping mechanisms were discussed in the target communities. Floods affect people differently due to their vulnerability and resilience to withstand floods. Older people and persons with disabilities are considered vulnerable to floods because they have limited capacities to escape from flood water and are highly dependent on assistance from family members or other people. According to the study findings, approximately 10% of households have a member who has some form of disability, such as visual or mobility impairment, or difficulties with communication.

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In Tanzania, one of the community members shared how he was caught up by a flood. His house was submerged with flood water and there was no one to help him get out the water since his mother was away. He had to stay in the water until his mother came and saved him.

In Rwanda during the May 2023 flooding, persons with disabilities were among the last ones to be evacuated. Two community members with visual impairments described the difficulties they faced.

"Everyone ran for their lives, leaving me behind. It was difficult for me to know where I was going without a guide. I left the house last while others had left earlier, and I could not carry any of my items for I could not see them and they were washed away by the water. Once outside the house, the rescue team took me to a safe place. "

"As I am blind it was difficult for me to locate the boat that had come to rescue us. Everyone was rushing and I had to be assisted by the Red Cross rescuers."

"A person using a wheel chair shared how the flood waters came without a warning while he was sleeping. I just waited for a person who is like a good Samaritan to help me. Luckily good people and Red Cross volunteers helped me by putting me on their shoulders, lifting me completely with their hands. They also helped to relocate some of my personal belongings and materials. I consider myself lucky to have been saved from the floods because fully abled people lost their lives in the floods."

Children are at high risk of drowning and getting sick from waterborne diseases. If schools become inaccessible due to floods, they cannot go to school.

"I usually do not go to school for fear of being swept away by the flood waters. I wait until the flooding decreases, then I go to school," highlighted a child participant from Lokichar, Kenya.

Community members affected by a worsening flood crisis received support from the Kenya Red Cross in May 2024.

Spotlight ⊕

How do the most vulnerable people cope with floods?

The study found that evacuation to safe areas was identified as the most common coping mechanism for all vulnerable groups. Besides that, coping mechanism vary.

The highest impact of floods is destroyed or lost property, assets or belongings.

In Rwanda, a question was raised whether adequate evacuation plans are in place in case of disasters. Concerns were expressed that persons with disabilities are only remembered at the late stage when flood waters are unbearable. The study found no significant association between a household having some of its members with some form of disability with access to early warning alert information. However, it was found that there are no specific efforts made to ensure that all people, including those in vulnerable situations, have access to early warning information, have received and understood the warnings, and receive the support they require to take action.

Persons with disabilities most commonly rely on information shared through radio and TV as well as from their caregivers. Some have phones which are used to pass and receive information. There is a need to identify all persons in vulnerable situations living in flood-prone areas and engage them in preparedness planning and all aspects of early warning early action.

The study showed that the highest impact of floods is destroyed or lost property, assets or belongings. This was common to all persons, regardless of gender, age, disability status or livelihood. Older people suffer from highest mortality and most injuries. Women, children and young persons are traumatised and get sick the most. Children and young people suffer from disrupted schooling. The biggest impact in terms of destroyed farms and crops and lost harvests is for farmers.

The source of livelihood was a big factor in determining the most affected in Rwanda and Tanzania where the crop farmers were viewed as the most affected. In Kenya, humanitarian aspects were considered the most, and thus older people and children were seen as the most affected people.

Vulnerable group	Coping Mechanism
Children	• Move to higher grounds with their families. • Assist women/mothers in construction of temporal shelters on raised grounds. • Wait for the floods to subside before going back to school. • Help move small livestock e.g. goat kids to higher grounds. • Take care of younger siblings.
Older people	• Helped to move to higher grounds by family members. • Offer prayers to ancestors to appease them. • Rely on relatives, people willing to assist and NGOs for food and shelter.
Persons with disabilities	• Helped to move to higher grounds by family members. • Rely on people willing to assist and NGOs for food and shelter. • Rely on people willing to assist on provision of assistive devices to help them cope. • Reliance from relatives who live in other regions.
Very Poor	• Heavily rely on external support to cope with floods for food and shelter. • Move to relative's or friend's homes which is located on higher grounds. • Can decide not to move and wait for the floods to subside. • Reliance from relatives who live in other regions.

4. Authorities and key actors to take concrete steps to strengthen resilience and early warning systems

Even though authorities have invested in better capacities, there is a need to scale up the use of early warning and early action systems at all levels. Based on discussions at the local level, early warning systems need to be further strengthened, and to be better linked to early actions and capacity building to improve community resilience to hazards.

The studies found that current meteorological capacities were insufficient especially at county / sub-national levels to respond to the growing demand and the needs of impact-based forecasting. Various weather stations used for the weather data observation at local level faced challenges and would benefit from investments, such as more resources for operation, maintenance or repairs.

There is a need for timelier, easier to understand and more area-specific weather alerts.

The systems would need to generate timelier, easier to understand and more area-specific weather alerts, which would provide adequate time for at risk populations to take actions. This combined with dedicated awareness raising efforts, especially towards youth, and ensuring that communication is done through the most effective and preferred channels would counter people's attitudes and negative perceptions.

One way to raise public awareness could be through radio where meteorologists could explain and open up the process of generating forecasts and warnings. Meetings could be organised with indigenous experts and meteorological agencies to exchange seasonal forecasts. In rapid-onset hazards, a different faster approach would need to be taken.

Telemetry station for water level measurement in Telimbere, Nyundo sector, Rwanda.

In communicating forecasts, alerts or warnings, the key is to understand the target audience and ensure that authorities, actors and stakeholders at all levels, as well as people, have access to relevant, actionable information and are able to take actions. From the communities' perspectives the points below are central for the trust and understanding of the information:

- Alerts must be very specific in terms of locality in order to allow the community to be sure that the predicted hazard is most likely to happen in their locality.

- The language used must be simple, understandable and actionable, especially the information reaching the communities via media channels.

- Local languages and dialects must be used in communications. For this, local radio stations and vernacular radio can be the best channels. These are often also the most impactful ways to reach a large number of people.

The development of appropriate and context-specific strategies for disseminating weather forecasts and alerts to communities can only happen with the participation of people, and with a people-centred approach. However, as weather forecasts are centralised in nature, there are limited or even non-existing mechanisms to develop forecasts and warnings with communities. Several good practices emerged from the study which can be scaled up in similar local contexts to better connect a community early warning system to the authorities' system.

- Authorities and meteorological agencies can set up systems, mechanisms and linkages between weather stations for data collection and warning dissemination purposes, as well as with teachers, local resource persons and indigenous experts.

- Meteorological agencies can work with the local administration in the formation and strengthening of community weather monitoring committees or forums.

- Mechanisms for frequently sharing information on rainfall amounts and the possibility of floods, as well as timely alerts on imminent flooding can be facilitated between communities residing in the upper catchment area to send warning alerts after heavy rainfall to communities downstream.

- Linking a local resource person from among the pastoralists with the meteorological agency could ensure that pastoralists access weather forecasts and alerts as they move with their livestock, as in Kenya.

Spotlight ⊕

Rwanda: Preparing for floods

In Rwanda, the government had undertaken a hydrologic assessment of the Sebeya Basin and identified disaster-prone communities in the Kanama Sector of the Rubavu District by using flood hazard maps. The authorities took several structural measures to reduce the flood risk. They constructed a retaining dam to hold the waters and prevent flooding downstream, drainage channels through villages, lateral dykes, diversion channels and a concrete flood retention wall along some parts of the Sebeya River to hold the waters. In addition, land restoration measures, including radical terraces to reduce soil losses, progressive terraces, trenches in forests, afforestation and agroforestry were taken.

These structural flood protection measures reduced the intensity of the flooding but proved to be insufficient in May 2023 when heavy rains triggered floods and landslides in north-western Rwanda. The Sebaya River water overflowed the embankment and into the farms. The destruction of the reinforced wall along some sections of the Sebeya River resulted in flooding of highest ever magnitude in some areas.

Multistakeholder collaboration needs to be strengthened

While coordination is taking place and platforms and systems exist, there is a need to strengthen cooperation as disaster management and disaster risk reduction cut across several sectors. This requires collaboration across sectors and within the society as a whole and involves, or should involve, diverse stakeholders. In addition to the meteorological agencies, several other institutions are engaged across all the four elements for multi-hazard early warning systems, including the production and dissemination of weather forecast reports and alerts. If these institutions and actors are not aligned and coordinated, this may create confusion and risk the efforts to build trust among the general public in forecasts and warnings.

Appropriate strategies for disseminating weather forecasts and alerts require the participation of people.

There is also a need to have institutional frameworks and legislation in place and clear roles and responsibilities for key actors. Public authorities have a key responsibility in convening all relevant stakeholders to develop new and to review existing legal frameworks, policies, strategies and plans. In addition, for some transboundary hazards, collaboration is necessary with the meteorological and disaster management agencies between neighbouring countries.

Close collaboration between disaster management systems and structures, as well as hydrometeorological agencies and with key stakeholders, helps to achieve stronger coordination and alignment and to strengthen early warning systems. Using the most appropriate, user-friendly and accessible communication channels for the dissemination of forecasts and authoritative early warnings to inform action ultimately reduces the risk of disasters and ensures that people in vulnerable situations are protected. Collaboration is also crucial in the development of an anticipatory action approach and exploring the benefits of acting early.

5. Recommendations

Based on the field studies in Kenya, Rwanda and Tanzania, the following key recommendations provide perspectives on people-centred early warning systems and enhancing communities' capacities to act early:

Recommendations for all actors

- Increase public awareness of the generation and dissemination of weather forecasts and alerts and the functioning of early warning systems.
- Ensure that warning messages are simplified, context specific, language appropriate and shared at appropriate times to the end users.
- Use communication channels preferred and most widely accepted by community members, noting that multiple channels are required and messages must be repeated. Identify specific channels and methods for reaching people in vulnerable situations.

For the National Red Cross and Red Crescent Societies and other local level actors

- Enhance community early warning systems and connections to local and national systems.
  ◦ Empower communities in monitoring rainfall and river levels.
  ◦ Strengthen upstream and downstream collaboration mechanisms.
  ◦ Strengthen the practice of having local resource persons.
- Support communities in developing prioritised anticipatory actions to mitigate the effects of weather- based hazards.
- Identify existing good practices in nature-based solutions and local flood water control techniques and scale up their implementation.
- Identify all persons in vulnerable situations living in hazard-prone areas and establish mechanisms to ensure that they
  ◦ have access to weather forecasts and alerts,
  ◦ are part of preparedness planning, and
  ◦ receive the assistance they need to act early based on warnings.

For the authorities

- Invest in preventing and controlling flooding through structural and land restoration measures.
- Raise public awareness of all aspects of disaster risk management, especially of early warning early action.
- Identify existing good practices in nature-based solutions and local flood water control techniques and scale up their implementation.
- Apply a people-centred and inclusive approach to the development of early warning systems from national to local levels.
  ◦ Co-produce warning messages with end users to maximise their usability.
- Utilise traditional knowledge and local observations to get timely local data to be combined with scientific data.
- Use multistakeholder collaboration to increase access to forecasts/warnings and their understanding.
- Build capacities at district level to interpret forecasts and communicate them to the local level.
- Strengthen linkages and set-up for information sharing and alert systems between weather stations in upper and lower areas.
- Increase collaboration and coordination across government departments and agencies which benefit from weather forecasts and alerts, from national to local levels.
- Encourage collaborative efforts towards anticipatory and early action.

ANNEX: Methodology

Hazard perception studies were conducted in Kenya, Rwanda and Tanzania in March–April 2023 by Berachah Synergies and finalised in November 2023. A follow-up study was conducted in Rwanda in October 2023. Qualitative data was collected through Focused Group Discussions (FGDs), key informant interviews (KIIs), document review, and site visits.

The first three studies were conducted in Kilosa District, Morogoro region in Tanzania, Mbigiri, Mateteni and Mabana (in Mbigiri ward), Tindiga A and Tindiga B (in Tindiga ward), Kibaoni (in Mambwelembele ward), Changarawe (in Masanze ward) and Mambwega (in Msowero ward), in Turkana County in Kenya, covering two Sub Counties; Turkana South and Turkana Central, and in Rubavu District in Rwanda, in Rugerero, Kanama and Nyundo sectors.

The quantitative data was collected through household surveys using a structured questionnaire that involved a total of 1,329 randomly sampled respondents; 456 respondents (259 women, 197 men) in Kenya, 442 respondents (265 women, 177 men) in Rwanda and 431 (239 women, 192 men) respondents in Tanzania.

The majority of the respondents were aged between 18 and 35 years (46.7% in Kenya, 42.5% in Rwanda and 35.6% in Tanzania). 74.1% (n=341) of the respondents in Kenya, 73.8% (n=326) of the respondents in Rwanda and 66.5% (n=288) of the respondents in Tanzania were the head of household.

In the follow-up study in Rwanda, a total of 555 respondents (287 women and 268 men) were interviewed, of whom 73.4% (n=409) from Nyundo cell, 25.7% (n=143) from Mahoko cell, and 0.2% (n=1) from Kavoomo Cell, Terimbere Cell and Yungwe Cell each. 54.8% (n=305) of the households were male headed, 43.8% (n=244) were female headed, while 1.1% (n=6) were child headed. 36.8% (n=205) of the respondents were aged between 18–35 years, 38.6% (n=215) between 36–49 years and 24.2% (n=135) were aged 50 years and above.

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