



Wilton Park



Image: World Food Programme/Peter Casier

Report

Flooding in the Greater Horn of Africa: building effective early warning systems

Wednesday 28 – Friday 30 September 2016 | WP1497

In association with:



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Executive summary

- There is a clear need to increase the efficacy of Early Warning Systems (EWS) in the Greater Horn of Africa (GHA), to reduce the impact of flooding events on the lives and livelihoods of people living in that region. In particular, EWS must reach the so-called 'last-mile'; highly vulnerable communities based in remote and rural areas with a low inherent resilience to disasters
- To be effective, EWS should be 'impact-based' and 'people-focused', empowering user communities to take appropriate action rather than providing a technically accurate meteorological or hydrological forecast and delivery, and engage the end users across the whole EWS process from requirement gathering to design
- The chain of institutions, stakeholders and actors involved in most EWSs is long and complex; there is a need to reduce this complexity to increase the systems' efficacy.
- At the same time for any EWS to be effective it must understand its users completely, and have their confidence and trust. It must ensure that its users are motivated to take appropriate action in the event of a (flooding) disaster
- In order to satisfy these contradictory aims, an effective EWS must be one with:
 - Reduced complexity at the top (supplier) end of the chain
 - Increased specificity at the bottom (user) of the chain
- To achieve this requires increased levels of five qualities throughout an EWS:
 - Coordination
 - Communication
 - Institutional Capacity
 - Ownership
 - Empowerment of the end-user
- The specific socio-political context of the GHA provides some barriers to increasing the efficacy of EWS in that region. Namely:
 - Different political systems and cultures
 - A lack of political drive to improve EWSs
 - A lack of inter/intra-national funding for relevant institutions
 - A lack of connectedness of each country's various early warning systems
 - A lack of connectedness BETWEEN countries early warning systems
 - Political instability
- The WMO framework for EWS evaluation was critiqued during break-out group discussions (see page 11)
- Based on the discussion, representatives from each of the GHA nations (present at the conference) developed strategies to implement in their countries. In every case the aim to increase collaboration between relevant national stakeholders and neighbouring countries was expressed. (See pages 11-12 for more detail.)

Introduction

- Flooding has multiple and substantial impacts on the nations and economies of the GHA. To help reduce the damage to lives, property and livelihoods caused by flooding it is necessary to build effective EWS and equip people with the appropriate knowledge and power to take action.
- Wilton Park brought together many of the stakeholders involved in this process, including representatives from NGOs, intergovernmental institutions, the United Kingdom (UK) Met Office, the World Meteorological Office (WMO), World Bank and meteorologists and hydrologists from a variety of backgrounds. The aim of this collaboration was to discuss the current frameworks and guidance that exist regarding flood forecasting, EWS and disaster risk reduction (DRR), noting if and where this guidance could be improved or updated. Through constructive dialogue participants also examined *why* EWS need to be more effective for countries in the GHA and identified ways to help EWS in the GHA progress as well as the barriers to change that must be overcome if greater efficacy is to be realised.
- This report provides an overview of some of the current projects that are working to improve EWS in the GHA, and summarises how EWS might be improved, noting that success hinges on increased levels of:
 - Coordination
 - Communication
 - Institutional capacity
 - Ownership
 - Empowerment of the user

Background and context

Flooding disasters have enormous global impact. In 2015 alone, 3455 floods were reported globally, 22,773 people lost their lives, 98.6 million people were affected by those disasters with US\$66.5 billion of economic damages.¹ Current and future climate change is predicted to augment both the unpredictability and magnitude of flooding events, which further adds severity to this threat.

Globally, disaster losses have increased to \$250-300 billion a year, over 80% of economic losses from disasters are due to weather-related hazards.²

Current and future climate change is predicted to augment both the unpredictability and magnitude of flooding events, which further adds severity to this threat.

Flooding tends to impact communities both in the short term, through:

- Loss of life, destruction of homes, crops and livestock
- Damage to buildings, businesses and infrastructure
- Contamination of drinking water resulting in diseases such as cholera and typhoid
- Creating unclean water sources which allow the spread of diseases such as malaria

and in the long term, through:

- Destroying livelihoods and damaging long-term economic security
- Food/water insecurity and famine
- Long-term effects of disease and poor health
- Population displacement
- Disabled transport networks (due to still unrepaired infrastructure).
- In the GHA, deaths and damage due to flooding events have been rising in recent years despite advances in science and technology. This suggests that the EWSs in use (in that region) are not tangibly affecting those people worst affected by flooding events or, at the very least, that EWSs in the region are not as effective as

¹ http://www.unisdr.org/files/47804_2015disastertrendsinfographic.pdf;

<https://www.unisdr.org/we/inform/publications/47804>; <https://www.unisdr.org/we/inform/disaster-statistics>

² <http://www.unisdr.org/archive/46793>

they need to be. Consequently, the United Nations International Strategy for Disaster Risk Reduction (UNISDR) identified a need for guidance on people-centred EWS and, in 2006, created a framework that is still widely used today.

At the time of writing, nations in the GHA have operational EWS of varying standards. In most cases, however, the efficacy of these systems can be improved.

Existing frameworks

The UNISDR and global community ratified the *Sendai Framework for Disaster Risk Reduction 2015-2030*³ at the third UN world conference in Japan during 2015; the successor instrument to the *Hyogo Framework for Action 2005 – 2015*.

The UNISDR's *Guidelines for People-Centred Early Warning Systems (2006)*⁴ provide a four point approach, specifically to help with assessment and improvement of EWSs.

- Risk Knowledge
- Warning Service
- Dissemination
- Response Capabilities

These guidelines are due to be reviewed in 2017 at the Global Platform for DRR in Cancun.

Current projects

Multiple actors are involved in the improvement of EWSs for flooding in the GHA. Below is a summary of some of the key projects shared, and their specific aims:

1. Severe Weather Forecasting Demonstration Project (SWFDP) - WMO

- This project is successfully strengthening capacity in National Meteorological and Hydrological Services [NMHSs] to deliver improved forecasts and warnings of severe weather.
- SWFDP uses a cascading forecast process:
- Global Numerical Weather Prediction [NWP] centres pass information to specialised Regional Meteorological Centres (RMCs)
- RMCs then disseminate forecasts to national meteorological centres, which have are the mandated or authoritative voice for the forecast/warning

2. The Intergovernmental Authority on Development's Hydrological Cycle Observing System Project (IGAD – HYCOS)

- This project operates in each country in the GHA (Eritrea, Djibouti, Sudan, South Sudan, Ethiopia, Somalia, Kenya and Uganda) as well as in Rwanda and Burundi.
- It will provide the region with a hydrological observing/information system
- It will assist countries in developing their national capacity for efficient, cost-effective and sustainable water management.

3. IGAD Climate Predictions and Application Centre (ICPAC)

- Operating within the same countries as IGAD's HYCOS project and also in Tanzania, this institution provides climate predictions and guidance to the region.
- ICPAC are involved with the United Nations Development Programme [UNDP] in a specific project to strengthen IGAD's capacity to 'Build Resilience in the Horn of Africa'

4. United Nations Operational Satellite Applications Programme (UNOSAT)

- This programme is exploring ways to deliver satellite solutions to relief and development organisations, including IGAD.
- UNOSAT can assist organisations' planning through disaster mapping. It also aids NMHSs with satellite-derived forecast products such as rainfall rates, which are invaluable in the absence of rainfall radars.

5. WISER (Weather and Climate Information Services for Africa)

- DFID's WISER mission is to deliver transformational change in the quality, accessibility and use of weather and climate information services at all levels of decision making for sustainable development in Africa.

³ <http://www.unisdr.org/we/coordinate/sendai-framework>

⁴ <http://www.unisdr.org/2006/ppew/info-resources/ewc3/checklist/English.pdf>

- WISER is a coherent programme focussing firmly on developing operational services and making a step change in the quality, reach and application of weather and climate information which support poverty reduction and development. The initial projects focus on the countries of East Africa (Kenya, Tanzania and Uganda) and Ethiopia.

6. Climate Risk Early Warning Systems (CREWS)

- Climate Risk Early Warning Systems initiative launched at COP21 - CREWS initiative aims to significantly increase the capacity for seamless Multi-Hazard Early Warning System (MHEWS), to generate and communicate effective impact-based early warnings, and risk information for hazardous hydro-meteorological and climate events. Its purpose is to protect lives, livelihoods, and property in Least Developed Country (LDCs) and Small Island Developing States (SIDS). CREWS initiative is supported by three international organizations: the WMO, the UN Office for Disaster Risk Reduction (UNISDR) and the World Bank's Global Facility for Disaster Reduction and Recovery (GFDRR).

How to Improve EWS?

The chain of institutions, stakeholders and actors involved in most EWSs (in the GHA) is long and complex. The process of transferring meteorological data to regional and national meteorological and hydrological services is defined for the most part under the World Meteorological Organisation's resolutions (25, 40 and 60). The local services may have international organisations or NGOs assisting them with donations of technology, expertise or manpower.

The Disaster Risk Management (DRM) process is unique to each country, however one common component is the requirement of the NMHSs to engage across the entire spectrum of the national DRM infrastructure. This includes communicating risks to their governments and citizens, which involves working closely with media organisations and communications institutions. The DRM process can at times cause confusion, break down, and take too long to disseminate warnings, particularly to remote and rural communities. There is significant potential for one link in the chain to perform less than optimally, lowering the overall efficacy of the EWS. Consequently, there is a need to reduce complexity in EWSs in the GHA.

For any EWS to be effective it must include the needs of its users, and have their confidence and trust. It must also ensure both that its users are aware of what action they can take in the event of imminent flooding, and that there is trust in the message that it is necessary to take action in order to minimise losses and reduce the impacts of flooding. This is crucial if the EWS is to impact effectively on the lives of the 'last mile', those (remote) communities in the region that are especially vulnerable. All of this requires parts of the EWS chain to be highly specific and involved and, therefore, complex.

In order to satisfy these contradictory aims, an effective EWS must be one with:

- Reduced complexity at the supplier end of the chain
- Increased specificity at the bottom (user) of the chain

To achieve this requires increased levels of five qualities throughout an EWS:

- Coordination
- Communication
- Institutional Capacity
- Ownership
- Empowerment of the user

Coordination

Coordination must be increased at all of the levels involved in an EWS.

Between NGO's/Donors

- A need for greater coordination between donor NGOs working in the GHA to avoid duplication of effort
- Duplication of donated meteorological/hydrological equipment is an issue as is the

requirement of donors to spend money within a pre-defined timeframe.

- Examples were given of some organisations having multiple items of the same piece of equipment but no-one trained to use or maintain that equipment.

Outcome

- WMO to organise a forum for coordination and collaboration of UN System Organisations and Development Partners in the implementation of hydrometeorological projects that address multi-hazard early warning systems (MHEWSs) for DRR in Africa through enhancement of NMHSs on the continent to minimize duplication of efforts and make optimum use of available resources.
- WMO to reach out to fellow UN organisations to develop weather and climate service procurement frameworks which ensures national capability and sovereignty remains at the heart of any service delivery and is in line with the WMO Convention of 1947.

Between nations in a region

- Flooding disasters do not respect international borders, often affecting more than one country in a region
- Almost every nation in the GHA shares a watershed/river basin with at least one other nation in the region. There needs to be increased collaboration between NMHSs in the GHA so that upstream and downstream observations and forecasts can feed into individual countries' EWSs
- Increased collaboration could build on the example of the Greater Horn of Africa Climate Outlook Forum (GHACOF) which already sees NMHS and other institutions & stakeholders collaborate in respect of the production and dissemination of the seasonal forecast
- Clear mandate for regional bodies or role in region
- Transparency in Disaster Response Reduction (DRR) protocols' between individual nation's governments is required. Some countries in the GHA are still in the planning stage when it comes to implementing the Sendai Framework. Their DRR procedures should be shared amongst neighbours to aid regional coordination of response efforts
- The proposed Southeast Europe Multi-Hazard Early Warning System (MHEWS) provides an example of the benefits of increased regional co-ordination, with nations in that region grouped into dynamic clusters with a unified operation, building on some parts already operational.

Outcome

- Proposed that WMO support individual countries in the GHA to have appropriate and available DRR protocols, with principles from the *Sendai Framework* embedded
- Increased coordination between national institutions across the GHA region is necessary to develop and share standard operating procedures. This will allow implementation of a MHEWS operating on a regional scale with nations able to be grouped into dynamic clusters as per SE Europe
- Sharing best practice.

Between institutions in a nation

- Strong evidence to support the increased efficacy of *joint* meteorological and hydrological centres when producing warnings for flooding, for example the UK Met Office and Environment Agency's collaborative flood forecasting centre (FFC)
- Many nations in the GHA do not have joint meteorological and hydrological centres, and additionally lack close working relationships or easy exchange of data and guidance. This leads to confusion and inefficiency in the creation of warnings for natural hazards and disasters.

Outcome

- National meteorological and hydrological centres need to forge links between their institutions and coordinate their warnings and responses to flood situations. Mechanisms for efficient, free exchange of data must be developed and personnel trained to understand the technical language of their counterparts, as well as how to communicate their messages plainly and unambiguously to the media and public.
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Between NMHSs and national governments

- National governments are ultimately responsible, and liable, for the protection of their citizens. Their response to flooding events must be coordinated with NMHSs to ensure effective and timely action
- National governments should look to harness all aspects of the government infrastructure, including not only the traditional DRM agencies but also utilising the capability offered national defence forces and also linkages into the often extensive civil society networks.

Between national governments and users of EWS

- National governments must coordinate with user communities so that the latter are aware of their government's response-procedures and the former understand what is required by their user communities
- Local government and community leaders should be involved in creating protocols, which can then be fed back to communities, for how to respond in a flooding crisis. Such protocols might include the following information:
 - Knowledge of where community members can shelter
 - Where community members should be evacuated to, if necessary
 - What special measures are in place for children, less able and elderly persons
 - Provision of food, security of existing assets & property, return and rebuild plans following any disaster.

Communication

Communication is an essential component in any EWS chain and must be improved/consolidated at all levels if a warning is to be timely, relevant and effective. Good communication is also required if coordination between actors is to be increased.

Official flood warnings are often managed and communicated through the DRM agency. NMHS need to work as an effective component of the national DRM process in the dissemination and communication of EWS.

Between users of EWS and Suppliers of Warnings

- For any EWS to be effective it must understand the needs of its users, and ensure users are involved in the EWS design as well as its implementation.
- Increased dialogue between EWS suppliers and recipients of warnings will help to ensure that the former understand the needs of the latter, which includes an appreciation of local culture, custom, media and geography.
- In order to reach the User Groups at the "Last Mile" located on the margins of society at the grassroot level, WMO must enact a policy or resolution that recognises incorporation of Indigenous Knowledge (IK) and Traditional Forecasting Systems (TFSs) as well as their conveyance into the scientific forecasting methods including service delivery, advocacy, communication and outreach programmes

Education

- One of the most effective ways to build rapport and understanding between NMHSs, governments and user communities is through mutual education
- Primary education in particular can be instrumental in building long-term trust and understanding of the risks of flooding in a community, and what actions they can take
- Education of suppliers of NMHSs as to local customs and culture is also essential. It will inform how they decide to disseminate a flood warning, and what barriers to action they can expect from their user communities
- Re-education of user communities regarding both the risks of flooding and the courses of action available to them is also important. Research has demonstrated that powerful, action-inducing memories of natural disasters tend to persist in communities for only 7 years. Frequent reminders and re-education of the hazards and threats that a community may periodically face ensure the resilience and alertness of the community will remain high
 - Drills, practise warnings and 'dry-runs' of responses to disasters are effective methods of (re-)education
 - Visual reminders of disaster threats help to improve the longevity of communities' memories of those disasters
- Climate change adds additional need for re-education as unprecedented weather

patterns may cause new/unusual disasters, which have not occurred in living memory

- User communities must also be educated in what action they can take in the event of a flooding event, so that they understand:
 - That they might need to be evacuated
 - Where they will be taken if they are evacuated
 - What to do to help children and the elderly during flooding events
 - What they can expect in the aftermath of a severe flooding event
 - When they can return

Media

- Media is an essential part of any EWS and one of many tools for the dissemination of a warning.
- Knowledge of the types of media that user communities possess (and favour) is essential for governments and NMHSs when disseminating a warning
- Many remote, rural communities in the GHA rely on VHF radios as a primary method of communication. This type of media, in particular, necessitates a concise, coherent warning message
- It is important that the media involve the communities to help disseminate warnings. Here, knowledge of community demographics is important to ensure that every group is targeted by some form of media
- For example, one community may rely heavily on radio or television, whereas others are better reached through local religious institutions or by their community elders visiting their homes in person
- Multiple forms of media need to be used, but there must be coordination with NMHSs, DRM and governments to ensure that a concise, precise and identical message is disseminated so that contradictions and confusion are avoided
- Those responsible for disseminating warnings must remain abreast of developments in media and communications technology
- The increase in mobile phone usage in the GHA opens new possibilities for effective dissemination of a flood warning
- Mobile phone usage in the GHA is predicted to continue to increase in the coming decades, allowing many more users to be reached by SMS. However, in many agricultural communities far fewer women/children have mobile phones than men, so communication by this media is disadvantageous for them and creates a gender discrepancy in the efficacy of an EWS reliant on mobile phones

Outcome

- NMHS must work with national DRM agencies to ensure information and advice reaches all forms of media allowing a unified message to be disseminated to all users
- New forms of media offer new avenues for dissemination of warnings
- NMHSs and governments must remain aware of developments and trends in communications, capitalising on new opportunities but with awareness of any embedded demographic discrepancies.

Institutional capacity

Increasing national institutions' capacity is another essential ingredient for the improvement of EWSs. If realised, it will: enable the inter-institutional communication and coordination to be achieved; increase country ownership of both their national meteorological and hydrological systems and their EWS and disaster response; and increase institutional capacities allowing them to operate free from external support or aid in the long-term.

Technology and data

- National institutions need to have functional and comprehensive meteorological and hydrological networks to provide NMHSs with enough relevant data to generate accurate forecasts and guidance
 - Projects like IGAD-HYCOS are helping to address technological short-comings in GHA nation's hydrological observing systems by providing 163 real-time stations for hydro-data
 - Donor organisations will often provide expensive items of technical equipment but with funding only for 1 – 3 years of operational support.
 - Once donor funding ceases, government funding for NMHSs in the GHA is often insufficient to meet the operational running costs of expensive equipment

and so the technology becomes redundant

- Donor organisations will also sometimes fail to provide sufficient training for staff to operate technical equipment in their absence. When donor support is withdrawn, NMHSs are then left unable to operate the equipment effectively. The donor community needs to think longer term or come together with governments to consider how investments can be made sustainable
- NMHSs in the GHA often lack extensive and detailed historical records of relevant meteorological and hydrological data, necessary for improving climate expertise and flood forecasting skill.
- Projects, for example at ICPAC, are helping 'rescue' historical data and create digital record sets for NMHSs

Investment in leadership and soft skills

- Increasing institutional capacity requires investment not just in technical systems, but in social systems too; developing internal leadership skills and confidence is essential
- There is a reluctance on the part of donor organisations to invest in social systems because:
 - It is difficult to quantify monetary returns on this type of investment
 - Returns from investments are often only realised in the long-term (eg at least 3-5 years after the initial investment is made)

Outcome

- Donor organisation investment philosophies need to be challenged to combat this desire for clear-cut 'short-term' returns on donations
- Donor organisations need to show greater willingness to invest in less tangible social systems within institutions such as leadership
- Donor organisations need to pursue a more 'long-term' approach to technology and funding in the GHA which should include working with government and other agencies to ensure long-term sustainable funding beyond the lifetime of any project completion. Training needs to be provided alongside technical equipment and an agreed funding plan with the recipient organisation so that operational costs will always be covered by at least one party
- Governments in the GHA need to provide reliable and sufficient funding to NMHSs
- There is scope for exploring mechanisms to monetize the sector (eg by selling data) or involve the private sector, however, both of these options need to be approached with caution to ensure coordination and communication between institutions on both intra and inter-national levels is not compromised
- NMHSs should embrace technical solutions that lower their operational costs where possible; for example, improvements in satellite-derived rainfall rates will increasingly lessen the need for individual countries to operate a network of weather radars
- Continued support is necessary for those projects involved in the rescue of meteorological/hydrological data and creation of digital historical records.

Other countries provide ideas of how institutional capacity can be improved

- Southeast Europe - where countries are developing a MHEWS that will operate on a regional scale by grouping nations into dynamic clusters.
 - This example highlights the need for institutional capacity to reach a level where NMHSs and governments can co-operate throughout the GHA region and operate in groups of nations rather than individually
- United Kingdom (UK) – Following a government review of a major flooding event in 2007 the UK Government realised that both meteorological & hydrological organisations needed to collaborate more effectively to reduce the impact of future flooding events. This eventually led to the creation of the joint met / hydro agency Flood Forecasting Centre (FFC). The FFC has since been deemed invaluable for flood warning and protection, demonstrating the benefits to countries in the GHA of an increase in the institutional capacity of NMSs and NHSs and allowing similar collaboration
 - The UK FFC also recognises the importance of building trust and rapport with their user groups by long-term usage of highly-recognisable icons

Outcome

- NMHSs and governments in the GHA should look to the EWSs and flood forecasting processes adopted by other countries to see how their own institutions'

capacities might be increased.

Ownership

Warnings of any kind contain responsibility. Therefore, for an EWS to be effective actors at every level of the chain need to take responsibility for their part in the process. The best way to ensure that all the actors, including the recipients of warnings feel responsible is to increase their ownership.

At the intergovernmental level

- The WMO must provide support and advice to its members to work across their own national DRM agencies, and for the DRMs to ensure that DRR procedures are in place that incorporate, as much as possible, UNISDR guidance, and the *Sendai Framework*

At the governmental level

- Governments in the GHA need to increase their efforts to mitigate the risks to their people conferred by flooding. They must be aware that ultimately it is their responsibility to protect and help the citizens in their country. This ownership can extend to:
 - Helping to unite meteorological and hydrological institutes
 - Ensuring NMHSs have access to sufficient funding to operate the necessary technical systems for an effective EWS
 - Ensuring NMHSs have access to appropriate media for dissemination of warnings
 - Mobilising the whole spectrum of government assets including those from the armed forces to assist with warning dissemination, pre-disaster preparation and post-disaster response

At the intra-national institutional level

- NMHSs need to improve the dissemination of their warnings/forecasts, by:
 - Working in partnership with all actors in the national DRM infrastructure to ensure hydromet information is assimilated and communicated across the official DRM channels
 - Ensuring their forecast or warnings meet the needs of users
 - Ensuring their forecasts are timely and accurate
 - Ensuring their forecast is disseminated to all appropriate forms of media (this includes managing a network of appropriate media contacts)
 - Ensuring their forecast is communicated in simple language, using lay terms that will resonate with the media and recipients of the warning
 - Ensuring consistency in the forecast message, so that the media are dealing with one, authoritative voice at all times

At the community level

- Communities must take ownership of disaster situations:
 - Ensuring warnings are communicated to all sections of the community
 - Ensuring that all community members understand the requirement to act
 - Empowering community members with knowledge of what action(s) they can take
 - Community leaders can and do play a significant role in facilitating this.

It is recognised that identifying a need to increase ownership is easier than actually bringing about that increase. To achieve the outcome requires work from intergovernmental bodies to impress upon governments their responsibility, with regards to EWS. This points to a need for governments and donor organisations to invest more in the social systems of institutions, building leadership skills in the relevant work forces that will enable change to occur.

Empowerment of the user

The tragic destruction wreaked on the Philippines by typhoon Hai'an in 2013 is testament to the importance of user empowerment in any EWS. When Hai'an struck, although it was well

forecast and warnings had been disseminated, many communities were unsure how to act or why they should take action. Some people rushed for underground shelters unaware that the typhoon's storm surges would inundate them; others simply failed to act altogether, lacking the empowerment or incentive to do so. Too often EWSs are designed without sufficient understanding of the warning's recipient, which lessens their efficacy. Users should therefore participate in the design of any EWS.

To empower a user (of an EWS) to act, it is first essential to ensure that the user has both received and understood a warning. To ensure that this occurs disseminators of warnings must be familiar with local culture and customs so that the warning is communicated appropriately. Knowledge of local culture allows senders of warnings to:

- Ensure their message reaches all demographics in a community, not just one gender or sector of a society
- Research demonstrates that women in most rural communities are significantly more likely to lose their lives than men due to a variety of local customs (eg lower levels of mobile phone ownership and proximity to dependent children).
- Knowledge of the specific customs that provide barriers (to female survival) is essential if those barriers are to be targeted and overcome.
- Ensure appropriate members of the community, including tribal chiefs, village elders and/or religious leaders, play a role in facilitating the dissemination of the warning messages

Having received a timely, accurate and intelligible warning, users will only be empowered to take action if they know *what* actions they can or should take. This again requires detailed knowledge of the specific user groups which an EWS is targeting.

How to provide communities with knowledge of what actions they can take

- Educating communities about their options requires input from government institutions, schools and community leaders
- Governments need to liaise with community leaders to develop or adapt (existing) disaster response protocols that are appropriate for that particular community. Local leaders can then educate their communities as to the procedures they should follow
- Schooling provides a long-term mechanism for educating communities as to their options in a disaster
 - It is acknowledged that it can take a generation for this knowledge to truly embed, as children are rarely decision makers for their communities
- Frequent drills and dry-runs of disaster scenarios within communities further reinforce knowledge within that user group of how to respond in flooding events

How to ensure users to take action in flooding events

- For those disseminating the warnings, this is one of the most critical aspects of an EWS to understand. There is extensive research that demonstrates people will often not take drastic, preventative action unless they are incentivised to.
- Incentives are required because in some communities people:
 - Have ancestral ties to the land they live on and a fear of 'land grab' in their absence
 - Are afraid to leave their homes and concerned that if they do they will never be able to return
 - Fear that their livelihoods will be irreparably damaged
 - Wish to remain with children, relatives or animals who refuse to, or cannot leave, their community
 - Believe they can endure the adversity any floods will bring
 - Do not fear for their survival
 - Partially or wholly doubt the accuracy or validity of flood warnings
 - Do not trust the government or foreign NGOs to ensure their welfare
 - Cannot imagine or comprehend disaster on the scale that is being forecast
 - The barriers that prevent user action vary according to region and geography, but understanding what they are is paramount if appropriate incentivisation is to be achieved
- Incentives, like barriers, vary across regions, however some generic examples are:
 - Instructions or advice from community leaders urging community members to take appropriate action

- Knowledge of where community residents will go in the event of evacuation
- Reassurances from government that they will be able to return to their homes
- The blessing or instruction of spiritual or religious leaders to take action
- Mobile cash transfers, such as 'forecast based finance', so that families have some resources to depend upon if they have to evacuate their homes
- Knowledge that children, pets and elderly relatives will be catered for in any disaster response effort
- Knowledge that individuals have a role to play in responding to a disaster in their community
- Actors involved in delivering EWSs to users must invest time and resources in understanding the communities they are trying to help. They must have knowledge of their users' local customs and culture both to ensure warnings are communicated effectively, but also to ensure that they are acted upon.
- If communities know how to respond to flooding events and have appropriate incentives there is a greater chance that they will respond effectively.

Barriers to progress

This report has identified aspects of the EWS chain that need to be improved if truly effective EWSs are to be achieved in the GHA. However, it is important to acknowledge that there are also barriers, in parts of the GHA, which prevent some or all of these improvements from being realised. Below are examples of barriers that affect one or more nation in the GHA:

Political barriers

- Political instability and conflict prevalent in parts of the GHA which makes regional coordination difficult and weakens national institutions over time

Lack of funding

- Some countries in the GHA have weak or fragile economies and government funding and support for NMHS is often limited or non-existent
- Hydrometeorology is a key component of an effective DRM process but some governments are not in a position to prioritise resources due to severe limitations in funding which can lead to lack of visibility, which in turn leads of a significant funding shortfall
- Without political stability and economic improvements, it is unlikely that large sources of home-grown funding for NMHS and EWS will become available in all GHA nations

Lack of political interest

- Individual governments in the GHA may have insufficient political incentive or interest to engage with EWSs or their counterpart NMHSs until a disaster happens. Prioritisation of other areas weakens the relevant national institutions over time and makes regional coordination slow and unreliable, limiting the efficacy of the whole GHA's potential for effective EWSs.

UNISDR EWS Guidelines in relation to Flooding

A number of suggestions were made in relation to UNISDR's four-part framework for EWS that relate specifically to flooding. These will be fed into the review of the UNISDR EWS in 2017:

Risk Knowledge

- In some places, risk knowledge is poor and would benefit from increased risk mapping
- Risk mapping is useful but limited by only providing a static assessment of present hazards, when climate change may alter the frequency/type of risks in the future
- Users of EWS are often unaware of their nation's response capacity during disasters
- Multi-hazard assessments are useful
- There are too few water-level measurements taken on river basins in the GHA

Warning Service

- Forecasts and warnings need to be impact-based
- Forecasts and warnings need to be clear, unambiguous and easily understood
- To be 'people-centred' EWS need to be designed in collaboration with the user groups
- Warning services need to be accountable if warnings are issued late, or are contradictory or ambiguous in their message(s)
- National forums may help to increase communication and data sharing between institutions
- EWSs need to consider the vulnerability of their user groups to different types of risk when creating a warning for those users

Dissemination

- There need to be mechanisms for users of EWSs to provide feedback to the warning suppliers
- Innovative approaches and techniques for dissemination should be explored, for example colour-coded warning icons and impact-based matrices

Response Capability

- Once users lose confidence in an EWS, it is difficult to regain their trust
- More focus needs to be directed on the long-term implications of flooding events, such as disease epidemics and damaged homes and livelihoods
- Attention should be focussed on changes in land use that will lessen risks and hazards for vulnerable populations. For example, restoration of coastal mangrove forests can greatly reduce the risk of storm surges flooding coastal communities.

Country-specific next steps and resolutions

Ethiopia

- More data-sharing between Ethiopia and neighbouring countries is needed, in particular, upstream and downstream data for contiguous river systems
- Ethiopia needs to initiate standardised data series for hydrological data
- Ethiopia should work to complete the remaining 50% of the Woreda risk profiles
- Institutional capacity will be increased nationally through effective training of employees
- Ethiopian representatives at the conference will feed their conclusions back to their country's disaster response commission

Uganda

- More focus needs to be given to urban flooding, and Kampala in particular
- Uganda representatives at the conference will ask the Prime Minister's office to help them bring together all the relevant stakeholders to improve their nation's EWS, including community councils, faith-based organisations, user community leaders and transport companies

Kenya

- Existing EWSs within Kenya need to be upscaled to cover the whole country
- Kenya needs to develop a MHEWS, which is designed in collaboration with key stakeholders, civil societies and user communities
- Meteorological/hydrological observing systems need to be upgraded and their capacity needs to be increased
- The national flood warning centre needs to be expanded and incorporate more NWP models into its forecast process
- User communities' risk knowledge and preparedness needs to be improved

IGAD

- The WMO will be approached to provide more region input and coordination, in particular to coordinate donor/NGO efforts in the GHA
- Efforts will be made to fundraise for this cause.

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