Early Warning as a Human Right

Building resilience to climate-related hazards

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

UNEP

Early Warning as a Human Right: Building Resilience to Climate Related Hazards

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Contents

Glossary

Adaptation: Adjustment in natural or human systems to a new or changing environment, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.

Climate: Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.

Climate change: The UN Framework Convention on Climate Change defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods."

Disaster: Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery.

Disaster risk reduction: The conceptual framework of elements intended to minimize vulnerability to disasters throughout a society, to avoid (prevention) or limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development.

Drought: The phenomenon that exists when precipitation is significantly below normal recorded levels, causing serious hydrological imbalances that often adversely affect land resources and production systems.

Early warning: The provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare an effective response.

Early warning system: The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities, and organizations threatened by a hazard to prepare to act promptly and appropriately to reduce the possibility of harm or loss.

Floods: Usually classified into three types: river flood, flash flood and storm surge. River floods result from intense and/or persistent rain over large areas. Flash floods are mostly local events resulting from intense rainfall over a small area in a short period of time. Storm surge floods occur when floodwater from the ocean or large lakes is pushed on to land by winds or storms.

Livelihood: The resources used and the activities undertaken in order to live. Livelihoods are usually determined by the entitlements and assets to which people have access. Such assets can be categorized as human, social, natural, physical, or financial.

Hazard: A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Resilience: The capacity of a system, community or society potentially exposed to hazards to adapt by resisting or changing in order to reach and maintain an acceptable level of functioning and structure.

Risk: The potential for consequences where something of human value (including humans themselves) is at stake and where the outcome is uncertain.13 Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the consequences if these events occur. This report assesses climate-related risks.

Traditional knowledge: The knowledge, innovations, and practices of both indigenous and local communities around the world that are deeply grounded in history and experience. Traditional knowledge is dynamic and adapts to cultural and environmental change, and also incorporates other forms of knowledge and viewpoints. Traditional knowledge is generally transmitted orally from generation to generation. It is often used as a synonym for indigenous knowledge, local knowledge, or traditional ecological knowledge.

Vulnerability: An intrinsic feature of people at risk. It is a function of exposure, sensitivity to impacts of the specific unit exposed (such as a watershed, island, household, village, city or country), and the ability or inability to cope or adapt. It is multi-dimensional, multi-disciplinary, multi-sectorial and dynamic. The exposure is to hazards such as drought, conflict or extreme price fluctuations, and also to underlying socio-economic, institutional and environmental conditions.

Human Rights-Based Approach: A human rights based approach is about empowering people to know and claim their rights and increasing the ability and accountability of individuals and institutions who are responsible for respecting, protecting and fulfilling rights.

Abbreviations

Abbreviation	Term in full
CBO	Community Based Organization
CDKN	Climate and Development Knowledge Network
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EWS	Early Warning System
FbF	Forecast based Finance
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
HFA	Hyogo Framework for Action
HRBA	Human Rights Based Approach
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Intergovernmental Panel on Climate Change
LPP	Livelihood Protection Policy
MCII	Munich Climate Insurance Initiative
MNO	Mobile Network Operator
NDMA	National Drought Management Authority
NGO	Non-Governmental Organization
ODI	Overseas Development Institute
UN	United Nations
UNDG	United Nations Development Group
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNISDR	United Nations International Strategy for Disaster Reduction
WHO	World Health Organization

Foreword

This year is critical for progress on three global challenges: sustainable development, disaster risk reduction and climate change. In March, national governments finalized the Sendai Framework for Disaster Risk Reduction 2015-2030. In September, nations will commit to the Sustainable Development Goals. Finally, in December, a new agreement on climate will hopefully be reached during the Convention of the Parties (COP 21) of the United Nations Framework Convention on Climate Change.

These three global challenges are interrelated. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change concludes that precipitation patterns are changing, sea levels are rising, and the frequency and intensity of temperature extremes are increasing. Extreme events can result in significant human and financial loss, jeopardizing development gains and entrenching poverty in areas with limited social safety nets. As expressed in the Sendai Framework, "It is urgent and critical to anticipate, plan for and reduce disaster risk in order to more effectively protect persons, communities and countries, their livelihoods, health, cultural heritage, socioeconomic assets and ecosystems, and thus strengthen their resilience."

To achieve resilience, governments and citizens must be empowered to take action. Early warning systems can be used to share information about climate-related hazards, helping individuals and communities anticipate risks in advance. In so doing, early warnings can reduce the loss of lives and property when hazards approach.

This highlights links between early warning of climate related hazards and human rights. It is now well understood that climate change adversely affects a broad range of human rights. A safe, clean, healthy and sustainable environment is indispensable to the full enjoyment of human rights, including rights to life, health, food, water and housing, among many others. Human rights and a human rights based approach can also be used as a tool for solutions, ensuring that needs of the vulnerable are considered in planning and service providers are held to account.

With this in mind, the report evaluates ways to ensure delivery of effective early warnings to people in the most vulnerable situations. To develop the report, UNEP went directly to communities in Burkina Faso, Ghana and Kenya. In household interviews and focus group discussions, women, disabled individuals, the elderly and youth, in both rural and urban areas, shared their concerns about climate change and identified ways to better design early warning systems. The results were combined with stakeholder meetings and comprehensive literature reviews to ensure the views of expert practitioners and scholars were also taken into account.

Even though significant gaps remain in the countries' early warning efforts, various opportunities exist for improvement. These are mainly found in the combination of people's increased access to multiple communication channels, such as mobile phones and media, and the use of low-technology warning channels aligned with local communities' characteristics and capabilities, such as flag systems. To heighten the effectiveness of early warning responses, the report presents frameworks containing best practices.

The findings in this report aim to provide policymakers with a better understanding of the needs of early warning users and can be used in building community-based, multi-hazard early warning systems. It is our hope these systems will be developed through participatory processes, as called for in the Sendai Framework.

Achim Steiner
UN Under-Secretary-General,
UNEP Executive Director

Executive Summary

Key messages:

Climate change can affect the enjoyment of a broad range of human rights.

Early warning systems (EWS) can improve resilience of households to climate related hazards, by providing information for early action. However, to be effective, early warning systems must themselves incorporate aspects of resilient systems: diversity, flexibility, local relevance, learning, acceptance of change, consideration of justice and equity.

Every individual has the right to information about climate related hazards. Indeed, access to information is not simply a liberty right but a welfare right. Early warning is necessary for the enjoyment of basic human rights including the right to life.

The success of early warning is not based solely on technical or meteorological systems, but is dependent on social systems. Marginalized or impoverished individuals or groups may not receive or be able to respond to warnings. Addressing factors that increase vulnerability, such as poverty, inequality and lack of education, can help improve outcomes of warning systems. Early warning must therefore not be considered a service provided solely by meteorological agencies. Development practitioners must also contribute. Achieving development goals is critical for warning success.

A Human-Rights Based Approach can be used to help improve early warning systems. HRBA can help ensure early warning systems focus on the needs of the most vulnerable. HRBA also can provide mechanisms with which to hold warning providers to account. For example, citizen Report Cards or Community Score Cards could be examined as tools to enhance transparency and offer rights holders with means to hold duty bearers to account, helping ensure the creation of people-centered early warning system.

To ensure early warning results in early action, it is critical that communities have developed relevant and effective response plans, and that they have access to finance mechanisms that allows them to engage in this response after a warning is received. Forecast based finance is a new tool, currently being piloted in several countries, which may help ensure early action. However, thresholds for action need to be identified and tested for different hazards and sectors.

At the 2010 UN climate talks, the 16th session of the Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC), governments committed to "**a maximum temperature rise of 2 degrees Celsius** above pre-industrial levels." Five years later with the 21st Conference of the Parties of the UNFCC approaching, governments are working to finalize intended nationally determined contributions (INDCS), which will outline cuts to greenhouse gases. Significant emissions gaps remain (UNEP, 2014a).

Regardless of the outcome, the earth's climate is already changing. According to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change land and ocean surface temperatures have already increased by nearly 1°C since 1901 (0.89°C global average) mainly as a result of anthropogenic activities[1]. Between 2016 and 2035 further warming of 0.3 to 0.7°C is likely (IPCC 2013)[2]. The frequency and intensity of extreme events, such as heat waves and precipitation has been altered (IPCC, 2014). With adaptation gaps increasingly apparently (see UNEP, 2014b), there is an urgent need to build resilience to climate related hazards!

Early warning systems (EWS) can be used to help communities and households anticipate climate related hazards and take early action. By filling gaps in knowledge about climate related hazards, they offer an adaptation tool. In March 2015, governments around the world agreed to the Sendai Framework on Disaster Risk Reduction. In doing so, they committed to "substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030". They also promised to "Invest in, develop, maintain and strengthen people centred multi-hazard, multi-sectoral

1 Contributions from natural forcing and internal variability are both likely in the range of -0.1°C to 0.1°C (IPCC 2013).

2 Note this represents a global mean. Inland and high latitude changes may be much higher.

ES Figure 1. Word cloud of early warning response needs based on 1003 answers from community surveys. Larger words were mentioned more often by respondents.

forecasting and early warning systems, disaster risk and emergency communications mechanisms, social technologies and hazard monitoring telecommunications systems."

Since 2013, the United Nations Environment Programme's (UNEP) Climate Change Early Warning Project (CLIM-WARN), supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, has sought to identify how to design multi-hazard early warning systems and how to better communicate risks of hazards to the most vulnerable. Consultations have been held with policy makers, academic experts, non-governmental organizations and vulnerable communities in three countries: Burkina Faso, Ghana and Kenya. The report, *Early Warning as a Human Right: Building Resilience to Climate-Related Hazards*, highlights the results of household surveys, focus group discussions, expert stakeholder meetings and literature reviews.

Participants in Focus group discussions in Burkina Faso © Z. Zommers

ES1 What climate related hazards are important to communities?

Floods and droughts are prevalent in Burkina Faso, Ghana and Kenya. Other hazards mentioned by communities include disease outbreaks, the spread of crop pests, windstorms (Ghana, Kenya), bushfires (Ghana, Burkina Faso), and landslides (Kenya). While sites within a country face different hazards, all face multiple hazards. This highlights the critical need for multi-hazard warning systems. Diverse socio-economic indicators result in different vulnerability profiles in different regions of each of the countries. Warning systems are thus challenged to provide a standard service, but ensure warnings are appropriate to local conditions and needs.

While large disasters, such as the 2012 famine in the Horn of Africa, recieve the most media attention and humanitarian response, community members consider small scale and low impact hazards the most damaging. Extensive risk is traditionally under-reported and is rarely captured in global risk modeling (UNISDR, 2015). Yet over time small-scale events erode livelihoods and assets, jeopardizing long-term development gains. Early warning systems must not only identify large-scale hazards but must also cover extensive risks and exposure.

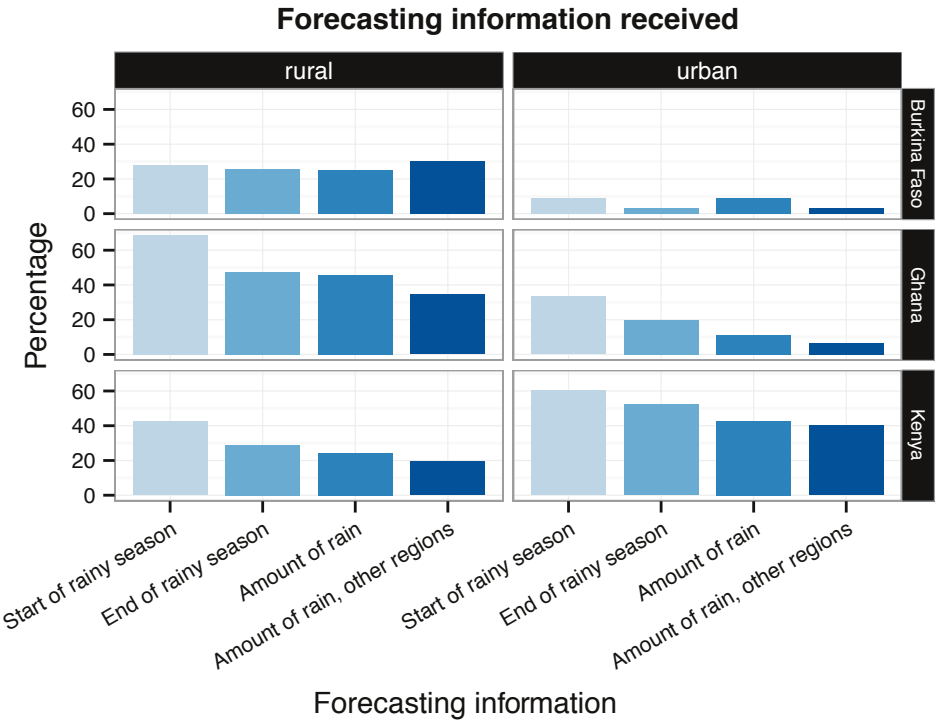
ES2 What is the status of existing EWS in the study countries?

Many respondents, particularly in urban areas, do not receive warnings. It is also noticeable that in urban areas there are fewer institutions that disseminate warnings. Perhaps hazard and climate related information is perceived as more relevant to groups in rural areas such as farmers. However, hazard risks extend to urban areas and substantial economic losses may occur here as well. **Warning system coverage needs to extend to both urban and rural areas and must provide information relevant to each different group of users.**

Nairobi © Z. Zommers

Village in Burkina Faso © Z. Zommers

Not all institutions are trusted equally. Institutions that provide official warnings may be less trusted than traditional institutions such as village elders or religious groups. Across countries in rural areas, **family, friends, community members and religious groups are generally the most important channels through which people receive early warnings, highlighting the importance of social networks for the communication of warnings.**



ES Figure 2 Percentage of respondents that received different types of information

Women in Burkina Faso © Z. Zommers

Women in Kenya © Z. Zommers

ES3 Who are the users of warnings?

The users of EWS are diverse in terms of vulnerability and coping capacity, knowledge of hazard risks, use of media, trust in institutions, hazard preparedness and response options. They have different needs. It is challenging to design an effective EWS which accounts for diversity but delivers uniform service.

Generally, people living in rural areas have a larger household size, a greater number of dependent children, lower education levels and limited diversification of livelihood sources. Such factors increase vulnerability to the impacts of climate related hazards. Households in urban areas had higher levels of education and a greater diversity of income sources. This is likely to increase their ability to bounce back from shocks.

EWS will only be effective if concerted action is taken to reduce vulnerability and underlying drivers of risk such as poverty and inequality. This requires investment in basic services and social protection mechanisms in marginalized areas.

Even within communities, vulnerability differs between households and individuals within households. The poor and those who face discrimination, especially multiple and intersecting forms of discrimination, and those who lack social safety nets are the most affected by hazards. Women have less education, are more likely to be illiterate, and are less likely to engage in wage labour. The IPCC's Fifth Assessment Report underscored that existing gender inequalities, manifested for example in women's limited access to financial resources or wage labour, land, education, health care and other basic rights, prevent women from coping and adapting to climate change impacts. The disabled and elderly are also vulnerable. In the study, they reported problems accessing warnings. Reasons included: information is provided in an unsuitable format for individuals with impairments, inability to access information points due to limited mobility, lack of proper representation in community committees, and low confidence or trust in existing institutions. Individuals that receive warnings were generally better connected to information providers, with links to multiple institutions. To ensure all indiviudals recieve messages warnings must be sent through multiple sources and trusted channels in several different formats.

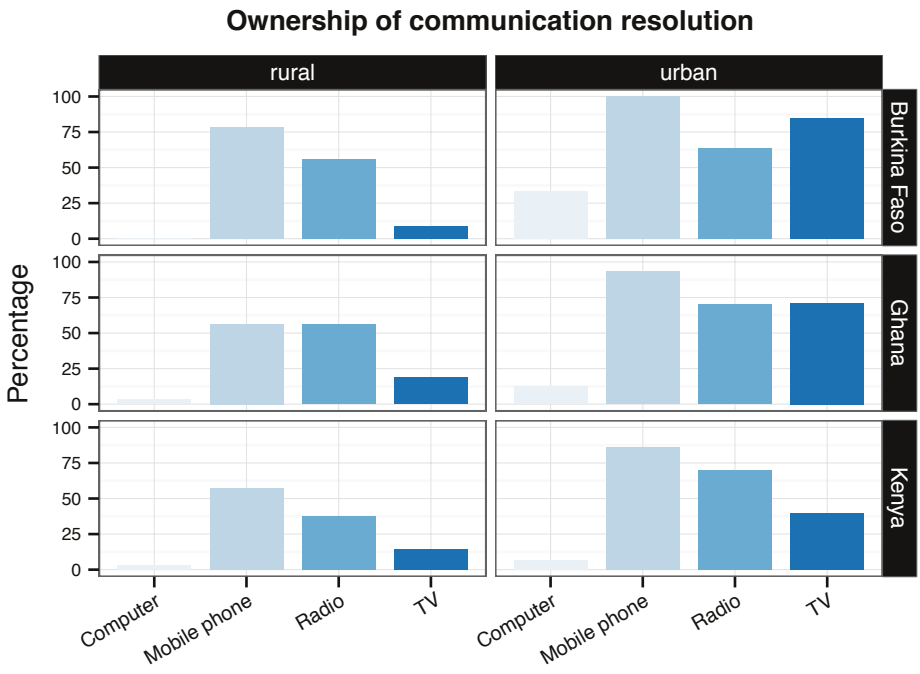
ES4 How should early warning be communicated?

Radios are prevalent in both urban and rural areas in the three case study countries, and use of the mobile phone is increasing. In urban areas sampled, ownership of mobile phones was above 90 per cent, while in rural areas the rate was between 55 and 80 per cent. Mobile phones are the fastest growing communications technology around the world. Growth is especially high in developing countries (World Bank, 2014). As such, this communication channel can play an important role in warning systems. However, gaps in coverage, limited ownership of phones or ability to read messages, and problems financing SMS distribution limit current suitability. In order to increase the certainty that a household will receive the warning, early warning messages should be disseminated through multiple communication means. Messages have to be sent in many different formats, though many different channels, and address different information needs.

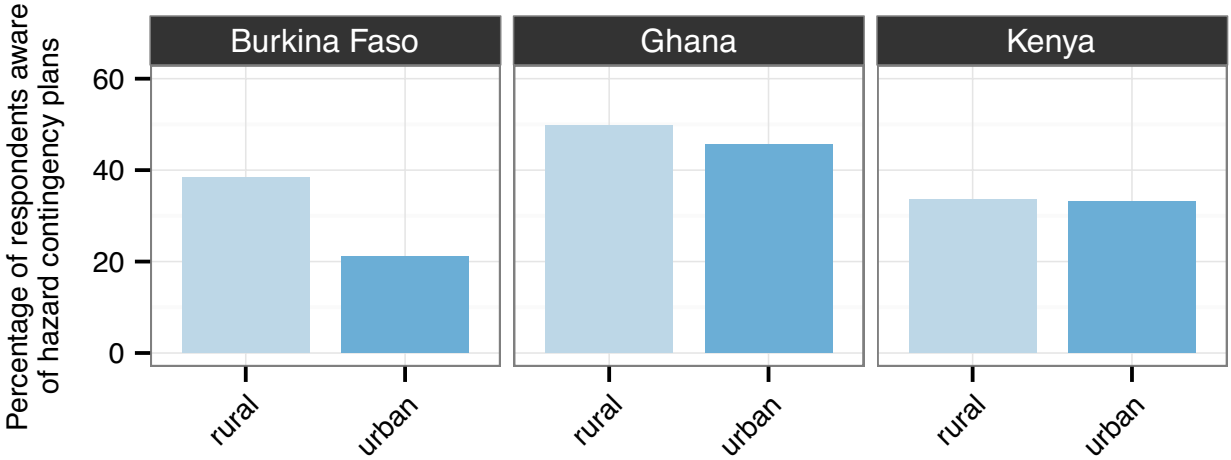
ES5 How can early warning lead to early action?

After warnings have been communicated early action needs to be initiated by recipients in order to minimize loss (UNISDR, 2014). Response options may focus on ensuring safety from sudden onset hazards (evacuation; shelter; protection of property; closure of infrastructure; and having an emergency team on standby) to building long-term resilience (changing agricultural and environmental management practices; introducing water conservation techniques; building climate proof infrastructure; purchasing insurance). Survey respondents generally had little awareness of response plans or options. **Communities requested training or education to improve knowledge of appropriate actions. Warning messages could also include specific instructions for protecting life and property.**

It is critical to build and strengthen the capabilities required to respond. Lack of funding often hinders response. **To ensure early action, financing needs to be made available. Expansion of risk transfer mechanisms, at the individual or sovereign (country) level, may improve resilience to hazards.**



ES Figure 3 Percentage of respondents owning communication devices. Urban areas have a greater access to different modes of communication. In Burkina Faso about one third of respondents indicated computer ownership, compared to around 12 per cent in Ghana and just three per cent in Kenya. This may not be representative and may be explained by the selection of the research sites.



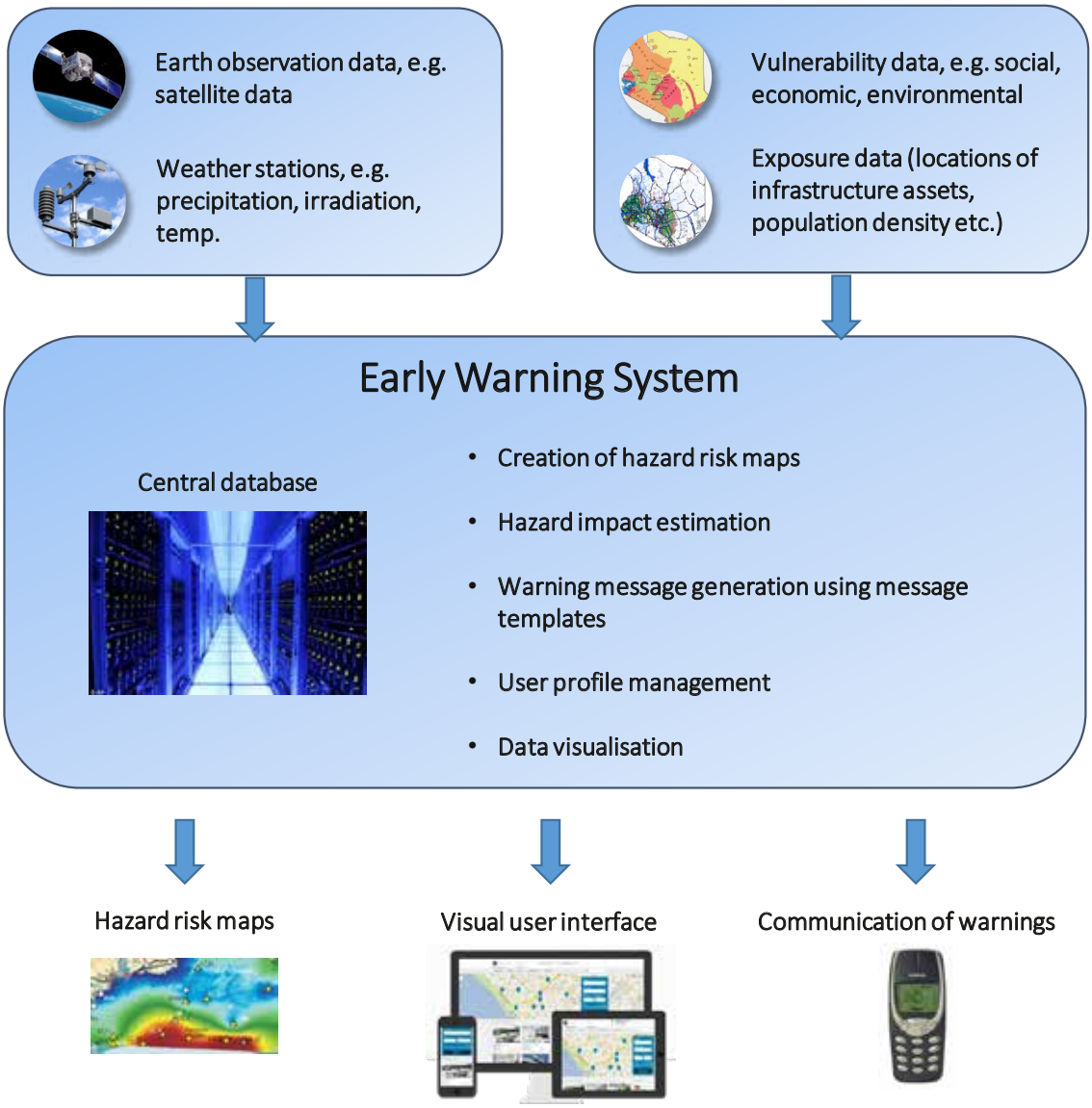
ES Figure 4 Awareness of contingency plans

Risk transfer mechanisms include risk insurance (crop insurance, weather related index based insurance, national hazard insurance), reinsurance instruments, and catastrophic insurance pools. **African Risk Capacity is an example of an initiative that could be expanded to help ensure improved response to climate related hazards.** Social protection measures, including social safety nets, social insurance or market interventions such as minimum wage, can also protect the most vulnerable from shocks.

At the same time, EWS will only be effective if concerted action is taken to reduce vulnerability. This requires investment in basic services such as education. Drivers that curtail resilience to hazards include poverty, inequality and rising pressure on land, water, and biodiversity. As expressed in the Sendai Framework for Disaster Risk Reduction, "More dedicated action needs to be focused on tackling underlying disaster risk drivers, such as the consequences of poverty and inequality, climate change and variability, unplanned and rapid urbanization, poor land management and compounding factors such as demographic change, weak institutional arrangements, non-risk-informed policies, lack of regulation and incentives for private DRR investment, complex supply chains, limited availability of technology, unsustainable uses of natural resources, declining ecosystems, pandemics and epidemics." Improved development outcomes will enable households to both prepare for and respond to hazards. Reduced losses from hazards will then further enable economic growth and contribute to development gains. EWS must be integrated within the broader domain of development, and not considered solely a service of meteorological agencies.

ES6 What are the steps forward?

A variety of technology and policy tools can be employed to design effective multi-hazard warning systems, allowing standardization of information but also incorporating diversity and allowing for flexibility at the local level.



ES Figure 6 Conceptual diagram of an EWS. Weather or climate data is collected to create forecasts of events such as heat waves or droughts. This can be combined with vulnerability or exposure data to identify areas where warnings are needed. Warnings are then disseminated through a variety of means.

ES7 Technology

Technology exists to combine information about different hazards and exposure into a single user interface, which can be used by different people or agencies to distribute warnings tailored to specific needs and groups. Such a platform would provide uniform service but allow for local adaptation.

As a proof of concept, a prototype web-based EWS was created for the CLIM-WARN project. (It can be found on: http://prototype.climwarn.org/). The prototype is capable of generating the early warning messages for specific drought and flood periods in three pilot areas (Nzoia, Turkana and Kwale counties in Kenya). It demonstrates integration of different climate risks into one system and shows analysis and creation of warnings not only for hazards, but also for exposure and risk. It is based on a modular approach combining dynamic hazard modules driven by near real time gridded weather data, a vulnerability module developed from multi-layer information on exposure, sensitivity and adaptive capacity. The risk module ranks risk as a function of hazard and vulnerability. The choice of indices and data layers determining the key modules is flexible and can be adjusted to the needs of specific users, be they DRR professionals, farmers or pastoralists. In order to visualize the impact of hazards, or impacts of hazards, the prototype includes GIS layers of infrastructure, location of houses, schools and health centres that indicate possible impact of flooding. Further GIS operations can quantify these.

A communication module generates profiles from users registering their phone numbers and email addresses and can incorporate pre-defined sets of users linked to particular administrative areas and organizations. Triggers can be established for the system to send warnings to users. In the absence of structured recovery plans and specified tasks of actors, it was not possible to tune the content of the messages to recovery activities and actions that a particular actor is expected to undertake. However, once recovery plans have

been specified in further detail, corresponding messaging can be included.

In future, the prototype can be expanded to other countries, other thematic hazards and geography, consider other hazard indices and vulnerability layers. More detailed information on local circumstances and location of people and their resources will make the system more robust. Such prototypes can be embedded into existing structures of authorities mandated to issues warnings. The system should also incorporate a bottom up communication module to receive information from local people on hazards. Other means of warning dissemination should be explored including links with community radio.

ES8 Policy

Beyond technology, an innovative approach is needed to ensure that early warnings reach and benefit all that are potentially affected by disaster. Human rights, or more specifically a human rights based approach (HRBA), should be considered as a tool to increase accountability for warning and ensure warnings reach the "last mile".

The International Covenant on Civil and Political Rights affirms the right to life (Article 6(1)) and recognizes this right as fundamental and non-derogable (Article 4). The Human Rights Committee has broadly interpreted this right to impose obligations on states to take measures to protect human life, including measures to reduce infant mortality, increase life expectancy, and eliminate malnutrition and epidemics. The right to life also imposes strict duties on a State Party to prevent and safeguard against the occurrence of environmental hazards that threaten the lives of human beings. State responsibility arises regardless of whether an act or omission is deliberate, reckless, or merely negligent. Accordingly, the duty to protect the right to life entails an obligation for Parties to establish and operate adequate monitoring and early warning systems to detect environmental hazards before they threaten human lives.

Acknowledging the link between human rights and early warning can improve early warning system design and operation. Duty bearers, government agencies that issue warnings, have a clear duty to ensure that the warnings reach all who are potentially affected in a timely and understandable manner. Checks and balances can be introduced to ensure that rights are being provided, for example by introducing the provision of warning into regulatory and legal frameworks. Rights holders, community members, have a responsibility to hold duty bearers to account for the provision of warning.

Further, a HRBA can help warnings reach "the last mile" by ensuring that the following questions are asked: Who has been left behind? Why? Who has the duty or responsibility do something about it? What is needed in order to take action (knowledge, resources, organizational or individual abilities)? HRBA should be used to empower duty bearers and rights holders to know and claim their rights. This means giving communities greater opportunities to participate in shaping and monitoring early warning systems. It also means increasing the ability of governments to recognize and respect rights, for example by increasing their capacity to accurately issue warnings. Ultimately, a HRBA can help provide a people-centered approach to early warning rather than a hazard-centered approach. Further research and review should examine how it can be specifically applied to EWS.

Women in Turkana County, Kenya © Z. Zommers

Chapter 1

What are Early Warning Systems?

The earth's climate is changing. According to the Intergovernmental Panel for Climate Change (IPCC) Fifth Assessment Report, land and ocean surface temperatures have increased globally by nearly 1°C since 1901 (0.89°C global average), mainly as a result of anthropogenic activities. In parts of Africa, Asia, North America and South America, surface temperatures rose by up to 2.5°C between 1901 and 2012. Urban areas in particular have seen heightened increases in temperature, as altered storage and transfer of heat, water and airflow result in urban heat islands[3]. Although a recent slowdown in surface warming has been observed[4], rapid warming is expected (England et al., 2014; Marotzke & Forster, 2015). The IPCC predicts that a global mean temperature change of +0.3 to +0.7°C is likely between 2016 and 2035 (IPCC, 2013). Extreme weather events are also on the rise. In the 2012 report "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation", the IPCC predicted a growing frequency of heat waves, rising wind speed of tropical cyclones, and increasing intensity of droughts (IPCC, 2012). The IPCC (2014b) warns of greater risk of flooding at the regional scale (medium confidence) and reports an increased occurrence of extreme sea levels, as experienced in storm surges, since 1970. Figure 1.1 shows a number of observed impacts of climate change.

Natural hazards can result in significant human and financial loss, placing development gains and national security at risk (Gould, 2009). Over 8,800 disaster events were recorded globally between 1975 and 2008, resulting in the death of 2,283,767 people (Shepherd et al., 2013). Between 1980 and 2004 the economic cost of extreme events reached US$1.4 trillion (Royal Society, 2014).While the severity of the impacts depends on the nature of the hazard and on the extent of exposure of communities or ecosystems, impacts from recent climate-related extremes show that both natural and human systems are highly vulnerable (Shepherd et al., 2013; IPCC, 2014a). "Societies are not resilient to extreme weather today, and our analysis shows that the risk it poses is increasing," concludes the 2014 Royal Society report "Resilience to Extreme Weather".

Women in Turkana, Kenya walk long distances in search of water
© Z. Zommers

Up to 325 million extremely poor will be living in the 49 hazard-prone countries in 2030. Large populations in Africa, Europe and Asia will have a greater exposure to flood and drought events (Royal Society, 2014). Natural disasters can entrench poverty in areas with limited social safety nets and in those without insurance (Shepherd et al., 2013). According to the Overseas Development Institute (ODI), the 11 countries most at risk of disaster-induced poverty are Bangladesh, Democratic Republic of Congo, Ethiopia, Kenya, Madagascar, Nepal, Nigeria, Pakistan, South Sudan, Sudan, and Uganda (Shepherd et al., 2013). However, even within all countries there is significant variability of vulnerability, with groups such as women and children being most at risk (Seager, 2014).

3 According to the US EPA, Urban heat island refers to built-up areas (cities or metropolitan areas) that are significantly hotter than nearby rural areas due to human activities. Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality (http://www.epa.gov/heatisland).

4 It must be noted however that a recent study by Karl et al. (2015) presented a contrary view. The study suggest an equal or faster rate of global warming during the last 15 years compared to the latter half of the 20th Century.

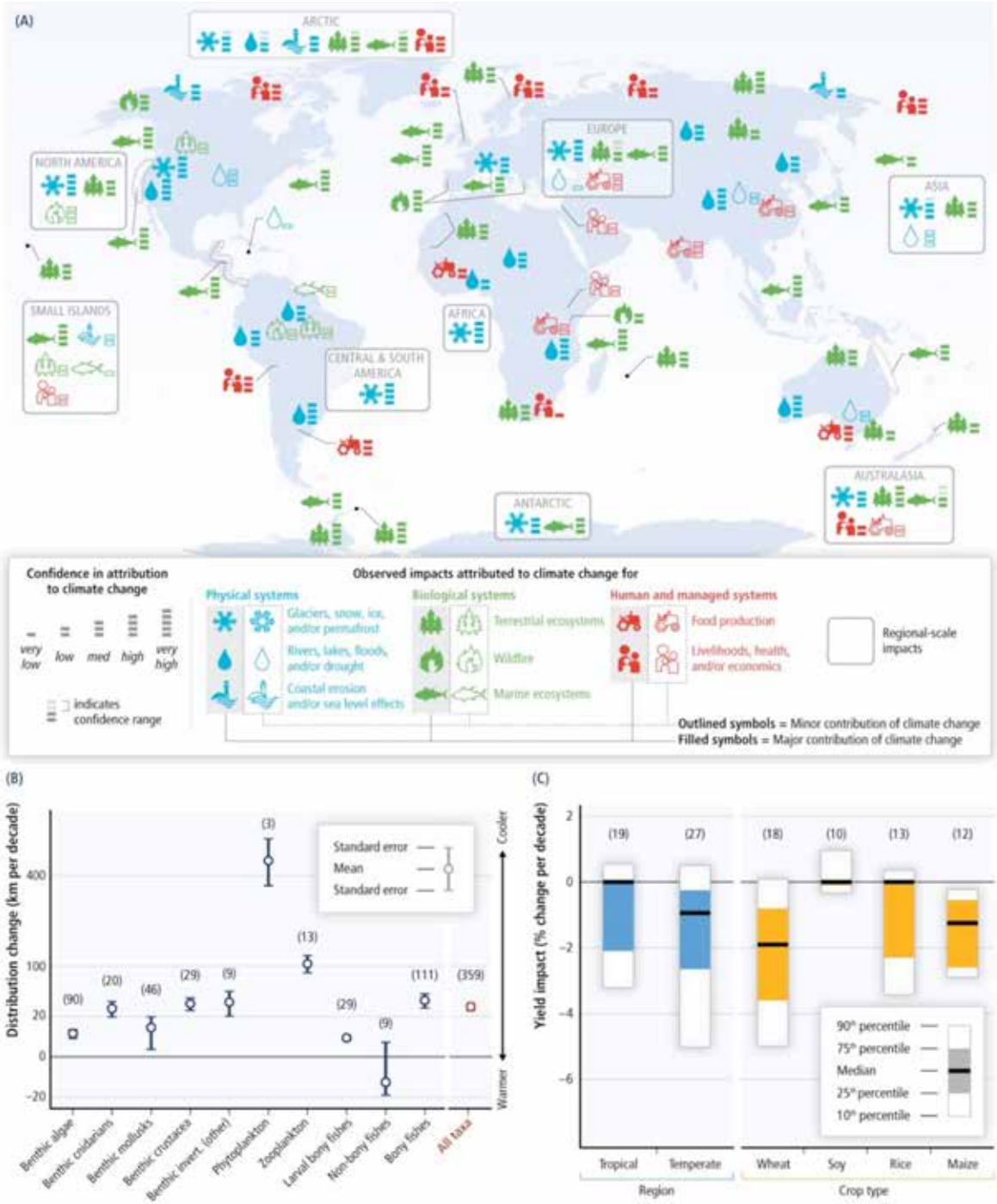


Figure 1.1. Observed impacts of climate change on human and natural systems. In almost all regions climate change is a major contributor to changes in floods and droughts, and has had an impact on livelihoods.

Source: IPCC (2014).

1.1 Early Warning Systems

"The first step towards adaptation to future climate change is reducing vulnerability and exposure to present climate variability."

IPCC, 2014

Early warning systems (EWS) can help reduce losses by ensuring that communities have time to take action and minimize exposure to hazard related risks. Already in 2005, the former UN Secretary-General Kofi Annan called for the establishment of a worldwide EWS for all natural hazards (UN, 2005). The Hyogo Framework for Action (HFA) (UNISDR, 2007), endorsed by the UN General Assembly in the Resolution A/RES/60/195 following the 2005 World Disaster Reduction Conference, encourages countries to enhance early warning (Priority 2, core indicator 2.3). Over the past decade, the importance of EWS has been reiterated elsewhere as well. The 2010 Cancun Agreements specifically invite "all Parties to enhance action on adaptation…by…enhancing climate change related disaster risk reduction (DRR) strategies (such as) EWS[5]." IPCC SREX Report (IPCC, 2012) concludes that, "the implementation of EWS does reduce loss of lives and, to a lesser extent, damage to property and was identified by all the extreme event case studies (heat waves, wildfires,

5 See: https://unfccc.int/files/adaptation/cancun_adaptation_framework/adaptation_committee/application/pdf/1_cp.16.pdf

drought, cyclones, floods and epidemic disease) as key to reducing impacts from extreme events." Most recently the Sendai Framework for Disaster Risk Reduction, which will help set government action between 2015 -2030, encourages parties to "invest in, develop, maintain and strengthen people centred multi-hazard, multi-sectorial forecasting and EWS, disaster risk and emergency communications mechanisms, social technologies and hazard monitoring telecommunications systems."

What is an Early Warning System?

According to the UN International Strategy for Disaster Reduction (UNISDR), EWS is, "the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss". The basic components of such a system are outlined in Figure 1.2

However, others have argued for a much broader definition of EWS. Consensus does not exist over the meaning of the terms "early", "warning" or "system". Different sectors of society need different amounts of time to respond. What may be "early" for some populations is insufficient time for others. "Warnings" may range from broad outlooks to specific alerts. It has been argued that historical trends offer a form of warning. Others claim that warnings must give future projections. A "system" may be composed of sub-systems that include mechanisms for forecasting, transmission and reception. Many societies rely on systems of informal "local knowledge". Finally, the different EWS systems may have different goals. EWS may serve to educate, to reduce infrastructure damage and economic costs, or to save lives. Operational goals may include creating and maintaining credibility, identifying the appropriate warning level, minimizing political interference and maintaining transparency (Glantz, 2004). Given these differences, Glantz (2004) therefore argues that the definition of an EWS must be "broad enough as to allow for a wide range of interpretations and flexible enough to accommodate in

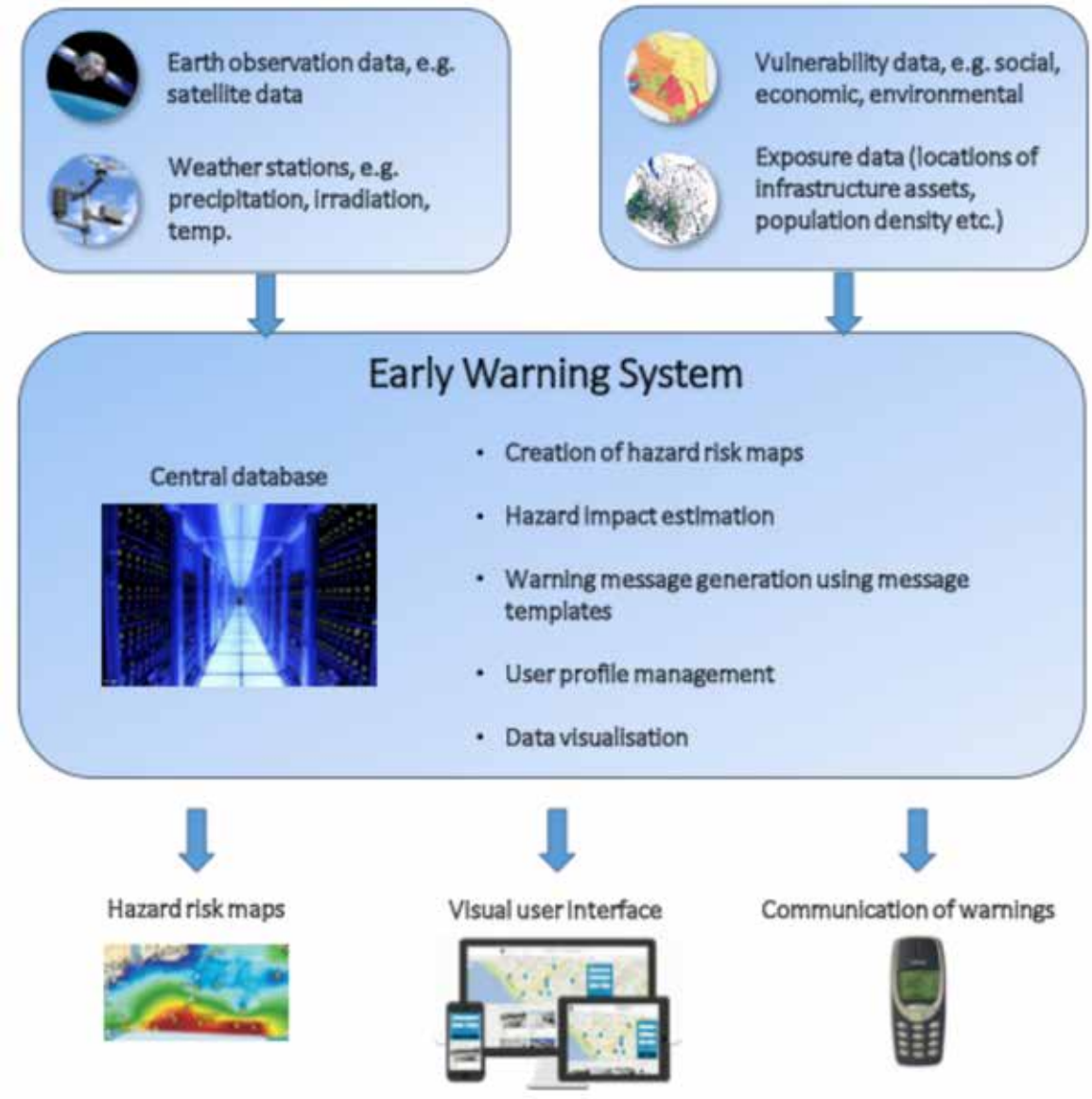


Figure 1.2 Conceptual diagram of an EWS. Weather or climate data is collected to create forecasts of events such as heat waves or droughts. This can be combined with vulnerability or exposure data to identify areas where warnings are needed. Warnings are then disseminated through a variety of means.

time and space the societal recognition of new hazards and the development of new EWS technologies."

Regardless, all EWS must address "five Ws"(Glantz, 2004):

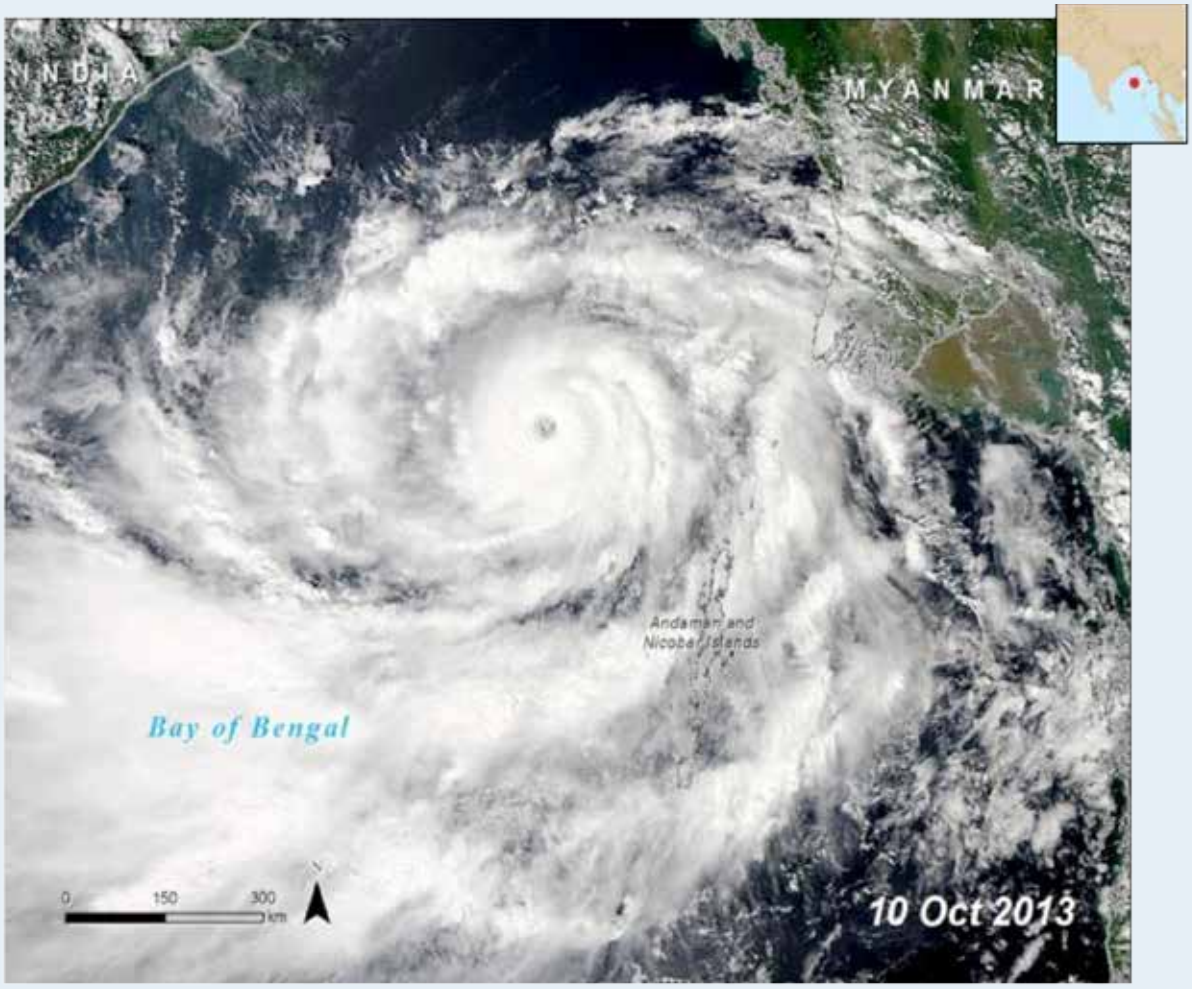
1) What is happening with respect to the hazard(s) of concern?
2) Why is this a threat in the first place (i.e., what are the underlying causes for potential adverse impacts)?
3) When is it likely to impact (providing as much lead time as possible to at-risk populations)?
4) Which regions are most at risk?
5) Who are the people most at risk (i.e., who needs to be warned)

According to UNISDR (2006), to be effective, EWS must be people-centred and must integrate four elements: knowledge of risks, technical monitoring and warning service, dissemination of warnings to those at risk, and public awareness and preparedness to act. Failure in any one of these four elements may cause failure of the entire EWS (UNEP, 2012).

Over the past decade there has been some progress in DRR. The UN Special Representative of the Secretary-General for DRR, Margareta Wahlstrom, concludes, "economic growth and improvement in development conditions in many low and middle-income countries, including an enhancement of capacities in early warning, disaster preparedness and response, have contributed to a downward trend in mortality

Box 1.1 Early Warning saves lives

On the evening of October 12, 2013 tropical cyclone Phailin brought torrential downpours and damaging wind speeds of up to 223 km/h to the eastern Indian states of Odisha and Andhra Pradesh. This was accompanied by storm surges of up to 3.5 m along the coast in the eastern Indian states of Odisha and Andhra Pradesh (GoO, 2013). A comparable cyclone, cyclone 05B, hit the same area in 1999 with winds of up to 260 km/h (IFRC, 1999). It had a devastating outcome, resulting in the loss of more than 10,000 lives (World Bank, 2013). By contrast, 21 lives were lost in 2013 (GoO, 2013). This considerable difference in impacts can be attributed to early warning alerts disseminated 4 days before cyclone Phailin, which allowed for the evacuation of approximately 400,000 people on or before 11 October *(Senapati et al., 2013)*.



NASA MODIS Aqua image of Tropical Cyclone Phailin circling over the over the Bay of Bengal, moving west towards India, on October 10, 2013.

(Credit: NASA MODIS Rapid Response Team in Gutro, 2013; visualisation by UNEP/GRID-Sioux Falls)

risk, at least for those weather-related hazards where early warning is possible" (UNISDR, 2013). Particular progress has been made in the area of early warning. In the 2013 UNISDR Global Assessment Report (GAR), 86 countries report progress towards the creation of EWS. Most EWS are for floods, cyclones, earthquakes, tsunamis and droughts (UNISDR, 2014). Box 1.1 highlights an example of how improvement in EWS helped reduce mortality during an extreme event.

Despite progress, significant gaps in EWS remain. Financial constraints and insufficient human capacity are major challenges (UNISDR, 2014). International funding for disaster preparedness and early warning is inadequate. Of the US$ 106.7 billion the international community allocated for disasters between 1991 and 2010, US$ 69.9 billion was for response, US$ 23.3 billion for reconstruction and rehabilitation, and only US$ 13.5 billion was dedicated to DRR (Kellett & Caravani, 2013). As a result of resource shortfall, many countries are unable to upgrade and maintain EWS equipment, such as space-based rainfall observation satellites that are critical for flood prediction, and meteorological data stations.

Furthermore, most EWS have large gaps in geographic coverage. Even within areas of coverage, the communication of warnings and outreach to the users need improvement. Vulnerable groups, including women, children, elderly, the disabled, and others, do not receive the warnings or are unable to act on them. Most systems do not incorporate preparedness plans and focus only on short term alerts even though seasonal or decadal predictions are now possible. Additionally, most of the systems do not integrate multiple hazards in a single interface.

Other challenges reported within the HFA include poor coordination between stakeholders and inability to address underlying risk patterns (UNISDR, 2014). Poorly planned development, environmental degradation, poverty, inequality and weak governance continue to drive risk. For example, private and public investments are often concentrated in hazardous areas, such as cyclone and tsunami prone coastlines, increasing exposure to hazards. In current policy, disaster is generally conceptualized as an external shock to normally functioning economies thus failing to highlight the underlying risk drivers inherent to current development policies and practices (UNISDR, 2013). As expressed in the Sendai Framework for Disaster Risk Reduction, "more dedicated action needs to be focused on tackling underlying disaster risk drivers such as the consequences of poverty and inequality, climate change and variability, unplanned and rapid urbanization, poor land management and compounding factors such as demographic change and weak institutional arrangements."

1.2 UNEP's CLIM-WARN Project

A guiding principle of the Sendai Framework is that, "DRR requires a multi-hazard approach and inclusive risk-informed decision-making based on the open exchange and dissemination of disaggregated data, including by sex, age and disability, as well as on easily accessible, up-to-date, comprehensible, science-based, non-sensitive risk information, complemented by traditional knowledge". Governments are also encouraged to develop EWS through a participatory process, and to tailor them to the needs of users.

UNEP's Climate Change Early Warning Project (CLIM-WARN) seeks to apply this approach to identify how to better design multi-hazard EWS, and communicate risks of hazards to the most vulnerable. Three case study countries in Africa were selected: Kenya, Ghana and Burkina Faso. Africa is highly vulnerable to climate change, and faces major gaps in EWS. According to the ODI, "Unless something changes – and changes fast – up to 118 million extremely poor people in sub-Saharan Africa will be exposed to drought, floods and extreme heat hazards in 2030 alone" (Shepherd et al., 2013). Furthermore, the selected countries provide a combination of different climates, geography, culture and level of vulnerability to extreme events that could possibly help identify the range of factors relevant to improving EWS globally.

Over the course of two years, expert meetings were held to identify the current state of EWS in the case study countries. Systematic reviews of literature were also conducted to identify best practices and tools in communicating warnings, responding to warnings, coordinating institutions and financing warning systems. Furthermore, household surveys and focus group discussions were used to identify community needs and suggestions for locally relevant EWS. Between June and August 2014, 1148 household surveys and 108 focus group discussions were conducted in 36 communities in the case study countries. The questionnaires focused on households' assets, coping capacity, hazards of relevance, warning communication and response. The findings were then used to inform the development of a prototype EWS. Box 1.2 provides more information on the methodology.

This report summarizes the main findings from the project. Chapter 2 of the report presents background information, main hazards, vulnerabilities and gaps in existing EWS in the three case study countries. Chapter 3 explores the results of interviews and discussions conducted with vulnerable groups, thereby providing a community perspective of perceived hazards risks. Chapter 4 reviews best practice of warning communication while warning response is explored in Chapter 5. Finally, Chapter 6 discusses steps forward and argues that a Human Rights-Based Approach (HRBA) could be used to help increase the operational effectiveness of EWS.

The United Nations Human Rights Council has stated, in Human Rights Council Resolution 18/22 that "climate change poses an immediate and far-reaching threat to people and communities around the world and has adverse implications for the full enjoyment of human rights." On the most recent Human Rights Day, 10 December 2014, all of the UN human rights special mandate holders came together to issue a joint statement on climate change and human rights, which stated, "climate change is one of the greatest challenges of our generation with consequences that transform life on earth and adversely impact the livelihood of many people.

Expert and stakeholders' meetings held in the three countries.

Box 1.2 Methodology

HOUSEHOLD SURVEY

- 1,148 households surveyed in the 3 study countries
- 4-12 interviewees per site
- Training of interviewers done by UNEP and partner staff
- Questionnaires covered the following areas:
  - ❏ Vulnerabilities and copying capacity
  - ❏ Hazard profiles
  - ❏ Communication of hazards
  - ❏ Preparedness and response

FOCUS GROUP DISCUSSIONS (FDGs)

- 108 FGDs conducted in 36 communities within study countries
- 3 groups of people in each locality: Disabled/ Elderly; Women; and Youth. At least 5 people in each group.
- Discussion topics were categorized into:
  - ❏ Hazard timelines
  - ❏ Institutional analysis
  - ❏ Warning communication and response

Women

Disabled/elderly

Youth

Disabled community member in Turkana, Kenya. Climate change has a disproportionate effect on many disadvantaged, marginalized, excluded and vulnerable individuals and groups, including those whose ways of life are inextricably linked to the environment © Z. Zommers.

It poses great risks and threats to the environment, human health, accessibility and inclusion, access to water, sanitation and food, security, and economic and social development. These impacts of climate change interfere with the effective enjoyment of human rights. In particular, climate change has a disproportionate effect on many disadvantaged, marginalized, excluded and vulnerable individuals and groups, including those whose ways of life are inextricably linked to the environment."

As Chapter 6 explains, early warning of climate related hazards should be considered relevant to a human right, related both to liberty and welfare rights such as freedom of information and also to the right to life. By addressing the linkages between early warning and human rights, this report can help governments identify steps forward to ensure EWS benefit all, especially people in vulnerable situations. The HRBA can be used to help ensure that programmes further the realization of human rights, and that human rights principles and standards guide all development co-operation and programming. Applying the HRBA means that human rights principles, such as equality and non-discrimination, inclusion and participation, accountability and the rule of law, are considered in all stages of project design. Such an approach can help ensure that early warnings reach the last mile.

Chapter 2

What is the Problem?

This chapter provides an overview of the three case-study countries (Figure 2.1) presenting results from literature studies and fieldwork on the hazards faced by these countries. In addition, it reveals how local communities perceive these hazards, as well as their vulnerability to them.

While, Burkina Faso, Ghana and Kenya face similar climate-related hazards, mainly drought and flood, their diverse socio-economic indicators result in different vulnerability profiles. Current EWS in these countries are operational to different extents.

According to 2013-2015 National Progress Reports on the implementation of the Hyogo Framework of Action (HFA)[6], Kenya has seen some progress towards Priority Action 2 indicator 3 which aims to identify, assess and monitor disaster risks and enhance early warning, "but without systematic policy or institutional commitment". The Kenya national report notes, "the existence of EWS for major hazards lack a coordinated approach and are issued sometimes with little consultation due to lack of a legal coordination framework."

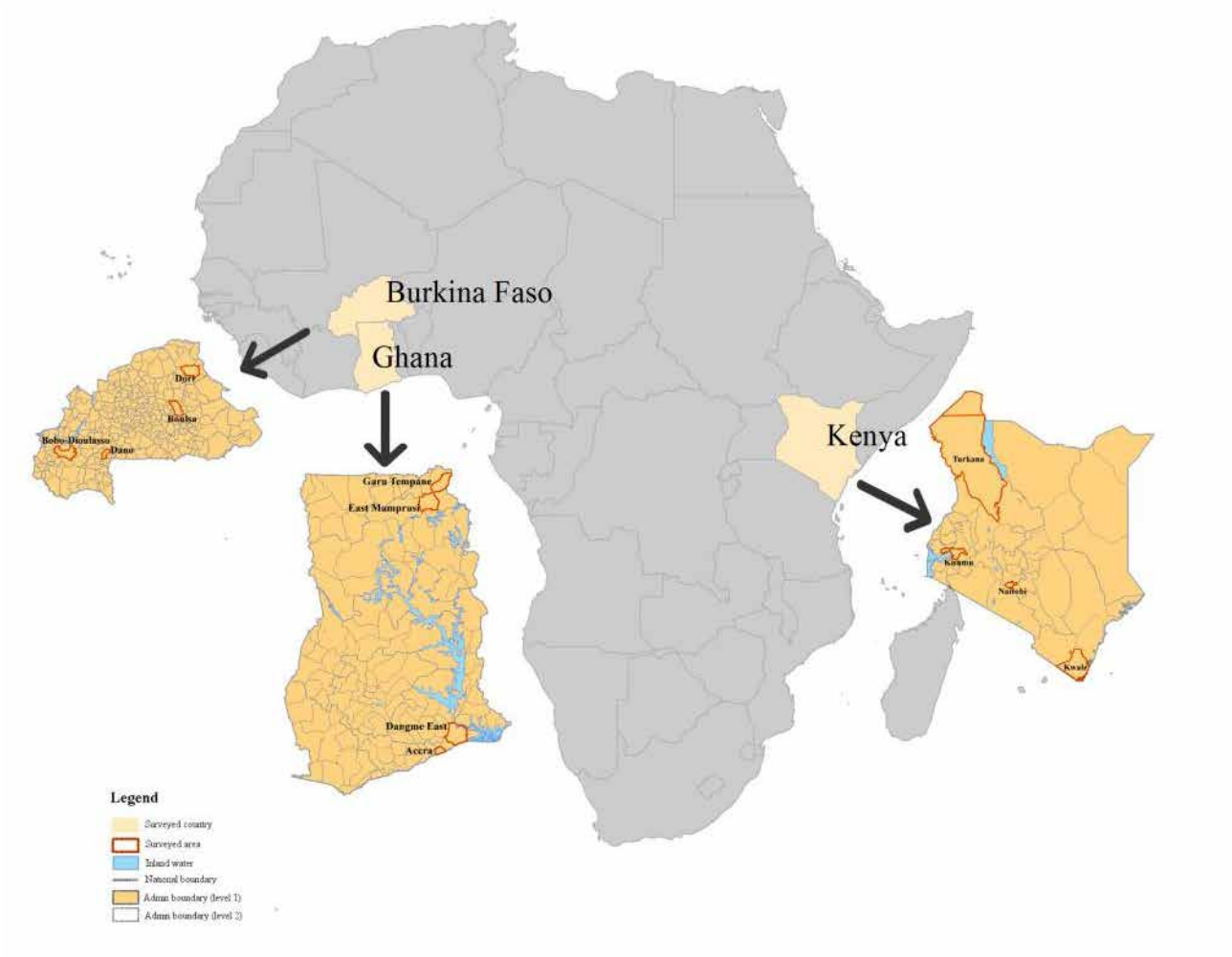
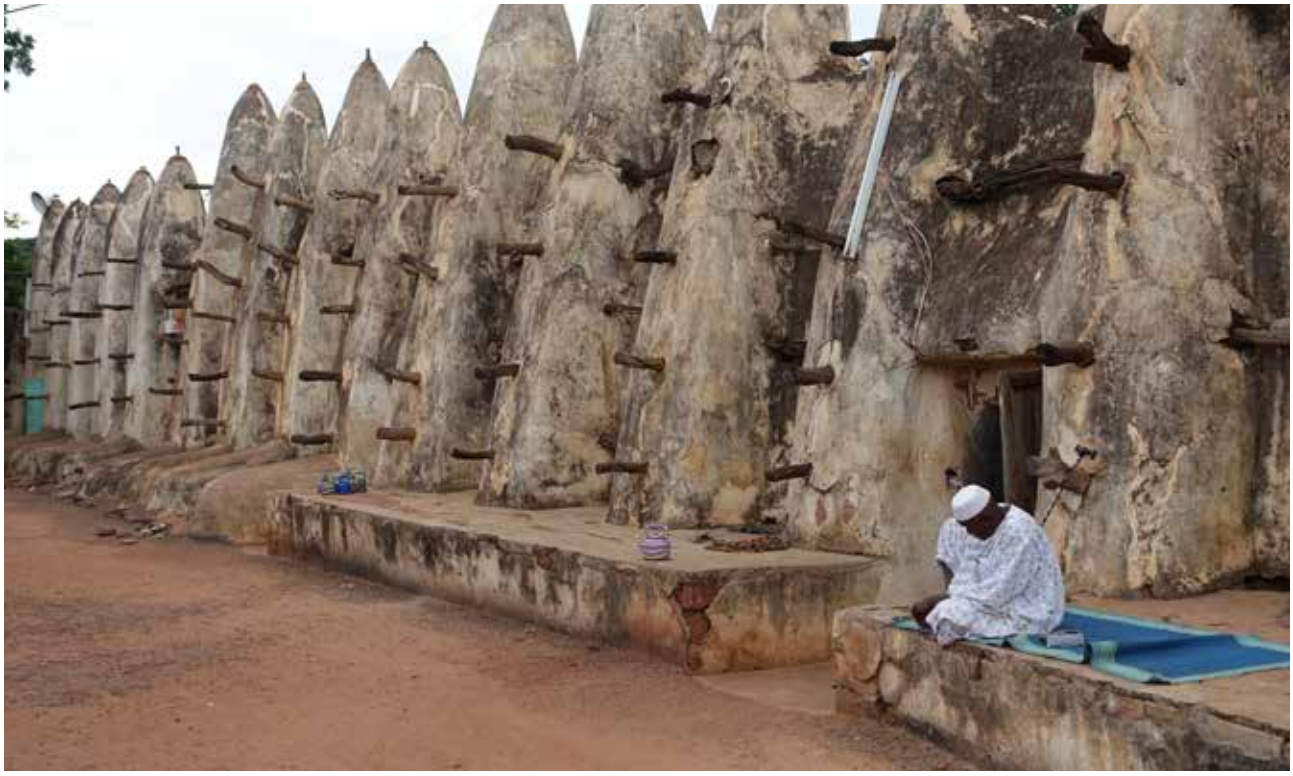


Figure 2.1 Map of Africa showing three study countries: Burkina Faso, Ghana and Kenya

6 See: http://www.preventionweb.net/files/42432_KEN_NationalHFAprogress_2013-15.pdf



Mosque in Burkina Faso in the city of Bobo-Dioulasso © Z. Zommers

By contrast, Burkina Faso reports that "institutional commitment has been attained, but achievements are neither comprehensive nor substantial."[7] Data relevant to DRR is collected from different sectors, including health, agriculture, transport, education, and the environment. However EWS are not operationalized due to inadequate human and financial resources.

The Ghana National Report[8] notes substantial achievement in early warning "but with recognized limitations". Here institutional data sharing is a problem, as well as data collection and storage. However, innovative dissemination strategies are used, including the use of "information vans ...that give information and educate the population on local level preparedness of impeding hazards."

Though only a self-assessment, such national reports indicate clear differences in achievement in areas such as institutional governance structure, data collection and finance. These differences can help highlight opportunities for cross-country learning and cooperation.

2.1 Burkina Faso, Ghana and Kenya at a glance

Burkina Faso and Ghana, in West Africa, and Kenya, in East Africa are characterized by diverse socio-economic indicators (Table 1.1). According to the 2014 UN Development Programme (UNDP) Human Development Index report[9], Burkina Faso is ranked 181 out of 187 countries and classified as a low human development country. Kenya is ranked 147, also considered a low human development, while Ghana is ranked 138 and classified as a medium human development country. With 44.4 million, Kenya has the largest population of the three countries, followed by Ghana (25.9 million) and Burkina Faso (16.4 million). The World Bank World Development Indicators (2015) show that Ghana is the most urbanized with just over half of its population (53 per cent) living in urban areas, while Burkina Faso (28 per cent) and Kenya (25 per cent) are relatively rural countries. Furthermore, the majority (61 per cent) of Ghanaians have access to electricity, compared to 23 per cent of Kenyans and 13 per cent of Burkinabés (World Bank, 2015). In all countries access to electricity is more widespread in urban areas than in rural areas. In terms of information technology, Kenya has the most internet users (39 per cent). Mobile phone use is relatively common in all countries. These indicators are critical to EWS design as they determine in what ways communities can receive warning messages and to what extent they are able to respond. Table 2.1 outlines a number of socio-economic indicators for the three case-study countries.

2.2 Hazard profiles

A highlight of the three case-study countries' disaster profiles is presented in Box 2.1. The most important climate-related hazards in Burkina Faso, Ghana and Kenya are droughts and floods. All three countries regularly experience these hazards, which have resulted in considerable human and economic losses (Boko et al., 2007).

Droughts are slow-onset hazards that result from below-average rainfall and high evaporation rates due to high temperatures, and are characterized by water deficiency in the soils, groundwater and/or surface waters, leading to potential negative impacts on agricultural production and ecosystems (Wilhite & Glantz, 1985; Mishra & Singh, 2010). Drought affects food production systems, ultimately leading

7 See: http://www.preventionweb.net/files/42847_BFA_NationalHFAprogress_2013-15.pdf
8 See: http://www.preventionweb.net/files/41995_GHA_NationalHFAprogress_2013-15.pdf
9 The 2014 Human Development Report - Sustaining Human Progress: Reducing Vulnerabilities and Building Resilience: http://hdr.undp.org/en/2014-report

Table 2.1. Socio-economic indicators for Burkina Faso, Ghana and Kenya

Indicator	Burkina Faso	Ghana	Kenya
Population (million)	16.4	25.9	44.4
Population growth rate (%)	2.8	2.1	2.7
Rural/urban population (%)	72/28	47/53	75/25
GDP per Capita PPP (2011 International Dollar)	1,582	3,864	2,705
GDP growth rate (%)	3.5	5.4	2.9
Access to electricity (% of total population)	13	61	23
Access to electricity in rural areas %	1	38	8
Access to electricity in urban areas %	47	82	58
Internet users (per 100 people)	4	12	39
Mobile subscriptions (per 100 people)	66	108	72

Source: Compiled from the World Bank World Development Indicators (2015) and reflect data entries, depending on the indicator, between 2007 and 2014.

to food insecurity. In Kenya, nearly 70 per cent of the country's land is at risk of drought, particularly Eastern and North Eastern areas, the coast (especially in Kwale County), and part of the Rift Valley (Ojwang et al., 2010). In Ghana, the Upper West and Upper East regions show the highest exposure[10] to drought, whereas the four southern regions experience the highest drought intensity[11]. In Burkina Faso the North and Eastern regions (Sahel regions) are most prone to drought.

Floods can be related to meteorological events or to sea level rise. Between 1970 and 2014 Kenya experienced 44 floods (Guha-Sapir et al., 2014). Floods tend to occur during the rainy season and are often accompanied by landslides in Kenya. Areas around the Lake Victoria basin (Western Province), Nyanza (Budalang'i, Nyando, Rachuonyo) and along the Tana River are particularly vulnerable (UNDP, 2014).

According to Ghana's National Disaster Management Organization (NADMO), floods are the most frequent extreme events in Ghana, particularly in the coastal areas. There were 16 flood incidences in the 1970-2014 period (Guha-Sapir et al., 2014). The disastrous impacts of flooding were made evident in June 2015, when a combination of flood and explosion at a petrol station led to the dead of about 150 people[12] and infrastructural damage of more than 100 million US$.[13]. This was one of the worst disasters in Accra's history. For the population living along the coastal areas of Ghana, flooding related to sea level rise is projected to increase as a result of climate change. A study by Addo et al. (2011) analysed potential impacts from future sea level rise in the coastal area of Accra and argues that the Dansoman coastline could recede by about 200m by 2100 relative to an average baseline for the 1970 - 1990 period.

Flooding is also the most frequently occurring climate-related hazard in Burkina Faso. Between 1970 and 2014, the country experienced 17 major floods, which affected 382,203 people and claimed 93 lives (Guha-Sapir et al., 2014). Severe flooding in September 2009 affected more than 150,000 people in Ouagadougou alone (Guha-Sapir et al., 2014). Damages in the Ouagadougou floods exceeded 150 million US$ (Guha-Sapir et al., 2014).

These two major climate-related hazards, droughts and floods, are associated with increased incidences of water, air and food borne **disease outbreaks**, most notably malaria, meningitis and cholera. Between 1970-2014, Kenya experienced 31 disease outbreaks, Ghana experienced 20 outbreaks and 22 outbreaks were recorded in Burkina Faso (Guha-Sapir et al., 2014).

Crop pests (e.g. grasshoppers, aphids, cantharides, caterpillars, seed-eaters, migratory locusts, diseases) are also hazards of concern in Ghana and Burkina Faso, resulting in serious crop losses, tree destruction and low yields. In Burkina Faso, locust invasions from neighbouring countries such as Mauritania, Niger, Chad and Mali have resulted in disastrous crop failures, as well as livestock mortality. One of the most serious invasions in 2004 affected the entire country and particularly the northern regions (World Bank, 2011).

Other hazards affecting the countries include **wind storms** (Ghana, Kenya), bushfires (Ghana, Burkina Faso), and **landslides** (Kenya).Box 2.1 Disaster profiles for Burkina Faso, Ghana and Kenya.

Cattle grazing in a village in Burkina Faso © Z. Zommers

10 Drought exposure is the total value of elements at-risk as a result of drought occurrence. It is expressed as the number of human lives, and value of the properties, that can potentially be affected by the drought and it is a function of the geographic location of the elements *(Pelling et al., 2004)*. Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest (http://www.unisdr.org/we/inform/terminology).

11 Drought intensity are the physical parameters describing the severity of the drought. Intensity standards have been developed by WMO and adopted by 188 Member States for monitoring and reporting of hazards. (Source: Global Change and Environmental Hazards http://www.aag.org/HDGC/ www/hazards/units/unit1/html/unit1frame.html)

12 See: http://edition.cnn.com/2015/06/05/africa/ghana-explosion-floods/ and http://floodlist.com/africa/flood-accra-ghana-fire-explosion

13 See: http://www.news24.com/Africa/News/Ghana-flood-damage-estimated-at-more-than-100m-20150613

Box 2.1 Early Warning saves lives

Hazards have frequently turned into disasters and have affected millions of Burkinabé, Ghanaians, and Kenyans. The graphs below provide disaster profiles of the countries. While the left-hand graphs paint, per country, a general picture of the type and number of disasters faced between 1970 and 2014, the right-hand graph focuses on the number of people affected by the two most frequent climate-related disasters - droughts and floods. The graphs show that, generally, floods are more common than droughts, but affect less people. Whereas droughts typically affect millions, floods are seen to impact between hundreds to hundreds of thousands of people.

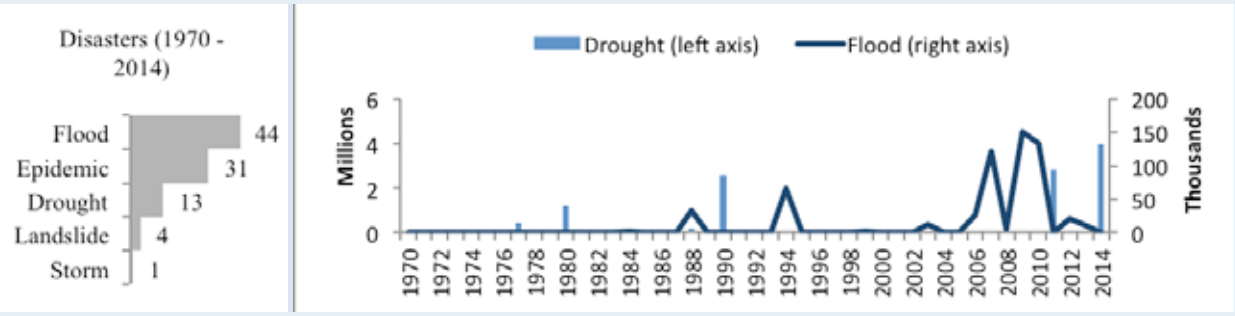


Figure 2.2 Disaster profile, Burkina Faso – Type and number of disasters between 1970 - 2014 and number of people affected by droughts and floods (1970-2014)

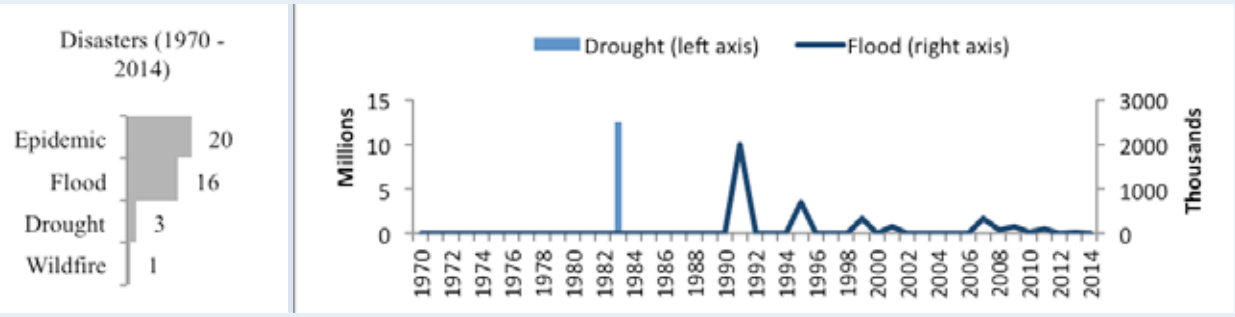


Figure 2.3 Disaster profile, Ghana – Type and number of disasters between 1970 – 2014 and number of people affected by droughts and floods (1970-2014)

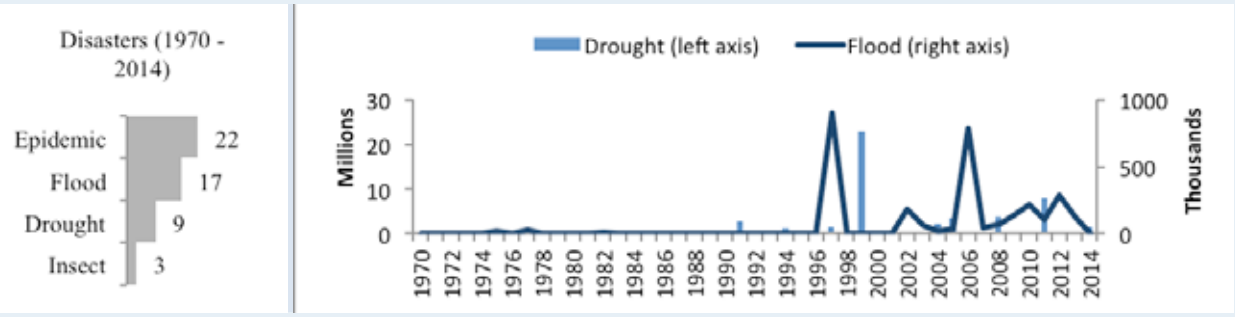


Figure 2.4 Disaster profile, Kenya – Type and number of disasters between 1970 – 2014 and number of people affected by droughts and floods (1970-2014)

Source: Compiled from EM-DAT: The International Disaster Database (Guha-Sapir et al., 2014)

2.3 The communities' perspective

It is important to analyse hazards not only in terms of aggregated, nationwide statistics, but also from the perspective of the community. Community level data may provide a more nuanced, fine-scale perspective of vulnerability to, and impacts from, hazards. Figure 2.5 shows interviewers in Burkina Faso and Kenya conducting household surveys.

As part of the survey conducted for the CLIM-WARN project, interviewees were asked to rank hazard types according to frequency and damage. Figure 2.6 illustrates the two highest ranked hazards (ranks one and two) in each study area in terms of frequency and damage. Sites within a country differ in terms of hazards selected, reflecting varying climatological conditions between different locations. For example, in Burkina Faso fire is considered a frequent hazard in Ada while drought is frequent in Boulsa and Dano. In Kenya, disease is considered a frequent hazard in Kwale, Nairobi and Turkana whereas fire is reported by some respondents in Turkana. Dansoman, in Ghana, is affected more often by floods and diseases, while droughts are more frequent in the other three study areas.

These community survey results show that hazards with high frequency of occurrence cause the most damage. This indicates the importance communities place on extensive risk. According to the UNISDR (2015), extensive risk "is used to describe the risk of low-severity, high-frequency disasters, mainly but not exclusively associated with highly localized

Interview conducted with various households in Burkina Faso and Kenya © Z. Zommers

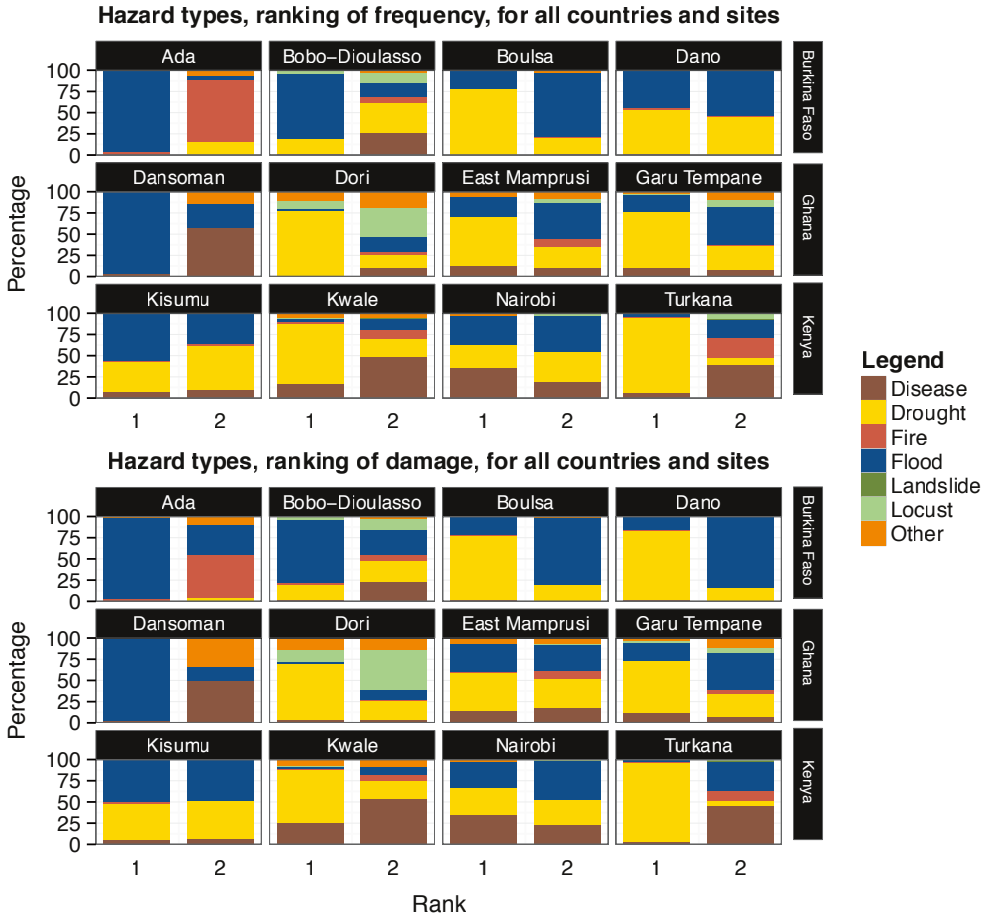


Figure 2.5 Perceived hazard risks, ranking of hazard frequency and damage – ranks 1 and 2 for each site per country

hazards." Extensive risk is often under-reported, failing to be captured in global risk modelling or international reporting (UNISDR, 2015). However, the 2015 Global Assessment Report on DRR notes that 99.1 per cent of local level loss reports are manifestations of extensive risk[14]. The impacts of extensive risk are magnified by inequality and poverty, environmental degradation, and badly planned urban development. Recurrent but small-scale hazards are a significant concern to low income households as they are often least able to respond. This conclusion is supported by the CLIM-WARN results.

In line with the rankings, the respondents outlined the types of damages experienced as result of occurrence of these hazards: loss of household items, destruction of property, destruction of infrastructure like roads and bridges hence impairing the transportation system, displacement, disease outbreaks, loss of livestock, inadequate clean water, low crop yields and increased food prices.

14 Extensive risk is the widespread risk associated with the exposure of dispersed populations to repeated or persistent hazard conditions of low or moderate intensity, often of a highly localized nature, which can lead to debilitating cumulative disaster impacts. It is mainly a characteristic of rural areas and urban margins where communities are exposed to, and vulnerable to, recurring localised floods, landslides storms or drought and is often associated with poverty, urbanization and environmental degradation (Source: UNISDR http://www.unisdr.org/we/inform/terminology)

2.4 Main gaps in existing EWS

In all of the three case study countries, governments have devised strategies and developed bills, planning and action programs to strengthen the capacities of people in vulnerable situations and avert and manage disaster risks. Differences in policy exist between countries. In Burkina Faso and Kenya, DRR is organized in a decentralized manner with different institutions being responsible for warning of different hazards. In Ghana, on the other hand, there is one centralized institution responsible for reducing risks for all hazards (NADMO).

As indicated by the National Reports for the Hyogo Framework of Action, the legislative instruments listed in table 2.2 are often incomplete, not regularly updated, or without any implementing instruments. Disaster Risk Reduction (DRR) policy is often understood and/or implemented in terms of disaster risk management (emergency relief) and not in terms of disaster risk prevention (monitoring, early warning and early action). The effectiveness of EWS range from one country to another based on a number of underlying factors - institutional capacities, legislative frameworks, response capacity, among others. Furthermore, warning systems, like their legislative frameworks, often suffer from duplication, a lack of coordination or a lack of resources[15]. In Burkina Faso, for example, the two main DRR institutions - Permanent Secretary of National council on environment and sustainable development (SP/CONEDD) and the Permanent Secretary for National council for emergency assistance permanent secretariat (SP/CONASUR) address climate change adaptation and DRR and management separately. There is a lack of communication between the institutions because there is no functional relationship between the two entities (CONASUR, 2012; GFDRR, World Bank, & UNISDR, 2011).

The weakness of current systems was made evident during household interviews in communities in each of the three case study countries. Respondents were asked whether they received warning information, sources of information, type of information received, whether they trust the information received, and whether received information was helpful.

As indicated in Figure 2.7 respondents received some climate information including the start and end of the rainy

Table 2.2 DRR-related policy and legislative framework in Burkina Faso, Ghana and Kenya

Country	Legal Document	Role
Burkina Faso	Order n.2003_0011 / MAHRH / SG / HPFB of 04/02/03, establishing the EWS (SAP) for food security (2003)	EWS (SAP) was established by the Ministry of Agriculture as a service within the General Directorate of Promotion Rural Economy (DGPER)
	Decree N°2004-624/PRES/PM/ MASSN establishing CONASUR, the National Council for Emergency Relief and Rehabilitation (2004)	DRR activities are placed under the coordination of CONASUR which is Burkina Faso's main risk prevention and humanitarian action coordination institution. CONASUR is attached to the Ministry of Social Action and National Solidarity and has a Permanent Secretariat (SP/CONASUR), regional (CORESUR), provincial (COPRSUR), district (CODESUR) and village (CODEVI) committees.
	Decree n°2002-542 PRES/ PM/ MECV establishing the National Council on Environment and Sustainable Development (CONEDD) (2002)	CONEDD's mission is to ease effective mainstreaming of key environmental management principles into national and sectorial development policies to promote sustainable development. CONEDD has also its Permanent Secretariat (SP/CONEDD), which is in charge of promoting environment and sustainable development policies and regulation.
	Decree N°2009PRES/PM/MAHRH/ SG establishing the Action Plan for Integrated Water Resource Management (PAGIRE) (2009)	The Permanent Secretariat (SP-PAGIRE) is the technical structure of PAGIRE National Steering Committee, organized in two technical, one administrative and financial service, and one executive secretary. It is attached to the General Secretariat of the Ministry of Agriculture, Water Resources and Fisheries (MAHRH).
	National Action Plan for Desertification Control (PAN/LCD) (1995)	First strategic framework developed and implemented in Burkina Faso, under the International Convention on the Fight Against Desertification (UNCCD), was signed and ratified in December 1995
	National (Climate Change) Adaptation Programme of Action (NAPA) (2007)	Burkina Faso has prepared and presented its National Adaptation Programmes of Action (NAPA) in 2007 and is entitled to benefit from the LDC Fund for the implementation of priority measures PANA. In the implementation of priority actions identified by NAPA, the project complies with the Conference of the Parties (COP-9) and also meets the criteria set by UNFCCC and GEF. The project was approved by the National Focal Points of the UNFCCC and the GEF.
	National Multi-risk Contingence Plan for the Preparation and Response to Catastrophes (2009)	This plan was adopted in 2009 and revised en 2012. Further to this plan, a law on the prevention of hazards in Burkina Faso has been adopted in April 2014.
	Strategy for accelerated growth and sustainable development (SCADD) (2008)	SCADD replaced the Strategic Framework for the Fight against Poverty (CSLP) since 2011 and is the main framework for sectorial development policies
	LAW N ° 012-2014 / AN establishing The National Strategy for the prevention of hazards (April 2014)	Guides the policy on the prevention and risk management, humanitarian crisis and disaster. This Guidance Act is to prevention and risk management, humanitarian crises and disasters in Burkina Faso, whatever the nature, origin and scope.

15 for more information, see countries' biennial reports to HFA at http://www.preventionweb.net/english/hyogo/progress/reports/?pid:222

Table 2.2 *DRR-related policy and legislative framework in Burkina Faso, Ghana and Kenya* ***(contineud)***

Country	Legal Document	Role
Ghana	The National Disaster Management Organization Act of 1996	This is the major policy document which establishes a National Disaster Management Organization (NADMO). The act specifies the mandate of NADMO and the National Committee whose role is to analyse the nature of hazards, vulnerability, and risk situations in particular areas.
	The National Action Plan on DRR 2011-2015	The plan has been crucial in the implementation of the Hyogo Framework of Action (HFA). The emphasis of the plan is on multi-sectorial approach to DRR and the need for all DRR stakeholders to invest in disaster reduction programmes.
	The draft climate change policy	The policy has been approved by the parliament and would play a crucial role in promoting mitigation of and adaptation to climate change related impacts like droughts and floods.
Kenya	The Disaster Management policy (draft)	The policy would aim to strengthen Disaster Management institutions, partnerships, networking and mainstreaming DRR in the development process. The policy has remained in draft form since 2002.The slow pace is attributed to regular amendments to include new issues that are affecting the country e.g. political violence.
	The National Climate Change Action Plan 2013-2017	The plan highlights the need to reduce disaster risks through the use of climate risk information in economic activities (such as farming), public infrastructure investment and government planning decisions.
	The Constitution of Kenya (2010)	Provides ground for the formulation of adaptation and mitigation legislation, policies and strategies by guaranteeing the right to a clean and healthy environment under the Bill of Rights.
	Vision 2030	This is a national development blue print that encompasses various flagship programmes and projects with aspects of adaptation and mitigation.
	The National Policy for the Sustainable Development of Northern Kenya and other Arid Lands	The policy focuses on climate resilience and requires the Government to find solutions that would address various climate challenges and to come up with measures to manage drought and strengthen livelihoods.

season and the amount of rainfall that is expected both within and outside the region the surveyed regions. However, information fails to reach a large proportion of respondents. Households in rural Burkina Faso and Ghana report receiving climate-related information more often that households in urban areas. The opposite is true in Kenya. Such differences between urban and rural areas may reflect information needs. Climate information may be perceived to be more relevant to rural households, which often rely on agriculture or pastoralism for subsistence. Alternatively such differences may also reflect the number of information sources available. Rural areas may have more information providers.

Rural areas' respondents received warning information from a wide range of different sources (Figure 2.8), which are trusted to different extents (Figure 2.9). National and local governments are important sources of information in all the three countries. In Kenya, people rely on more sources of information. Religious groups and elders are also frequently mentioned as important sources of information.

It is noticeable that in urban areas there are fewer institutions that disseminate warnings than in rural areas. For instance, in urban Burkina Faso, the national government was the predominant institution named as a source of warning information. In rural Burkina Faso, respondents reported that several other institutions, including the local government, religious leaders, and headmen/elders, delivered warnings. While results may not be anomalous to the urban area sampled, in Ghana, the results appear very similar. Kenya shows a higher variety of early warning sources and a smaller difference between urban and rural areas.

Not all institutions are trusted equally. In Burkina Faso and Ghana people have trust in notably fewer institutions. For example, in urban Burkina Faso, people only expressed trust in the national government. In rural Burkina Faso, and urban and rural Ghana, the most trust is with the national government, local government and CBOs. Kenyan respondents trust a variety of institutions. The main reasons cited for the variation in trust among institutions were the general significance of institutions in terms of accessibility by the general populace and reliability in times of need or emergency. For example, in Turkana, Kenya, where the prolonged drought increased reliance on relief food, most of the interviewed vulnerable groups listed humanitarian organizations among those they trust. Individuals also tend to attach trust to the past circumstances. For instance, if previous information given by a specific institution was accurate in terms of predictions and/or warnings this institution is likely to be perceived as trustworthy.

Focus group discussions conducted with women, youth, the elderly and people with disabilities (figure 2.10), were used to investigate whether early warnings reach the most vulnerable groups. Compared to the household interviews, a larger proportion of those interviewed through the focus group discussions did not receive warnings. In Kenya, for instance, 83.3 per cent of the focus groups indicated that they did not receive warnings for floods. Over 72 per cent did not receive warnings for droughts. Women were more likely to receive warnings than the youth or the disabled and elderly. The disabled and elderly cited a number of reasons for lack of access to warnings including unsuitable information package (e.g. for those who cannot read and hear); inability to access

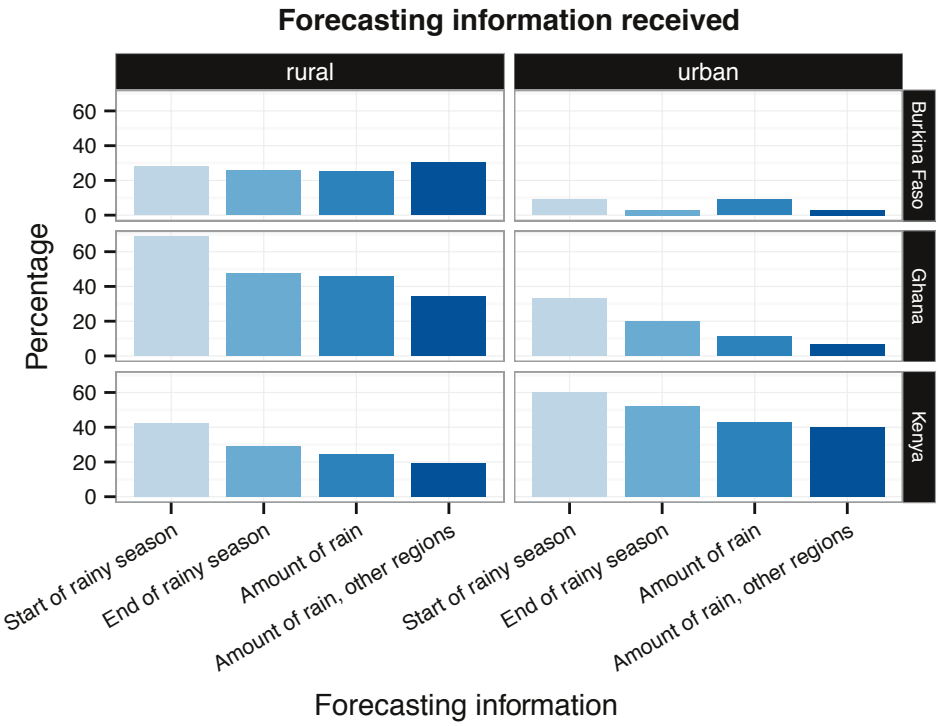


Figure 2.6 Percentage of respondents that received different types of information

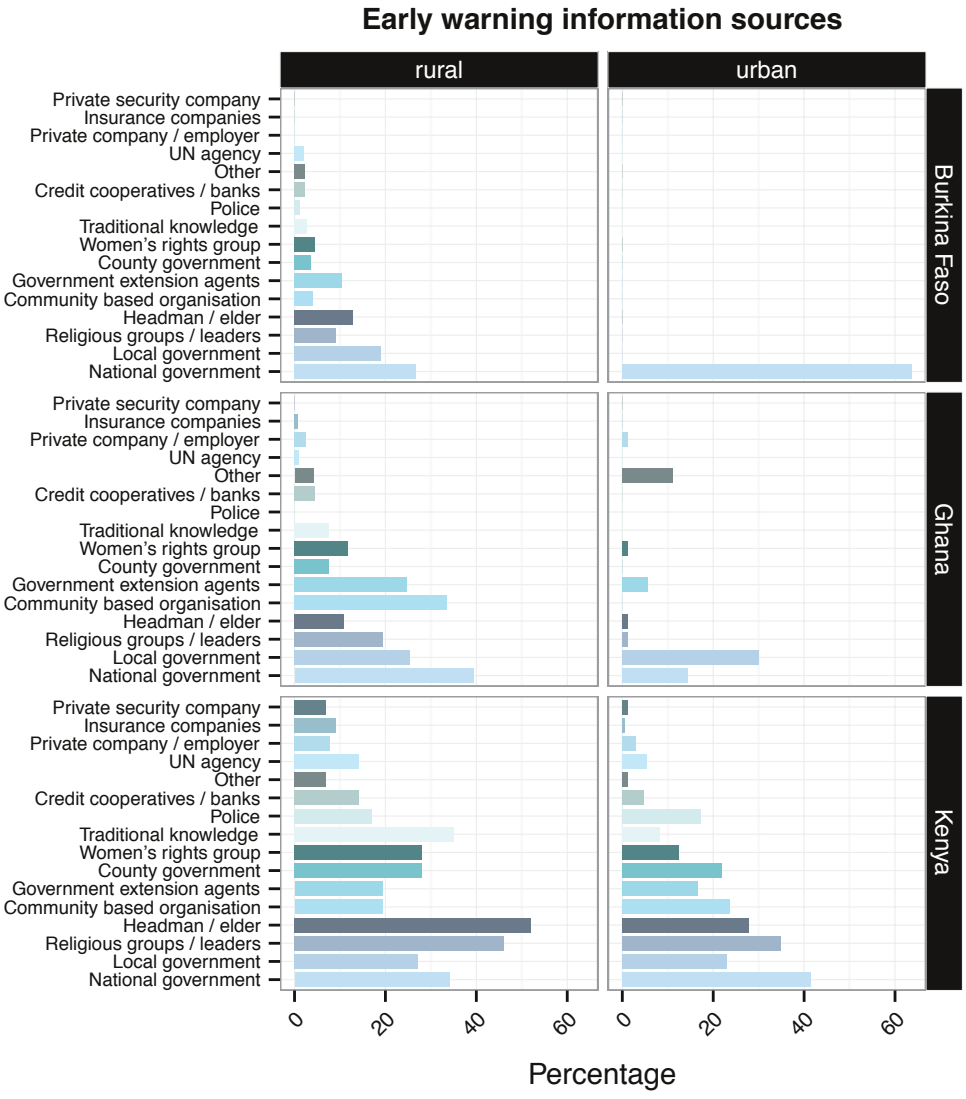


Figure 2.7 Sources of early warning information and the percentage of respondents that receive information through these sources

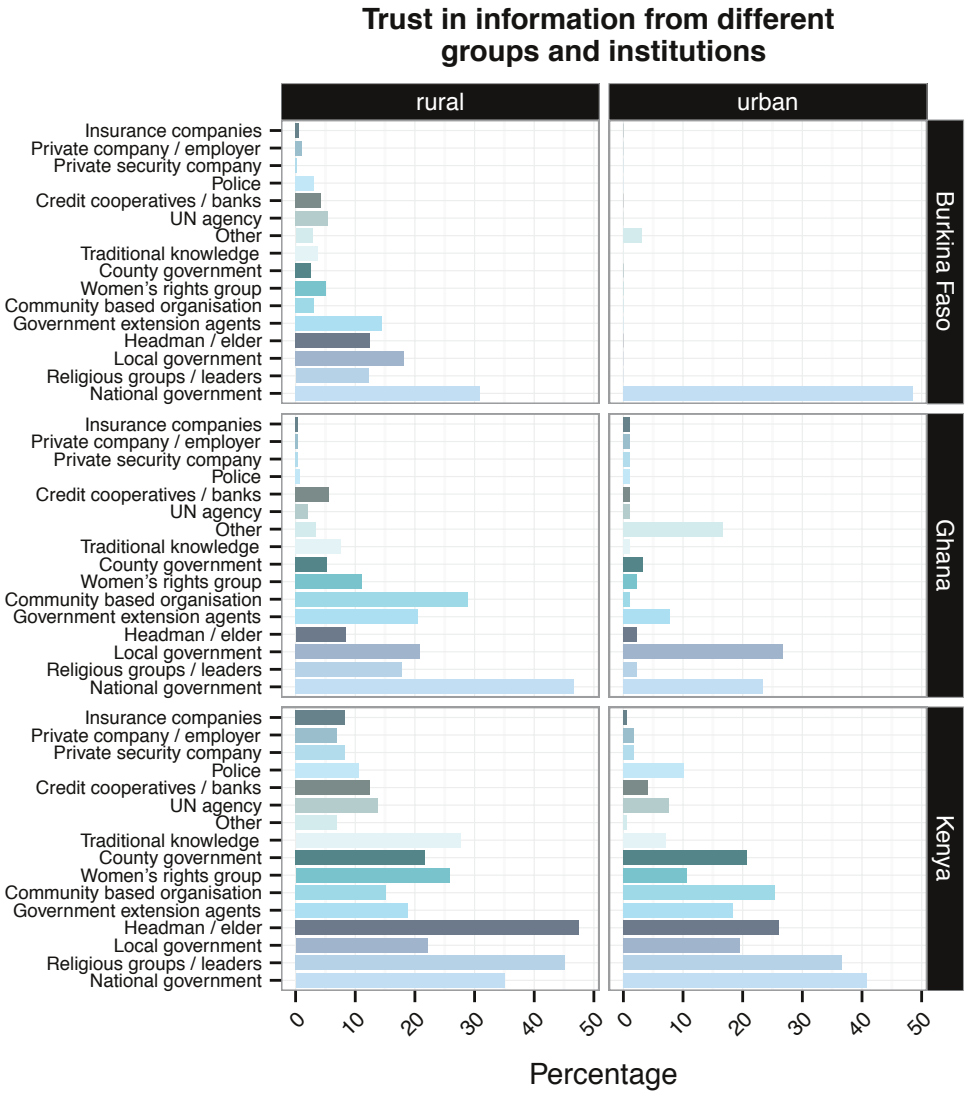


Figure 2.8 Percentage of respondents that trust information from various groups and institutions

information points due to limited mobility; lack of proper representation in committees and low confidence or trust in existing institutions. Women may receive warnings more often because they are better connected to information providers. For instance, analysis of the focus group discussions in Kenya shows that the interviewed women had links to more than five different institutions, more than the disabled, elderly or youth. Women also have stronger ties to government institutions, an important provider of warnings. Although the disabled/elderly feel that the government is significant, they cannot access government institutions easily.

2.5 Conclusion

This chapter reviewed hazards and warning systems in three case study countries: Burkina Faso, Ghana and Kenya. These countries are characterized by low to medium development and have diverse socio-economic indicators, such as levels of urbanization, access to electricity and usage of mobile phones and internet, which should be taken into account by EWS.

The most common climate-related hazards in the three countries are droughts and floods. Commmunity members note the negative impact of extensive risks, small scale and low impact hazards which are often underreported in national data. To warn their populations of impending

A small kiosk in Nairobi, Kenya. Due to diverse sources of livelihoods in cities, urban communities' vulnerability to climate-related hazards tend to be lower compared to rural areas where the major sources of livelihoods are sensitive to climate variabilitythrough these sources
© Z. Zommers

hazards, each country has created legislation focused on EWS and DRR. Furthermore, within these three countries a variety of government related institutions focus on early warning, or DRR more broadly. However, early warning systems and legislative frameworks in the countries usually suffer from duplication and lacks coordination and resources for effective implementation. Many survey respondents, particularly in

Focus group discussions in Nairobi, Kwale and Turkana Counties of Kenya. A blind and physically disabled community member explains their needs. Women were invited to share their opinions as well. © Z. Zommers

urban areas or from vulnerbale groups, indicate that they do not receive warning information. Furthermore, institutions that provide official warnings may be less trusted than traditional institutions such as village elders or religious groups. Thus, even though the countries have, to different extents, taken steps to provide their citizens with early warning, considerable gaps remain. Greater attention needs to be focused on maximizing the diversity of information sources. More focus is also needed in providing information appropriate to the diverse needs of users (see Chapter 3). Early warnings are needed in urban areas, as well as rural areas. Finally, it is important that EWS are able to help individuals prepare for small-scale events that undermine livelihoods, not just large-scale disasters which result in loss of life.

Chapter 3

Who Are the Users of Warning?

The needs and circumstances of communities are central to planning, evaluating and improving EWS. It is therefore critical to actively engage them in the development and on-going evaluation of warning systems. However, the users of EWS are diverse in terms of needs, vulnerability, coping capacity, knowledge of hazard risks, use of media, trust in institutions, hazard preparedness and response. The design of an EWS that meets the needs of all its potential users is therefore an immense challenge. To help improve early warnings, the CLIM-WARN project assessed the profiles and needs of users, based on stakeholder meetings/workshops (both at national and regional levels), review of literature and fieldwork surveys in Burkina Faso, Ghana and Kenya. This Chapter presents the results.

3.1 Categorization of Users of Warning

The relevance of warning information to specific groups of users depends, to some extent, on the type of hazard. The stakeholder meetings held in the three case-study countries categorised the users of warnings for respective hazards into different institutions and groups of people. Institutions include central and local government, academia, non-governmental organizations (NGOs), the media, community-based organizations (CBOs), health institutions, schools, specific economic sectors including insurance, tourism, transport, energy and agriculture. For instance, drought warnings are primarily targeted to farmers, pastoralists, policy makers, health practitioners, fishermen. Flood warnings are mainly

Box 3.1 Users and providers of Early Warning

Floridah Ereng is 36 years old. She was born and raised in Turkana, Kenya, where she later married. She lost her husband in 2010 and is now a widow taking care of six children. Farming is her main source livelihood. She inherited a piece of land from her late father who was once a pastoralist but became a farmer after losing his livestock as a result of prolonged drought. Floridah does not have any other alternative source of livelihood and she feels that she is highly vulnerable to climate-related disasters such as drought and floods. She says that the frequency and severity of drought has increased. When she was young, people never lacked food and water. She is worried about the increase in hazards and their impact on her community. According to Floridah, at least one in every five women has mobile phones in Turkana. However due to high illiteracy and poverty levels, most women cannot read messages. To help overcome this barrier, she is the founding chair of Edong'a dance group. The dance group relays early warning information in local language through dance and songs. Floridah's dream is to see many vulnerable people in Turkana access information easily so that they can make wise decisions. She also appeals to the government to invest more in systems that work for all the people. She strongly feels that she has a right to access hazard information held by the government and be protected from any harm.a

Alfred Litunya is 34 years. He has worked in various organizations in Turkana, Kenya, on issues related to information and statistics. Since 2011, he has worked for Kenya's National Drought Management Authority (NDMA) as a County Drought Information Officer. This position allows him to interact with communities in Turkana on a regular basis. He is actively involved in disseminating hazard information for the government, and in trying to improve current EWS. He thinks it is important to ensure that traditional community structures are linked with DRR. He recommends that, for communities like those in Turkana, early warning messages be simplified and translated into local languages. Stakeholders need proper training in formulation and dissemination of warnings, and local systems, such as traditional dances, have to be considered as crucial channels for communication of warnings.

targeted to urban planners, health practitioners, fishermen, tourism and energy sector etc.

Within such groups individuals are characterized by different factors, such as age, education level, size of the household, the source of livelihood (occupation), economic status, and others. These factors determine individuals' and households' vulnerability levels and their preparedness to respond to warnings.

3.2 Age, household size and number of children

Household demographics and size may influence vulnerability to climate-related hazards. The elderly, disabled and children are particularly vulnerable to hazards as they only have limited capacities to respond and are dependent on support from family members and institutions (Flanagan et al., 2011). In general households with a high number of children per adult are more vulnerable to hazards, with less opportunities to save money compared to smaller households with fewer children. Savings help cushion households against excessive loss or damage.

Children in a village in Burkina Faso © Z. Zommers

There are clear differences in population characteristics between rural and urban areas in all three countries in terms of age, household size and the number of children. Figure 3.1 shows the Box-and-Whisker plots of age, household size and the ratio children/adults for each household (adults being defined here as household members above 16 years of age).

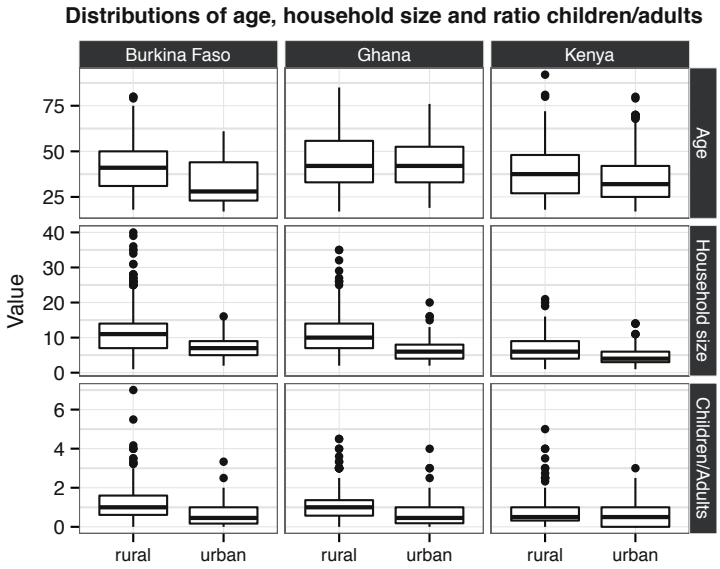


Figure 3.1 Age, household size and ratio children/adults. The lower and upper end of the box indicate the 0.25 and 0.75 quartiles of the distribution, meaning that 25% of points are below the box, 25% are above the box and 50% of values are in between. The middle line in the box indicates the location of the median, which means that 50% of all responses are below this value, and 50% of responses are above the value. For better visualization, household sizes above 40 (16 observations) and ratios of children to adults above 7.5 (1 observation) were removed prior to plotting.

The population in urban areas tends to be younger, household sizes are smaller and have a lower number of children per adult than in rural areas. As an example, the median age of respondent in urban areas in Burkina Faso was 28 years, the median household size was 7.4 people and the mean number of children per adult was 0.7 (among the sampled population). By contrast, the median age of respondent in rural areas was 41 years, with a mean household size of 14.2 people and a mean ratio of children to adults of 1.2 in rural areas in Burkina Faso. As rural areas in the three case-study countries showed higher numbers of children, elderly people and larger household sizes, the level of exposure to hazards risks is likely to be higher compared to urban areas.

3.3 Education level

Figure 3.2 displays the education levels of the respondents[16] as well as the education level of the head of household for all countries, distinguished by gender and area type. Education levels differ between rural and urban areas as well as between genders. In rural areas of all three countries, the majority of the population has no formal education. For example, the percentage of respondents with no education in rural areas in Burkina Faso ranges between 70 per cent (male) and 80 per cent (female), whereas in the urban area a much lower share of respondents had no education (50 per cent of females). All male respondents had attained various levels of education with a majority having secondary education). In general, individuals in urban areas tend to have higher education levels, including university degrees or degrees from technical schools.

16 Respondents generally comprised of male or female members of households, above 18 years of age and selected based on the randomization table.

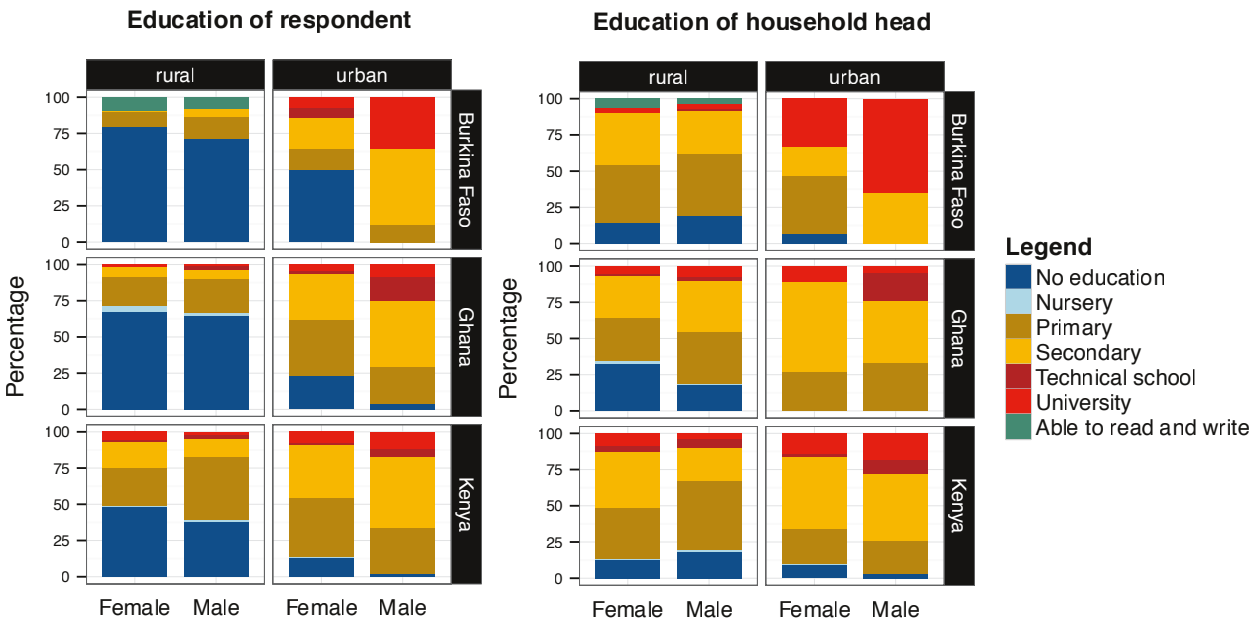


Figure 3.2 Gender disaggregated data on educational levels in the three case-studies countries

Furthermore, there is a significant gender divide in education levels. Across all countries and location types, women have lower education levels than men, with important implications for their vulnerabilities. This is illustrated by the Focus Group Discussions (FGDs), during which most women in rural sites across the case-study countries acknowledged that they could not read the warning messages they received on their phones (for those who had phones). For instance, a woman in Kisumu, Kenya shared an experience where she had to wait for a week for her son to come and read the message, yet the flood had already occurred. Women stated that not being able to read warnings significantly contributes to their vulnerabilities as they are not able to prepare for impending hazards and act on time.

Looking at the education levels of household heads it is found that these are significantly higher than that of other respondents, reflecting the fact that 50 per cent of individuals interviewed were women and therefore not likely to be the head of a household. However, as described above, even within the group of household heads, more household heads in rural areas had no education or had only acquired primary education compared to those in urban areas. In urban areas across the case-study countries, the percentage of household heads with university degrees is also considerably higher, and the number of household heads with no education or primary education is lower.

3.4 Job sectors

Table 3.1 provides an overview of the most important job sectors of interview respondents, categorised by gender, area type (rural or urban) and country. Job sectors differ in terms of vulnerability to specific climate-related hazards. For example, the agricultural sector is highly vulnerable to drought, whereas the education or transport sectors are less so. Therefore, the job sectors of respondents are indicators of vulnerability. In addition, by diversifying risks across sectors, increased diversity of job sectors within communities may reduce the community's collective vulnerability. Urban areas show a higher diversification of livelihoods than rural areas. Rural areas are dominated by farming, fishing and pastoralism. Respondents in Burkina Faso and Ghana depend to a much

Children walking home from school in Kenya © Z. Zommers

Individuals working a field in Burkina Faso © Z. Zommers

higher degree on farming and pastoralism than respondents in Kenya. While farming, fishing and pastoralism are majorly practiced in rural areas across the case-study countries by both female and male respondents, the share of respondents in Kenya is lower (at about 45 per cent) compared to the other countries (75-95 per cent). Gender disparity is also evident. For instance, the majority of female respondents in urban areas of Ghana and Kenya sell food and drinks, or work in shops for a living, whereas male respondents mainly work in the transport sector, do office work or manual labour. In urban Burkina Faso, men are engaged in education (either as students or as teachers/lecturers). Education was not the main occupation of female respondents in all the case-study countries, again highlighting an imbalance of education level

Table 3.1 Main job sectors of respondents, divided by country, location type and gender.

	Location	Female		Male	
Burkina Faso	Rural	N=160		N=188	
		Farming, livestock, fishing	75.6%	Farming, livestock, fishing	92.6%
		Taking care of household/ children	15.6%	Manual labour	5.9%
		Manual labour	3.1%	Taking care of household/ children	0.5%
	Urban	N=16		N=17	
		Taking care of household/ children	31.3%	Student	35.3%
		Student	25.0%	Teaching / education	17.6%
		Artisan / service sector	25.0%	Office work	11.8%
Ghana	Rural	N=128		N=154	
		Farming, livestock, fishing	75.0%	Farming, livestock, fishing	92.9%
		Selling food / drinks, shop attendants or owners	21.1%	Taking care of household/ children	17.5%
		Taking care of household/ children	18.0%	Selling food / drinks, shop attendants or owners	6.5%
	Urban	N=56		N=30	
		Selling food / drinks, shop attendants or owners	33.9%	Transport	10.0%
		Artisan / service sector	14.3%	Office work	10.0%
		Taking care of household/ children	7.1%	Manual labour	10.0%
Kenya	Rural	N=111		N=103	
		Farming, livestock, fishing	45.9%	Farming, livestock, fishing	45.6%
		Taking care of household/ children	45.0%	Collecting selling water/ firewood/ charcoal	20.4%
		Collecting selling water/ firewood/ charcoal	27.0%	Transport	12.6%
	Urban	N=82		N=86	
		Selling food / drinks, shop attendants or owners	30.5%	Manual labour	25.6%
		Farming, livestock, fishing	24.4%	Farming, livestock, fishing	24.4%
		Taking care of household/ children	22.0%	Selling food / drinks, shop attendants or owners	9.3%

Job sectors in urban areas are often service oriented, such as selling food and drinks, working in shops, artisan work, teaching/ education and the transport sector, while rural areas are dominated by farming, pastoralism and fishing. Note: In Kenya, multiple responses were given, whereas in Ghana and Burkina Faso, only one response was possible (due to different instructions of interviewers).

A section of Mukuru Kwa Njenga, Nairobi. © Z. Zommers

Table 3.2 Main job sectors of household head.

	Location	Main job sectors	
Burkina Faso	Rural	N=352	
		Farming, livestock, fishing	91.2%
		Manual labour	5.4%
		Artisan / service sector	1.7%
	Urban	N=33	
		Teaching / education	18.2%
		Office work	18.2%
		Selling food / drinks, shop attendants or owners	12.1%
Ghana	Rural	N=287	
		Farming, livestock, fishing	82.6%
		Taking care of household/ children	13.9%
		Selling food / drinks, shop attendants or owners	6.6%
	Urban	N=90	
		Selling food / drinks, shop attendants or owners	28.9%
		Transport	8.9%
		Manual labour	8.9%
Kenya	Rural	N=214	
		Farming, livestock, fishing	54.7%
		Collecting selling water/ firewood/ charcoal	15.9%
		Taking care of household/ children	11.2%
	Urban	N=169	
		Farming, livestock, fishing	23.7%
		Manual labour	18.9%
		Selling food / drinks, shop attendants or owners	17.8%

between the genders. Women more often engage in taking care of the household which is not among the top three occupations of men in any of the study sites in the case study countries.

Similar to the education level, the job sector of the head of household is an important indicator of the vulnerability of the people living within the household. Table 3.2 shows the main job sectors of the household head grouped into countries and location types. Again, rural areas across all three countries are mainly characterized by pastoralism, farming and fishing, while urban areas show a higher diversity of jobs, without the clear dominance of only one field of activity.

3.5 Ability to pay household expenses

Figure 3.3 shows the result of the survey on the ability to pay household expenses for rural and urban areas in all three countries. The differences vary across countries with no uniform tendency for all countries. In rural areas in Kenya, households struggle more with covering household expenses than in urban areas. In Kenya, more than 70 per cent of respondents in rural areas acknowledged that their households did not have sufficient funds to cover household expenses and other costs, compared to 50 per cent of respondents in urban areas. In Burkina Faso and Ghana, however, there is no clear difference in the ability to cover expenses between rural and urban areas: In Ghana, approximately 50 per cent of households in urban as well as in rural areas do have sufficient funds to cover all household costs. In Burkina Faso, in rural and urban areas alike, approximately 65-70 per cent of households have insufficient funds to cover all household expenses.

The importance of relying on the support of family members is very different between countries. In Burkina Faso, a relatively large fraction of respondents indicated that they

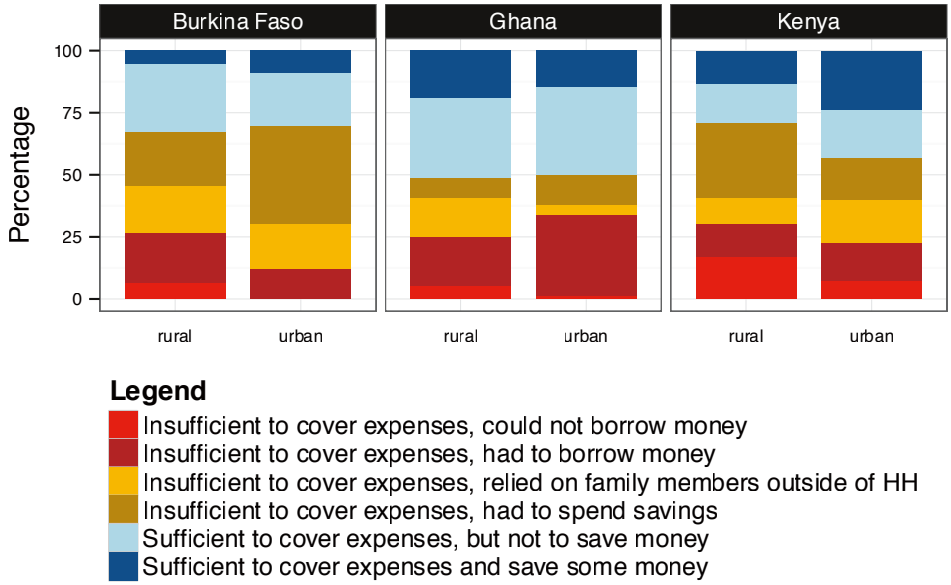


Figure 3.3 Ability to pay household expenses

relied on family members to cover expenses. Approximately one fifth of households relied on family members outside the household in times of financial constrain, both in rural and urban areas. In urban Ghana, on the other hand, this number is only three to four per cent.

The percentage of households that are particularly vulnerable, in that they have insufficient funds to cover household expenses and cannot borrow money, is highest in rural areas in Kenya (10 per cent). In urban areas in all three countries, this fraction of households is negligible, ranging between zero and one per cent.

A household's ability to take care of all expenses, whether or not by borrowing, and save some money is an indicator of wealth status, which translates into the ability of that household to respond in case of any disaster. From both the surveys and Focus Group Discussions (FGDs) conducted, those who said they would not take any action if they received warnings this was attributed to a lack of capacity (in terms of funds, new places to relocate to etc.).

3.6 Conclusion

This Chapter looked at the results of household surveys in Burkina Faso, Ghana and Kenya, highlighting differences in household size, education, employment and ability to cover expenses. These factors, among others, influence vulnerability to hazards.

The results show significant variability in vulnerability, often within a country. Rural areas tend to have households of larger size, with lower education levels and income sources concentrated in individual sectors, primarily agriculture or pastoralism. Rural communities are therefore more likely to be vulnerable to climate-related hazards. They are also less likely to be resilient to shocks and disturbances, as income is concentrated in one area and there is limited ability to cover expenses. Even within communities and households vulnerability differs. Women have less education, are more likely to be illiterate and are less likely to engage in wage labour, increasing their vulnerability levels. Households in urban areas may have higher levels of education and a greater diversity of income sources. This is likely to increase their ability to bounce back from shocks.

The diverse profiles and needs of EWS users pose a huge challenge for governments attempting to offer uniform service. However, it also offers important lessons. First, to reach the last mile EWS need to be flexible and locally relevant. Messages have to be sent in many different formats, through different channels, and address different needs. The forms of communication are further explored in the next chapter.

At the same time, EWS will only be effective if concerted action is taken to reduce vulnerability. This requires investment in basic services such as education. Drivers that curtail resilience to hazards include poverty, inequality and rising pressure on land, water, and biodiversity. As expressed in the Sendai Framework, "more dedicated action needs to be focused on tackling underlying disaster risk drivers, such as the consequences of poverty and inequality, climate change and variability, unplanned and rapid urbanization, poor land management and compounding factors such as demographic change, weak institutional arrangements, non-risk-informed policies, lack of regulation and incentives for private DRR investment, complex supply chains, limited availability of technology, unsustainable uses of natural resources, declining ecosystems, pandemics and epidemics." Improved development outcomes will enable households to both prepare for and respond to hazards. Reduced losses from hazards will then further enable economic growth and contribute to development gains. EWS must be integrated within the broader domain of development, and not considered solely a service of meteorological agencies.

Chapter 4

How Should Early Warning be Communicated?

Even if predictions are accurate, if warnings do not reach users, or users do not act on warnings, EWS are ineffective. Lessons are offered by the 2014 Ebola outbreak. In Nigeria warning messages were spread through multiple communication channels, reached a wide audience and were thought to be credible by the population (Anyaka, 2014). In Liberia communities did not trust the warnings and did not act upon the provided instructions (Daily Mail, 2014). As a result, by 20 October 2014, Nigeria was declared Ebola virus free by the World Health Organization, three months after its introduction into the country[17]. By contrast, at this same time, cases were still increasing in Liberia and the situation was characterized as "the most worrisome"(WHO, 2014).

In national Hyogo Framework for Action progress reports, the governments of Burkina Faso, Ghana and Kenya, among many others, acknowledge the difficulties of warning all individuals of impending hazards (UNISDR, 2014). To overcome these difficulties, this chapter examines respondents' access to different forms of communication technology and best practice in warning communication. Results are based on household surveys as well as on a systematic review of literature. A total of 128 publications (78 peer-reviewed scientific papers and 50 "grey" articles from leading non-governmental and intergovernmental organizations) were reviewed. Best practices for warning communication were identified based on the results.

4.1 How can warning information reach communities?

Field research conducted in Burkina Faso, Ghana and Kenya show that local communities have access to numerous communication channels (Figure 4.1). Ownership of communication devices such as mobile phones does not depend on gender, but there are clear differences between urban and rural areas. In the three countries, ownership of mobile phones in urban areas is above 90 per cent, while in rural areas this rate is lower (between 55 and 80 per cent). Households in urban areas are also more likely to own radio or TV. Between countries, TVs are more widespread in Burkina Faso and Ghana than in Kenya. Personal computers are not widely owned, but are present in urban areas.

17 See: http://www.who.int/mediacentre/news/statements/2014/nigeria-ends-ebola/en/

Women in Turkana and Nairobi, Kenya, with mobile phones.
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In addition to the ownership of communication devices, the survey analysed respondents' use of media and communication channels (in general, not specific to receiving warning). Understanding access to media can broaden the variety of channels that can be used to disseminate warning messages, thereby increasing the reach of warnings. The results are presented in Figure 4.2.

In urban areas TV and radio are widely used – usually daily or weekly – in receiving general information and news updates. The frequency of usage is aligned with the ownership rates of these devices. Whereas in urban Ghana newspapers do not seem to have a large audience, in Burkina Faso and Kenya, newspapers have a wider readership. As can be expected from computer ownership levels, only a small proportion of respondents regularly use the internet. In rural areas the most widely and regularly used medium is the radio: in Ghana, almost 90% of people generally listen to the radio daily or weekly, in Burkina Faso and Kenya this number is between 54% and 60%. Internet and newspaper do not play an important role transmitting general information here.

4.2 How are people warned?

In terms of issuing warnings, the radio is the most relevant channel, both in rural and urban areas across all three countries. In rural areas, besides the radio, family, community members, friends, religious groups and public places are

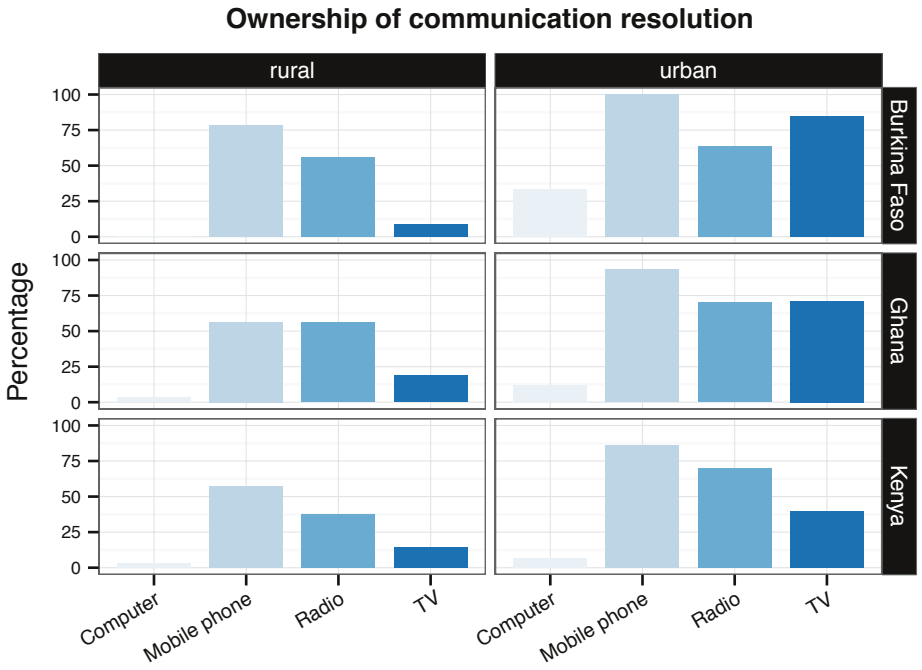


Figure 4.1 Percentage of respondents owning communication devices. Urban areas have a greater access to different modes of communication. In Burkina Faso about one third of respondents indicated to own a computer, compared to around 12 per cent in Ghana and just three per cent in Kenya. This may not be representative and may be explained by the selection of the research sites.

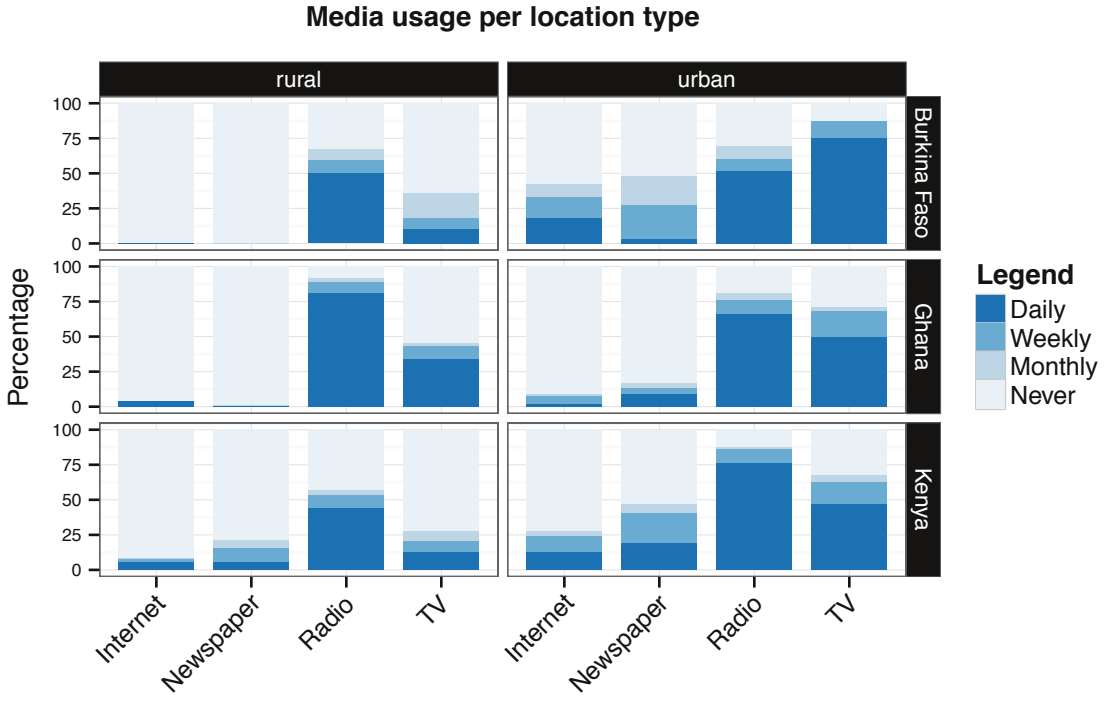


Figure 4.2 Frequency of media usage by respondents

generally the most important channels through which people receive early warnings, highlighting the importance of social networks for the communication of warnings. In urban areas, the TV plays an important role in addition to radio. Respondents in urban areas in Kenya have a higher diversity of communication channels and a higher reliance on social networks than those in urban areas in the other two countries. SMS and mobile phones play an important role in Kenya, but are less important in Burkina Faso and Ghana. This is displayed in Figure 4.3.

4.3 Local Involvement

Local involvement is critical to the success of EWS (e.g. Birkmann et al., 2013; Susmayadi et al., 2014). Local participation can also contribute to the spread of information or warnings. Mechanisms for local involvement in data collection or communication should therefore be identified when EWS are designed (see Section 4.4 on warning communication best practices).

Traditional knowledge is one way to include communities, as is citizen science or mapping (see box 4.1 for an example

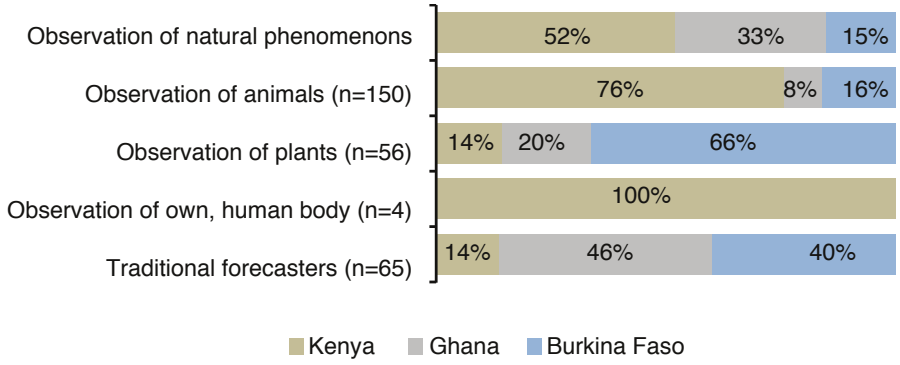


Figure 4.3 References to traditional knowledge indicative of climate-related hazards per country, made by respondents who indicated to use such types of knowledge

of citizen mapping). Community members can collect data relevant to hazards, by observing bio-indicators for example, or by helping monitor weather (Zommers, 2014). Communities often have accumulated centuries of knowledge on local climate and weather conditions. This, combined with the fact that they are based in potentially affected areas, makes local communities ideal observers of bio-indicators or traditional knowledge that are indicative of impending hazards.

During CLIM-WARN fieldwork, respondents were asked whether or not they used traditional knowledge related to climate hazards, and if so what type of knowledge. A total of 429 references grouped into five categories of knowledge were collected (Figure 4.4). Observation of plants is most common in Burkina Faso while in Kenya individuals also observe animals to understand weather patterns. Respondents for example mention that the appearance of certain birds and the movement of insects, the croaking of frogs, and the sprouting of certain trees are indicative of incoming rain. Similarly, changes in cloud patterns, lightning, and changes in (night) temperatures are used by respondents to forecast the weather. How this information can be shared and used for early warning should be further explored and the accuracy of information should be evaluated.

4.4 Gathering and communicating warnings

Data and information on hazards and risk need to be gathered before warnings can be communicated. To be effective, the delivery of warning need to coordinated. One way to ensure coordination is for the EWS to be applicable for multiple hazards. The CLIM-WARM project has designed a prototype of such EWS (Box 4.2).

Clearly a variety of mechanisms exist through which to share information with communities, and a variety of data sources are possible. How should this information be best communicated? Suggestions specific to SMS are provided in Box 4.3.

The literature review further revealed a total of thirteen best practices for communicating early warning messages to communities. These can be grouped into three categories: “recipients”, “design”, and “process”. These three categories are pillars of effective early warning communication (Figure 4.7).

Box 4.1 Engaging communities with mapping tools

Since 2013, UNESCO has been carrying out a pilot project in Kenya that aims to advocate, inform and prepare communities in undertaking DRR measures to enhance resilience in post-conflict and post-disaster (PCPD) situations.

The pilot project aims to promote community engagement in decision-making processes concerning natural resource management in disaster prone areas of Mathare slums in Nairobi. It is part of the larger project called World Map of UNESCO Points of Interest (POI Project) that is being piloted in Mathare slum of Nairobi, Kenya.The POI Project strives to contribute to a free, open and web-based world map through citizen’s participation (crowdsourcing) with the objective to strengthen the resilience of local communities, and the response of UNESCO and the global organizations to PCPD situations through an openly licensed GIS data infrastructure.

Through the use of Ushahidi Open Street Map - a Swahili word for testimony or witness – the the POI Project has been able to provide a platform on which community members, government authorities, journalists and experts are able to acquire, share and disseminate information.. The project has also been able to promote public accountability and ownership, combined with elements of social activism and geospatial information that enable people to submit reports of activities in their areas using their mobile phones, through SMS and social media (Facebook and Twitter). The key points of interest include: Primary schools, Secondary schools, Colleges, Universities, Special schools, Early Child Hood Development Centre’s (ECDC), among others.

The POI project has created an online Open-Source Map that serves as an advocacy tool for community organizations in the area. The platform also permits community organizations to have real-time data on problems that the community faces.

Giving communities the possibility to directly voice their concerns, through a mapping tool, allows for bottom-up communication and can directly inform policy makers. This way, early warning communication, planning, and response can benefit from more informed and more inclusive decision making.

Box 4.2 A web-based multi-hazard EWS: Proof of concept

Response is often limited not only by lack of information but also by lack of coordinated delivery of information. EWS often exist for separate hazards, but communities are threatened by multiple hazards. CLIM-WARN helped design a web based prototype which compiles information into a central platform: http://prototype.climwarn.org/. It demonstrates that it is possible to integrate thematic hazards into one system, identify vulnerable subpopulations and then issues warnings to a preselected database of users by SMS or email.

The prototype (Figure 4.4) demonstrates the generation of early warning messages for specific drought and flood periods in pilot areas Nzoia, Turkana and Kwale counties in Kenya. It is based on a modular approach combining dynamic hazard modules driven by near real time gridded weather data, a vulnerability module developed from multi-layer information on exposure, sensitivity and adaptive capacity. A risk module then ranks risk as a function of drought hazard and vulnerability. The choice of indices and data layers determining the key modules is flexible and can be adjusted to the needs of specific users by the DRR professionals, farmers or pastoralists.

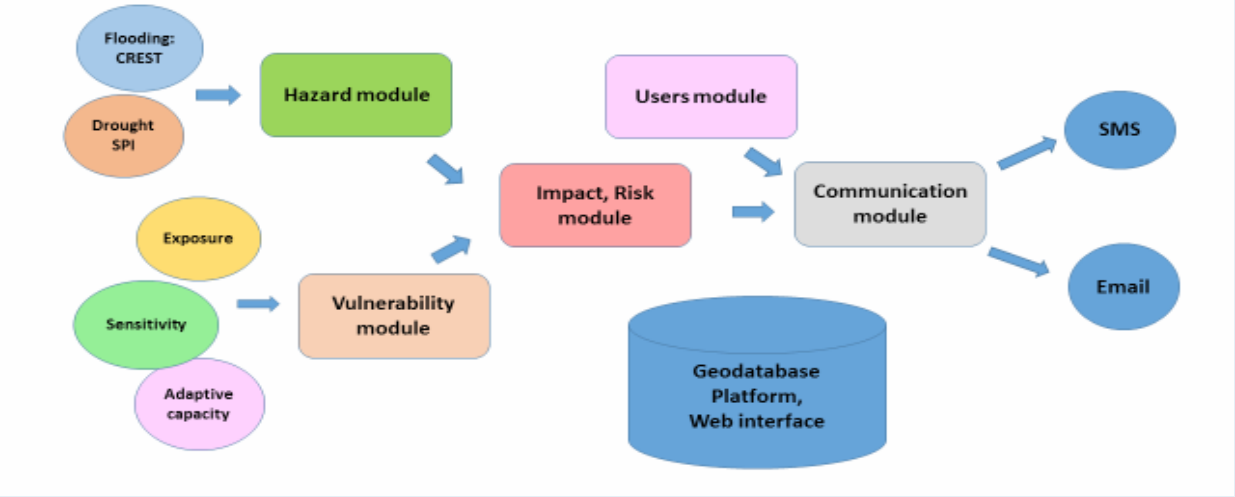


Figure 4.4 Prototype functional design:

The prototype uses open data to feed open, well established drought indices (Standardized Precipitation Index SPI [1]) and hydrological models and tools (Coupled Routing and Excess Storage distributed model CREST [2] and GIS flood tools [3]. Thresholds were identified as triggers for warnings. When a threshold is passed, a warning can be sent to a group of users (Figure 4.5). A communication module can be used to compile and store user profiles, including phone numbers and email addresses. Warnings will be sent to these people.

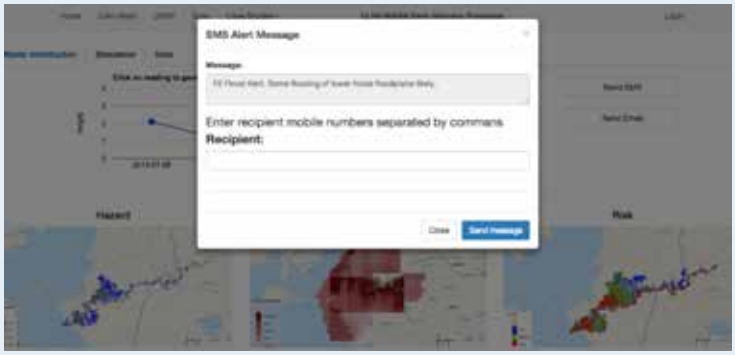


Figure 4.5 Communication module interface

The prototype aggregates the input data and model output by the lowest administrative units, to provide a geographic reference useful at the local level (see Figure 4.6). In order to visualize the impact of a risk situation, the prototype includes GIS layers of infrastructure, location of houses, schools and health centres that indicate possible impact of flooding.

This figure shows a simulation of how the prototype could work, to use hazard and vulnerability data to identify areas at risk. Data and forecast results from multiple hazards could be combined to create a visualization of areas at risk from multiple hazards. Messages could then automatically be distributed to vulnerable users.

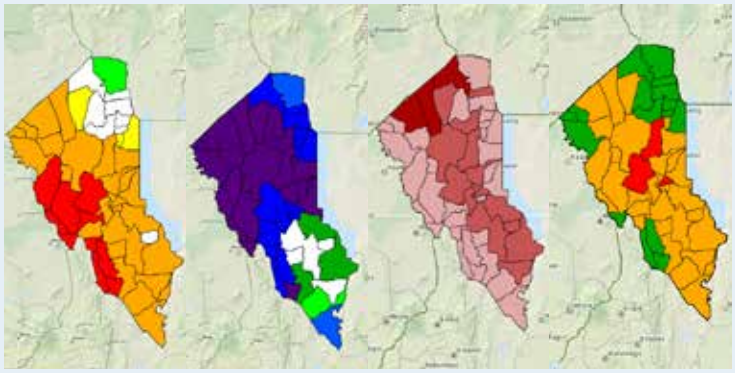


Figure 4.6 Turkana County drought hazard, vulnerability and risk, in four wards.

Box 4.3 Guidance for growing use of SMS

Mobile communications is the fastest growing technology around the world and growth is especially high in developing countries (World Bank, 2014). In fact, the next billion mobile subscribers will consist mainly of the rural poor (World Bank, 2014). This makes mobile technology a key opportunity for sending warning. SMS can be delivered in areas where voice calls would fail, and SMS data can be instantly digitised to trigger automatic actions, reducing error rates and human effort in data collection (SIMLAB, 2015).

Robust platforms are now available to process large volumes of text messages. There are several open source providers of SMS gateways for the collection and dissemination of SMS, such as FrontlineSMS or Twillo's Rapid Response Kit[18]. When preparing warnings for SMS delivery, consideration should extend to questions of security (to ensure user details are not accessible by unauthorized parties), scalability of the platform (see GSMA, 2013 and GSMA, 2015) and cost of sending messages.

User-testing of both the content and the medium are essential when designing an EWS. As with all new product development, evolving the service based on evidence of use is the most important part of the product life cycle. With an SMS EWS piloting use with groups of rural users will help the product develop into a more useful service, whilst simultaneously building advocates on the ground that lend trust and credibility in the service.

Mobile phone charging business in Kenya. © Z. Zommers

The following are issues that should be considered when communicating warning through SMS:

1. Know your audience and be inclusive: is SMS appropriate for your end user? Should Interactive Voice Response (IVR) be adopted for sending recorded voice messages to end users that are illiterate?
2. Push vs. pull: should you build for 2-way communication with the end user?
3. Simple, active language: will the end user be able to easily understand and act upon your message? What language is most easily understood in written form?
4. Timing: When will you send your message? What time of day and at which level of warning?
5. Length: What length will your message be? Could three shorter messages be better understood than two 160 character messages?
6. Link to further information: such as a hotline or a webpage or a contact on the ground.
7. Market the service to build trust: build relationships with trusted stakeholders in the field and consider advertising on platforms such as vernacular radio.
8. Costs: will the service be free of charge for users or will the cost of the message be deducted from a recipient's airtime?

18 https://github.com/Twilio-org/rapid-response-kit

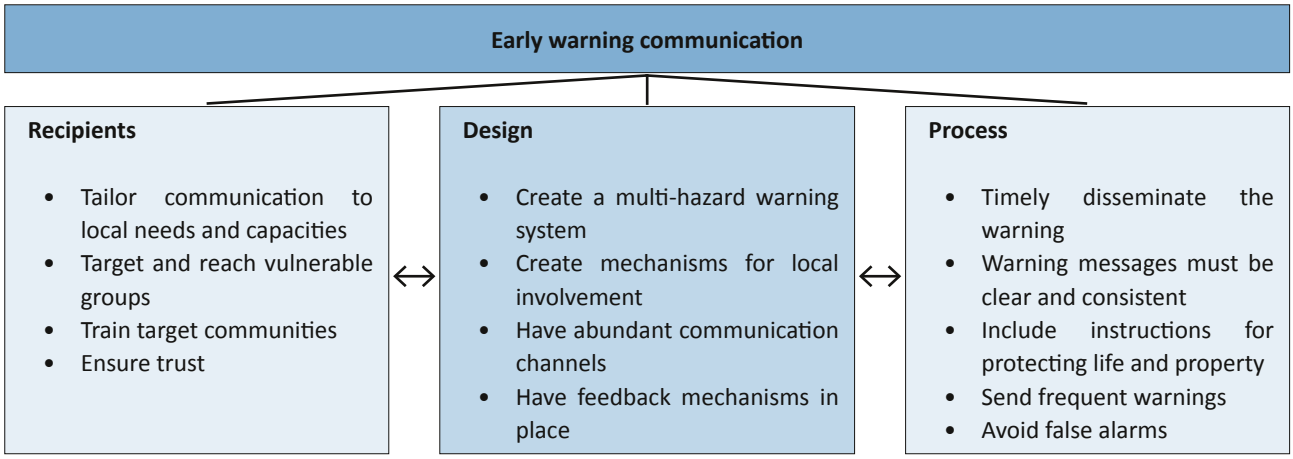


Figure 4.7 Three pillars of effective warning communication

Each pillar is necessary, but not sufficient, to effectively communicate warning messages.

The first pillar of effective early warning communication is centred on the recipients of early warning messages, i.e. people that potentially face a hazard. Early warning communication should be tailored to local needs and the local capacities for receiving warning (see box 4.4). In addition, target communities should also be provided with training so that they know how to receive and interpret warning messages, as well as what to do in case they face a hazard. Finally, early-warning messages should ensure trust and be sent through mediums that are trusted locally.

The second pillar of effective early warning communication is focused on the design of the communication. Rather than having different communication strategies for each individual hazard, EWS should be designed to communicate information about multiple hazards. Moreover, mechanisms for local involvement, as well as for feedback, should be in place. Furthermore, early warning messages should be disseminated through multiple communication formats, in order to increase the likelihood that the community will receive the warning.

The third pillar of effective early warning communication is focused on the process of disseminating the messages. Messages should be disseminated in a timely, clear and consistent manner. Also, warning messages should include recommended actions, e.g. instructions for protecting life and property. Warning messages should be sent several times, and where possible, false alarms should be avoided. To avoid such false alarms or confusion, trigger mechanisms for sending messages (e.g. certainty of hazard or impact size) should be clarified in advance.

The literature review also provided practical advices on how to ensure the three pillars of effective warning communication are realized. These are summarized in table 4.1 and can serve as broad implementation guidelines.

NDMA, in Kenya, incorporates several best practices in disseminating drought warnings. See box 4.5 for a discussion.

Box 4.4 Tailoring communication to local needs and capacities

It is important that warnings are tailored to local needs and capacities. This means that communication channels are selected based on technology communities can use (UNOCHA, 2013). Communication using high-tech equipment may not always be preferred. In areas where mobile phone ownership is low, or where signal is limited, traditional forms of communication are critical (Birkmann et al., 2013). For example, in Bangladesh cyclone-warning messages are effectively disseminated through colourful hot air balloons (Haque et al., 2012).

Similarly, means of communication need to be aligned with the local geography and demography. Whereas in the densely populated country of Haiti loudspeakers and sirens effectively disseminate warnings throughout the community (Wall & Gerald Chery, 2010) and can be adopted in other densely populated areas, these communication means are ineffective in sparsely populated areas (Haque et al., 2012). For practitioners to select appropriate communication channels, particular attention should be paid to the density of the population and the population's technological capacities.

On the basis of these two indicators a graph can be designed that provides practical guidance on the selection of communication channels. Population density is reflected on the vertical axis while technological capacity is reflected on the horizontal axis. Population density is measured by the number of people per square kilometre of land area. The number of mobile cellular subscriptions per 100 people is used as a proxy for technological capacity, even though other indicators can be used as well. Low technology targeted communication may be preferable in sparsely populated areas with low technological capacity. In areas with high technological capacity and high population density, communication formats such as social media may be appropriate. A number of (randomly chosen) countries are plotted in the matrix as an illustration (Figure 4.8). Although the figure applies a national level of analysis, sub-national areas within

these countries are likely to differ on the basis of these two indicators. Therefore, practitioners are advised to downscale the geographic level of analysis.

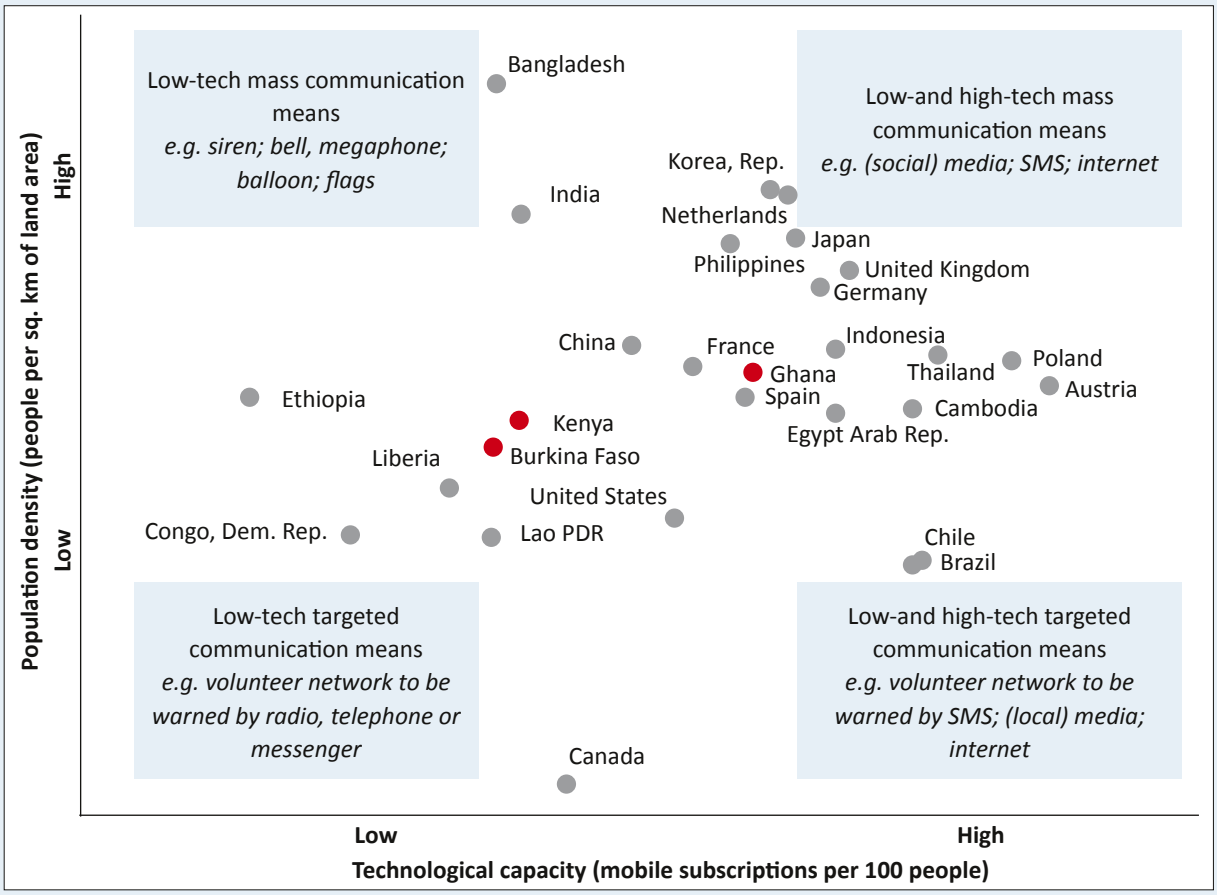


Figure 4.8 Selecting appropriate communication channels

Table 4.1 Implementing the three pillars of effective warning communication

Best practice	Required action
Recipients	
Tailor communication to local needs and capacities	• Stakeholder analysis and discussion to identify needs and capacities • Align communication channels with population density and local technological capacities • Align communication with local governance structure and fit with multilingual environments
Target and reach vulnerable groups	• Stakeholder analysis and discussion to identify vulnerable groups and how to reach these • Particular focus on children, elderly, disabled, women, socio-economic disadvantaged people and tourists
Train target communities	• Training program to increase awareness and appropriate response • Through public education, workshops and distribution of training material
Ensure trust	• Establish trusting relationship with recipients through transparency • Stakeholder analysis to identify trusted communication channels and authoritative sources
Design	
Create a multi-hazard warning system	• Integrate observation institutes for all possible hazards and send warnings through one channel
Create mechanisms for local involvement	• Include local communities in the design, development and maintenance of the EWS • Include bottom-up communication channels
Have abundant communication means	Select multiple, complementing communication channels based on population density and local technological capacities, and trust Enact legislation to mandate the media to provide early warning
Have feedback mechanisms in place	Include bottom-up communication channels designated for feedback and actively request feedback
Process	

Table 4.1 Implementing the three pillars of effective warning communication (continued)

Best practice	Required action
Warning messages must be clear and consistent	• Use understandable wording, include information about the threat level, impact area and time of occurrence. Consider use of graphics
Include instructions for protecting life and property	• Analyse local circumstances to identify appropriate responses • For rapid-onset hazards advise safety responses (e.g. evacuation, shelter). For slow-onset hazards advise resilience responses (e.g. stocking supplies, building dams and drains)
Timely disseminate the warning	• Send warnings timely and ensure warnings are timely received by the public and relevant authorities
Send frequent warnings	• Send warnings frequently depending on type of hazard (rapid- or slow-onset)
Avoid false alarms	• Combine high-technology and traditional observation techniques • Analyse warnings before disseminating them • Clearly communicate the probability of the hazard's occurrence

Box 4.5 The case of Kenya's NDMA drought EWS

Kenya's National Drought Management Authority conducts drought monitoring and produces a monthly bulletin. However, communicating drought warning in remote areas with limited access to modern forms of communication is a challenge. One such place is Turkana, in the north of the country.

To overcome this challenge NDMA engaged in discussions with local people. Subsequently, it decided to communicate drought information by means of color-coded flags. These flags are raised at central locations within the community, such as primary schools. Members of the community have been educated on how to interpret the colour and what actions to take through campaigns and sensitization forums.

Community members are also involved in the dissemination of drought information. For example, primary schools engage children as drought ambassadors, tasked with communicating drought information to other community members, and there is a drought dance group which communicates drought information through traditional dances.

Before the bulletin is released it has to be approved by the County steering Group. Upon approval an information officer communicates the drought bulletin information to focal persons at the 20 flag pole sites, who are responsible for matching the flag with the latest drought information. The different early warning phases in the flag system are;

NORMAL: This phase is represented by the green flag. The indicators show no unusual fluctuations and remain within the expected ranges for the time of the year in a given livelihood zone, division or county. In this phase, the drought status is normal, the risk is low, and vulnerability is low.

ALERT: The alert phase is represented by a yellow flag and it occurs when environmental indicators show unusual fluctuations outside expected seasonal ranges within the whole county or livelihood zones. In this phase, risk is moderate, and vulnerability is moderate. Proposed environmental indicators for the EW phase classification include remote sensed indicators measuring meteorological and agricultural drought while hydrological drought is assessed using local informants.

ALARM: This phase is shown by an orange flag and it occurs when both environmental and production indicators fluctuate outside expected seasonal ranges affecting the local economy. This condition affects most parts of the county or specific livelihood zones and directly or indirectly threatens food security of vulnerable households. In this phase, risk is high, and vulnerability is high.

EMERGENCY: The red flag is hoisted at this phase where all indicators are outside of normal ranges and local production systems have collapsed within the dominant economy. The emergency phase affects asset status and purchasing power to extent that seriously threatens food security. As a result, coping strategy index, malnutrition (MUAC) and livestock mortality rates move above emergency thresholds.

NDMA's drought warning system embodies several of the identified best practices. In terms of recipients, it tailors communication to local needs and capacities and it trains target communities. In terms of process, warnings are disseminated timely, the flag system is clear and consistent, warnings include instructions, they are sent frequently and they are checked for false alarms. Nevertheless, improvements can be made in terms of design. Furthermore, the system should be extended to cover other areas at risk of drought.

Turkana women in an NDMA monitored community discussing design of early warning system. © Z. Zommers

4.5 Conclusion

To be effective, warning communication should focus on the recipients of the warnings, the design of the communication and the process of disseminating warnings. Communities in Burkina Faso, Ghana and Kenya have access to a variety of communication means. However, the preferred form of communication differs by area. In rural households, family, friends and community members remain a common communication channel. Households in urban areas are more dependent on modern technology such as TV and SMS. They also receive information through more diverse sources. The use of SMS is growing, and offers huge potential. However in many areas gaps in mobile phone reception and cost limit use of SMS. Further, mobile phone systems may be overwhelmed in times of crises. Therefore, sending warning through a mix of different formats such as radio, TV, SMS, community meetings, flags, will have the greatest reach. In communication, as with livelihood sources, diversity increases resilience.

At the same time, avenues to include people in the warning system through bottom-up communication should be explored. Engaging community members as citizen scientists by enabling them to provide local or traditional knowledge, or by allowing people to map areas of importance for early warning and response can bring valuable additions to EWS.

Chapter 5

How Can We Better Ensure Early Action?

After warnings are issued, early action is needed to reduce the possibility of loss or damage. Numerous examples illustrate how reliable information about impending hazards has not been effectively utilized to avoid loss, including the 2005 Hurricane Katrina in the United States, the 2008 famine in Zimbabwe (IFRC, 2009), and the 2011 and 2012 droughts in the Horn of Africa and Sahel regions, respectively. Similarly, the challenges containing the Ebola virus in Guinea, Liberia and Sierra Leone reflect the complexity of responding to impending crises.

Governments not only have the responsibility to issue warnings, but also to ensure that people respond to warnings in ways that minimize losses. To do so, it is critical that communities have the required capabilities to respond and have developed, or are aware of, response plans.

This chapter provides an overview of household awareness and understanding of response plans and options, based on survey results. In addition, the chapter reviews best practices in responding to warning, as identified through a comprehensive review of literature and response plans for three common hazards: floods, droughts, and storms. The roles of different actors are discussed. Lastly, tools to help promote early action, including innovative policy and financial instruments, s are reviewed.

5.1 How do people respond to early warning?

During the household surveys, respondents were asked whether contingency or response plans existed for their community. The percentage of people who responded "Yes" is presented in Figure 5.1. Ghanaians appear to have either the highest awareness of contingency plans, or the highest number of community level contingency plans. In Burkina Faso and Kenya, fewer people report the existence of contingency plans. Generally, people in urban areas were less aware of the existence of contingency plans.

5.2 How should people respond to early warning?

Communities were invited to describe their response needs. During the household interviews individuals who were not aware of any contingency plans were specifically asked: "What should be done to prepare for hazards?" The answers are displayed below as word clouds (Figure 5.2). Responses did not appear to differ by gender. Words frequently used in the responses are larger, and more prominent, than words used less often. Based on the answers, it is clear that communities see a need for education, general awareness raising, earlier warning times and changes to practices related to planting of crops and general infrastructure development, such as improved water drainage and road maintenance. Both communities and national governments should play a role in response to hazards.

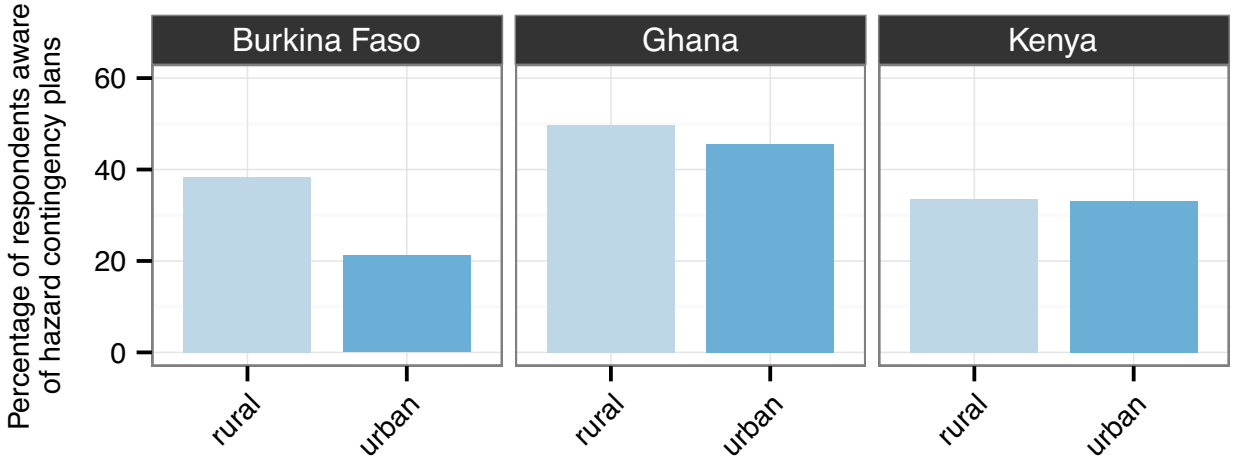
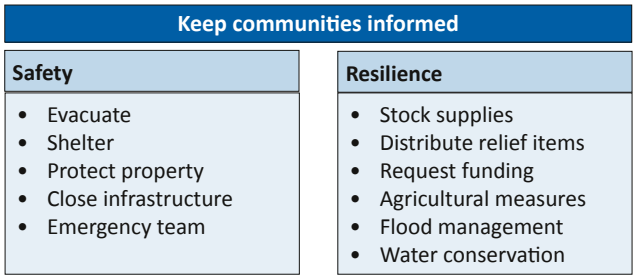


Figure 5.1 Awareness of contingency plans

Figure 5.2 Community identified needs or actions to prepare for hazards in Burkina Faso (top), Ghana (middle) and Kenya. Larger words were mentioned more often in household surveys.

A literature review was also conducted to identify response options. A total of 148 articles (100 peer-reviewed scientific papers and 48 grey literature publications) were analysed to identify key features of warning response. Twelve specific measures were prominent in literature: keeping communities informed, evacuation, providing shelter, protection of property, closure of infrastructure, activation of an emergency team, stocking of supplies, distribution of relief items, requesting of funding, undertaking agricultural specific measures, engaging in flood management, and conserving water. Of these twelve, keeping communities informed is a general response appropriate to all hazards. The remaining eleven responses can be categorized as related to safety and resilience (Figure 5.3). Responses focused on safety aim to avoid the impact of an approaching hazard, and are most appropriate for rapid-onset hazards. Responses focused on resilience, on the other hand, aim to enable people cope with the hazard over the long term and may be appropriate for slow-onset hazards. Such responses may aid long-term adaptation.

Figure 5.3 Basic response measures



The type of response most appropriate in a given situation depends first on the type of hazard. Floods and droughts demand a set of specific responses, including building (sandbag) dikes and drains for the former, and water conservation measures, such as quotas and fines, for the latter. The agricultural sector is often visibly impacted by natural hazards and the nature of the sector requires a specific set of responses, such as altered planting of crops and selling of livestock and produce. These were combined under the heading "agricultural measures".

Four factors are important in determining which type of response should be initiated: time, impact, people and capacity. These factors are inter-related and their individual and collective importance allows practitioners to decide which response is most appropriate. Figure 5.4 displays these four factors and their relation to the response plans.

drought warning is issued (with a relatively long lead time) people may have enough time to stock food supplies and adjust the planting patterns, thereby allowing them to cope with the drought conditions. Naturally there is overlap in the two response plan categories. It is critical to build resilience to all hazards, and take actions to minimize risks over the long term.

Second, the projected impact of the impending hazard influences the appropriateness of the response plan. Hazards may pose direct or indirect risks to human lives or assets. In case of direct projected impacts, safety responses are advised. In turn, in case of indirect projected impacts, resilience response may be more appropriate. For example, in case an impending flood is projected to cause a direct risk to the lives and health of those in the impact zone, people need to be brought to safety through evacuation and other measures. However, if the flood is forecasted to indirectly influence human health and safety, it may be sufficient to initiate resilience responses such as flood management (sandbag dikes, drains etc.).

The other two factors, people and capacity, also influence the selection of response plans. The first of these, people, takes into account who is vulnerable to the impending hazard and the location of these individuals. Specific attention

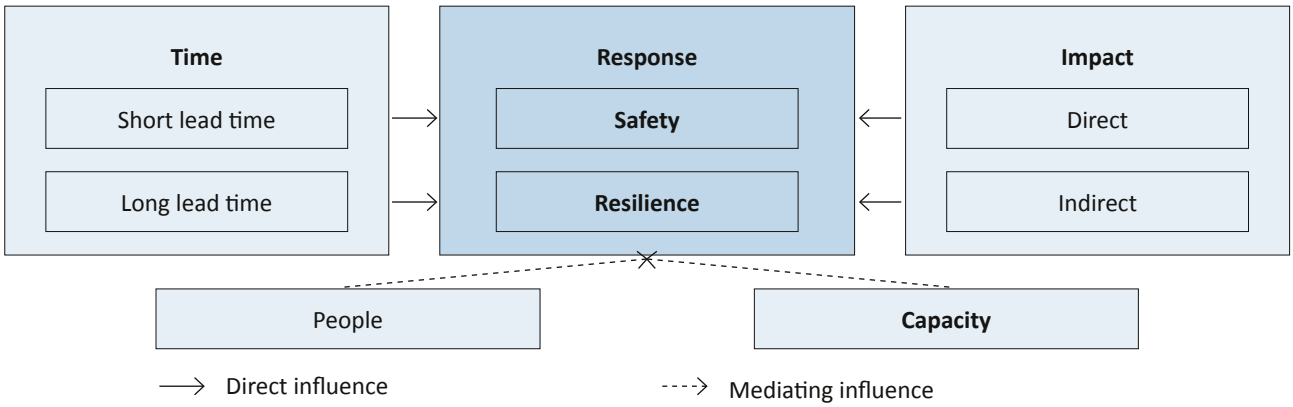


Figure 5.4 Factors influencing the choice of warning response

Time and impact directly influence choice of response plan (safety or resilience). As posited by Post et al. (2009), knowledge of how much time people need to take appropriate action versus how much time they actually have, is crucial in determining appropriate response. Hazards are generally characterized as being either rapid or slow-onset and thus have varying lead times.

In general it can be argued that for rapid-onset hazards, which provide little time for preparations, it is most appropriate to initiate safety responses[19]. For example, if a storm is quickly approaching people may need evacuate to avoid the storm's impact. In contrast, for slow-onset hazards, which provide more time for preparations, it is more appropriate to take resilience responses[20]. To illustrate, if a

should be paid to vulnerable groups within the community. Subsequently, it has to be determined whether those who are potentially affected are able to respond in the way advised.

Response plans need to be aligned with the capacities of the affected people and their environments. The local capacity, based on the local geographic and topographic conditions, population density, distribution of critical facilities, and infrastructure, all influence the devised response plan. For example, during flooding, if geographic conditions do not allow for evacuation to higher ground, or if infrastructure does not allow affected people to be moved, other responses, such as the construction of (sandbag) dams and drains, will be needed

Practitioners can use this model to select appropriate responses to impending hazards. In doing so, responses need be selected that adhere to the conditions of time and impact while including all people and local characteristics. It should

19 These are responses that enable people to avoid the impact of the approaching hazard

20 These are responses which allow people to cope with the hazard when it materializes

Table 5.1 Prototype response plans for floods, droughts, and storm surges

Prototype response plans per hazard and lead time				
Hazard Application	**Lead time**	**Flood**	**Drought**	**Storm Surge**
General	Medium - long	• Construct drains • Construct dams • Construct dikes • Provide shelter • Stock emergency supplies • Increase infrastructure resilience	• Construct irrigation systems • Set-up micro-insurance • Stock food supplies • Enact water conservation policies • Well drilling • Rain water capture	• Stock emergency supplies • Increase housing resilience • Provide shelter
	Short	• Evacuate • Sandbags • Clear drains • Mobilize volunteers • Seek shelter • Distribute emergency supplies • Install water pumps	• Distribute food supplies • Enact water conservation policies • Distribute water supplies • Well drilling • Rain water capture	• Evacuate • Mobilize volunteers • Storm proof houses • Seek shelter • Distribute emergency supplies
Agriculture	Medium – long	• Obtain insurance • Flood resistant crops • Adjust planting • Enhance irrigation	• Obtain insurance • Drought resistant crops • Stock food for cattle • Enhance land-use • Adjust planting • Increase access to seeds • Increase access to fertilizer	• Obtain insurance • Build storm resilient stalls • Build storm resilient greenhouses
	Short	• Move livestock to higher ground • Access markets • Adjust harvest • Baling of hay for conservation	• Access markets • Access grazing areas • Distribute seeds • Adjust harvest • Livestock destocking • Vaccinations and deworming	• Protect livestock • Provide shelter for livestock

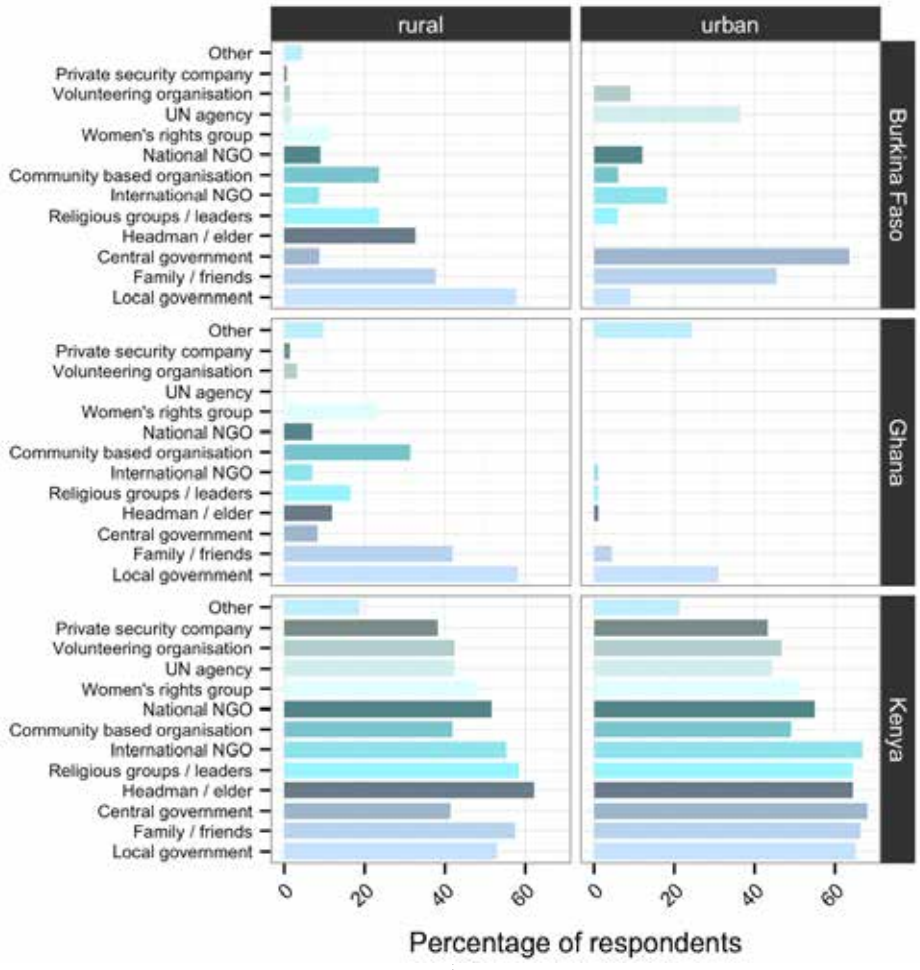


Figure 5.5 Confidence in support by different groups and institutions

be kept in mind that the safety and resilience responses are not mutually exclusive and complement each other. Subsequently, the identified responses should be aligned with characteristics related to people and conditions.

Specific actions that can be included in response plans, based on literature or suggestions by survey respondents, are presented in Table 5.1. These were subsequently classified as either of a general nature or specific to the agricultural sector. It should be noted that these actions are not exhaustive.

5.3 Who should facilitate early warning response?

Various actors may be involved in early warning response. Figure 5.5 highlights confidence in institutions involved in response after the onset of a hazard. Survey responses indicate that people not only turn to the central and local governments but also to groups of people like friends and family.

In Kenya, people rely on a wide variety of institutions and groups of people. The difference between responses in rural and urban areas is relatively small. Important response institutions are the central and local government, family and friends, religious groups and headmen / elders. NGOs (international and national), community based organizations (CBOs), women's rights groups, UN agencies, and private security companies are also identified as sources of support during crises.

In rural Burkina Faso, the most important institutions for support are the local government, family and friends, headmen / elders, CBOs and religious groups. The central government and UN agencies do not appear to play important role. However in urban Burkina Faso, these groups are mentioned.

In urban areas in Ghana the local government plays an important role, while n rural Ghana, people also rely on family and friends, CBOs, women's groups and religious groups.

In summary, it is clear that while traditional humanitarian actors remain key actors in response, crisis-affected communities also rely on peer-to-peer support and organizations from within their own communities.

5.4 What tools can aid response?

Responding to warnings may be costly, and households and communities may not have the financial capabilities to ensure effective response. During interviews and expert meetings, lack of finance was mentioned as a major obstacle to effective response. Fortunately new tools, such as Forecast-based Financing, are being piloted to finance preparatory action, described in Box 5.1.

Increasing access to insurance is another tool through which to absorb risk and provide finance for response. Traditional insurance services in low-income markets are characterized by high costs (Hochrainer-Stigler et al., 2012). As opposed to indemnity based micro-insurance, in which products are

Box 5.1 Forecast-Based Financing: an approach for catalysing action based on extreme weather and climate forecasts

The Red Cross Red Crescent Climate Centre (RCCC) is developing a framework for Forecast-based Action (FbA), based on Forecast-based Financing (FbF). Funding is distributed to communities based on forecasts and according to risk-based Standard Operating Procedures (SPOs). The SOPs are to be defined in advance of a forecast, and carried out when a forecast exceeding pre-specified risk level is issued. The SOPs specify what actions should be taken at what probability/magnitude of forecast, and by whom. The goal of FbF is to reduce losses and suffering by accelerating delivery of disaster response services and, whenever possible, prevent the losses and suffering from happening in the first place or even take advantage of opportunities offered by unusual conditions. These SOPs are accompanied by funding mechanisms that predictably disburse the required amount of funding when a forecast is issued.

Assuming that there is availability of skillful and reliable climate forecasts, the FbF systematically integrates three main components: information about worthwhile actions; available funding mechanisms and designated entities that are responsible for taking the pre-planned actions.

- **Matching forecasts with actions:** Actions need to correspond to the strength of the specific forecast, such that high-regret actions are not taken based on a very small increase in disaster likelihood.
- **Funding mechanisms:** There has to be a standard funding mechanism for FbF that is designated for use before potential disasters. Funding from this mechanism is disbursed to vulnerable groups/individuals when a forecast is issued, supplying enough money to carry out the selected actions, with the understanding that occasionally funding will be spent to "act in vain". Financial procedures need to be in place to ensure the rapid disbursement of the fund when an early warning is issued, and accountability measures such that the funding is only used for designated early actions that correspond to that early warning.
- **Responsibility:** Organizational processes need to be defined to assign responsibility to act based on warnings. An organization-specific set of SPOs is proposed that can specify each selected forecast, the designated action, the cost, and the responsible party. It is also assumed that there will be instances of 'acting in vain' but stakeholders can continually evaluate and update the information used to create the SOPs, ensuring on-going effectiveness of the mechanism

This FbF system has been initiated in Pilot Studies for flood risk in Uganda and Togo, and their success has led to the development of further Pilot Studies in Mozambique, Peru, Ethiopia and Bangladesh.

Box 5.2 Climate Risk Adaptation and Insurance project in the Caribbean

In the past thirty years the Caribbean has seen a steady increase in extreme events, including storms, floods and droughts (IPCC, 2014b). In the light of the magnitude of these risks the Munich Climate Insurance Initiative (MCII) and the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) set up the Climate Risk Adaptation and Insurance in the Caribbean project. It is funded by the International Climate Initiative of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), and it is being implemented by the MCII and its partners: the Caribbean Catastrophe Risk Insurance Facility and Micro Ensure, while Munich Re provides reinsurance capacity. By addressing climate change through promoting weather-index based insurance, the purpose of the project is to assist countries increase social resilience (MCII, 2013).

The Livelihood Protection Policy (LPP) is at the forefront of the project. It is a weather insurance policy aimed at individuals that are at risk of severe weather events. By providing timely cash pay-outs in the case of an extreme weather event, the LPP enhances response of individuals and reduces their risk. Additionally, the LPP provides people with access to financial services they may not have had access to previously. This may increase individuals' financial certainty and improve their creditworthiness, providing them with increased certainty to make investments and enhance their livelihoods.

In practice the LPP reflects a pragmatic design that aims to ensure simplicity, flexibility and accessibility. As described in MCII (2013), subscribers to the LPP firstly receive training on how the insurance policy works, the conditions that trigger a pay-out and how this payment is handled. Subsequently, subscribers receive a policy card with personal details, after which the policy is active. In case of extreme weather events, subscribers will get an early warning SMS message. This warning message is delivered by the policy's cooperation with disaster management offices in all three of the LPP project's countries. If the extreme weather event reaches a certain threshold the subscribers receive a SMS message that contains the trigger level and the pay-out. This pay-out is completed regardless of the actual damage experienced by the subscribers, and it is automatically transferred to the subscribers' accounts.

Micro-insurance can thus be a viable way of providing those at risk of impending weather related hazards with access to finance to initiate response. Additionally, micro-insurance programs such as the one discussed can include a communication mechanism, by means of which warning communication costs are covered by the program.

written against actual losses, micro-insurance can also be index-based, in which case products are written against events that cause loss rather than the loss itself (Linnerooth-Bayer & Hochrainer-Stigler, 2014). Such events may be weather and climate-related (Skees & Collier, 2010). A recent course of action is to link insurance pay-outs to forecasts with the aim of increasing clients' liquidity to take preventive measures to reduce losses (Skees & Collier, 2010). As such, micro-insurance may be an effective ex ante risk management strategy as micro-insurance pay-outs can enable people to respond adequately to warning messages. An example of such a micro-insurance project is given in Box 5.2.

For further discussion on sustainable insurance options see UNEP's "Principles for Sustainable Insurance Initiative" which provides a global roadmap to develop and expand the innovative risk management and insurance solutions to promote disaster-resilient communities. With a world premium volume of more than $4 trillion and global assets under management of more than $24 trillion, insurers that embed sustainability in their business operations can catalyse the kinds of financial and investment flows and long-term perspectives needed for disaster risk reduction and sustainable development.

Sovereign insurance can also be used to help ensure finance for government response to disasters. The African Risk Capacity (ARC) is a Specialized Agency of the African Union (AU) that helps Member States enhance disaster risk reduction efforts by pooling risk. In May 2014, ARC Ltd issued drought insurance policies totalling $135 million for a total premium cost of $17.5 million to a first group of African governments – Kenya, Mauritania, Mozambique, Niger and Senegal. Plans are in place to expand to 20 countries with coverage for drought, floods, cyclones and even epidemics. The work of ARC is further outlined in Box 5.3.

5.5 Conclusion

Early warning should induce early action to minimize loss. However, in Kenya, Ghana, and Burkina Faso the majority of people surveyed were not aware of contingency plans and could not respond to warnings prior to act impending hazards. Greater education and awareness is needed, as well as resources to facilitate action. This chapter reviewed publically available response plans in order to identify measures which should be included in response plans. Responses to rapid-onset hazards should ensure safety, while response to slow-onset hazards should increase resilience and build adaptive capacity. Responses for the agricultural sector are available in published literature but more research is needed to identify, and make public, responses specific to other economic sectors including energy, transport, manufacturing and telecommunications.

It is important that institutions and groups engaged in response have strong local support and capacity. Interviews indicate that a wide range of actors must be involved in response, not only traditional humanitarian agencies or national governments. Once response plans have been drafted and relevant actors are engaged, mechanisms to finance early action must be identified. Tools including Forecast-based financing, individual and sovereign insurance, can potentially fill financing gaps to ensure response can be initiated.

A new vision of early action and response is emerging, as described in the report, "Future of Humanitarian

Box 5.3 African Risk Capacity

The ARC programme has been developed on the rationale that the international system for responding to natural disasters is not as timely or equitable as it could be, hence funding is secured on a largely ad hoc basis after disaster strikes and only then can relief be mobilized toward the people who need it most. This leads to loss of lives, depletion of assets and infrastructure that translates into chronic destitution and food insecurity in the world's least developed countries.

ARC works to 'transfer the burden of climate risk' away from governments – and the farmers and pastoralists whom they protect. This African-owned, AU-led financial entity uses Africa RiskView, an advanced satellite weather surveillance and software developed by the UN World Food Programme (WFP), to estimate and trigger readily available funds to African countries hit by severe weather events. Because such events do not happen in the same year in all parts of the continent, the creation of a disaster risk pool like ARC is financially effective. Pooling risk across the continent significantly reduces the cost to countries of emergency contingency funds, while decreasing reliance on external aid.

By merging the traditional approaches of disaster relief and quantification with the concepts of risk pooling and risk transfer, ARC will help create a pan-African disaster response system that meets the needs of those affected in a timelier and more efficient way and provides an important step forward in creating a sustainable African-led strategy for managing extreme climate risks.

Financing: Looking Beyond the Crisis". In future, "Crisis-affected individuals will receive a 'bundle' of financial and material assistance through a variety of channels, including commercial savings, loans and insurance; cash and material assistance from relatives and local collectives; government cash transfers and welfare payments; temporary access to subsidised or free goods and services provided by the domestic and international private sector; and finally cash, material relief and access to services provided by domestic civil society organizations and international humanitarian actors."

Finally, contingency planning at the global level should be encouraged, as should early action by donors. Forecasting models for natural hazards may help anticipate crises and inform financial preparedness so funding can be made available in advance of crises.

Chapter 6

Steps Forward

Early warning systems (EWS) can help build resilience to hazards by helping households anticipate shocks. However, ensuring that warnings are received and action taken remains a challenge for governments with limited resources and diverse populations. To ensure that DRR efforts assist those most vulnerable to hazards, additional tools are needed. A Human Rights-Based Approach (HRBA)[21], applied to the design and operation of EWS, could help ensure accountability. HRBA offers a universal and inclusive approach to disaster risk reduction.

6.1 Early Warning as a Human Right?

Information about impending hazards affects human right.

According to the United Nations Human Rights Council, "Climate change poses an immediate and far-reaching threat to people and communities around the world and has adverse implications for the full enjoyment of human rights." In December 2014, on the occasion of Human Rights Day, the UN Special Procedures Mandate Holders reiterated that, "impacts of climate change interfere with the effective enjoyment of human rights." Early warning of hazards, or the lack thereof, can also influence the enjoyment of full human rights.

Both substantive and procedural human rights are relevant to EWS (UNEP 2014c) (Box 6.1). Article 19 of Universal Declaration of Human Rights (UN General Assembly, 1948) states, "Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers." Rights to information lies within the scope of freedom of expression (McDonagh, 2013). A growing number of countries have recognized the right to information in domestic laws. As of September 2013, at least 95 countries, including 16 in Asia, 9 in Africa and 15 in the Americas, had nationwide laws establishing the right of the public to request and receive government-held information.

Young woman in Burkina Faso. © Z. Zommers

Access to information related to climate can be (Mathiesen, 2012) necessary for the enjoyment of the right to life (McDonagh, 2013). The Universal Declaration of Human Rights proclaims the right to life (Article 3) as does the International Covenant on Civil and Political Rights affirms the right to life (Article 6(1)). It recognizes this right as fundamental and non-derogable (Article 4). The right to life also imposes strict duties on a State Party to prevent and safeguard against the occurrence of environmental hazards that threaten the lives of human beings. Accordingly, the duty to protect the right to life entails an obligation for Parties to establish and operate adequate monitoring and early warning systems to detect environmental hazards before they threaten human lives. In other words, it places a duty on government to not only respect the freedom of information but to actively provide

21 A human rights based approach is about empowering people to know and claim their rights and increasing the ability and accountability of individuals and institutions who are responsible for respecting, protecting and fulfilling rights.

Box 6.1 Human Rights Relevant to EWS

A variety of internationally recognized Human Rights are relevant to early warning systems. Some examples include:

- Article 3 of ***Universal Declaration of Human Rights*** – "Everyone has the right to life, liberty and security of person".
- Article 19 of ***Universal Declaration of Human Rights*** –"Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers."
- Article 19 of ***International Covenant on Civil and Political Rights*** – "2. Everyone shall have the right to freedom of expression; this right shall include freedom to seek, receive and impart information and ideas of all kinds, regardless of frontiers, either orally, in writing or in print, in the form of art, or through any other media of his choice."
- Article 3 of ***Convention on the Elimination of All Forms of Discrimination against Women*** – "States Parties shall take in all fields, in particular in the political, social, economic and cultural fields, all appropriate measures, including legislation, to ensure the full development and advancement of women, for the purpose of guaranteeing them the exercise and enjoyment of human rights and fundamental freedoms on a basis of equality with men."
- Article 1 of ***Aarhus Convention*** of 1998 states that information about changing environment or environmental hazards should be considered a human right – "In order to contribute to the protection of the right of every person of present and future generations to live in an environment adequate to his or her health and well being each Party shall guarantee the rights of access to information, public participation in decision making, and access to justice in environmental matters." Article 7 refers to "public participation concerning plans, programmes and policies relating to the environment, and in Article 9 "access to justice").

Box 6.2 Summary of *Oneryildiz v. Turkey (From UNEP 2014c)*

The applicant lived in the "slum quarter" of a district of Istanbul with twelve close family members.

A collection of slums were haphazardly built on land surrounding a rubbish dump that had been used jointly by four district councils since the 1970s and was under the authority and responsibility of the main City Council of Istanbul. Some decontamination work was commenced in 1989, then stopped by order of a court. An expert report drawn up in May 1991 drew the authorities' attention to the fact that the tip was in breach of the relevant technical regulations and the Environment Act, and to the lack of any measures to prevent a possible explosion of the methane gas being given off by the decomposing refuse. On 28 April 1993 a methane explosion occurred at the dump. Following a landslide caused by mounting pressure, the refuse erupted from the mountain of waste and engulfed some ten slum dwellings situated below it, including the one belonging to the applicant. Thirty-nine people died in the accident, including nine members of the applicant's family.

Istanbul City Council was found liable because it had failed to act earlier in preventing increasing technical problems that already existed in the area since it was created in 1970, and because their oversight placed the slum dwellers in danger. The Court found "[T]he positive obligation to take all appropriate steps to safeguard life for the purposes of Article 2 entails above all a primary duty on the State to put in place a legislative and administrative framework designed to provide effective deterrence against threats to the right to life" (para. 89).The Court made it clear that the obligation to safeguard life included the licensing, setting up, operation, security and supervision of dangerous activities, and required all those concerned to take "practical measures to ensure the effective protection of citizens whose lives might be endangered by the inherent risks" (para. 90).

information. Governments must develop appropriate systems for dissemination of information to all members of society especially the most vulnerable and marginalized. Further, the right to information will often require that resources be developed to give people the needed skills to comprehend information, for example through efforts to increase literacy (Mathiesen, 2012).

Courts in several countries have ruled in favour of such positive obligations related to freedom of information. In *Osman v. United Kingdom* the Court ruled that the State failed to protect the Right to Life when authorities failed to provide information about an immediate risk to life. In *Oneryildiz v. Turkey* the European Court of Human Rights ruled that the Government violated the right to life when it did not take measures to provide citizens with information "enabling them to assess the risks they might run as a result of choices they had made." The case refers to an incident in which 39 people died as a result of a previously predicted methane explosion and landslide (UNEP 2014c) (Box 6.2).

Implementation and enforcement are major challenges in international human rights and the international environmental field respectively (UNEP 2014c). However cases such Oneryildiz v. Turkey demonstrates how human rights can be used to compel governments to enforce environmental laws and/or disclose information. Applying the Human Rights Based Approach to policy or programme design may offer a technique with which to improve service provision and ensure community needs are met.

6.2 Can a HRBA aid Early Warning System Design?

A HRBA recognizes that **individuals and communities are rights-holders** and **States or State actors are duty-bearers**. Duty-bearers and rights-holders have a close relationship. Duty bearers should be enabled to respect (refrain from interfering with the enjoyment of the right), protect (prevent others from interfering with the enjoyment of a right) and fulfil (adopt appropriate measures towards fulfilling the right, to provide proper enabling environment) rights. They have the responsibility towards rights holders and are accountable for their human rights obligations. Rights-holders should be enabled and empowered to hold duty-bearers to account. But they also have responsibilities and obligations and are not passive recipients of benefits, or in the case of risk, passive 'victims'. They become key actors in their own development.

A HRBA means giving people greater opportunities to participate in shaping the decisions that impact their rights. It also means increasing the ability of those with responsibility for fulfilling rights to ensure rights are met. A HRBA could help DRR programs reach the most vulnerable by ensuring that the following questions are asked:

> *What hazards pose the biggest risk? Why are these problems occurring? What are the underlying and root causes of the vulnerabilities which are leading certain groups to suffer from hazards?Who is most vulnerable and therefore the most affected? Who or which individuals and/or institutions have the duty to reduce these disaster risks? What capacities are needed to address disaster risk, both for those who are being denied their rights through disaster vulnerability, and those who have the duty to address these problems? Can duty bearers fulfill duties? (knowledge, resources, organizational abilities). Do they want to fulfill the duties? (relationship, motivation, leadership). Who should fulfill the duties? (authority). Can rights-holders act on their rights? (knowledge, resources, individual abilities). Do they want to act on their rights? (organisational abilities, security, etc.).*

Once answers to these questions are identified, steps can be taken to improve EWS.

Table 7 Main differences between CRC and CSC

Citizen Report Card	Community Score Card
• Unit - household/ individual	• Unit – Community
• Level - macro	• Level - for local level
• Main output is demand side data on performance and actual scores Implementation, time longer (3-6 months), Information collected through questionnaires	• Emphasis on immediate feedback and accountability, less on actual data, Implementation time short (3-6 weeks) Information collected through focus group discussions

6.3 Tools for accountability

Participatory tools, such as Citizen Report Cards (CRC) or Community Score Cards (CSC), can be used to help collect community-level feedback. CRCs and CSCs are similar in their purposes but differ in their scope and methods. These differences are described in Table 7. Their use in EWS could be expanded.

The CRC emphasizes demand-side data and focuses on "user perceptions on quality and satisfaction with public services" (Singh & Shah, 2005). The World Bank (2004) highlights seven distinct phases for CRC implementation: Identification of Scope, Actors and Purpose; Design of Questionnaires; Sampling; Execution of Survey; Data Analysis; Dissemination; Institutionalization. For application of CRC, certain components must be present including:

- an understanding of the socio-political context of governance and the structure of public finance
- technical competence to scientifically execute and analyse the survey,
- a media and advocacy campaign to bring out the findings into the public domain, and
- Steps aimed at institutionalizing the practice for iterative civic actions.

The four components of the CSC process include "an input tracking scorecard, a community generated performance score card, a self-evaluation scorecard by service providers and an interface meeting between users and providers to provide feedback and generate a mutually agreed reform agenda" (Singh & Shah, 2003). Unlike the CRC process, the CSC emphasizes the interaction between users and providers to generate action on reforms. For the first component, gathering baseline supply-side indicators informs the rest of the CSC process. These indicators are tracked based on the community's final inputs.

EWS evaluation through a CRC or CSC process can take on many forms:

Option 1. Inclusion in CRC or CSC Process – The first option involves integrating an early warning component into an existing CRC or CSC process. This would be useful if only to gather baseline information about a country or community's EWS. Despite the limited amount of information this option would generate, it would be the easiest to implement and would only involve liaising with existing institutions that are

Table 8: Sample Baseline Questions for Option 1

Inclusion in CRC or CSC Process
• Besides the (school system, public utility company, community health centre), have you ever interacted with the local disaster
• During the last hazard (provide name of hazard, location, and date), did you receive an early warning?
• If provided an early warning, were you satisfied with its delivery?

seeking to apply a participatory process or collecting data. Nevertheless, there is a possibility of confusing participants if EWS questions are completely unrelated to the rest of the process. This could lead to the collection of bad or incomplete data.

Option 2. Creating a Standalone CRC for EWS – Initiating a standalone CRC for EWS would generate standardized feedback from a large group of users and provide specific EWS information that could be acted upon by governments. Because this option would be a standalone card, targeted information could be derived. The CRC process also includes an advocacy component, which calls for generating media attention to spur decision makers to action. The CRC is further meant to gather macro-level data, which would provide a national picture of an EWS. Yet, compared to the CSC, it is likely to take a longer amount of time for implementation and capturing a significant level of community participation and feedback is regarded as challenging.

Table 9: Sample Questions for a CRC on EWS

EWS Questionnaire
• From which agency did you hear the early warning on this year's drought season? ❑ National disaster management authority ❑ Local government official ❑ Village chief
• After receiving or hearing about the warning, how long did it take for your local government official/chief to initiate a plan for the hazard? (Weeks, Days, Hours)
• Have you ever interacted with the national disaster management authority?
• Do you believe the disaster management authority takes into consideration traditional knowledge of your community into understanding hazards?
• How would you rate your community's EWS? (5-Very Satisfied, 4-Mostly Satisfied, 3-Neutral, 2-Dissatisfied, 1-Very Dissatisfied)

Option 3. Creating a CSC on EWS – Finally, the third option is to initiate a participatory CSC process on EWS. CSC would allow communities to define specific indicators for success and failure, in contrast to the CRC process. A CSC process is less time-consuming than the CRC and it would be able to capture specific information from communities. However, the CSC process involves significant preparatory work to ensure a proper outcome.

Given the emphasis on people-centred early warning, CSC process could be encouraged to ensure that EWS capture specific community experiences. Providing the supply-side indicators ties into the broader concept of a rights-based approach to EWS as users would become aware of their entitlements to services in the context of early warning. An example is shown in 10.

Figure 6.2 Community discussion about hazards and warning in Burkina Faso

Table 10: Input Tracking Community Score Card

Input	Entitlement	Actual	Remarks/Evidence
Drought warnings disseminated	(e.g. Number of warning fliers posted in public markets, 1 month prior to predicted beginning of season)		
Flood warnings disseminated	(e.g. 3 warnings a day on radio and television/48 hours before typhoon to make landfall)		
Preparatory workshops conducted per village	Based on mandate of disaster management authority, local laws, etc.)		

The second component of the CSC process is generating the community-generated performance score card. After the identification of the community and the facilitators for this process, focus group discussions could be held to identify performance criteria to base the evaluation of the EWS. Focus groups must be created and determined systematically. During focus group discussions community members would be given the opportunity to develop their own criteria and scorecard format. The facilitator would play a key role in leading the discussion and generating feedback from the groups present.

After identification and consensus of these indicators from the group, the facilitator would then shift the discussion to assigning scores for each. After determining a scale for the scores (1-5, 1-100 or others), the focus group discussion would turn to reasoning behind the scores given and insights on how to improve the scores for the future. Table 11 provides examples.

Then, providers of the EWS would generate their own scorecard, based on the criteria from the community. They too would be given the opportunity to provide the necessary justification behind their scoring and provide suggestions for their improvement as well.

The final component of the CSC process is the interface meeting between the EWS providers and community members. The meeting provides an opportunity to assess the results of the generated scorecards and plan specific courses of action, directed by the suggestions of both users and providers. Substantive preparation would be required to ensure that the meeting is founded on "mutual understanding" between both sides (Singh & Shah, 2003).With substantive feedback and discussion, a CSC could undoubtedly be used to initiate improvements in an EWS. Consistent follow-up targeted towards institutionalization on findings must be used to ensure that the CSC process generates results beyond the community setting.

6.4 Conclusion

The Report of the Office of the United Nations High Commissioner for Human Rights (OHCHR) on the relationship between climate change and human rights is one of the first documents that explicitly highlights the links between the effects of climate change and the right to life, the right to adequate food, the right to water, the right to health, the right to adequate housing and the right to self-determination. OHCHR emphasized that "adaptation requires strengthening the capacities and coping mechanisms of individuals and communities." EWS are mentioned as being an essential component of climate change adaptation. However EWS are made all the more critcial because they also affect the enjoyment of affect human rights. In the past, EWS been linked to human rights in the context of public health and conflict. Recognition of the relationship between climate change, early warning and human rights should be futher cause for greater action. Citizen Report Cards, and especially Community Score Cards, can help ensure communities and governments are both engaged. Such tools enhance transparency and offer rights holders with means to hold duty bearers to account, helping ensure the creation of people-centred early warning system.

Table 11: Sample Community Generated Score Cards on EWS

Indicator	Score (out of 100)	Score after 6 months	Score after 1 year
Clarity of early warning delivered			
Timeliness of early warning delivered			
Completeness of early warning information delivered			

Indicator	1 - Very Bad	2 - Bad	3 - Neutral	4 - Good	5 - Very Good
Reach of early warning in the community (all members were aware of warning)					
Community support in place to take action on early warning (community action plan activated)					

Chapter 7

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