ISDR

International Strategy for Disaster Reduction

Early Warning Practices can Save Lives: Selected Examples

Good Practices and Lessons Learned

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Early Warning Practices can Save Many Lives: Good Practices and Lessons Learned

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Please send your feedback and suggestions, including further case studies for consideration, to:

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Foreword

Early warning is highlighted as a major component of disaster risk reduction in the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters. The Framework emphasizes that early warning systems must be centred on the needs of people which means that warnings must be timely and understandable to those at risk.

Following the call of former Secretary-General Kofi Annan in 2005 to develop a global early warning system for all types of natural hazards that covers all communities down to the last mile, some countries reacted by implementing multi-hazard early warning systems and upgrading the systems that were already in place. Since then a number of regional initiatives have been developed to strengthen and support the efficiency of national level systems. Initiatives have been launched that target both disaster preparedness and mitigation.

The United Nations International Strategy for Disaster Reduction promotes a people-centred approach to the development of early warning systems. People-centred early warning systems are built on empowering individuals and communities threatened by hazards to act in sufficient time and in an appropriate manner so as to reduce the possibility of personal injury, loss of life and livelihoods, as well as minimizing damage to property and the environment. The key ingredients revolve around the local ownership and leadership that is accountable in terms of validing local knowledge of the indicators of risk. Consequently this approach challenges our technology-centred systems to fully consider early warning as a social process for generating maximally accurate information about possible future harm and for ensuring this information reaches the people, their homes and livelihoods, threatened by a hazard.

Communities must be aware of the warning service and know how to react to warnings. This requires a systematic approach to education and preparedness programmes that should be built on existing structures and existing information systems that are led by disaster management authorities. Strong inter-linkages are required between all of the elements, underpinned by effective governance, the ‘right to know’, and institutional arrangements, including good communication practices. This requires the multi-disciplinary and multi-sectoral involvement of a broad range of actors.

United Nations International Strategy for Disaster Reduction
Platform for the Promotion of Early Warning

Introduction

The impact of the 2004 Indian Ocean tsunami pushed the international agenda on early warning and motivated widespread support among 168 states and numerous organizations to immediate agree to the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters in Kobe, Japan in January 2005. Early warning systems backed by community-level risk assessments form one of the most important thematic areas for immediate action on a global scale for implementation at all levels. Foremost in the approach to early warning is the needs of people as recipients of the warning message and drivers of the disaster risk management processes.

Developing and implementing an effective early warning system requires the contribution and coordination of a wide range of individuals and institutions. Each player in the cycle has a particular function for which they should be responsible and accountable. During the actual warning stage there are specific political responsibilities for ensuring that accurate and valid warnings are issued and acted upon and that evacuation plans are effective.

This publication is a compilation of good practices and lessons learned on early warning systems at different scales. Covered are natural hazards such as wildland fire, drought, floods, tsumani and extreme weather events. Not all regions are covered due to the amount of submissions received. After a first internal revision submissions have been reviewed by an expert team.

The compilation is aimed at ISDR system stakeholders that are interested in early warning issues. The examples are intended to encourage organisations, governments and non-governmental, and regional stakeholder groups to contribute in gathering cases in their country to build awareness on the importance of early warning systems as part of disaster risk reduction.

This publication highlights the importance of having an integrated approach on the relevance of community participation in planning and managing early warning systems as a key component in risk reduction programming which will save lives and property.

For ease of reference, each good practice is presented in the same format beginning with a short abstract, an overview of the initiative that includes the objectives and the process, the presentation of the good practice, itself, the lessons learned, and finally how the initiative can be replicated.

United Nations International Strategy for Disaster Reduction
Platform for the Promotion of Early Warning

Executive Summary

It is evident that the level of awareness of the need to establish early warning systems for natural hazards has been increasing in the last years particularly since the 2004 Indian Ocean tsunami. Effective people-centred early warning systems are in great demand for several reasons. More extreme weather events are expected in future due to the current impacts of climate change, rapidly expanding urbanization and increasing environmental degradation, all of which contribute to augment the number and scale of disasters. The overall goal is to establish a global early warning system which consists of early warning systems at different scales that reduce risk and vulnerability at all levels.

The objective of people-centred early warning systems is to empower individuals and communities exposed to hazards to act in sufficient time and in an appropriate manner to reduce the possibility of personal injury, loss of life and damage to property and the environment. A complete and effective early warning system comprises four inter-related elements, characterized by knowledge of hazards and vulnerabilities, education and training for people at risk which are well harmonized with monitoring tools, warning systems, dissemination strategies as well as preparedness and capacity to respond.

Good practice in early warning systems also includes in having strong inter-linkages and effective communication channels between all the elements. Responsibilities need to be clearly defined and people need to be well-informed and feel a degree of ownership of the implementation process. Much depends on establishing institutional capacities to ensure that early warning systems are well integrated into governmental policy and decision-making process.

The examples in the first section of the publication - focusing on early warning systems itself - show how communities can be involved in this process or how they can initiate the establishment of an early warning system at local level in connection with those at national, regional and international levels. Examples in the second part describe activities that support the functioning, the data quality and the monitoring of early warning systems.

1 Early Warning System Examples

Summarising the case studies in the first section, the following three findings can be highlighted: Participatory Approach, Clear Responsibilities and Structure, and Use and Familiarity with Simple Techniques.

Participatory Approach

The participatory approach builds upon the capacity of local populations and empowers people to play a pro-active role in ensuring the security of their families and livelihoods. The case studies describe the strengthening of greater self-reliance and increased awareness. Communities acknowledged that they have the primary responsibility for protecting their own lives and livelihoods and that people can take greater control over their lives through community managed initiatives, when disaster strikes and before external assistance arrives. In addition, regular testing of the system as a whole and practice drills for everyone, conducted, helped the people and the local government to understand the system and feel responsible for it.

Two community-based projects in Mozambique describe the advantages of the participatory approach: INGC and InWEnt emphasize to build upon the capacity of local populations and empower them to play a pro-active role in ensuring the security of their families and livelihoods. The local flood early warning and response system is based on peoples' own capacity to protect themselves as far as possible by creating and training local Disaster Management Committees who have the role of warning and guiding the population and informing authorities and relief agencies.

With the help of the INGC, and projects supported by Munich Re Foundation and GTZ, the inhabitants in the second project were able to rescue themselves and others during severe flooding caused by the Cyclone Favio. Regular testing of the system as a whole and practice drills, conducted, helped the people and the local government to understand the system and feel responsible for it.

Practical Action Nepal describes in the case study that a greater self-reliance and increased awareness was created with communities themselves having the prime responsibility for protecting their own lives and livelihoods. The main success of the project has been that it has demonstrated that when hazards strike people can take greater control over their lives through community managed initiatives, independent of external assistance, hence reducing their vulnerability and risk to the hazards.

Clear responsibilities and structures
Clarity about the issuance and dissemination of warnings is essential at different levels. Equally, communities need to be aware of relevant risks, how to interpret warnings and to respond in time. Early warning systems should build upon existing structures and strengthen partnerships and linkages. As soon as different partners are involved synergy needs to be sought and a team effort process needs to start.

The Community Tsunami Early Warning Centre (CTEC) initiative in Sri Lanka is a purely community-based initiative in the beginning focusing only on tsunamis and later expanding to multiple hazards. The case study illustrates the responsibilities and structures between national and local level which need to be clearly defined.

The European initiative Meteoalarm, coordinated by EUMETNET, is a case study at regional scale, demonstrates how accurate and time-relevant information and warnings on weather-related hazards, available in 27 individual languages, can be effectively and widely distributed by using a website. The concept is simple and has a well developed alarm capability for all involved partners.

The development of a tsunami early warning system in the Indian Ocean region by governments and technical institutions, coordinated by the Intergovernmental Oceanographic Commission (UNESCO/IOC) and supported by an ISDR system partnership in the Tsunami Flash Appeal project stands out as an example of good regional practice helping to strengthen local, national and regional coordination, partnerships, linkages and synergies among governments, international agencies and donors. Various project activities have led to new opportunities for further developing early warning and other risk reduction capacities in the region.

Use and familiarity with simple technologies
Using simple technologies, easy to be applied by people, enables effective information sharing and effective action. In combination with training exercises, education and awareness raising the population can be better prepared and can reduce their vulnerability to natural hazards.

For example, the so called Ferny Creek Bushfire Alert System (FCBAS) in Australia is a good practice example of how a community accepts responsibility for its safety and remains informed in order to live safely with the risk of bushfire. FCBAS provides opportunities for the engagement and empowerment of the local community by enabling partnerships between local emergency service agencies and local, state and federal governments. The system builds a known and easy replicable concept: Sirens are used to alert the community.

The Garba Tulla Development Organization in Kenya presents the cost effective use of VHF radio stations for communication in remote locations. The radio system, initially installed for drought monitoring and warning, is used for diverse relevant information transfer. It links various communities, development agencies and government departments in an innovative manner enhancing development collaboration.

HazInfo, also in Sri Lanka, demonstrates several characteristics of good practice. Communities play a pivotal role in the receipt, relay and response to the hazard warning system by setting up the final end of a national early warning system. Moreover, it uses popular technology along with more advanced technology. This approach is also used by the Mobile Democracy Emergency Alert project in Turkey. It uses common and widely distributed mobile technologies for effective information sharing.

2 Supportive activities to establish early warning systems

The second part of the publication showcases some specific tools for risk assessment and monitoring systems. This includes key components such as access to data, data quality, data distribution as well as monitoring tools to be used in early warning systems.

Jaxa's project "Sentinel Asia" focuses on retrieving and sharing disaster information in the Asia-Pacific region. State-of-the-art space technologies based on communication satellites and advanced information technologies are utilized in order to implement this project.

The University of Tokyo published a pilot study of an early warning system for the arid and semi-arid areas of Northeast Asia. An integrated model was developed that combines field-surveys, remote-sensing and modeling techniques for selected sites. The project aims at minimizing the long-term risk of land degradation by assessing land vulnerability in order to prevent the occurrence of a disaster as well as mitigate the post-occurrence effects.

The Georisks project in Indonesia highlights how the BGR assisted in disaster assessment and mitigation. The project contributes to making development planning transparent by strengthening the institutional participation of the population at risk.

The German Technical Cooperation (GTZ) developed a tsunami specific checklist "Implementation of Tsunami Early Warning in Indonesian Local Communities" that serves as a tool for assessment, planning and monitoring. This process provided the baseline for the project and its partners to develop an action plan for the implementation of a tsunami early warning system.

The second GTZ project focuses on designing a simple, low-tech, but sufficient and adequate tsunami hazard mapping methodology, an inter-institutional team of experts conducted a tsunami hazard mapping exercise in a pilot area in Java, Indonesia. The team worked closely with representatives from the local government and local organizations, in order to include all available local knowledge.

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Photo by InWEnt

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Early Warning Systems Examples

Early warning systems can save many lives as long as they are centred on the needs of the people. Effective systems are characterized by education and training for people at risk which are well harmonized with monitoring tools, warning systems as well as dissemination strategies. Responsibilities need to be well-informed and feel a degree of ownership of the implementation process. The examples show how communities can be involved in this process or how they can even initiate the establishment of an early warning system.

Australia

Ferny Creek initiative “loud and clear”

Ferny Creek Bushfire Alert System

Photo by Anna-Marie Shew

Abstract

The Ferny Creek Busfire Alert System (FCBAS) is an emergency communication system broadcasting via three independent, strategically-located sirens. Operational during declared fire danger periods, its purpose is to sound the alarm only to alert residents when an emergency call fulfils predetermined criteria pointing to a potential threat in the vicinity. The alert provides essential extra minutes to implement pre-determined fire safety plans. This is necessary because steep, densely forested terrain severely restricts visibility and precludes the normal visual warning of the outbreak and approach of a bushfire. A systemic community education campaign has been an important component, and has proved to be highly effective.

Dedicated residents, supported by the community, the local Shire of Yarra Ranges emergency management team and emergency service agencies, have implemented the system and provided households with a broad range of information so that in the event of a bushfire, responses will be appropriate and safe. The system operates in area of the village community of Ferny Creek in Melbourne’s outer urban/rural interface which is particularly susceptible to wildfire. The Ferny Creek Bushfire Alert System is an innovative, good practice example of how a community accepts responsibility for its safety and remains informed in order to to live safely with the risk of bushfire.

Goals and Objectives

The major goals and objectives of the Ferny Creek Bushfire Alert System are to alert the community immediately to a potential fire threat to themselves and their properties by the use of an easily understood signal that will alert both the informed and uninformed in the area.

The Initiative

Ferny Creek, in Melbourne's Dandenong Ranges, is a high risk residential area for bushfire. The settlement includes 11 streets and covers an area of approximately 2.5 square kilometres and 150 households accommodating about 400 people. Arson is the principal cause of bushfire in this area. On January 21, 1997, a deliberately lit fire caused the deaths of three people and the loss of nearly 40 homes. The community is located at the top of a mountain with dense eucalypt forests incorporated in a National Park below. Fire will travel up the steep hill in a very short time. In 1997 a bushfire took just eight minutes to reach the community, leaving many residents with no time to implement fire safety plans, as citizens were unaware that a fire was in progress. In the summer of 2007, arsonists lit more than 25 fires in the area immediately surrounding the area of Ferny Creek.

Following the devastation, the need for some kind of early warning system was recognised. The Country Fire Authority (CFA) has no mandate to provide public warnings and the Victoria State Police, whose role it was, did not have the infrastructure to provide the timely alert necessary to inform an entire community. With the support of the community, the local Shire of Yarra Ranges Emergency Management team, and the Victorian State Government's Department of Justice, along with dedicated residents, sought a solution to a local problem.

In 2000 a siren alert system was established. It features three strategically placed sirens that are connected to CFA's brigade paging system. Decoders within the siren control panels are programmed to respond only to codes for fire alerts with potential to threaten the community's safety. The alert's 'catchment' includes additional strategic response areas in neighbouring areas.

Residents have been provided with a broad range of information so that in the event of a bushfire, responses will be appropriate and safe. The Ferny Creek Bushfire Alert System is an innovative, good practice example of how a community accepts responsibility for its safety and keeps informed in order to live safely with the risk of bushfire.

Photo by Julian Morgan-Smith

The community is kept informed of all aspects of fire risk by disseminating appropriate information from a number of key groups - the CFA, the Shire of Yarra Ranges, Department of Justice, Department of Sustainability and Environment, Victoria Police, Ambulance Victoria, as well as electronic stores providing such things as discounts on scanners, so that residents can listen to radio traffic during an incident. Other activities include fire safety planning, strategic planning, and awareness of topographic and environmental hazards. A community network was established to share knowledge and provide opportunities for solutions to safety issues as well as to provide the opportunity to link with appropriate agencies and individuals for education and insights. Furthermore, to educate the community various agencies are brought together who share a broad range of information and knowledge. In order to provide and maintain the alert system infrastructure, all possible networks and communications are incorporated to ensure that fire safety remains important for residents. The FCBAS was recently upgraded to include the technology required for Victoria's new Emergency Alerting System (EAS). The possibility of having the system linked to a mobile telephone SMS service is being studied.

The initiative was launched by the community itself with the help of the Shire of Yarra Ranges Emergency Team. It was supported by a variety of different agencies, such as the local police, the CFA, various departments in local, state and federal governments and Emergency Management Australia (EMA). Funding was initially provided by the Shire of Yarra Ranges with additional funds provided for administration and maintenance. Grants were also received from EMA and the CFA. Following the incorporation of the system in 2005 the committee applied for and secured funds through the Federal Attorney General's "Working Together to Manage Emergencies" funding stream. This enabled the complete upgrade of the system in preparation for future fire seasons. The private sector and community members have also contributed monetarily.

The Good Practice

The FCBAS represents an example of using a combination of old and new technology. There is an abundance of 'quality' information available to the community. The siren system provides a simple 'quantity' message only. Its message is to alert as many people as possible in the quickest possible time. People will respond by informing themselves about the cause of the alarm and implementing fire safety plans. FCBAS is not a signal to evacuate.

The community has its own initiatives to expand its education on the alert system and knowledge base so that all responses to a siren and a bushfire emergency will be appropriate and planned. New residents are contacted and the importance of understanding bushfire safety messages is explained. A reliable network of the latest information is provided to ensure preparedness, fire management and prevention. FCBAS has facilitated an ongoing commitment to community safety. The project was evaluated by the Victorian Office of the Emergency Services Commissioner and has provided a benchmark for community warning within the State.

FCBAS provides opportunities for the engagement and empowerment of the local community by enabling partnerships between local emergency service agencies and local, state and federal governments. The win-win partnership of the system is found in its simplicity. Three sirens with response areas strategically designated both within and outside the local brigade area have maximised the relevance and timeliness of the alert to the community. The systematic and relevant education campaign links all the emergency service agencies and enables residents to be aware of their individual roles as well as the interaction and cohesion between them.

Additionally, the siren system has alternative power supplies and battery back up, meaning that the loss of electricity supply will not compromise the alert capability.

Lessons Learned

An alert message from a siren during the declared Fire Danger Period will enable residents to respond appropriately and reduce the impact of a bushfire and mitigate trauma from loss of life and property. For decades, the community had used fire brigade sirens as an early warning system and did not know that sirens frequently did not sound if their local brigade was already deployed. It takes an ongoing and systematic effort from dedicated people to provide and maintain an alert system and an associated education programme.

FCBAS has added value to the CFA Community Fireguard and Bushfire Ready programmes, and has provided opportunities for networking and communication between various agencies and federal, state and local government and the community. The benchmark for fire preparedness and appropriate community knowledge, community response and community alert systems was raised to a new standard.

Potential for Replication

An audible alert broadcasting system for an entire community is not a new concept. Sirens are an old concept, which makes them an easily understood warning signal. To fine tune the operation of the siren, so that its sounding is always relevant, would easily be replicated by applying different risk and event responses and supporting it with a systematic education programme relevant to that context.


Photo by Julian Morgan-Smith

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Europe

Meteoalarm - Alerting Europe for extreme weather

Meteoalarm, Network of the European National Weather Services (EUMETNET)

Photo by Austrian Press Agency

Abstract

In the past the Weather Services of Europe have been issuing warnings based on different parameters in very different early warning and forecast schemes. Large catastrophes like windstorms or floods were dealt with by using different warning levels in different countries, resulting in confusion for travelers and companies or institutions active in more than one country. In the framework of EUMETNET, a network grouping the European National Weather Services, a program was set up to put all alert levels and/or warnings on a common web platform and to harmonize the process of issuing an alert level or a warning as much as possible. The website offers the overview and many details on the weather awareness situation within Europe.

A large set of meteorological parameters (wind, rain, snow/ice, thunderstorms, fog, extreme high/low temperature, coastal events, avalanches) are taken into account in the program. Some parameters are optional as they occur only in certain parts of Europe. The following 30 European countries participate with their National Weather Service in the project: Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Malta, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, the Netherlands and the United Kingdom.

Goals and Objectives

The mayor objectives of this initiative are to:

1. Improve meteorological warnings and their impact on the behaviour of citizens and users;

2. Improve the quality of the information given to civil protection in the individual countries and on the European level; and

3. Develop and harmonize a warning system with different warning levels applicable in all parts of Europe, for 10 different warning parameters and a clear language towards the users in terms of expected weather events, their possible impact, as well as, the advice on behaviour.

The Initiative

The project has recommended that the alert levels be published in a unified system of four different levels with a clear relationship between the different meteorological features, possible damage and proposed behavior to avoid damage. The meteorological parameters are explained with easy to understand symbols for each parameter. The color-coded maps provide the latest warnings of expected severe weather for the next 48 hours over most of Europe. Each country is color-coded on the map to represent four levels of warning: red to indicate exceptional risk from dangerous weather conditions, down through orange and yellow to green, indicating that severe weather is not expected. The site offers also a grayscale map for color blind people.

The thresholds for these levels differ from region to region, as for example, wind exposure and protection measures on the Irish west coast are much larger than in the inner cities on the continent. On the other hand, damages happen usually at much lower wind speeds in normally wind protected city locations. A sophisticated climatology concerning the expected damages for all regions was employed to find warning levels as coherent and meaningful as possible for all of Europe.

The demand for such a standardized system is apparent due to a number of noticeable requests from institutions, such as WMO, UN-SPIDER and European Commission Monitoring and Information Centre (MIC), to export and promote the system in other parts of the world. Since the project was implemented in early 2007, the responses by media and the public are very high and numerous feedbacks from institutions and individuals were received. Among the responses from Civil Protection in individual countries were contributions and suggestions for further improvements and enhanced collaboration.

Before the website could go online a two year preparation phase in the EUMETNET Program European Multipurpose Meteorological Awareness (EMMA) was needed. The outcome of the project, the Meteoalarm website, is frequently visited and gets up to 12 million hits per day. The warning information is provided for 250 million Europeans, the 400 million tourists in Europe who travel outside their own country, as well as users outside Europe.

Photo by Austrian Press Agency

The project was funded by EUMETNET with project management and servers located in Salzburg, Austria. Responsible partners for the EMMA project were the National Weather Service of Austria (ZAMG) as well as all National Meteorological Hydrological Services (NHMS) of the participating countries.

A second phase of the project (EMMA II) has been prepared. It contains additional partner countries, the improvement of the infrastructure and the cooperation with institutional partners such as MIC, WMO, and ECMWF.

The Good Practice

Through the warning website the project has had a direct impact on users in very diverse, cultures and countries. The website is clearly arranged, easily understandable and a large number of people can be reached. The accurate and time-relevant information is available in 27 individual languages with updates every 10 minutes. The concept is simple and straightforward, and has a good harmonized alarm capability for all involved partners based on structured promotion work. In addition, the 29 partners are constantly providing data and information to the web database. It is important to investigate the need for harmonization, the harmonization gaps and to develop corresponding data structures and information flow as well as keeping the needs of different users, different institutions and the public in mind.

Lessons Learned

The lessons learned from this project were to start with the users needs, to structure them well and to set up a system capable of growing in both content and partners. The mayor challenges to overcome have been the harmonization of gaps in the practice of the different partners involved and language problems. The latter could be solved by providing the static content of the website in 27 different languages and constructing a database which allows implementation in additional languages without large effort or expenditures. The high number of requests on the website suggests enlarging www.meteoalarm.eu in a multi-hazard platform as users from institutions, the public and the media have a high level of confidence in the information provided and visit the website regularly.

Potential for Replication

The concept of Meteoalarm could be applied to other areas with existing knowledge of data handling and the harmonization process. This could be done by widening the existing warning area toward other regions or applying the same concept and strategies to other parts of the world. The high number of visitors to the website resulted in an improvement of the hardware-software infrastructure to cope with the demand. The project could be easily replicated if the user needs concerning meteorological warnings and structures of institutions which provide the information are assessed and well analyzed.

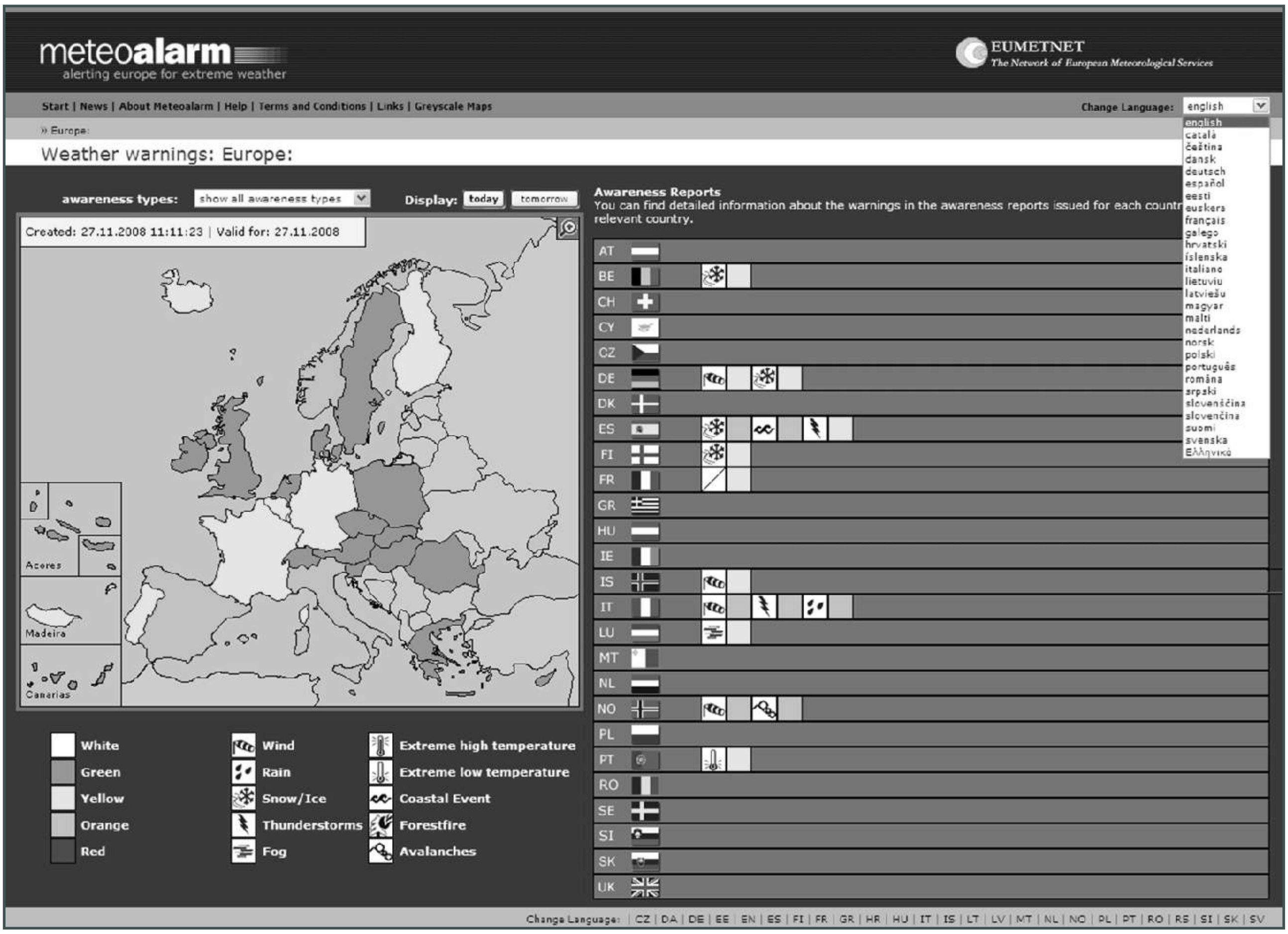

Figure: Meteoalarm Website

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ISDR
International Strategy for Disaster Reduction

UNESCO
United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

Indian Ocean Region

Strengthening community-based disaster preparedness in Indian Ocean countries

UNESCO Intergovernmental Oceanographic Commission
United Nations International Strategy for Disaster Reduction

Photo by AIDMI

Abstract

The project underscored a partnership approach to supporting the integrated development of tsunami early warning systems in close collaboration with numerous United Nations and other organizations which are oriented to improving disaster risk management and risk reduction. In particular, the project supported the United Nations Educational, Scientific and Cultural Organization Intergovernmental Oceanographic Commission (UNESCO/IOC) in its leadership to achieve a consensus on the core elements of a tsunami early warning system and set-up an interim warning system in the Indian Ocean region.

The initiative “Evaluation and Strengthening of Early Warning Systems in Countries Affected by the 26 December 2004 Tsunami” was facilitated by the United Nations International Strategy for Disaster Reduction (UNISDR) and coordinated by the thematic platform of the ISDR system Platform for Promotion of Early Warning (PPEW) in Bonn, Germany.

Goals and Objectives

The overall objective was to provide an integrated framework for strengthening early warning systems in the Indian Ocean region by building on the existing systems and to facilitate coordination among various specialized and technical institutions. The project is highly relevant to the mandate of the UNISDR by advocating for action on early warning within the ”Hyogo Framework for Action, 2005-2015: Building the Resilience of Nations and Communities to Disasters”.

A main goal of the project was to support to the development of a tsunami early warning system by linking the available technical capacities on tsunami early warning systems with humanitarian and emergency management capacities and quickly implement the first steps to establish effective tsunami warning capacities in the region.

Specifically, it aimed to assist facilitating an interim warning capacity based on existing national and international capacities; supporting a conference to achieve technical specification and political consensus on the design of an appropriate early warning system; developing networks among practitioners and authorities concerned with all hazards; conducting regional meetings of relevant practitioners for both training and coordination aims; developing interim information materials for practitioners and community leaders; providing necessary coordination for the affected countries and developing educational support and demonstration projects.

The Initiative

The project was providing an overall integrated framework for establishing an early warning system in the Indian Ocean by building on the existing systems, facilitating coordination among various specialized technical institutions and providing overall organizational assistance.

This initiative successfully assisted in strengthening partnerships, linkages and synergies among the implementing agencies and donors during the process of implementing the project. The project contributed to maximizing effectiveness of inputs and resources by providing strategic direction for the implementation and monitoring of the activities and avoiding overlaps between the operational agencies.

The project components were identified in the two areas of warning system development and preparedness. As a cross-cutting theme, the project has promoted “people-centred early warning systems” emphasizing (i) risk knowledge, that is, prior knowledge of the risks faced by communities, (ii) monitoring and warning service, (iii) communications and dissemination of understandable warnings to those at risk, and (iv) response capability and preparedness to act by those threatened.

Seven donors (the Governments of Finland, Germany, Japan, Netherlands, Norway, Sweden and the European Commission Humanitarian Aid Office) financed the project with a total of US$10.5 million. UNISDR-PPEW coordinated the project. It was part of the larger Flash Appeal coordinated by UNOCHA, and was implemented by 16 partners, namely the United Nations Development Programme (UNDP) India and Sri Lanka Offices, the United Nations Environment Programme (UNEP), the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), United Nations Educational, Scientific and Cultural Organization (UNESCO) Jakarta Office, the UNESCO Intergovernmental Oceanographic Commission (UNESCO/IOC), the United Nations Office for Project Services (UNOPS), the United Nations University Institute for Environment and Human Security (UNU-EHS), the World Meteorological Organization (WMO), the All India Disaster Mitigation Institute (AIDMI), the Asia-Pacific Broadcasting Union (ABU), the Asian Disaster Reduction Center (ADRC), the Asian Disaster Preparedness Centre (ADPC), the Centre for Research on the Epidemiology of Disasters (CRED), Sustainable Environment and Ecological Development Society (SEEDS) and the University of Geneva.

The activities of the project were structured into five key components, core system implementation, integrated risk management, public awareness and education, community-level approaches and project coordination. An interim tsunami early warning system in the Indian Ocean region has been operational since April 2005 with interim tsunami advisory information issued by two institutions, the Pacific Tsunami Early Warning Center (PTWC) in Hawaii and the Japan Meteorological Agency (JMA) in Tokyo. The tsunami advisory information is received by tsunami focal points of the Indian Ocean countries designated by 25 countries to date.

The project has created an enabling environment for building partnerships necessary for the development of “end-to-end” and “people-centred” early warning systems in the Indian Ocean region. The project activities are only the first step for establishing a fully-fledged tsunami early warning system within a multi-hazard framework. Strong political commitment of the Indian Ocean countries as well as substantial financial and technical support from the international community are crucial to achieving this goal in the long term.

The Good Practice

The project assisted in strengthening coordination, partnerships, linkages and synergies among the implementing agencies and donors. Various project activities have led to new opportunities for further contributing to the development of a tsunami early warning system (TEWS) in the Indian Ocean region. In addition, the UNISDR secretariat and the implementing partners collaborated with a much wider group of UN agencies and national and local institutions with the common goal of establishing an effective TEWS in the region. At the global level, both humanitarian and development organizations were involved.

For building and managing the regional early warning system and disaster management, the project also addressed the need for developing and promoting national and regional human and institutional capacity, transfer of know-how, technology and scientific knowledge through international cooperation and partnership.

Some success stories have been reported by the partners to the UNISDR-PPEW. The interim warning system established under the project has proven to be effective not only for tsunamis but also for other hazards:

1. The UNESCO/IOC and WMO reported that the Global Telecommunications System (GTS) demonstrated its effectiveness for the July 2006 tsunami in Java. Interim tsunami advisory information was issued from the PTWC and JMA. Several national warning centres in the Indian Ocean region, including the one in Jakarta, Indonesia, received the interim tsunami advisory information from PTWC and JMA soon after the earthquake took place.

2. The UNDP Sri Lanka office reported that the enhanced capacity for early warning and dissemination as well as the in-country partnership among relevant institutions saved some vulnerable communities in Sri Lanka on the occasion of the landslide in January 2007. The initiative in Sri Lanka aimed at addressing environmental factors relating to tsunami risk through building national capacity to integrate environmental assessment and management with national and regional early warning systems and disaster risk reduction efforts. Due to the implementation of flood and landslide monitoring systems and an early warning dissemination mechanism, valuable time for evacuations is gained.

   During a landslide in the Nuwara Eliya District in 2007, 56 families were evacuated in time, which resulted in no casualties. The landslide could be predicted with the help of the GPS instruments and hazard zonation maps by the National Building and Research Organization (NBRO) officials after villagers observed cracks in the ground, knowing its meaning because of awareness sessions conducted in the communities. Additionally the new technology also prove useful for determining safe areas for resettlement.


Photo by UNDP Sri Lanka

   The key success factors in this case include the development of standard operating procedures (SOPs) for which communities were trained. Disaster awareness sessions were also held. Beyond that an early warning mechanism was implemented and local authorities were trained to recognize disasters, and determine safe areas for resettlement in post-disaster scenarios and for the formulation of land usage plans for the unaffected areas. An early warning monitoring system was installed and a national agency was trained on its usage.

3. The UNESCO Jakarta office reported that the SOPs developed under the project in cooperation with KOGAMI, a local NGO, were effectively applied by the disaster control authority in Padang, Indonesia when the earthquake hit West Sumatra in March 2007.

   The specific objectives for the project were to identify and assess critical factors and issues related to community-based disaster preparedness for disaster prone or high-risk areas at the local level. The support of initiatives on community-based disaster preparedness at different levels and contexts in pilot sites was a follow-up action to the Community Based Disaster Preparedness (CBDP) assessment. It supported the development of coherent in-country strategies and a vision regarding CBDP, with emphasis on the effective interface between TEWS and CBDP.

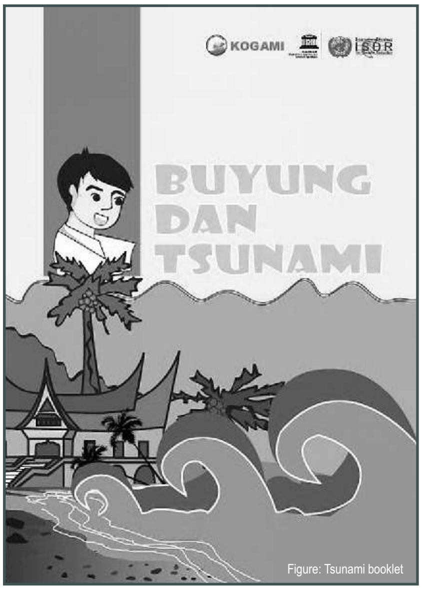

Figure: Tsunami booklet

   The comprehensive assessment comprised two components, i.e. a general assessment on preparedness in three pilot sites in Sumatra (Padang, Bengkulu and Aceh Besar districts) and an assessment on the use of traditional knowledge in disaster preparedness. Based on assessment results and in line with the recommendations put forward by the expert team, a range of follow up activities were organized in the pilot sites including training, workshops and public awareness activities. The activities have helped to put disaster preparedness on the agenda for key-stakeholders in the pilot sites, as well as generate a great interest in the broader public. Knowledge, attitude and behavior surveys showed improved awareness amongst key stakeholders.

   When a 6.4. magnitude earthquake hit the Indonesian island of Sumatra on 06 March 2007, at least 70 people were killed and hundreds of buildings were destroyed. Thanks to education and drill simulation, the resistance of the people had been high in the pilot areas supported by the Flash Appeal. There had been no casualties in Padang, “only” nine people received injuries.

   All outputs and publications of the Indian Ocean project have been disseminated to a wider audience by the UNISDR secretariat and each implementing partner to further enhance awareness on tsunami early warning and disaster risk reduction and to facilitate the Indian Ocean countries to exchange experiences and replicate good practices.

Lessons Learned

The project faced some administrative challenges arising from the multi-partner and multi-donor nature of the project. The project was implemented as a single integrated project with each donor having specific requirements and administrative procedures for written agreements, transfer of funds, reporting, monitoring and evaluation. Additional challenges included difficulties in monitoring the progress of all of the project activities that were implemented by respective partners and in obtaining substantive progress reports in a timely manner.

However, within the limited scope of the project activities, these difficulties were largely overcome by the coordinated support to all Indian Ocean countries.

Substantial parts of the capacity building and community preparedness were undertaken toward the end of 2005 and in 2006. It was a challenge for the project to provide rapid assistance to the countries when requested, and to assist in longer-term enhancements of national and local capacities. This latter task requires considerable time for preparation and consultation with a much wider range of stakeholders including disaster management authorities and development planning agencies.

UNISDR will use the experience thus gained to feed into the Regional TEWS and to disseminate the lessons learned to inform other community based preparedness and EWS in other countries of the Indian Ocean.

Potential for Replication

To generate an enabling environment for early warning systems, the UNISDR secretariat, its regional offices and other relevant organizations should continue to assist the countries in enhancing capacities and mobilizing resources necessary for both establishment of early warning systems and for strengthening national platforms for disaster risk reduction to effectively implement the Hyogo Framework for Action.

By building on the existing systems an overall integrated framework for establishing early warning systems in a specific region becomes cost and time effective. Facilitating coordination among various specialized technical institutions and providing overall organizational assistance can result in the effectiveness of inputs and resources. This can be maximized by providing strategic direction for the implementation and monitoring of the activities which avoids overlaps between the implementing agencies. In addition, multi-partner and multi-donor early warning projects can assist in partnership building, creating linkages and sustaining synergies among the agencies during the process of implementing the project.

Through minimizing the monitoring costs and by strengthening the sustainability of early warning systems, the multi-hazard approach can be efficient especially when the country is prone to low-frequency hazards that need to be monitored.

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Kenya

Use of community radios to promote drought early warning in Northern Kenya

Garba Tulla Development Organization (GTDO)

Photo by *GTDO*

Abstract

Garba Tulla Development Organization (GTDO) is a local community-based organization involved in community development initiatives in the semi-arid district of northern Kenya. In the Garba Tulla area, the community radio initiative began as a one base station and one mobile VHF radio operation to coordinate emergency relief intervention during the severe drought of 1992. The mobile station visited remote centres, monitored the situation, collected data and relayed back the information to the GTDO base station which compiled the report and sent it to the Government and other aid agencies for action. Through this type of radio transmission, it was easy to quickly identify the locations most in need and to act swiftly with an appropriate response. Over the years more radios were added to the network which enabled the connection of nine villages.

Goals and Objectives

The radio serves as an important communication tool between the villages; firstly, to relay drought early warning information on pasture, water and diseases between the villages and the GTDO base station, to relay security information, and soon, to undertake development program coordination. This initiative also greatly improved collaboration and coordination between the local communities, government administration and other aid agencies, who eventually consented to having their own radios linked to the community radio system, thereby improving coverage.

The Initiative

Garba Tulla Development Office (GTDO) works with grassroots pastoralist communities who have been previously ravaged and impoverished during the Shifta War (1964-67). The area continues to be devastated by recurrent droughts exacerbated by depleting and degraded natural resources (pasture, water, etc). Although drought is not a new phenomenon to the pastoral communities, their coping mechanisms have been undermined greatly by a combination of factors: disruption of traditional grazing patterns due to establishment of national game reserves, increased sedentarization due to increasing population and new lifestyle and lack of government appreciation for the pastoral way of life resulting in marginalization of the local communities. Whenever drought occurs, it causes death of livestock and suffering in the local populations. Government and aid agencies' responded in the form of emergency drought relief operations.

The project was proposed and implemented by GTDO with initial support from UNICEF. An expanded phase was supported by District Drought Monitoring and Management Project and Catholic Organization for Relief and Development Aid (CORDAID). In addition to GTDO staff, 10 to 15 community volunteers in each of the 9 villagers were involved in the radio installation. Overall, the total number of beneficiaries consists of more than 30,000 people in the district of Garba Tulla.

The project was implemented in 1992, as an emergency drought relief response. In 1994 it was expanded to cover 9 villages in the Garba Tulla District Isiolo, northern Kenya. In 2003, GTDO operations and administration were involved in a dispute with the local founding church. This led to a breakdown of coordination and oversight support for the community radio system causing some radios to cease operation. Nevertheless, communities continued to manage their specific radios. Some of the radios are still operating to date.

The radios' negligible running cost and hardiness made it favorable for sustainability in such a difficult working environment. The Community Radio is a high frequency, long distance coverage VHF base station installed in each village, which links remote pastoral villages where other forms of telecommunication do not exist.

The success of the GTDO community radio project in drought early warning has underscored its critical importance in ensuring that effects of drought are swiftly and effectively mitigated through early detection and appropriate responses. Because of the high value attached to the radios by the communities, it was not difficult for GTDO to hand over the management of the radios to the respective communities to manage and pay the operators. Unlike other development initiatives, the communities were willing to perform this role without much hesitation. Other organizations such as ActionAid, government agencies and Kenya Wildlife Service (KWS) have now set up similar networks of radio stations in other villages for wildlife protection and community development responses.

The Good Practice

The VHF radio stations are a cost effective, handy tool for communication in remote locations. Due to the vastness of the area and the poor infrastructure, the use of radio communications greatly contributed to the success. This radio communication has been used to link the various communities, development agencies and government departments in an innovative manner and thus, enhance development collaboration. Since its inception, there has been tremendous improvement in drought management through early detection, prediction and planning with better sharing of natural resource information such as pasture, water, insecurity and outbreaks of livestock and human diseases. Pastoralists have also used the radio to understand livestock market prices which leads to better decision making on the purchase and selling of livestock.

The GTDO has a community decision-making structure called the Deedha Councils through which the need for the project was discussed and agreements reached. Once the responsibilities of the implementing agency and of the communities have been agreed upon, the equipment for the radio station (radios, antennae, solar panels, and all connections) was sourced by the GTDO. The installation in all the villages took place within one day and was carried out by trained GTDO technicians.

The community radio operators, usually two people, were trained on the radio operation code of conduct and proper documentation of all messages. The Deedha Council appointed one community member to monitor the progress and to report any anomaly or issue to the Council who then informs the GTDO, which acts as a base station that regulates and coordinates all community stations.

The strategy encompassed enforcement of strict discipline through the agreed upon code of conduct and the recording of the radio messages by the community radio operators. This is regulated by the base radio station at GTDO which takes care of the clear understanding of roles and responsibility of the beneficiary community in terms of maintenance, monitoring and sustenance of the radio operators.

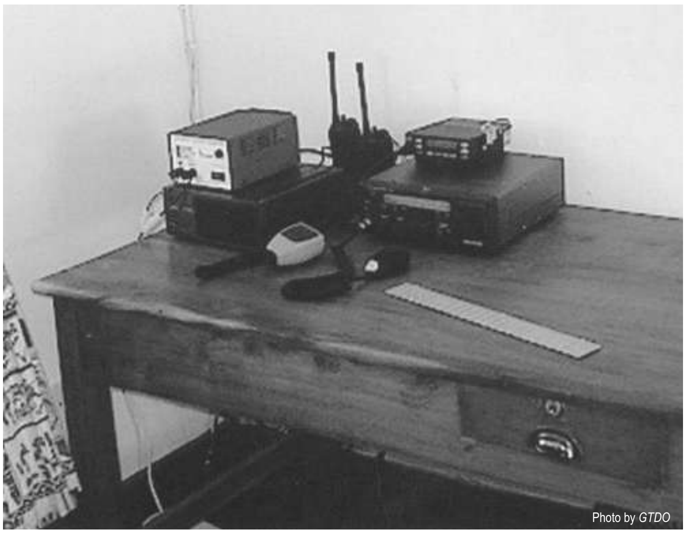


Photo by *GTDO*

Lessons Learned

A community-based project has a significantly higher chance of success and community support if it seeks to address the communities' needs and is implemented with a proper understanding of them. Since drought is a serious threat to the existence of the local community, the radios were viewed as an important tool for early warning and quick response. As such, communities were willing to pay for maintenance and operators' costs because they understood the importance of the radios in their lives.

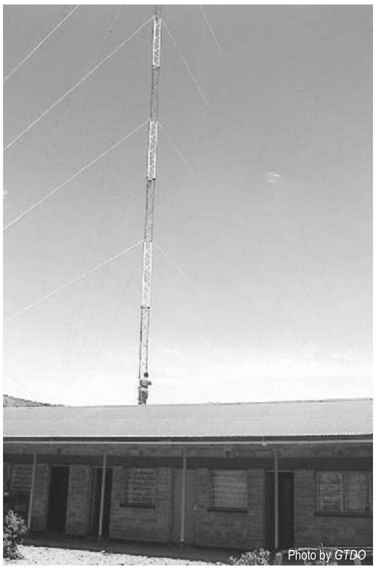
Clarifying the collaborative role for each stakeholder enhances the sustainability of the project. For projects that link different communities, there is a need for a stable, strong control centre for coordination and regulation. GTDO played this coordinating role. Regulating the different community radio operators was a challenge. Most operators were school drop-outs who usually moved on to other jobs after some years. This difficulty was overcome by having several under-study radio operators that were able to replace those who moved on.

The response of the communities was more effective in villages where there were no other forms of telecommunication. To ensure all radios operated at par, Deedha Councils were involved in the coordination between the participating villages. The repair of radios was sometimes a problem. On their own, the individual villages could not undertake this. For the most part the repairs were done in Nairobi, which is more than 400 km from Garba Tulla. Because of the remoteness, a central coordinating agency was welcomed in the project.

Ensuring a proper community mechanism to remunerate the radio operators and also to pay for repairs led to innovative methods that included establishing a revolving fund or a herd of livestock to cater for these recurring costs. Another solution was to train local technicians on basic repairs and thereby minimizing the costs of taking the radios to Nairobi for smaller repairs. This helped to strengthen the community support for the project.

Potential for Replication

Replications by other agencies have already been done in other parts of the Isiolo. The critical stages in the project are agreements between the communities and the implementation agencies. The other inputs are fairly easy to source and install. Repairs and maintenance are minimal and with proper care, the radios can last for years.



The effort of the community to alleviate the threat of recurrent droughts, disease outbreaks, insecurity and lack of other forms of telecommunication has meant that the communities placed great importance on the project.

This project was undertaken within a wider framework of GTDO's community-based development programmes. It was viewed as an important ingredient for the work which GTDO was doing within the community: alleviating poverty and supporting sustainable community development. The community context, which included a need for linkages between the neighboring communities, is an essential ingredient. A central coordinating organization such as GTDO that can create linkages is also quite essential. It is important to clarify roles and responsibilities of the different actors, especially the role of maintaining and sustaining the initiative. Training of the local radio operators and local technicians will ensure proper use of the radios and maintenance when occasional repairs are required.

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Mozambique

Disaster-resilient communities

INGC - Instituto Nacional de Gestão de Calamidades
InWEnt - Capacity Building International Germany

Photo by Susanne Neymeyer

Abstract

In spring 2000, the highest amounts of precipitation for 50 years, combined with four cyclones, led to an unprecedented flood disaster in Mozambique that killed around 800 and directly affected 4.5 million people. The German organization InWEnt, Capacity Building International, focuses on human resource development, advanced training and dialogue. On behalf of the German Federal Foreign Office InWEnt has assisted the National Disaster Management Institute of Mozambique (INGC) for several years. Its programmes also target INGC's multi-sector partners and civil society through awareness raising and training. This program is part of the official 10 year "National Master Plan for Disaster Risk Management and Reduction" of the INGC.

In 2007, INGC jointly implemented with InWEnt and in cooperation with the German Center for International Migration and Development (CIM) a local early warning and response system. The system is based on peoples' own capacity to protect themselves as far as possible by creating and training local Disaster Management Committees (DMC) who have the role of warning and guiding the population and informing authorities and relief agencies. It is an example of how disasters can be effectively met by concerted, decentralized community action and self-organization at a low cost. It ensures that improvements will not be washed away by the next flood.

Goals and Objectives

The major goal of this program is to support the development of disaster-resilient communities in Mozambique and to reduce the impact of disasters on the targeted communities.

Its objectives are:

1. To raise community awareness on hazards and disaster risks; and

2. To help communities enhance their capacities to address their vulnerabilities.

The Initiative

Mozambique is one of the poorest countries in the world and one of the most frequently affected by natural disasters. Most of the population depends on subsistence farming. The harvest is strongly influenced by the occurrence of floods, cyclones and droughts. Disasters threaten lives and an already precarious food security situation. This not only re-enforces the cycle of poverty but also reduces the impact of development gains. In 2007, INGC implemented with support from InWEnt and in cooperation with the German Center for International Migration and Development (CIM) a local early warning and response system. The program aims to strengthen the population’s ability to protect themselves by providing practical information on disaster risk strategies and building up an efficient local warning and response system.

A number of vulnerable communities were identified and encouraged to form local disaster management committees of 20-25 people. Members have specific roles and are trained in different fields of disaster reduction. Some members ensure that crucial information reaches concerned populations (warning), authorities and relief agencies. Others are trained in evacuation, first aid, shelter and relief. In order to practice the given knowledge and capacities, simulations are realized for floods, cyclones and earthquakes.

Moreover, the program includes the development of evacuation routes and risk maps, the design of community emergency plans and approaches that educate community members to better understand and respond to specific threats. A partnership with the Ministry of Education has been established in order to integrate disaster risk reduction into school lessons and into school infrastructure.

The approaches outlined above build upon best practices learned from other successful interventions in flood affected areas of Mozambique and have been adapted and enhanced for maximum effectiveness. Beyond the impact of improved disaster preparedness, reduced loss of life, property and livelihoods, the project also engenders strengthened community cohesion and increased self-confidence, assisting local populations to become “hands on” activists in the protection of their communities.

After preliminary preparation work, the first activities were rolled out in June 2007 with a series of consultative workshops with authorities, community leaders and other key community activists. The set up and development of DMCs is ongoing, with 34 DMCs established and trained so far. The plan is to ensure that all communities at risk of disasters are included in the scheme. The program is implemented nationwide in Mozambique. InWEnt supports INGC in six districts of the three Northern Provinces: Nampula, Cabo Delgado and Niassa. The six districts Moma, Mecufi, Nacala, Lago, Aldeia Sassalane and Metanculo were identified as very poor, and particularly vulnerable to disasters such as cyclones, floods and earthquakes. Prior to these current program interventions, the targeted communities had never received information and training on disaster risk reduction.

Approximately 50 people are involved per province in disaster risk reduction and awareness training, as well as in the development of local early warning and response systems. It is expected that by November 2008, approximately 60,000 community members living in high risk areas will have been supported by this initiative.

The program is implemented by involving all concerned authorities, community leaders and agencies in the region. The first activities have been a series of consultative workshops in order to discuss the details of planned activities. In the next step local DMCs were established in six districts, with the role of fulfilling specific tasks in case of emergency. This includes informing the neighborhood and relevant institutions, organizing evacuations, shelter, and relief, and providing first aid. In order to enable the members of these committees to fulfill their tasks training courses were conducted by INGC and InWEnt, including large-scale simulations of emergency. Besides trainers from INGC, trained local community workers from other successful interventions in Búzi, another flood affected area of Mozambique, volunteered to participate in training with the Disaster Management Committees.

To ensure sustainability and continuity, visual educational material on disaster risk reduction will be developed in the coming months and distributed to members of the DMCs in order to make sure acquired knowledge will stay in the community. The project represents a participatory approach which aims to strengthen the population's ability to protect themselves by providing practical information on disaster risk reduction strategies while concurrently establishing an efficient local early warning and response system.


Photo by InWEnt

There are a few economic and political constraints:

- Competing priorities within Mozambican Government's development agenda. This places a squeeze on both technical/administrative capacity and on access to resources.
- Poor infrastructure undermines access and supervision of remote areas.
- Mozambique's size and demographic make up means that certain areas have low population density. This means that investing in disaster mitigation responses for such areas is not always seen as cost effective.
- Sustainability means long term investment and training – which is resource intensive.

The Good Practice

The project is a good practice because it uses a participatory approach to build upon the capacity of local populations and empowers them to play a pro-active role in ensuring the security of their families and livelihoods. The benefits are easily demonstrated to participants and, therefore, encourages "buy in" for the identified approaches. It is cost effective and has been adapted from other effective interventions elsewhere in Mozambique. Furthermore, it is easily transferable and can be adapted to other regions and countries.

Interviews with members of local DMC demonstrated that people are highly motivated to take over the responsibility of protecting themselves whenever possible. This is a pre-condition for sustainability and one of the key impacts of the project. Additionally, the observed simulations on cyclones, floods and earthquakes provided much needed and highly useful opportunities to put theory into practice. More trainings and simulations have been requested by DMC members. A key factor to success is that it is clearly local populations that are most knowledgeable and best placed to identify multiple disaster risks. Coupled with the tangible benefits that effective disaster response brings to their communities, these factors highly motivate the target group of beneficiaries.


Photo by Susanne Neymeyer

Lessons Learned

The major lesson learned is that the community itself is a key actor in disaster preparedness. Once involved, people are highly motivated to protect themselves in the following manner:

- Communities need to be mobilized to take responsibility for the management of minimizing disaster risks.
- Involvement and integration of local government officials, elders and community leaders into the process and development of risk reduction plans is essential.


Photo by Albino Rodrigues Nguenha

The major challenges of the program have been the complex local dynamics, the lack of resources and the difficulty to access remote communities. Selected participatory approaches ensured that provincial district and community actors were all actively involved in the development in this program. The program will provide more megaphones, bicycles, stretchers, shovels, pencils and other material in order to improve the warning and response system. More training sessions, refresher courses and simulation exercises will be conducted to guarantee the continuity and sustainability of gained knowledge. Access to remote areas remains a problem.

Potential for Replication

The program can be easily transferred and adapted to other countries facing risk from disasters. Similar examples exist already in Bangladesh, Honduras and Costa Rica. For replication the program requires trained community workers in disaster risk reduction techniques and appropriate materials (megaphones, radios, first aid kits, etc.) depending on the given context and geographic situation. Moreover new projects should focus on provincial and district levels, in order to mobilize the population to take care of themselves.

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Mozambique

Disaster risk management in the Búzi river basin

Munich Re Foundation
INGC - Instituto Nacional de Gestão de Calamidades

Photo by Thomas Loster, Munic Re Foundation

Abstract

Efficient early warning systems are a vital part of any viable disaster risk reduction strategy. In recent decades, there has been a significant increase in flood disasters in many parts of the world, with Mozambique being no exception. According to estimates by Mozambique's National Institute for Disaster Management (Instituto Nacional de Gestao de Calamidades), some 285,000 people in the Zambezi region alone were endangered by flooding between December 2006 and January 2007. Since 2005 the Munich Re Foundation's Mozambique flood warning system project has been involved in setting up a simple but effective early warning system along the River Búzi.

Representatives of the German Agency for Technical Cooperation (GTZ), actively involved in the development work in the country for many years, developed a warning system adapted to the specific needs and skills of the people. The way it works is remarkably simple: village officials take daily precipitation readings at strategic points along the Búzi river basin. At the same time, they monitor clearly marked gauges on the river. If precipitation is particularly heavy or the river reaches critical levels, this information is passed on by radio. If reports reaching the control centre indicate widespread heavy rainfall, the alarm is raised. The gauges along the river are vital monitoring devices. Special training ensures that people are fully aware of the risk. Blue, yellow or red flags are raised depending on the flood alert level and an army of helpers spreads the warning by megaphone. Critical areas are immediately evacuated.

Goals and Objectives

The project is a community-based flood early warning system along the Búzi river. The main purpose was to build an easy to understand early warning system for Mozambique, primarily for the Búzi area. The country is one of the poorest in the world, with a female illiteracy rate of nearly 70 percent. Since hundreds of people lost their lives during the worst floods in recent history in 2000, an early warning project became indispensable. But it required an easy approach with no written signs. With the early warning system it became possible for the people in the greater Búzi area to react faster to possible flood threats.

The Initiative

The Búzi project was a collaborative initiative between the Munich Re Foundation, the German Association for Technical Cooperation (GTZ), the World Institute for Disaster Risk Management (DRM), and local experts and institutions. The project was initiated and co-financed by the Munich Re Foundation and the German Agency for Technical Cooperation. It started in August 2005 and was completed in December 2006. For the continuation of the project the area Machanga/Govuro at the River Save was selected and an additional project was launched in April 2007.

The project idea is an adoption of a successful scheme from Honduras. Experts had set up similar flood-warning systems in Central America before they came to Mozambique to train the people in the Búzi area. They worked together with the National Disaster Management Institute (INGC) and the Inter District Operational Flood Warning System for the Búzi River Basin (SIDPABB).

All people living along the Búzi river downstream of the village of Goona, including the locations Grudja, Estaquinha, Segaja, Inharongue, Munamicua, city of Búzi, Muchenessa are affected by floods. The overall number of people at risk lies between 10,000 and 20,000.

Photo by Thomas Loster, Munich Re Foundation

In February 2007 the Búzi area was affected by the Category 4 Cyclone Favio that caused major damage due to strong winds and heavy precipitation. In the villages along the river, precipitation readings regularly topped the 250mm mark. The rivers rose rapidly and 12,800 people were put at risk, but they had been well prepared. The district's disaster mitigation committee had alerted threatened villages two days previously (blue-flag alert) and announced evacuations.

After a meeting of the district government, the assessment and prognosis group of the SIDPABB was asked to monitor rainfall and water levels along the rivers. Directly after these measurements, the district government received a yellow-alert warning from the provincial government, indicating that the cyclone was to arrive in 12 hours. The local community and the services of the local council, the heads of the administrative centres, and members of the local disaster prevention committees were instructed to raise the warning flags and alert the population to the approach of Cyclone Favio.

In addition to hoisting the warning flags, the disaster committees used traditional methods such as drums, whistles and megaphones to ensure that people were alerted to the danger of the approaching cyclone.

The Good Practice

The early warning system is mainly a community-based project. With the help of the GTZ and Munich Re Foundation the inhabitants were able to rescue themselves and others. The best example is the reaction to Cyclone Favio and the following flood in February 2007. The district's disaster mitigation committee was aware of the cyclone, alerted threatened villages two days prior to landfall and announced evacuations. Around 2,300 people were taken to emergency accommodation centres and the District Administrator played a major part in coordinating and directing the operations. Even though the Cyclone Favio caused severe flooding, the number of casualties was limited to only 4 victims and 76 injured in the disaster zones. Regular testing of the system as a whole and practice drills for everyone, conducted at least once every autumn, before the start of the rainy season, helped the people along the river and the local government to understand the system and feel responsible for it.

Photo by Thomas Loster, Munich Re Foundation

The main innovation of the project was to implement an easy to understand early warning system for the inhabitants. The warning system with the colored flags is relatively simple and understandable for everyone. Together with the specially trained community groups and helpers it is possible to reach the population in a relatively short time. The warning officials are selected and formally appointed. This enhances their status, which helps to ensure that they take their duties very seriously. Follow-up training for the officials maintains their vigilance.

Lessons Learned

The key lessons learned from this project were that awareness has to start at an early stage and that it is necessary to inform the people directly at their schools, markets and other meeting points. The system must be simple and include visual and symbolic elements such as flags, maps or photographs. Regular testing of the system as a whole and practice drills are important to maintain success.

Photo by Thomas Loster, Munich Re Foundation

The major challenge was to reduce initial resistance in the communities when the evacuation started. This was accomplished with the help of the trained regional staff. The follow-up Save River project is an extension of the Búzi River early warning project, which was already a continuation of a project from Honduras. Hence, it is definitely possible to carry the concept on to other river areas in the world.

One real key issue is the ownership. Everybody in the community should know about the system and adopt it. Without ownership at all levels (children, adults, mayor, administrator etc) the system would not work.

Potential for Replication

Since the project has already been implemented successfully for the third time in two different countries, there is a potential of replication in different areas. The community is directly involved in the early warning activities and responsible for the measurements and the warnings. This should maintain a sustainable basis for the ongoing success of this project.

The practice can be replicated in nearly every country facing the same problems as Mozambique. The measurements are mostly people-centered and easy to adapt. The warning system will be duplicated at the River Save in the province of Sofala, Mozambique (2007-2009). Future steps will include implementation in different countries.

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Nepal

Early warning – Saving lives

Practical Action Nepal

Photo by Anup G. Phaiju, Practical ActionNepal

Abstract

This project aimed to establish a community managed early warning system (EWS) in flood prone areas of lowland Nepal. Due to annual flooding lives, assets and community resources are lost annually making long-term investment in land and property unrealistic. The lives of the poorest, who are forced to live in marginal riverside lands, become increasingly untenable. The EWS consists of five tower systems supporting electrically powered sirens. The sirens run on independent battery charged power sources that are recharged intermittently from the national grid system, but are not reliant on the grid system, which, like telephone services, are prone to failure during periods of heavy rain, when flood is most likely to occur. Towers were chosen for the increased distance of view they offered to observers, the increased range they gave to the sirens, and for their psychological impact within the communities. The establishment of the towers went hand in hand with a broad range of awareness raising activities, training in EWS use and operation, advice and guidance on long-term sustainability, and the management of the systems. By introducing EWS as part of a broader community-based program of disaster risk reduction (DRR) initiatives, the project was able to convince community members of the benefit and value of EWS which was build on their traditional "watch & warn" system for wild life.

Communities were also persuaded that only when the EWS was managed by the communities themselves, could they rely upon them. Linkages with upstream locations and other information sources, while desirable, was not realistic in the short term. The events of September 2007 demonstrated the case, when information provided by FM radio proved inaccurate and telephone systems became completely inoperable. If the communities had been reliant on external sources of information for EWS purposes, they would have been rendered more vulnerable.

Goals and Objectives

Its main objective has been to reduce the loss of lives, livelihoods and community assets due to annual floods, through the provision of greater warning and appropriate response and evacuation plans.

The greatest impact of the project has been the increased evacuation time given to people. This has been supplemented through the provision of rescue equipment and training, as well as a range of community assets (bridges, evacuation shelter). They have also started storing irreplaceable assets, such as livestock, food, water and household items, prior to the floods in safe places in their homes.

The Initiative

The project is located in the Chitwan and Nawalparasi Districts in the Terai plains of Nepal. Specifically, the Project Implementation Committees (PICs) in the villages of Meghouli, Jagatpur and Piple (Chitwan), Pithauli, Kolhuwa and Parsauni (Nawalparasi) were formed in March 2006. This initiative is a DRR programme, centred on community managed flood early warning systems.

In September 2007 the systems were tested in two locations as well as in one location used as an observation study site by Practical Action staff on a 'real time' basis. The project was implemented through two local partner NGOs, SAHAMATI (Chitwan) and CSC (Nawalparasi), along with project implementation committees in each community. The communities consist of diverse groups including indigenous Majhi (fisherman), Bote (sailer) and Tharu (farmer) populations, as well as more recent immigrants from hill regions and India. The population that directly benefits from the EWS consists of more than 35,000 people, and potentially more than 100,000 benefit from radio awareness broadcasts and other components within the broader programme.

The project was largely carried out through the local partner NGOs, but the EWS system, due to its technical nature, was primarily established by Practical Action. The District Authorities in Chitwan district were also an active participant, and produced, in coordination with Practical Action, a District Disaster Management plan. This was the first ever to be produced and published in the Nepali language in Nepal. The project was co-funded by DIPECHO (Disaster Preparedness European Commission humanitarian aid department) and the States of Guernsey and the Cooperative Bank (UK). Officially the project was completed in June 2007, but follow-up awareness raising and further training took place from May to August 2008.

There is no official next phase for the Chitwan/Nawalparasi programme, but a return to the locations in 2009 is being discussed. This is being planned with a view toward integrating the community systems within a larger district or watershed system. In this line two river watershed systems are currently being studied by Practical Action in the western districts of Banke and Bardia.

This project is operating among flood prone communities on the Babai and West Rapti rivers, where major floods and displacements of populations took place during the 2006 and 2007 monsoons.

Photo by Practical Action

The project is establishing river system based warning structures, in conjunction with the District governments, police and officials from the Department of Hydrology and Meteorology. In these systems, upstream river condition information will be relayed downstream by CDMA (robust, satellite-based telephone system), through three potential channels: (a) to District Disaster Response Committee consisting of Chief District Officer, Police, Army, Red Cross etc, (b) to FM radio networks, and (c) direct to the communities.

At the community level, warnings will be disseminated by hand sirens positioned along vulnerable sections of the river bank, numbering up to 40 in total. As with the Chitwan/Nawalparasi programme this EWS is part of an integrated programme of mitigation measures, training, capacity building and awareness raising.

The Good Practice

The establishment of an EWS should be seen as a good practice, because only communities that have adequate warning of risks and threats can react in time. Without prior warning other DRR activities are likely to be rendered useless, and at best, less effective than they could have been in protecting people's assets and belongings.


Photo by Practical Action

Apart from a small pilot project that was carried out by Practical Action in 2002, this was a new approach, and as such neither its success, technically nor socially, could be ensured. The success of the real time tests of the system during September 2007 can be attributed to the fact that a lot of time was put into extensive community planning and awareness activities prior to the establishment of the EWS. Managing peoples' expectations has also been an important element in ensuring the programmes success, as initially many saw the introduction of EWS as a panacea for all their problems. This view had to be slowly moderated for the communities. It took time for them to realise that an EWS is reliant on them, rather than vice versa, and that only through good planning and management would the technical (siren) components of the EWS be successful.

The main successes of the project has been that it has demonstrated that when disaster strikes people can take greater control over their lives through community managed initiatives, independent of external assistance. The project has created greater self-reliance and increased awareness that communities themselves have the prime responsibility for protecting their own lives and livelihoods.

Its main innovation has been to introduce tower-based siren systems, which are managed and operated by communities and supported by power sources independent of the grid power supply. The towers have not only provided an increased range for sirens and viewing, but also have a strong psychological component. They are a visible and universally recognizable location for the communities around them.

Lessons Learned

The main lessons learned are that:

- There needs to be a long lead time for this type of project, to explain the nature of EWS and its operation, as people tend to think it will cure all problems;
- Local management of relatively complex systems is achievable and sustainable;
- In setting up an EWS the human and social dimensions of the system need to be emphasized over the technical. A visible and universally recognized central point for warning is desirable, such as the towers in this project, which can serve both a physical and psychological need.

Photo by Practical Action

The main challenge was to keep aspiration and expectations realistic. This can only be achieved through on-going and consistent dialogue, emphasis on the human and social dimension of the EWS system can help ensure that the whole process is community led, meaning that the NGO and support agency only provides technical support when required.

In the future one should take into account that low-technology is good technology. The need for power and other technically fragile systems should be avoided if possible. The replication of the system could be established without the need for an external power supply. Apart from this, one needs to keep in mind that community-level EWS projects can only limit risk to a certain degree. To be fully effective they need to be linked to the bigger district system, and ideally to a national warning system.

Potential for Replication

It would be very easy to replicate this system, particularly as in many instances an external power supply would not be necessary. Every situation is different, however, and the tower approach is only applicable where local customs and observations are possible. The principle holds true for most stages and contexts in disaster management - awareness, observation, monitoring, warning, and planned response. The approach taken in this project was relatively costly, as the project wanted something visual to catch people’s attention and provide a focal point. Towers are not necessary, but some focal point is, so that people know where the warnings will be issued. Cheaper options are certainly possible and are presently being explored.

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Sri Lanka

Community-based tsunami early warning system in Peraliya, Sir Lanka

Community Tsunami Early Warning Centre (*CTEC)*

Photo by CTEC

Abstract

As part of establishing a centralized early warning system in Sri Lanka, several initiatives have been launched at the national level in Sri Lanka. While recognizing the fact that the missing link in issuing the early warning is between the decentralized government system and the community, initiatives such as the Community Tsunami Early Warning Centre (CTEC) play a major role in filling the gaps. The community survey on the effectiveness of the CTEC system suggests that there is a need for a community-based system to properly disseminate the alert, warning and evacuation messages of tsunami threats to the Peraliya community. The results of the survey emphasize the need for the CTEC system to continue not only as a multi-hazard early warning dissemination system, but as an integrated component of the multi-purpose entity for community development. The systems such as CTEC should be registered by the Disaster Management Center in each district and integrated with other related community infrastructures to ensure its sustainability.

Goals and Objectives

CTEC was established to provide information about tsunamis and other natural hazards to the public. The idea is to create a disaster preparedness culture in Sri Lanka at the community level to be achieved through community participation. Special emphasis is laid on the protection of vulnerable groups.

A community-based early warning center also helps to prevent adverse consequences during an emergency, such as providing security to property that cannot be taken along during evacuation.

The Initiative

In order to establish a centralized early warning system in Sri Lanka, several initiatives have been launched at national level. To ensure that the warnings reach the population community-based early warning systems need to be created in order to close the gap between national and local level. Community-based systems need to receive the information from the National Early Warning Centre and to disseminate the appropriate information and early warning alarms to the communities.

One of the community-based systems that exists in Sri Lanka is the Community Tsunami Early Warning Centre (CTEC) at Peraliya on the south-west coast of Sri Lanka. Peraliya was one of the most devastated areas by the December 2004 tsunami. The village drew media attention in the aftermath of the tsunami, because of the train that was toppled over by the giant waves, claiming over 2000 deaths including many villagers.

CTEC currently covers about five villages directly through its public address system. In addition, it has extended its services to the whole of the Galle District through its Community Focal Point (CFP) network. It conducts community awareness and educational programs to equip the public with knowledge and skills regarding emergency preparedness. Training programs and training material have been developed for these community awareness programs. CTEC has established volunteer teams in line with its CFP. The volunteers of these teams have been trained with regard to the action to be taken in an emergency situation. In addition, they are equipped with important skills such as basic life support, first aid and fire preparedness. Evacuation areas have been identified and tsunami signs have been established as a part of the community contingency plan.

CTEC has Information and Communications Technology facilities to link with both national and international warning agencies and media. It is open 24 hours 7 days a week. Youth selected from the community continuously monitor the system for emergency information and warnings. Institutional operational procedures have been developed that are to be followed in an emergency.

Though initially established to prepare the community against tsunamis, the CTEC activities have been expanded to cover a broader range of disasters. CTEC focuses on the needs of vulnerable groups in the society such as children, elderly, women or handicapped individuals. CTEC promotes the active participation of the communities it serves in all stages of its activities from planning through evaluation and monitoring.

CTEC was initiated by a group of local and foreign volunteers with the active participation of the affected community. It is now completely managed by the volunteer force of the local community of Peraliya with the support from interested stakeholders.

During the 2007 Tsunami Alert the CTEC played a major role in informing people using its loud speaker and mobile speaker (siren) system, to direct people towards evacuation places. A problem was that people having the number of the meteorology department in Colombo, tended to call there, which resulted in a congestions and failure of the system leading to problems in the operation of the organization. This emphasizes the need for community-based early warning systems, as the government cannot focus on individual enquiries at times of real emergency.

The CTEC system has a community database, which is updated daily and is displayed to the community. It has the following components:

Seismic activity recording: Every 15 minutes, the duty officer looks at websites and records in the center logbook the earthquakes with a magnitude more than 5 on the Richter scale. All earthquakes that occur in the Indian Ocean Region are extracted every 24 hours and are displayed in the CTEC notice board.

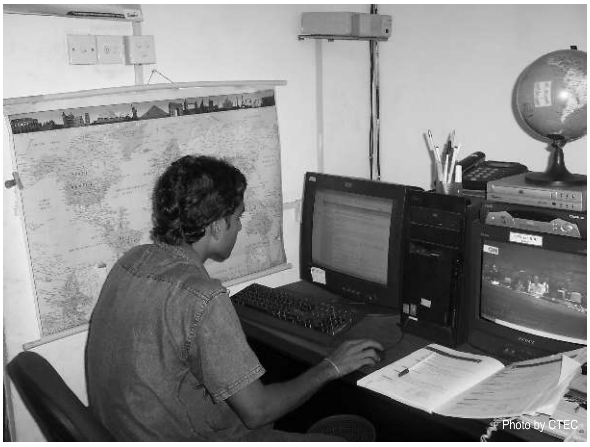
Photo by CTEC

Weather Information: The daily weather report issued by the Meteorology Department is read and recorded by the Duty officer. It is displayed on the CTEC notice board so that anybody interested can obtain the weather information.

Community Inquiries: Inquiries made by community members are recorded in the incoming call book. Date, time, name of the person who calls, location, contact telephone number, and the inquiry are recorded, as well as the action taken afterwards. This helps to identify areas where “rumors” are generated. The center officers can then reach out to these areas and educate people about their fears.

Disaster Information: The duty officer records disaster related local and foreign news in the Log Book. In addition, important and relevant newspaper articles with regard to natural hazards are collected.

The Good Practice

The CTEC initiative is intended to support and facilitate the government's efforts in DRM at the grass root level. CTEC does not issue any warning on its own; instead it provides the technological and human communication network needed to disseminate such warnings issued by the government to the communities. Based on the criteria developed for good practices in Community Based Disaster Risk Management (CBDRM) guidelines by the Asian Disaster Preparedness Center (ADPC), a community early warning system has been established with the specific aim of contributing to a safer community.

1. The CTEC initiative is a purely community-based initiative, founded after the 2004 tsunami, that later extended its relationship to the local government. At first, the focus of CTEC was only on tsunamis, as a national early warning system for tsunamis did not yet exist, and was later extended to multiple hazards.

2. The initiative is based on community knowledge about hazards. It is an opportunity to make people aware of other hazards, which can be done with community participation and through disseminating information via participatory tools.

3. CTEC has been carrying out awareness programs to make people understand tsunami early warning messages through the community focal points of CTEC in Peraliya.

4. CTEC made different channels available for the Peraliya community to receive tsunami early warning.


Photo by CTEC

An evaluation study disclosed that 80% of the people of the three communities covered under the CTEC system know about CTEC and benefited from its service in the past.

Lessons Learned

1. The link to the district disaster management focal center and the national level early warning authority is still missing. It should be established for the better operation of the last mile hazard early warning.

   Standard systems and procedures should be developed to make the message consistent from all directions. In order to do this, the government focal point for the tsunami early warning should develop standard operating procedures in disseminating early warning messages for all disseminators in a consistent manner, so that confusion over the early warning message from different sources (e.g. radio, TV, mobile SMSs) can be avoided.

2. Community-based early warning centers should be given authority to disseminate early warnings to a broader geographical area. To date CTEC only disseminate tsunami early warnings to the Peraliya community.

3. There are several concerns and questions on how to make these community driven initiatives sustainable in order to be replicated to other parts of the country. Relevant key questions are for example: Is it necessary to observe the seismic activities at the community level through this type of center?; Despite the fact that the news channels broadcast the weather information obtained from the meteorology department several times a day, do people use CTEC to obtain this information?

   Besides these specific questions, there are other general concerns about this setup. Is the system sustainable? What is the community coverage of this system, if we make it a community-based early warning initiative with a multi-hazard approach? How to keep the trained volunteers to do the job continuously?

4. The costs for well/functioning early warning systems are lower than disaster response and rehabilitation costs. To ensure the cost efficiency an sustainability for less frequent high impact disasters multi-hazard systems need to be designed.

   In the case of CTEC, different possible options were explored, recognizing the need for a community-based system: multi-hazard approach; use of existing entities for early warning purposes such as community centers and schools; integrating the system in daily life by e.g. using loudspeakers for religious sermons on a daily basis in order to ensure its functionality.

Potential for Replication

The following recommendations can be drawn for any community-based tsunami early warning system in other parts of coastal areas of the country in the future.

a) Using the existing systems: The existing system should be utilized in order to guarantee cost-effectiveness and sustainability. Proper operation in times of an emergency is also of great importance. To achieve this, the partnership of all stakeholders should be coordinated by the relevant government authority at a national level. The government in this case provides the legal authority; the private sector can contribute with resources and infrastructure, whereas civil society can help to maintain grass root linkages to provide a social infrastructure and motivation.

b) Using schools as community-based early warning centers: The system can be best carried out using schools involving teachers and children in community-based early warning initiatives. This can be applied for different types of hazards in the communities, as almost all communities in Sri Lanka have at least one secondary high level school, which has a laboratory and computer center facilities. Those can be utilized to create a community-based disaster early warning system, which would be even more reliable if volunteer students are trained to work with trained staff, such as school teachers, and with other outside representatives of other relevant authorities. The government introduced disaster management as a subject to advanced vocational training for teachers and to the school curriculum after the 2004 tsunami at all the schools starting from the first grade. However, the operation of an early warning center needs to be 24 hours 7 days a week. All the proposed activities should be coordinated by the district disaster management center.

c) Multi-hazard early warning: Multi-hazard early warning systems are the best option for community-based initiatives in terms of sustainability, utility and cost effectiveness of the community-based early warning systems.

d) The Disaster Management Centre should register all the community-based systems through its district disaster management centers. This registration will help to keep track of community-based initiatives, thus provide a legal authority to disseminate tsunami warnings within the geographical area of their coverage. It will also help to avoid overlapping of initiative by different stakeholders.

Photo by CTEC

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Sri Lanka

Evaluating last-mile hazard information dissemination (HazInfo)

LIRNEasia

Photo by LIRNEasia

Abstract

The research agenda of 'Evaluating Last-Mile Hazard Information Dissemination (HazInfo)' was to complement efforts at the national and global levels by preparing the last-mile communication segment of an end-to-end hazard detection and notification chain of early warning systems. While the main focus in the world is on detection and monitoring systems very little emphasis has been given to the last-mile segment of a national early warning system.

For purposes of the HazInfo project, the research focused on the non-government organization Sarvodaya, who provided oversight, training and a Hazard Information Hub for the monitoring of hazard threats and dissemination of alert messages to local communities within the Sarvodaya network of communities utilizing combinations of different Information Communication Technologies (ICTs).

The pilot project established last-mile networking capability for 32 tsunami-affected communities in Sri Lanka with five ICTs. These included the Addressable Satellite Radios for Emergency Alerting, Remote Alarm Devices, Mobile Phones, Fixed Phones and a Personal Computer coupled with Very Small Aperture Terminals. The last-mile hazard warning system pilot phase completed in 2007 deployed and assessed these alert and notification ICTs and the relevant processes intended to reduce the risk of local villages to natural and manmade hazards in the last-mile of Sri Lanka.

Goals and Objectives

The two objectives of the pilot project were:

1. To evaluate the suitability of the deployment of a combination of five technical systems, each with unique capabilities, for reaching Sarvodaya community leaders in an emergency; and

2. To evaluate the effectiveness of the human element of the warning system comprised of three components.

a. Sarvodaya-staffed Hazard Information Hub Monitors
b. ICT-Guardians maintaining the equipment
c. Emergency Response Plan Coordinators carried out the emergency response plans, the villagers, including the emergency response plan coordinators, were trained by Sarvodaya Shanthi Sena's HazInfo trainers.

The Initiative

HazInfo was a LIRNEasia managed last-mile hazard information dissemination pilot research project implemented by the Lanka Jathika Sarvodaya Shramadana Movement (Sarvodaya) through its Community Disaster Management Centre and Hazard Information Hub with field assistance from Shanthi Sena volunteers. The following organizations were also involved in the project: Dialog Telekom, WorldSpace Corporation, University of Moratuwa, Solana Networks, Vanguard Foundation, Microimage, and TVE Asia-Pacific. The project was funded by the International Research and Development Center of Canada.

The target audience was people in coastal villages in Sri Lanka affected by the 2004 Indian Ocean Tsunami within the Sarvodaya network. 32 communities participated ranging in size from 100 to 3,000 households which averaged five persons per household.

Photo by LIRNEasia

The overall strategy entailed reception and authentication of external data and official warning information by so-called monitors located at the Sarvodaya Community Disaster Management Centre. Relevant information will be communicated to the ICT-Guardians that are transferring the messages to sEmergency Response Plan Coordinator for dissemination to the affected population.

Communities in the last-mile realized the potential of the HazInfo system to help them sleep easy at night. Based on the research findings, it was concluded that revoking the system without enhancing it or expanding into the remaining 15,000 or more communities in Sri Lanka would jeopardize the trust they have in Sarvodaya. The communities in the pilot strongly requested that the disaster management programs started under this initiative be sustained and expanded. All Sarvodaya-trained villages established an "Emergency Disaster Management Committee". In most cases these committees were comprised of Sarvodaya community members. Tabletop exercises revealed that all communities needed guidance and assistance to strengthen the resilience in their neighborhoods.

The following paragraphs will highlight some research findings:

Despite the envisaged light-speed transmissions in the ICTs, a standard message transmission took approximately 7 seconds to carry a text message from the Community Disaster Management Centre to the community. There were delays caused mainly by human errors such as not correctly aligning the antennas of the satellite system; Java applet on the mobile phone accidentally deleted; wrongly configuring the application that restricted receipt of certain levels of hazardous events or the ICT-Guardian was not close enough to the wireless terminal devices to receive the message on time, or simply the ICT provider terminated the services for not having received a payment for the monthly bill.

An unusual occasion when human error was not involved was when the Mobile Phones and Fixed Phones failed on the day of the exercise as a result of the conflict situation in the eastern part of Sri Lanka. The government and military had instructed all commercial wireless operators, Global Standard for Mobile Communications and Code Division Multiple Access, to shut off cell phones in the respective battle zones. However, the unidirectional AREA satellite-based sets functioned in the war-zones when the terrestrial technologies were shut off.

The reliability and effectiveness is significantly better when individual ICTs are deployed in pairs within the communities. The AREA is quite ineffective as a result of the one-way capability but is very reliable as a satellite technology. However, when they are coupled technologies such as the Addressable Satellite Radios for Emergency Alerting and Mobile Phones and AREA and Fixed Phones then the performance is relatively high. The Mobile Phones is effective since it is capable of displaying alert text messages in Sinhala, Tamil, and English. However, as a stand alone, Mobile Phones is an unreliable terrestrial technology. When both the Addressable Satellite Radios for Emergency Alerting and Mobile Phones are coupled they complement each other in terms of their respective strengths in reliability and effectiveness, which is termed as “complementary redundancy”.

The reliability results, for the Emergency Response Plan Coordinator compared to ICT-Guardians are significantly lower because the Coordinator did not broadcast the message but distributed the message from house-to-house either by word-of-mouth or with a mobile Pubic Announcing system. In some cases they used temple and church bells and mosque Pubic Announcing systems to broadcast the message. These schemes were ineffective because the households did not hear the bells and the Coordinator had to repeat the dissemination process by informing the households by word-of-mouth.

Communications in English in the rural communities were difficult for the locals to comprehend. The active alert function was not up to signal the attention of the ICT Guardian. Also, certain restrictions of the terminal capabilities for carrying a full message caused false information propagation in the communities.

It was evaluated that the overall performance of the Community Disaster Management Centre was acceptable. However, additional training and drills must be conducted for the staff to be well versed with the procedures and to be able to carry out the tasks within the benchmark time. Although the reliability of the ICT component is relatively high it does have several gaps that need to be filled in order to ensure communication certainty and efficiency.

As a result it is recommended that policies be implemented to provide Monitors at the Community Disaster Management Centre and ICT-Guardians formal training and certification to ensure competence in communicating with accuracy and following proper procedures. Further exercises must be conducted to realize the true potential of using a community-based system; especially for the last mile.

However, through conventional trial and error methodologies the pilot project is able to suggest intuitive policies that can strengthen the performance of a national early warning system.

The live exercises revealed that inadequate training and improper notification resulted in unstable behaviour. The rating provides the planners with a set of indicators to enhance the reliability and effectiveness of individual components of the message relay, the ICT networks and terminal-devices, and the national and last-mile systems.

The project was also facing some difficulties from external factors:

- The research aims and delivery of project services under the project were not always apparent to those involved at the grassroots or to the beneficiaries themselves. In some cases this led to unrealistic expectations, for example, when certain communities wanted the Very Small Aperture Terminals rather than an ordinary fixed phone or mobile phone.

- A critical drawback of the project was that most of the village trainers and HIH monitors could not be retained under the project due to personal factors. As such, some left when they gained paid employment. The second group of volunteers did not receive the same level of intensive training. This caused a loss of some momentum and motivation. As a result the last mile hazard warning system may not be able to provide the expected level of services the communities require.

- As a result of the Northeast conflict, inadequate leadership, lack of resources, and language barriers prevented the Jaffna and Batticaloa District from successfully completing training, deploying ICTs, and conducting live-exercises.

The Good Practice

HazInfo demonstrates several characteristics of good practice. It is a community-based “last-mile” hazard information system demonstrating an understanding of the warning process. The communities play a pivotal role in the receipt, relay and response to the hazard warning system by setting up the final end of a national early warning system. Moreover, it uses familiar technology (mobiles, fixed phones) along with more advanced technology (satellite radio, Very Small Aperture Terminals, Remote Alarm Devices) that are tested by using a complete set of parameters such as: adoptability, alerting, Common Alerting Protocol complete, miniaturization and bi-directionality (two-way communications capability).

Photo by LIRNEasia

Key successes include:

1. Set up of a Community Disaster Management Centre at Sarvodaya;
2. Training of ICT-Guardians and Emergency Response PlanCoordinators within communities for implementation of the pilot;
3. Nine districts completed live exercises; and
4. Participating communities responded and showed support for hazard warnings and disaster resilience capacity building.
5. Integration of new technologies with basic technology already available at the community level such as church bells and mosque public announcement systems.

Lessons Learned

Similar projects can be improved by the following procedures:

1. Obtain government "buy-in" for the system as a crucial component to an end-to-end national early warning system. Otherwise, an Community Disaster Management Centre will need to develop a system for translating and / or reformatting messages quickly and accurately.
2. An element in the Common Alerting Protocol data definition document should be assigned to indicate that a warning message has been issued directly from the government. This selected element should preferably contain the entire government message as a single payload that can be copied and pasted into a Common Alerting Protocol message, rather than seeking interpretation from an Community Disaster Management Centre.
3. All villages in similar projects of this kind should benefit from training opportunities regardless of their role in the project.
4. Community Disaster Management Centre staff members would benefit from the development of an authorization procedure to qualify them as "Authorized Users" with the authority to compose and issue warnings over the HazInfo system.
5. New and existing Community Disaster Management Centre personnel must be required to attend training sessions in regular intervals. Regular training sessions might be scheduled prior to particular disaster-prone seasons.
6. Operational and maintenance checklists and guidelines should be set up for HazInfo and distributed in appropriate languages.
7. Community Disaster Management Centre should examine how HazInfo components may be used to deliver regular updates to ICT Guardians.
8. A module on community-based emergency communications planning should be developed
9. All HazInfo ICTs should be capable of full CAP features and multilingual message displays.

Potential for Replication

This project can easily be replicated to suit the disaster warning needs of communities in other countries as it takes into account the specific vulnerabilities of communities through direct involvement of community leaders and members. Technology tested in the project can be determined based on country specific data availability and type of disaster. The benefits of the HazInfo project include increased capacity building from community disaster awareness to preparedness through technology and training. Each village involved in the HazInfo pilot received training for the different technologies along with specific training on the development of emergency response plans, use and maintenance of the equipment, and proper monitoring of early warning resources. The good practice learned within the HazInfo Sri Lankan context may be replicated through a thorough understanding of communities' vulnerabilities to hazards. In Bangladesh, a study has commenced on replication of HazInfo within the context of Bangladeshi communities' extreme vulnerability to both floods and cyclones.

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Turkey

Mobile Democracy Platform Project

ECOTEL

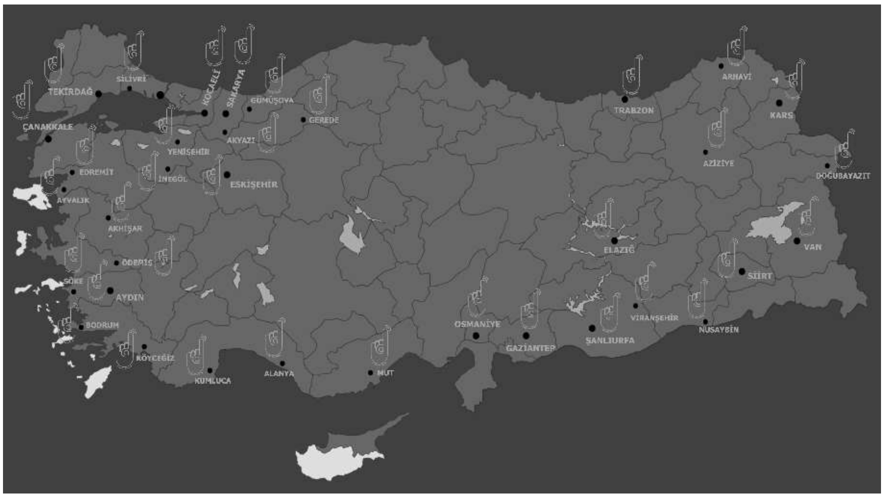

Figure by ECOTEL

Abstract

The Mobile Democracy Platform project illustrates a bridge between citizens and local administrations through mobile technologies that are used by people from every social and economical class. The project has been executed by the pioneer municipalities since 2004. It has two main components: the “888 Cell broadcast Channel” and the “3870 Interactive Participatory Channel”:

With “Mobile Democracy 888 Cellbroadcast Channel”, local governments can broadcast information on any subject related to their own region, in particular, contents within, prior to or following emergency situations such as warning, alert or guidance on what to do with the Cellbroadcast technology’s advantages. Local administrations inform the citizens through the “888 Cellbroadcast Channel”. Citizens can convey all their suggestions, requests or complaints to local authorities in sending a text message valued at the price of a single SMS through the “3870 Interactive Participatory Channel”. The advantage of this channel in emergency situations is that even when thousands of people send text messages at the same time, all can have access to the municipality therefore maintaining it to determine the areas of first priority and launch first aid in the areas with top most requirement.

Mobile Democracy Platform Project and its basic agenda, namely “Mobile Democracy Emergency Alert System,” is currently implemented in 35 local administrations in Turkey.

Goals and Objectives

The project aims to save lives by transmitting timely and effective information to people at risk. The project is also contributing to build a society of conscious individuals who are aware of the possible risks that may occur in their community and what needs to be done in emergency situations.

The general goal is to establish an inclusive early warning system through mobile technologies adopted by respective municipalities.

The Initiative

The project takes the advantage of GSM Cell Broadcast Technology that enables to shared information between the local government and citizens. The project developed two tools to broadcast information in both directions: With “888 Local Governments Cell Broadcast Channel” local governments can inform the citizens and by using “3870 Interactive Participatory Channel” citizens can send requests, suggestions or information about emergency situations to the local government.

The Mobile Democracy Platform and its primary agenda, namely Mobile Democracy Emergency Alert Project, is a project that is implemented by the stakeholders of Turkcell and Avea, being the GSM operators responsible for providing the technical infrastructure, by Ecotel company that responsible for the software solution and broadcast control, by the Mobile Democracy Association which is responsible for editing the content of the broadcasts and providing social innovation, by local administrations supplying the content of the broadcasts and finally by citizens who attend the project as beneficiaries.

Besides local governments and other local institutions, the Mobile Democracy Emergency Alert Project included the Search and Rescue Operations Organization, AKUT, which is the biggest organization in Turkey involved in research and rescue activities in disaster regions with well-prepared volunteers under the aim of raising consciousness on what to do before and after disasters.

Relevant information are also offered to the users through the web-based interface and the user can choose the most important and useful content to broadcast. The web-based interface is a device that gives the users the option to broadcast, assign other institutions’ representatives as “sub-users “, to fast and easily offer useful information to become the content of the broadcast and lastly to see text messages sent by citizens through the “3870 Interactive Participatory Channel”.

The sub-users as information sources can be institutions of that local area such as, Provincial or District Security Directorate, Local Health Authority, Directorate of Civil Defense, Fire Authority, Directorate of Disaster Affairs, Provincial Directorate of National Education or several NGO’s etc.

Our users in the municipalities choose the most significant, useful and highly required information among the contents offered by other local institutions to broadcast in line with the titles of top priority indicated in the “action plan” the Mobile Democracy Platform Project. The sub-users are authorized to collect and broadcast relevant information in emergency situations.

888 Cellbroadcast channel is offered to be used in emergency situations as an alert system. Furthermore under normal circumstances the local municipalities have the right of broadcasting maximum 3 times per day. The rule aims to avoid information pollution but in emergency situations this rule loses its validity. Broadcasts are controlled 24 hours by the software developers of ECOTEL. Thereby in any time of the day the channel avails to transmit information.

Mobile Democracy 888 Cellbroadcast Channel is not only formulated as an announcement but also as an education channel that contributes the improvement of social sensitivity. These broadcasts are part of the social problems of the country that are required to be ameliorated.

One of the most well known contents of Mobile Democracy 888 Channel are the broadcasts that can be useful in emergency situations which have a positive impact in preventing the victimization of individuals that serve the purpose of transmitting the right information “before” it is needed.

After the user has submitted the broadcast, the ECOTEL Company’s software developers and Mobile Democracy Association’s sociologists control the broadcasts whether they are written correctly, understandable or whether they include any non-relevant content. Following the control of the editors, the broadcasts are conveyed to the citizens to receive the information in a fixed period.

On the other hand, if the text messages sent through the 3870 Interactive Participatory Channel are correct in a formal way, they are directly transferred to the web page of the users in the municipality. If the format of the text messages is not correct, the SMS fall on the page of ECOTEL and the text is then corrected and once more forwarded to the citizen that is being recalled

Since the project was launched in 2004, the number of the Municipalities participating in the Mobile Democracy Platform Project increases.

The most concrete and verifiable results of the project are acquired from the text messages that are sent by citizens demanding participation to referendums or surveys that are carried out by the municipalities through the 888 channel, or only making suggestions, complaints or requests.

The next phase of the project is different for every Municipality according to the “action plan” of Mobile Democracy Platform. Our project has been implemented in 35 local administrations of Turkey. 21 of them are town municipalities and 14 of them are city municipalities.

The Good Practice

The Mobile Democracy Platform Project / Mobile Democracy Emergency Alert project uses common and widely distributed mobile technologies for effective information sharing. It highlights the importance of evidences the importance of the Information and Communication Technologies in contemporary societies.

Cellbroadcast technology makes benefit of the existing technological infrastructure, thus it is cost-free for the citizens involved as beneficiaries. The system can be effectively used in emergency situations since it is free from any possible breakdown stemming from overload. Any citizen having activated the 888 Channel can get information on the emergency situation or disaster risk regarding their respective location.

ÖZGÜR Kocaeli

20 ŞUBAT 2008 ÇARŞAMBA

KOCAKAYMAZ KÖY YOLU AÇILDI

BAŞKAN HEP DIŞARIDAYDI

OKUL ÖNLERİNDE ÇALIŞMA

Cep mesajıyla yardım isteyen köyün yolu açıldı

The village road of Kocakaymaz has been opened: A citizen has sent a SMS from the village informing the Kocaeli Municipality via 3870 interactive channel that the road is blocked by snow. The message has been transferred to the teams that are working in that region by radiophone immediately to take action.

The key success of the project is making use of cell phones that are parts of almost every individual’s daily life and can be seen as a source of receiving information that can save or protect lives. Ceaseless information can be provided in emergency situations and disasters in a way to guide people against the damage caused by panic. Since 3870 Interactive Participatory Channel is also free from any breakdown due to overload authorities can manage the situation in an effective way.

Lessons Learned

One of the most significant lessons having been taken in the course of the project is that every institution affiliated to that local administration should be assigned as sub-user and be sensitive about the importance of the project to send relevant information to the beneficiaries at right time. Administration can be easily amended with effective and useful information which underlines the significance of the broadcasts.

There are a lot of precautions to be taken beforehand not to be victimized in disaster and emergency situations. Awareness, right timing and being well-organized all depend on the information to be shared and the communication. The Information and Communication technologies can be used as shields that protect social-benefit against risks.

The major challenge of the project is that the 888 Cell Broadcast Channel is required to be activated by citizens. Municipalities try to overcome this challenge through several promotion campaigns such as opening stands in strategic places of the city and activating the 888 channel of the citizens with the help of officials or advertisement on billboards, distribute dodgers which includes the schema of how to activate etc.

Another challenge is to identify how many people received the broadcasts. The current solution is to collect reliable data through statistics of the text messages that are returned from citizens participating in the referendums and surveys, or attempt to increase the members of the website which includes a little window which is used to receive information from citizens whether their 888 channel is open or not.

Potential for Replication

The Mobile Democracy Emergency Alert Project could be applied by the General Disaster Coordination Center in benefiting from the advantages of Cell broadcast technology in extraordinary situations such as disasters or by the General directorate of Security in states of emergency. But it is essential that a GSM operator with the necessary Cell broadcasting technological infrastructure and of course stakeholders aspiring to take part in the project are required to implement in other places.

Through the implementation of Cell broadcast technology and the education broadcasts, it is possible to contribute the building of a consciouss society prior to disasters. Particularly with a similar project that can be implemented by the Ministry of Health, it is possible to improve the consciousness of health against epidemic diseases.

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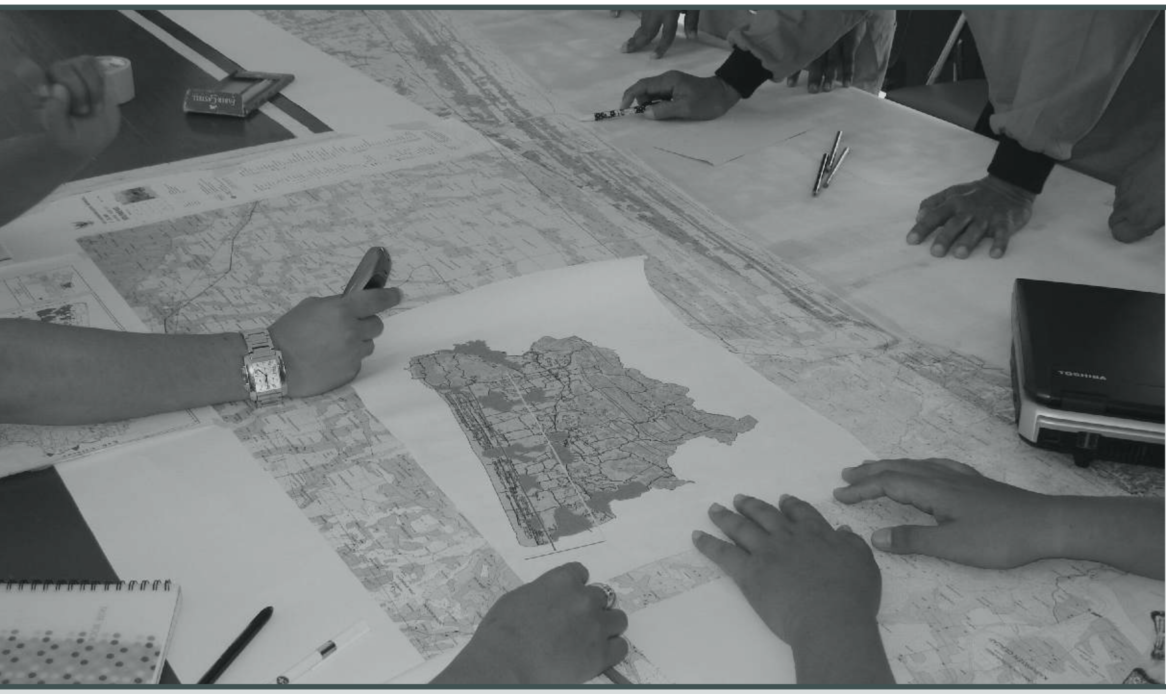

Photo by GTZ IS - GITEWS

2

Supportive activities to establish early warning systems

The section highlights the importance of risk assessments, for example by research and scientific institutes or agencies, that evaluate the conditions in the hazard prone area before developing or implementing early warning systems. This section showcases some specific tools for risk assessment and monitoring systems. This includes key components such as access to data, data quality and their distribution as well as monitoring tools for the establishment of early warning systems. Regional as well as community-based examples are presented.

Asia

Disaster management support system in the Asia-Pacific region - Sentinel Asia

Japan Aerospace Exploration Agency (JAXA)

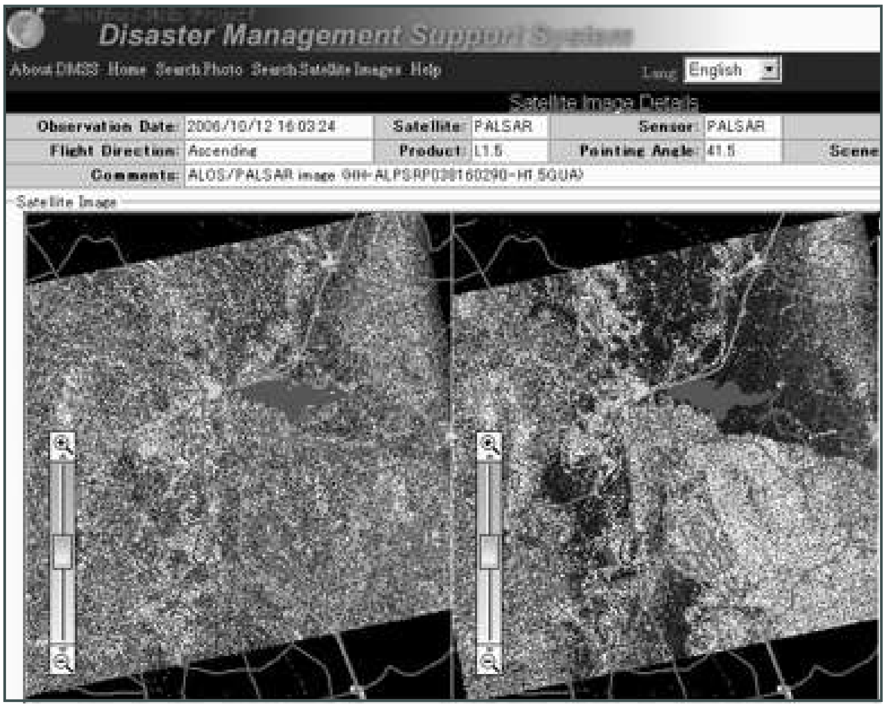

Figure: Shortcut of the Sentinel Asia Disaster Management Support System

Abstract

"Sentinel Asia" is an internet-based, node-allotted, information distribution backbone, distributing relevant satellite and in-situ spatial information on multiple hazards in the Asia-Pacific region. The system draws on satellite derived products and imagery from all available earth observing geostationary satellites, or low-earth orbiting satellites, including meteorological satellites that provide routine data to the region. The main derivatives of Sentinel Asia are overlaid satellite images on digital terrain maps provided by Digital Asia Web-GIS functions. The satellite images become value-added images when the disaster-effects are extracted and made available for combination with on-site digital camera images.

Goals and Objectives

The goal of the project is to create a fundamental distributing service which produces disaster and hazard-related data products and images in the Asia-Pacific region when and where possible, in near real-time.

These services encompass a variety of different deliverables. Space organizations provide true-color, best resolution JPEGs of satellite images. Satellite data also includes wildfire hotspot and precipitation data. Other basic data provided by Digital Asia is a millionth scale digital map by the National Geospatial-Intelligence Agency and LANDSAT images, which cover the entire area of Asia.

Furthermore, on-site digital camera images are supplied along with high-resolution, regional digital maps, which are contributed by national geography organizations among others. Additional detailed disaster information will be made available by the Asian Disaster Reduction Center (ADRC).

The Initiative

According to UN statistics, the Asia and Oceania region has the largest proportion of natural disasters in the world. Even before the recent Indian Ocean Tsunami (2004) and earthquakes in India and Pakistan, the region has been compounded by its high population (close to 3 billion). The region accounts for more than 50% of the global fatalities associated with such disasters. While droughts are still considered the number one world-wide cause of fatalities associated with disasters, other hazards such as flooding, earthquakes, wildfires, high winds and landslides are significant sources of deaths, destruction and economic losses in the region.

Sentinel Asia is promoted under cooperation among the following three communities:

- Space Community (Asia-Pacific Regional Space Agency Forum - APRSAF);
- Disaster Management Community (Asian Disaster Reduction Center - ADRC and its member countries); and
- International Community (UNESCAP, UNOOSA, ASEAN, AIT etc.)

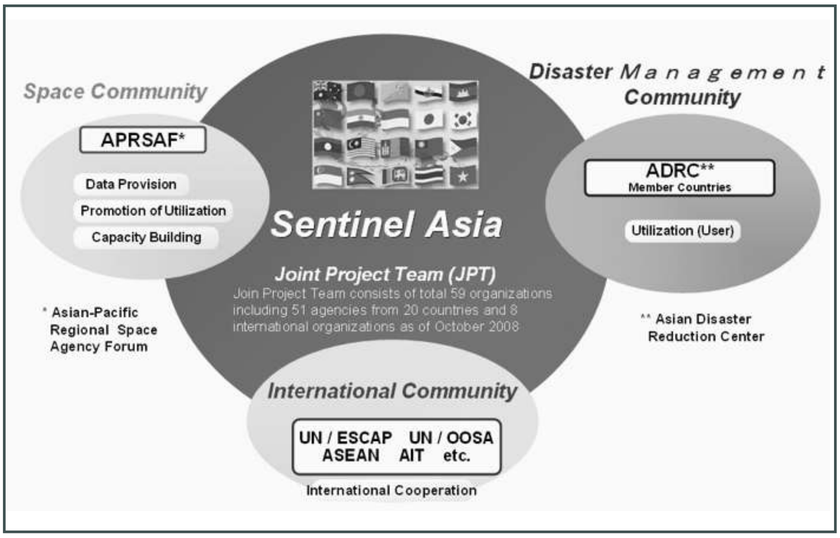

Figure: Framework of Sentinel Asia Step 2

To promote Sentinel Asia, the Joint Project Team was organized. The team is open to all the APRSAF member countries, disaster prevention organizations and regional and international organizations who wish to participate in disaster information sharing activities. Currently the Joint Project Team consists of a total of 59 organizations including 51 agencies from 20 different countries and 8 international organizations, as well as the Asian Disaster Reduction Centre.

Many of the causes and impacts of natural hazards, including droughts, are observable in real-time from space by earth observing systems. When effectively combined with modern information distribution methods, such data can be sent rapidly to impacted communities and local emergency agencies as an early warning alert message before the disaster occurs, or as post-disaster maps to assist in recovery operations. A new project called "Sentinel Asia" was proposed in 2004 by the Asia-Pacific Space Agency Forum (APSAF) to showcase the value and impact of earth observation technologies, combined with near real-time internet dissemination methods and Web-based Geographic Information System mapping tools.

“Sentinel Asia” is a "voluntary and best-efforts-basis initiative" led by the APRSAF to share disaster information in the Asia-Pacific region on the Digital Asia (Web-GIS) platform and to make the best use of earth observation satellites data for disaster management in the Asia-Pacific region. “Sentinel Asia” consists of three steps in the Disaster Management Support System. The first step was carried out beginning in 2006 by utilizing the earth observation satellite data. The system aims at improving safety in society by ICT and space technology. It is geared to improving speed and accuracy for disaster preparedness and early warning, leading to a minimization of victims, and social and economic losses.

The main activities of “Sentinel Asia” are manifold, such as emergency observation in case of major disasters, observation requests from the members of the Joint Project Team wildfire and flood monitoring, as well as capacity-building for the utilization of satellite images for disaster management.

The system is also intended for use by member countries to 'trigger' dedicated satellite-data acquisitions through their participating and cooperating space agencies during major disasters in their countries.

Currently participating satellites are ALOS (Advanced Land Observing Satellite), IRS, MTSAT-1R, Terra, Aqua and others. The ALOS, which was launched by JAXA in January 2006, is an earth observation satellite designed to obtain precise topographic data. The ALOS has three remote sensing instruments, or the Panchromatic Remote sensing Instrument for Stereo Mapping (PRISM), the Phased Array type L-band Synthetic Aperture Rader (PALSER), and the Advanced Visible and Near Infrared Radiometer type 2 (AVNIR-2).

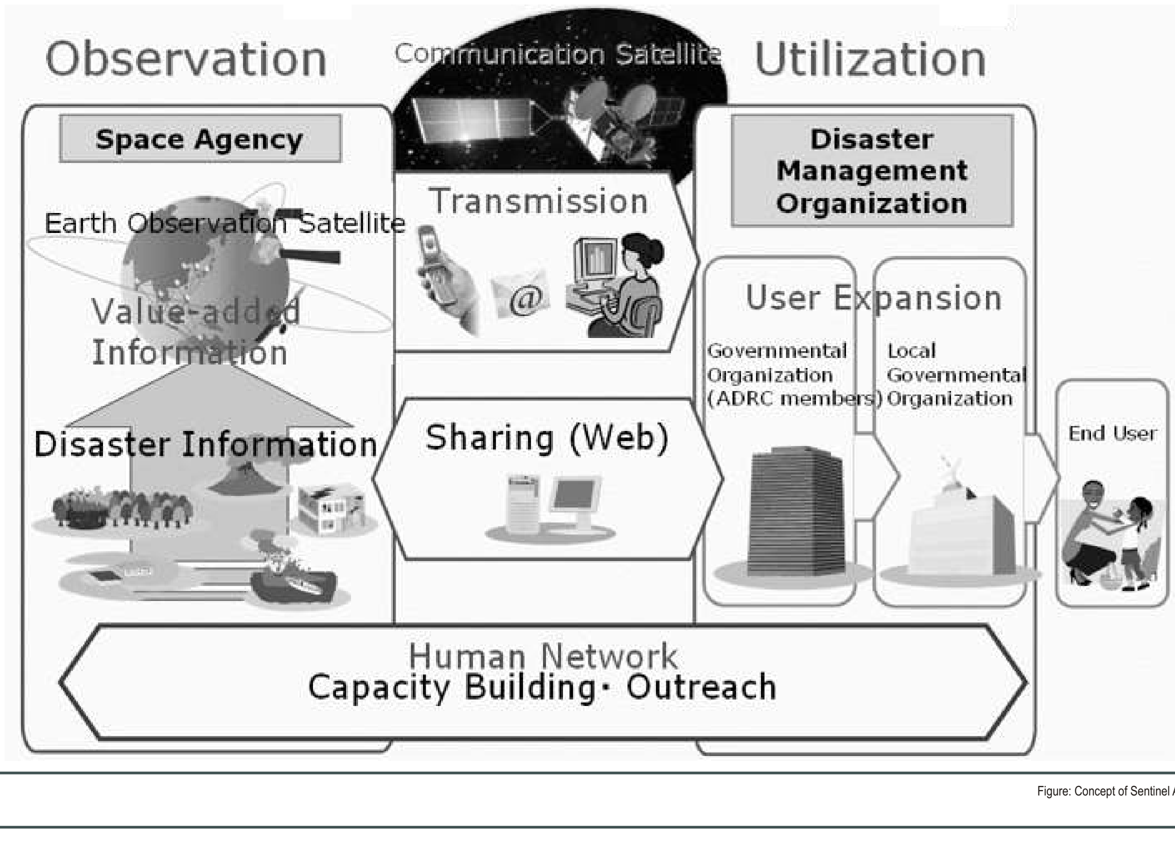

Figure: Concept of Sentinel Asia Step 2

The Good Practice

The project focuses on retrieving and sharing disaster information. State-of-the-art space technologies based on communication satellites and advanced information technologies are utilized in order to implement this project. In addition, the framework APRSAF and the network of ADRC are critical in making this project function appropriately.

Lessons Learned

It is still a challenge to find adequate ways how to effectively distribute satellite images to end-users, such as national or local decision-makers to enable them to deal with and respond to the damage caused by natural disasters. In order to send satellite images to the regions affected by natural disasters in a proper and prompt manner, the capacity for downloading images and data is critical. According to the survey conducted by Keio University of Japan, the downloading speed differs in Asian countries. Many Asian countries joining JPT (Joint Project Team) of APRSAF utilize low-speed circuits which are less than 512KB in the case of downloading from Japanese servers. The only exceptions are Australia and Korea. The average speed of JPT member countries is approximately 190KB. The web site system of "Sentinel Asia" should be developed to be efficiently utilized even in these narrow band areas.

Aiming at a more robust and user-friendly Web-based GIS system and reflecting wider ranges of user requests of data and information services, the "Sentinel Asia Step 2 (2008-2012)" was agreed upon at the APRSAF-14 meeting, which was held in Bangalore, India in November 2007. The main objectives of "Sentinel Asia Step 2" are as follows:

1. Participation of Various Satellite providers including
   - earth observation satellites: ALOS (JAXA), MTSAT-1R (JMA), IRS (ISRO), KOMPSAT (KARI), THEOS (GISTDA); and
   - Communications satellites: WINDS (JAXA).
2. Improvement of Accessibility to Information
   - From data sharing (Step 1) to transmission
   - Facilitate access to disaster-related information through various means including satellite communication using WINDS
3. Value-added Data
   - To provide analyzed images and easily comprehensible interpretations from images
   - To organize the framework for an analysis group
4. Expansion of Disaster Scope
   - To extend Step 1 to focus on wildfires and floods
   - To include monitoring for early warning before disasters happen based on environmental change models
   - Strengthening contribution to management of wildfire noting its substantial influence on global warming
5. User Expansion
   - To expand user base to include local disaster authorities in cooperation with UNESCAP

Potential for Replication

Worldwide, thousands of people suffer from disasters caused by natural hazards every year. There are strong needs in other continents for the utilization of satellite images to lessen the damage caused by natural hazards. "Sentinel Asia" can be replicated in other areas as a good application of space technology.

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Northeast Asia

Developing desertification assessment and constructing an early warning system

University of Tokyo

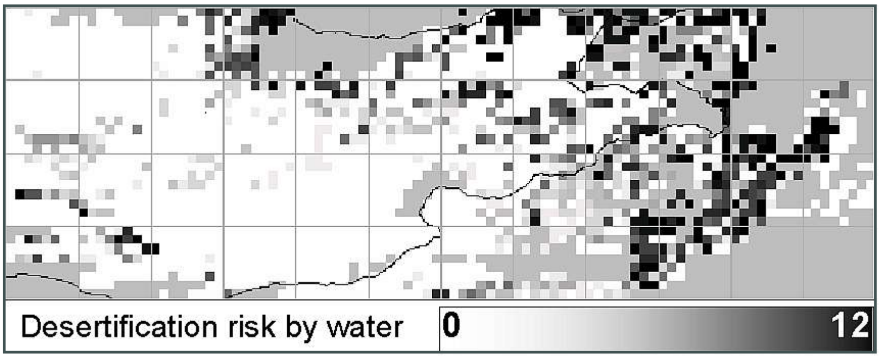

Figure: Desertification risk by water, which is the number of years in which water erosion rate is above the benchmark set based on field survey

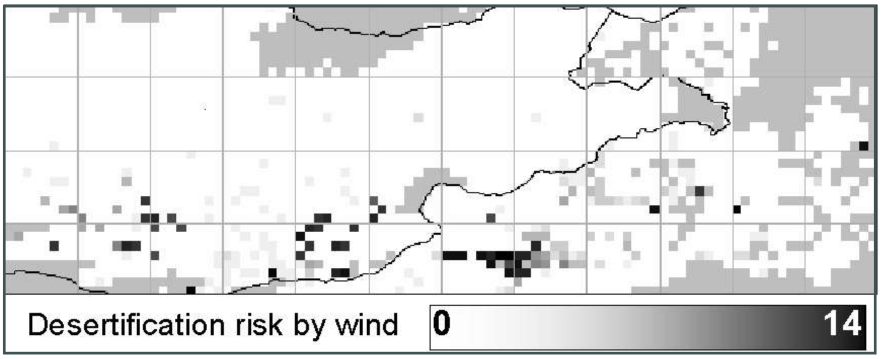

Figure: Desertification risk by wind, which is the number of years in which water erosion rate is above the benchmark set based on field survey

Abstract

The establishment of an operational and cost-effective early warning system (EWS) for drought and desertification is among the principal items on the agenda drawn up by the Committee on Science and Technology under the UN Convention to Combat Desertification (UNCCD). The University of Tokyo published a pilot study of an EWS for the arid and semi-arid areas of Northeast Asia. An integrated model was developed that combines field-surveys, remote-sensing and modeling techniques for selected sites (Gobi-steppe, steppe and shrub-steppe regions).

Goals and Objectives

The major goal was to develop an integrated model that makes it feasible to derive land vulnerability from local-scale surveys, to establish ecosystem management plans for a larger scale, and to identify the most appropriate land use possibilities. This study of large-scale desertification assessment includes the desertification benchmarks that indicate a long-term loss of agricultural productivity.

The project targets all people engaging in nomadic pastoralism and transhumance in the area of Northeast Asia. The initiative was implemented by the Ministry of the Environment of Japan.

The Initiative

The University of Tokyo initiated a multi-disciplinary research project to construct a desertification early warning system. The entire arid area of Northeast Asia was mapped in the first phase of the project that began in April 2004. Detailed cost-benefit analyses were carried out in three representative regions: the districts of Delgerkhaan (steppe) and Saintsagaan (desert steppe) in Mongolia, and in Naiman province in China (sandy loam) in the first phase of the project that was completed in March 2007. The next phase which started in April 2007 is scheduled to end in 2010.

To construct a fully functioning desertification EWS, it was necessary to (1) determine the key desertification indicators and benchmarks in various geographical conditions through a field survey in three major ecosystems, steppe, desert steppe, and sandy land; (2) monitor desertification indicators on a large scale, using remotely-sensed images of vegetation and soil moisture; and (3) develop an integrated model to assess long-term desertification status and land vulnerability on a large scale. The project integrates the observation of desertification indicators at a large scale and the desertification processes in relation to anthropogenic disturbances in various geographical conditions. The model accounts for climate, vegetation, hydrology, soil erosion, grazing regimes, and land modification by various desertification countermeasures. It also enables a cost-benefit analysis for various desertification countermeasures, from which an optimum land use and ecosystem management plan can be created that will help maintain a balance between the economic productivity and the long-term stability of the ecosystems.

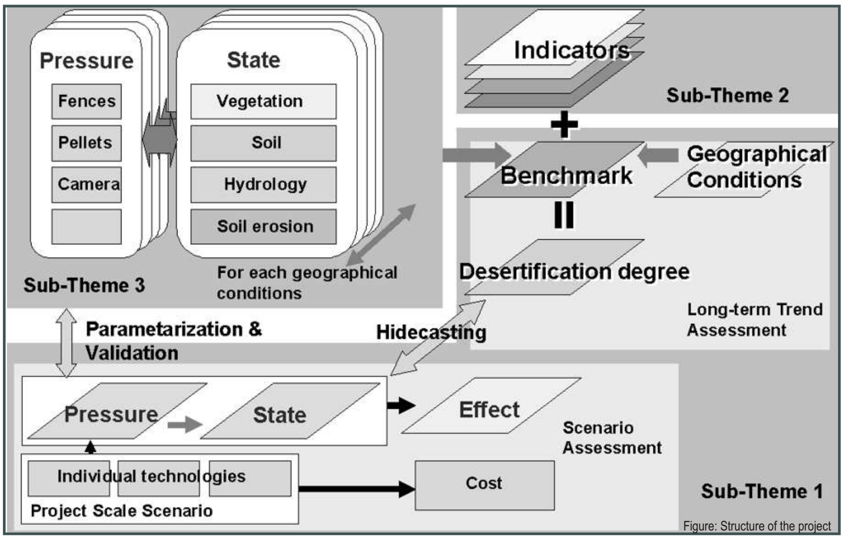

Figure: Structure of the project

This project is the first to assess desertification by employing both desertification benchmarks and indicators. Moreover, unlike existing operational drought EWSs, the integrated model developed by this project can provide cost-benefit data for the various types of desertification countermeasures, which will enable better decision-making.

The following results were achieved with the project:

1. A map showing the current desertification status and land vulnerability (risk for desertification) for Northeast Asia was created (figures below).
2. Desertification processes of different landscapes were identified.
3. Costs and benefits of various combinations of desertification countermeasures in different landscapes were also identified.

The Good Practice

This project is a good practice because it aims at minimizing the long-term risk of land degradation by assessing land vulnerability in order to prevent the occurrence of a disaster as well as mitigate the post-occurrence effects. It also provides concrete cost-benefit options, allowing decision-makers to consider the trade-offs between desertification and various other problems.

The initiative's success has been derived from the inclusion of most of the related disciplines (e.g., ecosystem studies, economics, climate systems, remote sensing, hydrology) within a sophisticated framework in the integrated model. The innovative elements and results of the project have been based on the following:

1. Linking large-scale and local-scale studies;
2. Linking various related disciplines;
3. Assessing the long-term risk of desertification (land vulnerability) at a large scale; and
4. Providing cost-benefit options for decision-makers from the results of academic research.

This project was a collaborative study that included iterative discussions. Desertification occurs through a complex combination of elements at the local scale, but is at the same time a phenomenon that manifests itself at a larger scale. The integrated model included a sophisticated framework that is based on a set of diverse principles and methodologies from related disciplines. The breadth of scope and the depth of complexity in a single examination have meant that conventional desertification research has been compartmentalized according to the different spatial scales involved in each respective project.

Lessons Learned

The design of the project was to implement an EWS that puts more emphasis on the neglected issue of land vulnerability. The integrated model provides a common foundation for the integration of what has hitherto been treated as separate issues: developing desertification benchmarks and indicators, both large-scale and regional in scope; monitoring and assessing desertification as well as creating a fully functioning desertification EWS. In the process, it was necessary to implement unscheduled tasks that had to be completed before the integration could take place. The benchmarks for people to move their livestock from drought-affected areas and for the grassland to degrade were different in the areas. Spatial and temporal scales for the different disciplines varied significantly. The nested strategy used in this project, which included various factors, was efficient in integrating the results from the different disciplines. The integrated model makes it possible to use land vulnerability as a criterion to assess local-scale desertification. It also helps to identify the most appropriate land usages, and to establish ecosystem management plans.

Integrating the various disciplines was a challenge for the project. As a sophisticated framework was critical for the success, it was necessary to discuss the common platform and terms of the different disciplines in advance. For example, the plant functional type level was used for observing, remote sensing, and modeling of vegetation because that is the common study target for these three disciplines. Another problem was the time limitation: The project had time limits even though land degradation is a long-term process. The key to overcoming this limit was to make full use of previously established experimental sites, including those that had been used by different projects. In addition to using such sites, existing research was searched and used as needed, to help further integrate the various aspects of the study, which required vast amounts of data.

Social dynamics that affect land-use patterns were not considered in the model. These factors were derived only from statistics, which were static. Simulating the nomadic system should enhance the usefulness of the results. There are various factors that do not yet have appropriate study methodologies. For example, nomadic pastoralism and transhumance are dominant in these areas, and historical grazing pressure is one of the largest sources of the project's uncertainty. Statistical data does not necessarily reflect the actual distribution of livestock. Additonal social surveys and possibly more high-resolution satellite remote sensing data may improve the accuracy of the grazing pressure estimates.

Potential for Replication

The EWS framework is not dependent on a specific area as long as the main agricultural products in the area are derived from pasturage. Surveys for patterns and processes would be necessary to replicate the practice in other regions. An extension of the framework would be necessary to integrate it with other agricultural practices. The integrated EWS model in this project describes mainly natural conditions through the use of the land system concept, which is applicable anywhere in the world. Social factors are included from available statistics. Therefore, the model structure is not dependent on the specific context of the target area and could be replicated in other areas as well.

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BGR

Mitigation of geohazards - Assessing disaster risk in Indonesia

Federal Institute for Geosciences and Natural Resources (BGR)

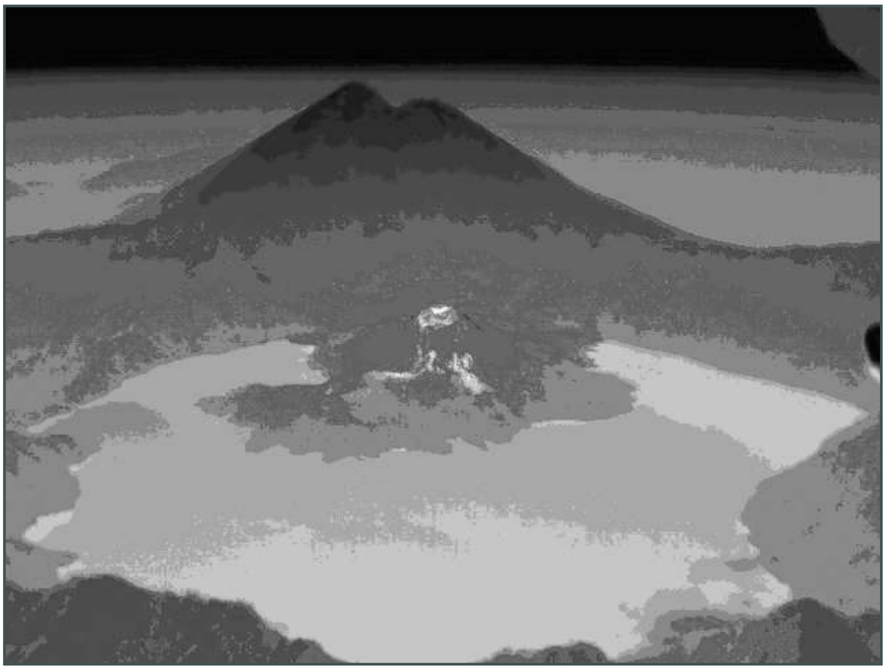

Figure: Thermography of Mount Agung, Bali (BGR)

Abstract

As a result of the crustal plates colliding along the Indonesian archipelago, the country is confronted with all types of natural hazards and catastrophes throughout the year. Earthquakes, volcanic eruptions, lahars, landslides and flooding occur every day. The country ranks as one of the most disaster prone areas on earth.

According to the “Law of Decentralization” of 1999, the country initiated a disaster management that comprises all parts of the nation and approached the Government of Germany to assist its initiative within the frame of its bilateral technical cooperation. Within the project “Management of Georisks” the local governments of Flores and Java were assisted in disaster assessment and mitigation. The lessons learned from the project were that disaster management is indispensable to safeguarding the lives of a disaster exposed population. The work contributes to making development planning transparent by strengthening the institutional participation of the population at risk.

Goals and Objectives

The Georisk project assisted in the selected municipalities Flores and Java in disaster assessment and mitigation. The basic principle was to introduce a multi-hazard assessment concept comprised of geologically related natural hazards, followed by a vulnerability assessment in order to produce a disaster risk assessment of the areas under investigation.

The concept comprised a geo-hazard assessment based on existing information, cross-plotted with socio-economic and ecological data. An early involvement of the civil society was made compulsory to institutionalize participation of the population at risk in all stages of local disaster mitigation planning. The project is now running in its second phase and is scheduled to last until the end of 2009.

The Initiative

The following four examples describe initiatives implemented by the Georisk project to establish the early warning system.

1) Indonesian National Disaster Risk Index

The regional distribution of disasters in Indonesia is quite unequal. Not every region is similarly exposed to natural hazards and potential disasters to the same extend and at the same frequency. In order to work out a national risk mitigation strategy that provides equitablel chances to safeguard the population at risk, the national disaster mitigation institution needed to complete a nationwide assessment of the different kinds of hazards that occurred in the past, their frequency and locations as well as their social, economic and ecological damages. As the majority of Indonesians live on Java island (160 million) their risk is different from that of the scarcely populated areas in central Kalimantan. Thus, the national mitigation strategy has to reflect this geological, climatic and socio-economical reality.

In order to assess the country's risk from disasters a "National Disaster Risk Index" (NDRI) was introduced, providing base line data on hazards, social and economic vulnerability and risks. Based on such a risk index a countrywide mitigation strategy can be worked out, to be implemented by local governments accordingly.

The main objective is that mitigation activities should be focused in those areas where population, industry, agriculture, cultural or recreational sites are at highest risk. Only after such an assessment has taken place can the national and local mitigation authorities be able to invest resources efficiently. In order to get an objective, reliable and transparent method, the Georisk project worked out a questionnaire (in English and in Bahasa Indonesia) to be adopted by the national and local disaster mitigation authorities for a nationwide standardized assessment.

The data that should be envisaged to be received, will then be evaluated to work out a general comparison of the risk exposure of the entire country. In general the concept follows the UNDP concept of establishing a standardized, worldwide mortality index from disasters.

2) Thermal imaging for volcano monitoring

Of the more than 200 volcanoes that form the Indonesian archipelago about one hundred are identified as dangerous and require permanent observation. The volcanoes are spread over the country from Aceh in northwest Sumatra to Mount Dukono on Halmahera. Many volcanoes that erupted in recent years, destroyed large parts of arable land and posing a threat to the population settling on its flanks. In June 2006, when Mount Merapi erupted more than 5,000 people had to be evacuated for months.

Next to in-situ monitoring systems based on visual inspections and seismic measurements, the most dangerous volcanoes of the country require a monitoring system that is fast, easy to handle and that covers a large area in a short time. This can be achieved with thermal imaging using a thermal camera that measures surface temperature changes resulting from ascending magma or along fumaroles, lahars or lava streams. With high resolution thermal infrared cameras deployed from aircrafts or helicopters such temperature regimes can be routinely monitored. In this respect not the actual temperature of the volcano's surface is of importance but rather changes in the temperature distribution over time. With such systems, areas can be identified where volcanic vents may be opening and where magma will erupt.

During two workshops, staff members of the Geological Agency (Bandung) and from the DISTAMBEN (Geological Agency of Aceh Province) were trained in the use of the thermal-infrared imaging. The 80 most dangerous volcanoes were prioritized according to their monitoring potential and needs.

A thermal camera was provided to the Geological Agency in Bandung that enables the agency to monitor volcanoes at risk on a routine basis. The Geological Agency is the central national institution for monitoring volcanoes and the one authorized to set the alarm levels in case of increased volcanic activities.

3) Quantification of soil loss

The hilly landscape of Indonesia, with its tropical climate combined with the extreme active tectonic movements, makes the country's soils highly prone to landslides, mass movements and soil erosion. More than 50% of Indonesian soils are taken to be at risk from erosion; 25 million hectares alone on Java are stated as “critical”. In addition the dense population especially in Central Java with abundant land clearance and growing settlements worsens erosion, leading to soil loss rates that pose serious implications for sustainable land management.

The acceleration of soil erosion all over the country makes guidelines necessary for land managers and policy-makers in order to reduce soil losses to safeguard the natural environment and to sustain a living from natural resources. More scientific information on soil loss due to erosion will enable the country to address this threat administratively and technically. The distinction of areas with high economic losses from soil erosion from those areas where soil erosion is negligible, will provide a base for an early warning system on soil erosion.

Due to the highly variable nature of erosion effects, this type of loss estimation model cannot provide information and indications for all local situations, but will give regional planners and decision makers a general guidance on how to cope with this ever-increasing threat. Due to the highly decentralized nature of the Indonesian Republic no data has ever been systematically collected on soil erosion processes and effects. Therefore results will have to be considered as a rough estimate that only can provide an answer in orders of a magnitude.

The primary objective of the soil loss assessment was to estimate the annual losses in revenue due to erosion and sedimentation. This pilot case study was carried out near Yogyakarta in the Sleman district at the south western flank of Mount Merapi in order to assess the economic impact of soil erosion and to demonstrate the potential for technical and administrative means to minimize these adverse effects. For this, the internationally accepted RUSLE equation was used, as a tool for soil erosion prediction and soil conservation. The equation considers soil type, rainfall, slope steepness and length, as well as land use and erosion protection measures.

Although there is a great paucity of data, it was possible to analyze the annual losses for the Sleman district. The results are reflected in the following:

Soil erosion - about 30 ton per hectare per year.

Fertilizer Replacement costs (the losses farmers have to bare from erosion) - about USD0.6 per ton of eroded soil, or about USD40,000 for the entire Sleman district

Yield reduction (the loss farmers have to bare from yield/harvest reduction) - of 2% of his yearly crop yield, or about USD25000 per year.

The study demonstrated that an estimation of soil erosion in the country especially of those areas that are prone to large scale erosion is overdue and will help the country to work out a countrywide mitigation strategy. It is only when policy makers are confronted with facts and figures that allow them to compare costs and effects of erosion mitigation and prevention measures, will they be inclined to put such mitigation on the agenda. Accordingly, the decentralized structure of Indonesia's political system requires a national effort to delineate the general framework of erosion mitigation of the country.

This should be followed by a set of guidelines and recommendations for the provincial and local governments to enact a countrywide adoptable erosion mitigation strategy for local conditions. As agriculture is dominated by regional soil management policies the overall effect of soil conservation on the livelihood resilience of the entire nation has to be addressed. Such an effort will lead to balancing public and private interest to ensure prevention of crisis and to safeguard sustainable development.

4) Economic loss assessment concept for Semarang, Java

The many disasters occurring every day in Indonesia not only claim a high number of casualties. They also cause heavy losses on the material and technical infrastructure: houses, streets, bridges, power and communication lines. Schools and hospitals are often partially or totally destroyed. The reconstruction severely burdens national and local budgets. Rehabilitation of the former status of social living is seldom achieved. Houses remain unrepaired with refugees staying for months in temporary shelters.

Disasters impact those parts of the society that normally have no alternative choice for living. Disaster mitigation thus becomes a means for poverty reduction and crisis prevention.

One central part of disaster management is the quantification of economic losses resulting from disasters. By assessing such losses, regional and local development planners will attain an insight on how the invested mitigation money will pay off. Therefore, an economic loss assessment became an indispensable requirement for any disaster management concept. Areas of risk can be identified by neutral, independent and measurable indicators which provide a means for regional risk comparison. In order to delineate mitigation countermeasures regional planners not only have to know about the geological and geographical setting of an area at risk, but also have to have an understanding of the social, economical and ecological vulnerabilities of the population at risk. Mitigation strategies are typically based on such assessments. A comprehensive economic loss assessment is one of the main instruments to delineate areas at risk before a disaster happens and is therefore put high on the political agenda.

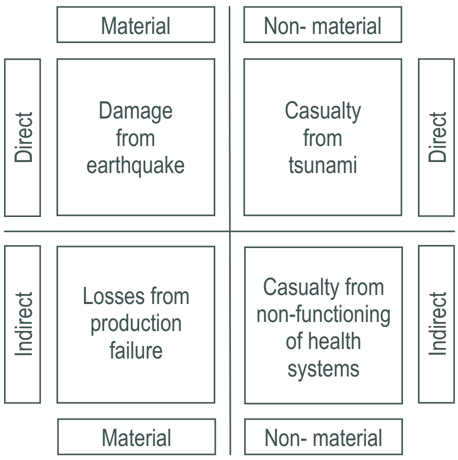

Figure: Economic loss assessment matrix (BGR)

The quantification of damages from disasters is comprised of four aspects:

- Direct losses (losses that can be attributed directly to the disaster event)
- Indirect losses (losses that cannot be attributed directly to the disaster event)
- Material losses (tangible losses)
- Non-material losses (intangible losses)

In a pilot study for the city of Semarang the economic losses were assessed. Semarang is a city with more than 1.3 million inhabitants and is well known for its severe land subsidence. Many parts of the city - formerly lying several meters above sea level - today are permanently under water; especially the area next to the harbour where the central railway station and the industrial areas are located. The data that was collected for the project together with the city administration enabled the project to elaborate subsidence scenarios as a base for disaster mitigation planning.

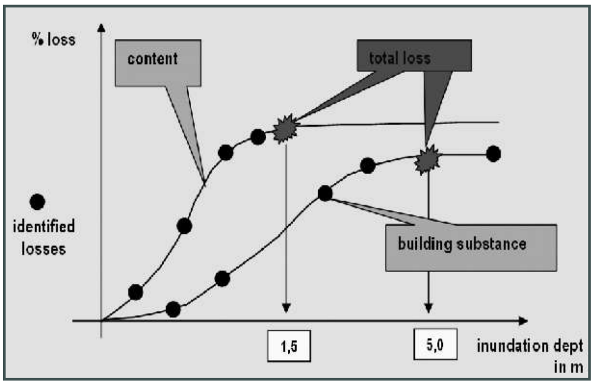

Figure: "Damage-loss equation" (flooding), asset losses versus inundation depth (BGR)

According to the project, the area of subsidence increased from 175 hectares in 1973 to more than 200 hectares in 1993 while at the same time the water extraction tripled to about 40 million m^3 today. Locally, subsidence rates of up to 10cm per year were identified from satellite images using permanent scatter interferometry. Based on this method, it is predicted that the affected area will increase by three times in the next ten years. Furthermore, a loss frequency curve was estimated for a ten year flooding event from rainy seasons with a 10% probability indicating annual losses of more than USD1 million. Taking a population increase rate of more than 2% means that roughly 50% of the future Semarang inhabitants may be endangered by land subsidence and flooding. The fragility curve indicates that business and industrial assets as well as residential installations are 2 to 3 times more endangered than normal farmland when inundation exceeds 2 meters.

The Good Practice

The initiatives made by the Georisk project are considered a good early warning practice as it strengthens Indonesian capacity on:

- Assessing disasters on a normalized and standardized form, leading to a comparison of risk exposure for the entire country;
- Disaster prevention activities by indicating the level of vulnerability;
- Capacity of the local and regional planning structures to work out mitigation strategies;
- The participation of the population at risk by an early involvement to reach a higher degree of resilience;
- Formulating a sustainable disaster mitigation policy for the disaster stricken provinces and by demonstrating responsible disaster management;
- Establishing a national instrument for disaster early warning; and
- Coping with international disaster management strategies.

Lessons Learned

- Disaster management is indispensable to safeguard the lives of disaster exposed population;
- Participation of local governments will increase and local development decision making processes will become transparent;
- Participation of the population at risk will be strengthened and institutionalised; and
- Resources invested in disaster prevention (technical countermeasures as well as investment in human resources) will pay-off many times.

Potential for Replication

The chosen practice follows well-established procedures. On one hand the strategy is directed towards a better assessment of hazards and vulnerabilities from disasters, while on the other hand it enables the policy makers to plan for a safer future. Furthermore, it involves the population at risk from the very beginning into disaster prevention and mitigation process and clarifies the different roles and mandates of decision-makers and the civil society in developing a disaster management culture.

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Indonesia

Implementation of tsunami early warning in local communities: "Checklist for assessment, planning and monitoring”

German Technical Cooperation (GTZ)

GTZ - GITEWS

Abstract

The Checklist “Implementation of Tsunami Early Warning in Indonesian Local Communities” was designed by adapting the framework and guideline questions from the “Checklist for Developing Early Warning Systems”, which was developed during the Third International Conference on Early Warning (EWC III) in 2006, Bonn, Germany. The tsunami specific checklist serves as a tool for assessment, planning and monitoring and was developed by the German Technical Cooperation International Services (GTZ-IS) German-Indonesian cooperation for Tsunami Early Warning (GITEWS) team in Indonesia in April 2007.

The document consists of two inter-related parts: (a) the provision of useful background information and the presentation of overarching issues related to the Indonesian Tsunami Early Warning System, and (b) a series of practical checklists. These checklists describe the crucial fields of actions for the development of a tsunami early warning system at community level or when evaluating its progress. As the implementation of a tsunami early warning is a multi-stakeholder task, the document also includes a stakeholder analysis tool to identify roles and responsibilities of each local actor.

Goals and Objectives

The checklists were developed to be used as a tool in the project:

1. Assessment tool
   - to identify the actual situation of the community regarding tsunami early warning;
   - to identify weaknesses and opportunities, as well as potentials for improvement; and
   - to identify all stakeholders involved.
2. Planning tool
   - to identify the aspects that require action;
   - to prioritize the actions;
   - to define objectives for working groups; and
   - to develop an action plan.
3. Monitoring and Evaluation tool
   - to monitor and evaluate the progress and achievements during the implementation process; and
   - to maintain and update the system once established.

The Initiative

GTZ-IS is implementing the “Capacity Building in Local Communities” project as part of GITEWS in Indonesia. An essential part of the project was the development of checklists that are structured in accordance with the UNISDR four key elements on early warning. The checklists for this project were applied in the GITEWS pilot areas (Padang West-Sumatra; the districts of Cilacap, Bantul and Kebumen, South Java; Badung district; and the province of Bali) during the first half of 2007.

They have been used throughout the tsunami early warning implementation process as a monitoring and evaluation tool until the project's conclusion in 2008. Additionally, the document outlines a number of cross-cutting issues related to effective governance and institutional arrangements, community participation and gender. The first part of the document provides useful background information and presents overarching issues for each of the key elements. The second part is a series of practical checklists describing the actions to be taken when developing the early warning system or evaluating its progress and results.

The checklists are applied by local working groups that are created in order to implement tsunami early warning practices in their communities. The inter-institutional working groups consist of representatives of local government and non-governmental organizations. Direct beneficiaries of the mapping process are the members of the working groups. The indirect and long term beneficiaries are the communities at risk that lie along the coast. Funding for the project is provided by GITEWS and the district government.

The implementation of tsunami early warning in Indonesian local communities is a multi-stakeholder task. Therefore, clarification about the main actors and their tasks is required. Each community needs to identify the relevant actors who are involved in developing and maintaining the different elements of the early warning system. For this purpose the checklist document includes a stakeholder analysis tool to facilitate the identification of the local actors' roles and responsibilities. The term “local communities” refers to communities at the district level down to the neighborhood level and includes local governments, community leaders, the private sector, local academic institutions, NGOs and the population in general.

Aspect	Progress	Action needed & Priority
1. Local characteristics of tsunami hazard ❑ Local characteristics of tsunami hazard (eg. Intensity, frequency and probability) analyzed and historical information evaluated.	❑ 0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 **0** not started yet **1** first steps done **2** ongoing process **3** nearly accomplished **4** fully accomplished	❑ 1 ❑ 2 ❑ 3 **1** high priority **2** medium priority **3** no action needed
2. Tsunami hazard maps ❑ Tsunami hazard maps developed to identify the geographical areas and communities that could be affected by tsunamis.	❑ 0 ❑ 1 ❑ 2 ❑ 3 ❑ 4	❑ 1 ❑ 2 ❑ 3
3. Integrated hazards map ❑ An integrated hazards map developed (where possible) to assess the interaction of tsunamis with other hazards.	❑ 0 ❑ 1 ❑ 2 ❑ 3 ❑ 4	❑ 1 ❑ 2 ❑ 3

Figure: Part of the Checklist requesting the status on tsunami hazard identification

The Good Practice

The checklists were developed by adapting the framework and guideline questions from the “Checklist for Developing Early Warning Systems” (EWC III, March 2006, Bonn, Germany) according to the needs of local communities in Indonesia and the context of the Indonesian Tsunami Early Warning System. The checklists were applied by local working groups on the GITEW in the three pilot areas under supervision of the GTZ-IS advisors. This process provided the baseline for the project and its partners in early 2007 and an action plan for the implementation of tsunami early warning. The structure of the checklist document and the guideline questions are used as a reference throughout the whole early warning system implementation process in the communities.

The success of early warning will express itself by the public reaction to the warning. Local actors play a very prominent role in achieving this result. The genuine tasks of local governments and their communities is to raise awareness and to improve knowledge about the natural hazards and potential impacts, receiving advisories and warnings from national institutions, as well as giving guidance and instructions to local population, thereby preparing people for disasters.

Establishing tsunami early warning in local communities requires an assessment of what is already in place. Planning, implementation and monitoring should be done in a structured and systematic way, in order to make sure that all elements are considered. To provide some guidance for this process, the project team developed the checklist document by translating internationally accepted standards for national warning systems into a simple, practical tool for local decision makers and stakeholders, which can be applied on community level without major external support.

Lessons Learned

Implementing tsunami early warning on the community level is a complex task which requires the participation and coordination of multiple stakeholders and partners from local government and civil society. A common understanding on concepts and the system to be build up is necessary, as well as a working strategy and coordination mechanism. By applying the checklist tool it was possible to increase the knowledge of all participants about tsunami hazards and early warning, and to introduce and familiarize participants with the scope of the four elements of early warning. This awareness made it possible to identify what is already in place and can be used to build upon, and to identify, who has to be involved and who needs to agree on a working plan. It also gives project advisors the possibility of acquiring a deeper understanding of local conditions and capacities. The discussion and learning process from the assessment is as important as the results one gets from the ratings.

Potential for Replication

The GTZ-IS GITEWS checklist is tailor made for Indonesian communities and the Indonesian Tsunami Early Warning System. It can be applied without modification in any Indonesian community. As it is based on the internationally adopted framework and elements from the UNISDR it can be easily adapted to other contexts, countries, hazards or types of warning systems as well. The checklist can be used by local actors on their own, without requiring external expertise or resources. However, self assessments are not effective without a self critical attitude and an open mind. The checklist is available in both English and the Indonesian language.
It can be downloaded from: www.jtic.org

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Indonesia

Tsunami hazard mapping methodology for district level

German Technical Cooperation (GTZ)

Photo by GTZ IS-GITEWS

Abstract

Understanding the tsunami hazard and the potential impact for communities in tsunami prone areas is a prerequisite for local decision makers and other stakeholders in the preparedness stage. However, for most Indonesian communities very little information is available right now. No generally adopted approach to tsunami hazard mapping at the district or community level has been developed. In several countries, there are solitary attempts to evaluate the tsunami hazard for selected coastal locations based on different approaches and methodologies. Due to this threat to the coastlines of Indonesia there is an urgent need for a better understanding of the tsunami hazard as a crucial step towards better preparedness. In a situation like this, tsunami hazard mapping is a task in which experts and local decision makers and planners should work hand in hand to use the available expertise and information in order to achieve maximum results. With the objective of designing a simple, low-tech, but sufficient and adequate tsunami hazard mapping methodology, an inter-institutional team of experts conducted a tsunami hazard mapping exercise in a pilot area in Java, Indonesia. The team worked closely with representatives from local government and local organizations, in order to include all available local knowledge. A joint working process was started and capacities were built along the way. As a result, the exercise did not only produce maps but also optimized the approach and adjusted it to local capacities. Throughout the process, experiences and lessons were evaluated and fed into the final methodology.

Goals and Objectives

The goal of the mapping exercise is twofold. The project aims at producing tsunami hazard maps for the project districts as well as developing a general tsunami hazard mapping methodology.

Throughout the working process a deeper understanding of the tsunami hazard in general has been generated. In addition, the initiative generated awareness among stakeholders at the district level about the local tsunami threat and its potential impact on communities in the project area.

The Initiative

The tsunami hazard mapping initiative was started in October 2007 in the districts of Bantul (Yogyakarta, Java), Kebumen (Central Java), and Cilacap (Central Java) until March 2008. These three districts represent one out of three pilot areas of the overall project. The other pilot areas are the City of Padang (West Sumatra) and the province of Bali. The hazard mapping is part of the project “Capacity Building for Local Communities”, which started in mid-2006 and runs until the end of 2008. It focuses on consultation and joint workshops among all districts involved. The hazard mapping initiative serves as an important basis for further activities that will build upon the results of the exercise; such as evacuation and contingency planning and local warning chain development.

The mapping exercise was initiated by German Technical Cooperation International Services (GTZ-IS) that acts in the framework of the German Indonesian Cooperation for a Tsunami Early Warning System (GITEWS) and involves national experts from the Ministry of Marine Affairs and Fisheries, the Gajah Mada University of Yogyakarta, and the Meteorological and Geophysical Agency in Yogyakarta. The inter-institutional team of experts worked in close cooperation with representatives of local government and non-governmental organizations which belonged to working groups for the establishment of the local tsunami early warning system. Direct beneficiaries of the mapping process are the members of these working groups. The products of the initiative such as hazard maps will benefit both the local government and NGOs. The beneficiaries are the communities at risk who live along the coast. Funding for the exercise is provided by GTZ-IS and the district governments.

As a result of the hazard mapping process three base maps have been produced. In a subsequent step the working groups together with the GTZ advisory team entered in a discussion about scenarios for potential tsunamis along the coast of the pilot area. These scenarios have been visualized as single scenario hazard maps and then been transferred into a final multi-scenario tsunami hazard map.

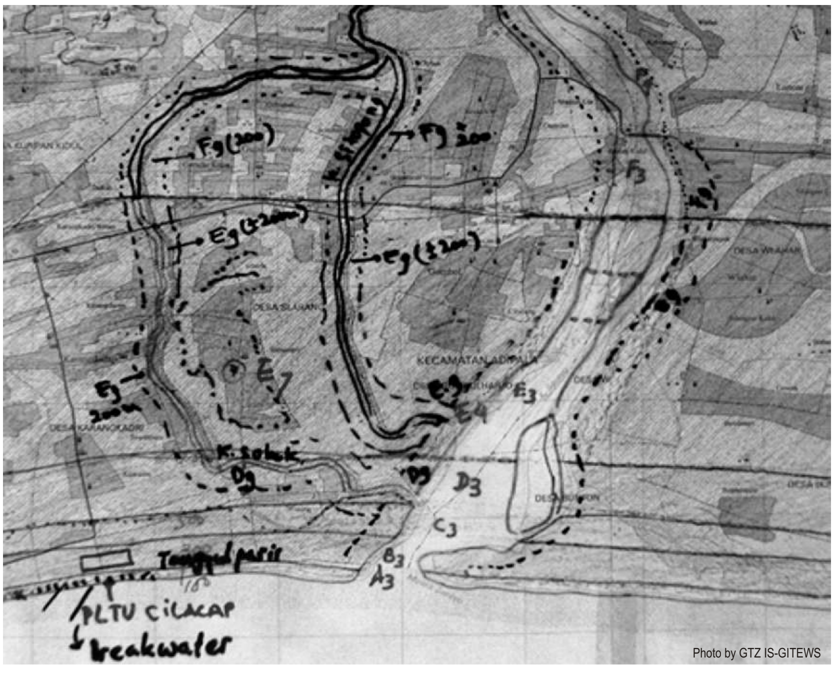

Photo by GTZ IS-GITEWS

The Good Practice

The assessment and mapping of the tsunami hazard is an issue that requires both expertise and local knowledge. A purely community-based approach without input from experts is due to the complexity of the issue not considered to be sufficient. Neither is one that does not involve local stakeholders. The cooperation between the advisory team and 'local experts' allows for the development of a methodology that is applicable for implementation at district level and triggers a learning process on both sides. The participatory exercise ensures that local knowledge is integrated and generates a deeper understanding about the potential threat, therefore building capacity.

Brief summary of process and methodology:

1) Getting started: after the advisory team has been formed, an introductory meeting among experts and local stakeholders confirms objectives and logistics, explains the methodology and compiles data. A field visit allows the joint group to get familiar with the area and provides the opportunity to discuss landscape features, as well as previous tsunami events and their impact.

2) Developing a base map: the tsunami hazard mapping similar to other approaches exploits three sources of information:
   - Local historical data from previous tsunami events
   - Modelling results for the area
   - Reference data from previous tsunami events in other locations in Indonesia

   This data provides the main parameters used: inundation and run up of the tsunami impact on land. Recorded in a simple reference matrix, it is documented in the topographic map in the following way:
   - Delineation of horizontal distances parallel from coastline in accordance to inundation data
   - Mapping of horizontal distances in rivers using the inundation
   - Delineation of horizontal distances on the river banks in order to anticipate an additional source of flooding during a tsunami event
   - Mapping of vertical lines to accommodate the run up data

   The topographic map provides information about geomorphologic and anthropogenic features as well as vegetation. The relevant features (sand dunes, dams and mangroves) are verified using satellite images and local knowledge.

   The geomorphologic and anthropogenic features are recorded in a matrix. The matrix produces a first zoning. It highlights different elevation levels combined with landscape features in accordance to their respective distances from the coastline.

3) Developing a multi-scenario tsunami hazard map: the final tsunami hazard map requires a scenario discussion. The advisory team provides input for different scenarios such as potential tsunami wave heights. By using the combination matrix several scenarios can be discussed and visualized on the base map resulting in single scenario hazard maps. The results of each single scenario will be superimposed and transformed into one map which contains information about multiple scenarios.

Despite the fact that Indonesia is located in a highly tsunami prone region the information about the tsunami hazard along many of the countries coasts is still very limited. No generalized adopted approach to tsunami hazard mapping at the district/community level has been developed. The presented initiative aims to fill this gap. Due to its simple approach, the tsunami hazard mapping methodology can be easily applied by stakeholders at the community level and will help to better understand the tsunami hazard and get prepared.

Photo by GTZ IS-GITEWS

Lessons Learned

The tsunami hazard mapping has been jointly conducted with local actors who are involved in tsunami preparedness. This participatory process not only provided results regarding tsunami hazard but also created awareness about the requirements for preparedness and the scope of the threat amongst all participants.

National experts worked in cooperation with local actors. The team composition provided the opportunity to combine scientific expertise with local knowledge about the area and its characteristics.

Photo by GTZ IS-GITEWS

Potential for Replication

Since the hazard mapping exercise uses a simple approach it can be replicated in other communities in Indonesia and elsewhere. It can be a task for the local community. However, it requires some technical input from experts in order to use all available knowledge. The final step of the exercise involves GIS technical skills that might not be available in all communities. If the technical requirements cannot be met, the hazard maps can also be developed manually.

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Acronyms

ABU	Asia-Pacific Broadcasting Union
ADPC	Asian Disaster Preparedness Centre
ADRC	Asian Disaster Reduction Center
AIDMI	All India Disaster Mitigation Institute
AKUT	Search and Rescue Operations Organization
ALOS	Advanced Land Observing Satellite
APRSAF	Asia-Pacific Regional Space Agency Forum
AREA	Addressable Satellite Radios for Emergency Alerting
ASEAN	Association of Southeast Asian Nations
BGR	Federal Institute for Geosciences and Natural Resources
CBDP	Community Based Disaster Preparedness
CBDRM	Community Based Disaster Risk Management
CDMA	Satellite-based Telephone System
CFA	Country Fire Authority
CFP	Community Focal Point
CIM	German Center for International Migration and Development
CORDAID	Catholic Organization for Relief and Development Aid
CRED	Centre for Research on the Epidemiology of Disasters
CSC	Non-governmental Organisation in Nepal
CTEC	Community Tsunami Early Warning Centre
Deedha Council	Council of Elders trained and enhanced as development committees
DIPECHO	Disaster Preparedness European Community Humanitarian Aid Department
DMC	Disaster Management Committees
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
ECMWF	European Centre for Medium-Range Weather Forecasts
EMA	Emergency Management Australia
EMMA	European Multipurpose Meteorological Awareness
EUMETNET	Network of the European National Weather Services
EWC III	Third International Conference on Early Warning (EWC III), 27-29 March 2006, Bonn, Germany
EWS	Early warning system
FCBAS	Ferny Creek Bushfire Alert System
FM	Frequency Modulation
GIS	Geographic Information System
GITEWS	German-Indonesian cooperation for Tsunami Early Warning System
GPS	Global Positioning System
GSM	Global Telecommunications System
GTDO	Garba Tulla Development Organization
GTS	Global System for Mobile communications
GTZ	German Technical Cooperation
GTZ-IS	German Technical Cooperation International Services
HIH	Hazard Information Hub
ICT	Information Communications Technology
INGC	National Disaster Management Institute of Mozambique
InWEnt	Capacity Building International
JAXA	Japan Aerospace Exploration Agency
JMA	Japan Meteorological Agency
KOGAMI	Tsunami alert community (Komunitas Siaga Tsunami)
KWS	Kenya Wildlife Service

MIC	European Commission Monitoring and Information Centre
NBRO	National Building and Research Organization
NGO	Non-govermental organisation
NHMS	National MeteoHydro Services
PIC	Project Implementation Committee
PPEW	Platform for the Promotion of Early Warning
PTWC	Pacific Tsunami Early Warning Center
SAHAMATI	Non-governmental Organisation in Nepal
SEEDS	Sustainable Environment and Ecological Development Society
SIDPABB	Inter-district Operational Flood Warning System for the Búzi River Basin
SOP	Standard Operating Procedure
TEWS	Tsunami Early Warning System
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO/IOC	Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
UNISDR	United Nations International Strategy for Disaster Reduction
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNOOSA	United Nations Office for Outer Space Affairs
UNOPS	United Nations Office for Project Services
UN-SPIDER	United Nations Platform for Space-based Information for Disaster Management and Emergency Response
UNU-EHS	United Nations University Institute for Environment and Human Security
VHF	Very High Frequencies
WMO	World Meteorological Organisation
ZAMG	National Weather Service of Austria

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