# Building Community Resilience to Flooding in the Sarapiqui Region

# A Story from Costa Rica

## Geographical, historical, environmental context of the pilot site of the Project

Sarapiqui is a rural Municipality belonging to Heredia Province in Costa Rica, and it is comprised by five districts (Box 1). The head town is Puerto Viejo. The Sarapiqui River is one of the most important of the basin which irrigates this region. The earthquake of 6.2 degrees magnitude on January 8, 2009 at the Cinchona area had an important impact on the landscape and hydrological variability in the Sarapiqui Basin changing the risk scenario at the basin. The drainage patterns suffered modifications and new risk areas for flash floods and mudslides have been created. The tons of material from landslides that fell into the river channel caused a huge avalanche that moved at high speed down the gorge of the river, endangering riverine communities and destroying much of the vegetation along the riverbanks and raised the height of riverbed due to the sediment accumulated. Landslides that may be triggered by heavy rainfall or earthquakes remain a threat in the mountainous areas of the upper basin, adding new elements and complexity to the prevalent risk situation.

## Box 1 : Relevant Information on Sarapiqui Municipality

Location and size: Sarapiqui is located at the North Caribbean region of Costa Rica (its Coordinates are 10°29'23'' North latitude and 83°56'15" West longitude); and with an area of 2,140.54 km² is one of the largest Municipalities of the country and it has boundaries to the North with Nicaragua

Population: Total 57.147, which 28.090 are women and 29.057 men. Density is 27 persons/ km² distributed in 5 districts: Puerto Viejo (Head town), La Virgen, Horquetas, Llanuras del Gaspar, Cureña

Production: Agriculture and livestock farming have been the main traditional activities, and nature-oriented tourism has emerged recently, so increasing related activities of commerce and services

Social situation: Very high rate of temporary and informal employment. Percentage of poor families is 35%

Geography and weather: This region is predominantly hot and one of the most humid of the country, with average temperatures ranging between 26 and 28° C. It is continuously influenced by trade winds and seasonally by tropical depressions and cold fronts that intensify between November and February. The elevation of the main towns ranges around 37 to 187 masl (meters over the sea level)

Environmental characteristics: The Sarapiqui territory is surrounded by dense rain forests, it is the home for wildlife, forest preserves and national parks, it is very important for water resources and biodiversity protection

Hydrologic characteristics: This is one of the 34 main watersheds of Costa Rica; the Sarapiqui river drains into the San Juan River and is the main water body that bath this region together with a group of rivers and streams fed by year-long rainfalls with periods of heavy rains between November and January

Hazards: Due to the combination of hydrographic, topographic characteristics, weather conditions and seismicity, the most important hazards for Sarapiqui region are flooding and mudslides. Landslides falling into the river adds new elements and complexity to the prevalent risk situation

# About the "Costa Rica Early Warning System for the Hydrometeorological Hazards Project"

To address these new challenges, the World Meteorological Organization through its Disaster Risk Reduction Programme, Regional Office IV (North and Central America) in Costa Rica and the Hydrology and Water Resource Programme, collaborated with the World Bank Global Facility for Disaster Risk Reduction (GFDRR), the National Meteorological Institute (IMN), the National Commission of Risk Prevention and Emergency Response (CNE) and the Costarican Institute of Electricity (ICE) through the implementation of the "Costa Rica Early Warning System (EWS) for Hydrometeorological Hazards Project". The project was funded by the World Bank and the GFDRR, and it started in early 2012 and it was completed in June 2013.

The purpose of the project was to develop an effective framework for an operational early warning system (Box 2) at the Pilot Site of the Sarapiqui river basin, strengthening coordination and cooperation among IMN, ICE, and CNE in collaboration with other national government and non-governmental agencies at the local level to strengthen the emergency preparedness and response, including community participation in the Project implementation and development.

The scientific and technical information developed through this project provides the elements for risk based warnings/advisory which are communicated to the local population in a language they understand. Providing clear risk based information (e.g. hazard characteristics and potential consequences of the hazard) allows local organizations and communities in the threatened area to implement pre-planned measures (also developed through this project) to protect their lives and livelihoods.

CNE and IMN worked together with local authorities and communities to develop standardized operations procedures (SOPs) for the activation and communication of the alerts (Box 3)

## Box 2: Early Warning System

An early warning system has four components, which include:

(i) Detection, monitoring and forecasting hazards,

(ii) Analyses of risks involved,

(iii) Dissemination of timely warnings - which should carry the authority of government,

(iv) Activation of emergency plans to prepare and respond to an imminent or forecasted hazard.

These four components need to be coordinated across many agencies at national to local levels for the system to work. Failure in one component or lack of coordination across them could lead to the failure of the whole system. The emission of warnings is a national responsibility; thus, roles and responsibilities of various public and private sector stakeholders for implementation of EWS should be clarified and reflected in the national to local regulatory frameworks, planning, budgetary, coordination, and operational mechanisms

In the context of the EWS it is very important that communities identify their own vulnerabilities and capacities

Over 20 Community Emergency Committees from the Sarapiqui river basin had a dynamic participation in the training activities of the Project

To improve the hydrological model and the confidence level of estimated flood hydrographs and flood prone areas, two Automatic Weather Stations (AWS) were installed as part of this project at the Puerto Viejo River Basin. The information recorded by these meteorological stations will validate the space and time distribution of the rain and it will allow improving rain forecast for the EWS.

All activities of the Project were carried out through an unprecedented close coordination and cooperation among the different stakeholders involved, each one leading its area of expertise and enthusiastically supporting the development of the other institutions' activities. Their abundant contribution on human and material resources has allowed having an amplification of the results obtained by the Project.

*"With this project, we intend to transfer all this accumulation of highly technical information generated to the communities in simple language, so they can make decisions and take actions for protection, according to the received information "*
*Oscar Arango, WMO*

# Leadership in community preparedness and response

More than 30,000 people live in riverine villages and flood areas along the rivers, and they are exposed to the overflowing of the Sarapiqui, Puerto Viejo, Sucio rivers, among others. This situation of recurrent floods is exacerbated by the growing population at the flood-prone areas, which increases the overall vulnerability of the community in the affected areas.

Community Emergency Committees (CECs) were created in several villages of the Sarapiqui region following the 2009 earthquake at Cinchona, which provided the basis for the organization of the local response component of this Project. The CECs are established through the Costa Rican National Law of Emergencies and Risk Prevention (Law 8488), under the responsibility of the National Commission for Risk Prevention and Emergency Response (CNE). CECs are composed mainly of representatives of the civil society and one of its priorities is the promotion of community organization for disaster risk reduction and implementation of emergency response interventions in their community.

Another relevant coordination body is the Municipality Emergency Committee (MEC), in charge of promoting and coordinating all risk management and emergency response issues at the local level (Figure 1). The MEC is an inter-institutional body composed mainly by governmental organizations and it has the task of gathering all strategic sectors to participate in these issues, as well as organizing and supporting the CECs. The head of the MEC is the City Major.

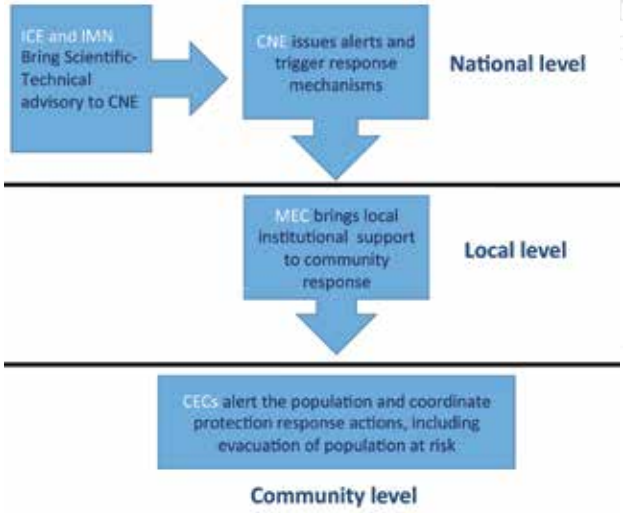


Figure 1: Disaster Risk Management institutional roles and responsibilities in the EWS context

Throughout the Project implementation, around 200 representatives belonging to CECs of 20 communities from the mid and lower Sarapiqui basin actively participated in the training and organizational strengthening activities. Through a series of workshops and fieldwork, members of these committees were trained on:

- ✓ identifying and mapping areas at flood risk in their communities
- ✓ organization of response activities
- ✓ use of radio communication devices
- ✓ warning and evacuation procedures

- ✓ emergency shelter management
- ✓ water and sanitation
- ✓ protection of animals in emergencies
- ✓ community census and inventory of community resources

*"Now we feel more secure and organized to face floods, but we still have to work to avoid them"*
*Carmen Montiel, CEC's coordinator of El Amigo*

In order to determine the pertinence and the level of local ownership of the EWS, a drill and an associated simulation exercise were conducted, involving all organizations related to its use and application. In the drill that took place simultaneously at Los Lirios, Naranjales, Caño San José and the Municipality Emergency Committee, the participating communities and institutions had to face situations that simulated the arrival of a dangerous hydrometeorological hazard that would affect the region. The drill tested the EWS from the institutional level up to the community level, such as the application of SOPs, warning messages, evacuation procedures, communication procedures, understanding of the community of the warning messages and procedures, etc., as well as the general behavior and performance of the organizations facing such extreme situation. More than 800 hundred persons took part of this exercise, corresponding to 27% of the population of the three participating communities.

The drill and simulation exercise were evaluated by a team comprised by members of MECs from other Municipalities of the Province. They assessed the actions and decision making process (e.g. information tracking, monitoring activation, activation of CECs, communication of alarms and alerts, evacuation, shelter activation, situation reports, supplies management, etc.), according to the established drill scenarios, and they briefed with their observations the different participating organizations. Correspondingly, the participants did their own evaluation on their performance, outcomes and gaps that needed to be addressed, as well as the related corrective actions to be taken in order to strengthen the EWS.

## Box 3. The basic premises for the SOPs

- The decision to evacuate is supported by reasonable certainty based on the thresholds provided through the EWS
- The spirit of the EWS is anticipation: local response structures receive sufficient and timely information to take the necessary protective measures. Population is alerted and instructed in advance enough so they can protect themselves and their goods before the overflow of rivers, so reducing the need of rescue operations

# Lessons learned

*"This project serves to demonstrate that local capacities should be strengthened to ensure effective risk management, as well as to strengthen the mechanisms and related legislation order to enhance the implementation of warning systems of this type". Vanessa Rosales, Executive President of CNE*

- ✓CECs still require strengthening their organization and increasing their skills for a larger release of information, and encourage greater and more active participation from the communities.
- ✓The graphic expression and explanation of SOPs and other related procedure SOPs for community level can still be simplified in order to make their understanding easier and their application easy.
- ✓CECs members need to be familiar with SOPs, so it is very important to continue working on their organization and training. A yearly exercise at the beginning of the rainy season should be a good refreshing tool to create awareness and preparedness "tradition" in the community.
- ✓Having an emergency structure organized and recognized in the community, allow the CNE can allocate more resources to improve emergency response capacity, such as radio equipment, equipped boats and outboard motors, as well as emergency supplies prepositioned, ready to start caring for flood victims. In the same way, members of the CCE will receive the identification and visual elements necessary for them to develop their tasks with more authority and recognition as emergency operations coordinators in their locality.
- ✓In the words of Hipolito Palma, CEC's coordinator of Caño San José, the greater contribution of this Project iis "to receive warnings well in advance and not waiting to see the rivers grow to activate and communicate alerts".

The project has had a significant and active participation of women, who undertake and lead the daily struggles for the betterment of their communities

# Scaling up to other regions in Costa Rica

This Project provides a model that could be utilized in other regions in Costa Rica because it addresses all four basic components of a EWS (Box 2.) and it strategy include:

- ✓Technical and organizational engagement and participation of national institutions: technical and scientific related institutions must provide human and technical resources for the development of the EWS, and compromise to support and follow up of results
- ✓Municipality authorities are actively engaged and they are supporting community efforts: Municipality must be an active partner and provide political and institutional support to the implementation and results of the Project
- ✓Institutions at local level supporting the Project in the areas related to their specialties
- ✓Active participation of communities: Community organizations involved in the whole process, including not only the CECs but other organizations functioning in the community.

*"The project has the necessary ingredients to be replicated in other basins of the country, since it has a good balance of scientific technical aspects to be provided to a community which has managed to build their capacity to understand and respond to a recurrent natural phenomenon".*
*Rafael Oreamuno, hydrologist.*

The drill exercise allowed to test different EWS procedures and the performance of organizations facing an extreme situation

Technical information should be transferred in understandable language to communities to facilitate their decision-making and undertake protective measures


**World Meteorological Organization**
Telephone: (506) 2258-2370
Fax: (506) 2256-8240
E-mail: oarango@wmo.int
P.O. Box: 7-3350-1000 San José, Costa Rica
www.wmo.int