DAY 1 – 11 AUGUST

1.0 INTRODUCTION

The workshop was opened by Jaime Massot, representing the Panamanian government, Dave Zervaas of the United Nations/International Strategy for Disaster Reduction (UN/ISDR), Julie Leonard of the US Agency for International Development/Office of Foreign Disaster Assistance (USAID/OFDA) and Dr. Lorna Inniss, Chairperson of the UNESCO/IOC Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE EWS).

Mr. Massot welcomed participants to Panama and in his opening statement emphasized the need to develop sustainable mechanisms and methodologies that are transferable to the region. He also underscored the importance of developing Early Warning Systems (EWS) within a framework of integrated coastal management.

Dr. Inniss welcomed participants on behalf of the Executive of the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Early Warning System for the Caribbean and Adjacent Regions. She noted that Barbados is the current Chair and the Vice Chairs are the United States and Venezuela, and will have oversight for the work of the ICG for the next two years. She added that at the first meeting of the Intergovernmental Coordination Group in Barbados in January 2006, the countries of the ICG agreed that the low frequency and high potential losses related to tsunamis require that vulnerable coastal communities be educated. This relative importance given to public education and awareness was translated into action with the establishment of Working Group IV.

On behalf of the sponsoring agencies, the Chair of Working Group IV on Preparedness, Readiness and Resilience, Julie Leonard, recalled that the Caribbean and adjacent areas have experienced a notable number of tsunamis in recorded history and in the lifetime and memory of most people at the meeting, there have been several tsunamis in both the Pacific and Caribbean coasts.
She recalled the purpose of Working Group IV which is to advise and recommend to the ICG/CARIBE EWS strategies to enhance preparedness, readiness and resilience capabilities among Member States and to develop the recommendations, tools and procedures in order to do so. Within this framework, the ICG decided to convene a meeting of experts on preparedness, readiness and resilience at the community level for tsunami and other coastal hazards in Panama, with the support of UNESCO/IOC, USAID/OFDA and UN/ISDR in collaboration with the Maritime Authority of Panama.

While Working Group IV may apply to the Caribbean and Adjacent Regions, Ms. Leonard noted that there are some relevant and very interesting experiences on the Pacific side of Central America as well as Colombia. Most of these countries have both Caribbean and Pacific coastlines.

Can these experiences be replicated? How would they need to be modified? Are some of the other countries in the region interested in replicating them? How would these connect with on-going initiatives, or other warning systems already in place? What are some of the obstacles to advancing that can be foreseen and what is the best way to deal with them? These are some of the main questions the meeting had been called to address over three days, delivering ideas, recommendations, proposals or concepts that would be fed back into the Working Group IV and to the ICG membership. Ms. Leonard suggested that the intention was not to end discussions at the meeting, rather, the movement forward would be vetted by the ICG, but the activities were up to member states, interested institutions, organizations, donors, private sector and all that were looking towards protecting their populations and also their investments.

1.1 **Keynote 1: "Essential elements of a community-based tsunami & coastal hazards warning system."** Dr. Juan Carlos Villagran, Institute for Environment and Human Security, UN University (UNU-EHS), Bonn, Germany.

Dr. Villagran introduced the main subject of the meeting by offering a systematic approach towards the components of a community-based early warning system. He described the three main pillars of such a system:

1. **Institutions** design, establish, and operate various or all components of the system.
2. **Civil Society** promotes the establishment of the system and participates in the Anticipated Response phase.
3. **Instrumentation** to monitor precursors, to exchange information, and to warn the population.
He also referred to the two conceptual frameworks for Early Warning Systems (EWS), namely the traditional approach implemented by technical agencies and the “People-centered” (End-to-End) enhanced view, applied by disaster preparedness agencies that most notably include an Anticipated Response where the community is prepared to initiate actions according to evacuation plans prepared in advance.

He then described the experience of Port of Galle in Sri Lanka, providing specific examples of how the end-to-end approach works in reality.

1.1.1 Recommendations

- The Anticipated Response should be an essential component of any EWS.
- Risk assessment for EW should target vulnerable groups to develop warning strategies.
- Warnings can only be effective if they reach the people who need to respond in a timely fashion.
- People need to understand the context of warnings, and how to react in case such warnings are issued.
- Sustainability has to be built into the systems in order for such systems to remain operational permanently.
- Hi-tech EWS allow for high precision, but in developing countries, cost is still an issue.
- Low tech community based EWS have been successful in involving community members and local governments in rural communities, especially in the case of small river basins. However, tools and instruments have to be adapted to their limitations.
- It is essential to promote an integrated approach, combining national and local strengths and capacities, to improve existing EWS or when implementing new ones.
- It is important to recognize the official institutional mandates and frameworks of national level agencies, especially in the case of disaster preparedness.

1.1.2 Comments on the presentation

Yadira Soto (Puerto Rico) commented that TsunamiReady™ is a program developed by the National Weather Service (NWS) of the National Oceanic and Atmospheric Administration (NOAA) that supports a multi-hazard approach to preparedness. TsunamiReady™ is designed to help coastal areas decrease the potential damages caused by tsunamis and their consequences. The objectives of this programme are:

→ Create minimum standard community guidelines for adequate tsunami readiness.
→ Increase public awareness and understanding of tsunami hazard.
→ Improve community pre-planning for tsunami disasters.
→ Encourage consistency in educational materials and response.

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→ Recognize communities that have adopted TsunamiReady™ guidelines.

Dave Zervas (EIRD Americas/ONU) made reference to the checklist produced at the ISDR meeting in Bonn, Germany, 2006. He cautioned about false alarms and their eventual negative impact on community preparedness. He indicated that technical devices for monitoring and detecting tsunamis are as necessary as the preparedness measures at the community level. Their usefulness is both for issuing warnings and also for cancelling warnings. He recalled that Climate Change will be affecting the world sea level in the next decades and its cumulated effect with naturally produced hazards will increase risk for coastal communities.

2.0 EXPERIENCES #1

2.1 Caribbean Sea: TsunamiReady™. Yadira Soto, (on behalf of Christa von Hillebrandt-Andrade, Yadira Soto and Víctor Huérfano, Puerto Rico Seismic Network, UPRM, Rafael Mojica, National Weather Service San Juan Forecast Office, NOAA, José Román, Mayagüez Emergency Management Agency, José Martínez Cruzado, Walter Díaz and Aurelio Mercado, University of Puerto Rico, Mayagüez and Carlos Rodriguez, VERNIX Engineering) PUERTO RICO.

Yadira Soto presented the experience of Mayagüez, Puerto Rico, in developing the local applications of the TsunamiReady™ concept and programme which at the moment includes 43 communities recognized as TsunamiReady™ in the United States, Puerto Rico and Guam. This is a “grassroots” program that promotes tsunami hazard readiness. It is a collaborative effort between federal, state, and local emergency management and the public and is meant to improve public safety during tsunami emergencies. In a nutshell, it prepares communities for the tsunami hazard.

To become TsunamiReady™ a community needs to:

→ Establish a Communication and Coordination Plan:
  o 24 Hour Warning Point
  o Emergency Operations Center

→ Receive Critical Tsunami Warning Information through redundant means:
  o NOAA Weather Radio
  o NOAA Weather Wire
  o Emergency Managers Weather Information Network
  o News Media (Radio/TV)
  o Internet
  o Pagers, cell phones, etc.

→ Increase Community Preparedness:
NWS staff provide tsunami safety presentations.
- Designate safe areas outside of inundation zone
- Establish tsunami evacuation areas, evacuation routes, and install evacuation route signs.
- Provide written, locality specific, tsunami hazard response material to the public.

Schools: encourage tsunami hazard curriculum, practice evacuations if located inside inundation area, provide safety material to staff and students

Administrative:
- Develop formal tsunami hazard operations plan
- Annual meeting/discussion by emergency manager with NWS
- Visits by NWS official to community at least every other year

She offered the following conclusions:

- The TsunamiReady™ program has proven to be an excellent way to promote and validate tsunami readiness.
- Several other municipalities in Puerto Rico, following the example of Mayagüez, are now seeking to be recognized as TsunamiReady™.
- Also, Mayagüez continues to improve its level of preparedness and installed the first AHAB (All Hazards Alert Broadcast) radio to alert people who are outdoors.

2.2 Pacific Ocean: National Tsunami Alert System of Colombia, 2005-2007: Lessons Learned. Col. Ricardo Molares, Director, Pacific Contamination Control Centre, Tumaco, COLOMBIA.

Col. Molares provided an overview of the projected Tsunami Warning Center for Colombia, to be located in Tumaco, Pacific Coast of Colombia. He briefly described the main components of the civil defence system in Colombia and the links with the projected Center for Tsunami Warning. He then described in detail three main recent experiences:

- Real Time Tsunami Drill, 2005
- Tsunami Warning Evacuation, 15 August 2007
- Earthquake, 9 November 2008

2.2.1 Real Time Tsunami Drill
Part of the city of Tumaco is located on a peninsula, where 86,000 residents live in high risk of tsunami inundation. A simulation exercise was developed and implemented in April, 2005, with the Vice-President of Colombia in attendance. The drill lasted four hours, beginning with a statement from the Mayor which was transmitted by radio and television. In less than 25
minutes, which was the estimated arrival time of the first tsunami wave, 12,000 residents were evacuated to seven safe areas.

The following steps were taken for preparation of the Real Time Tsunami Drill:
- Formation of a local committee for emergencies and disasters
- Research on historical tsunamis
- Tsunami disaster plan implementation
- Development of tsunami evacuation plans for schools
- Education for schools – companies – institutions
- Evacuation exercise guide
- Colombian Vice President invited

Results of the Real Scale Tsunami Drill:
- VHF local communications – OK
- Coordination with authorities – OK
- Evacuation signs in place – OK
- Community knowledge – Good, particularly amongst students
- Safe zones determined – OK
- 12,000 inhabitants in 25 minutes were evacuated to seven safe zones - walking

2.2.2 Tsunami Warning Evacuation – 15 August, 2007
On August 15, 2007, Col. Molares reported receiving a tsunami warning generated by the Peru earthquake and noted that the following response actions were undertaken:
  a. Dissemination of tsunami warning by the President over national television stations
  b. Some aspects of the Local Disaster Prevention and Response Plan were activated; the Navy sent a ship; the hospital emergency plan was implemented
  c. Evacuation of 75% of the population at night and during rainfall to previously defined safe zones
  d. The people were calm, no damages or robberies were reported.

Problems identified:
  a. No local emergency authority provided warning of the tsunami, the PTWC was the only source of information, along with the President’s communication.
  b. No communication between regional scientific authorities (Ecuador-Peru-Chile)
  c. The Local Prevention and Response Committee was not convened
  d. The technical commission did not have the tools to counteract the alarm before it was disseminated.
  e. Although the population evacuated to the identified safe zones, it was not done according to plan (by car, instead of by foot).
  f. Safe zones were not adequately prepared for receiving those evacuating.
  g. The telephone system failed.
  h. There were problems with the radio network; local emergency coordinators could not contact regional and national authorities.
  i. The local radio stations re-transmitted the PTWC bulletins without consulting national entities.
  j. No actual confirmation of whether or not a tsunami had occurred.
Immediate measures adopted:

- VHF radios were reconfigured
- A national tsunami warning center is being established
- A technical information package on tsunamis was provided to the media
- A protocol for tsunami warnings – based on Chilean, Ecuadorian and Peruvian protocols – is being developed.

Educational commission: disseminating the local emergency and contingency plan

- The hospital has been relocated.

2.2.3 Earthquake 9 November, 2008

On 9 November, 2008, there was another opportunity to test the system as an earthquake occurred in the vicinity of Gorgona Island, offshore of Tumaco. The following improvements were noted:

1. Radio communications systems worked well among local emergency coordinators.
2. The Local Disaster Prevention and Response Committee met in the Emergency Operation Center.
3. The media was kept well informed by the technical committee.
4. Communication was established with national entities through cell phones.

Problems identified:

- Although people were aware of the alert and were ready to evacuate, they did not evacuate.
- The telephone system failed again.

Recommendations

- National tsunami warning centers are needed to support coastal communities.
- Conduct real-time drills at least once a year and involve high-level authorities, such as the Mayor or above.
- Regional coordination and communication is critical.
- Redundant communication systems are needed for emergency authorities.
- Periodic communication systems checks should be standard.
- Regular meetings should be held with local committees.
- Established chains of communication and information need to be respected and to be provided by technical authorities.
- Public information needs to be disseminated on a regular basis.
- Evacuation centers/shelters and coordinators must be prepared and have the resources they need to receive evacuees.

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The plans need to be prepared on the basis of the “worst case scenario”, such as at night and in heavy rain.

2.4 Caribbean Sea: Tsunami & Coastal Hazards Preparation in the BVI. Sheniah Armstrong, Community Preparedness Manager, Department of Disaster Management, BRITISH VIRGIN ISLANDS

Sheniah Armstrong provided an overview of the coastal hazards to which the British Virgin Islands (BVI) are vulnerable and the current systems in place to manage these hazards. The principal threats to the British Virgin Islands are hurricanes, tropical storms, flooding, and tsunamis. The last recorded tsunami to have affected the BVI occurred on 18th November, 1867. The tsunami was caused by an earthquake along the Anegada Fault and is considered the most significant for the BVI in historic times. Since 1999, the Puerto Rico Seismic Network (PRSN) has been providing the BVI with information pertaining to earthquake and tsunami warning and in 2005/6 a Tsunami Warning Protocol was designed for use by the BVI, Puerto Rico and US Virgin Islands.

The BVI mitigates against tsunamis and other coastal hazards through the following measures:

a. The National Disaster Management Plan which is coordinated by the Department of Disaster Management (DDM) contains policies for managing all hazards including Standard Operating Procedures relevant to tsunamis.

b. The BVI operates an Early Warning System which relies on radio communication, local TV, VHF, HF, SSB as well as satellite phones and a National Siren System on all main islands.

c. The Strong Motion Sensor program provides early warning of impending natural disasters and the data is used to improve the design of earthquake resistant structures.

d. Public information and education programs are conducted to increase the level of public awareness of tsunami signs/warnings and to elicit the appropriate response to these signs/warnings.

e. Through its Community Preparedness Programme the Department reviews and
evaluates public and private sector disaster plans for all hazards including the tsunami threat and associated evacuation drills.

f. Regulations and projects related to planning and hazard mitigation have been implemented.

Future projects
- Expansion of siren and seismic network to include Cell Broadcasting and DDM web site update notification.
- Tsunami inundation maps to identify areas that require mitigation methods to prevent flooding.

3.0 KEYNOTE 2 “5 Simple Steps for Preparing for a Tsunami.” Bernardo Aliaga, UNESCO/Tsunami Unit

The 5 steps are:

1. Perform an extended research on tsunami hazard in your area: Planners need to understand the unique features of each at-risk region. To this end, the following surveys and research need to be conducted:
   - Search of historical events
   - Survey of socio-economic factors
   - Research on the effects of topography

   Topography is particularly important because tsunami damage is greatly influenced by topographical factors, such as coastal configuration (coastline and inland topography) and sea floor topography.

   By obtaining a clear understanding of the extent and causes of life and property damage of past earthquakes and tsunamis, we are able to develop a profile of the largest historical earthquake. This not only helps to design a theoretical tsunami, but also permits us to assess potential damage to coastal areas.

   New scientific research and updated land surveys, as well as the latest seismic information on earthquake-free areas and earthquake periodicity should be also included when developing the risk profile of a given area. Catalogs for Central and South America as well as for the Caribbean are already available.

   Planners will carefully consult surveys, reports and historical records in local archives to develop accurate profiles of past earthquakes and tsunamis. Such archives often describe the reconstruction efforts following earthquakes and tsunamis. From these records, we can learn much about the features and extent of damage caused by a tsunami, including through direct interviews with historians and witnesses. For less frequent tsunamis planners should bear in mind that historical details may often be more legendary in nature and not always so reliable.
2. **Define your worst case:** From relevant data obtained for the largest past tsunami (as identified by relatively precise high water marks or geological evidence). Estimating highest water levels is as necessary as an accompanying estimated arrival time of the tsunami. Arrival time is determined by the distance between the wave source and the coastline in question. This arrival time serves to define the an evacuation time for people, ships and boats.

If science and technology are available then modeling the worst case will provide detailed information for planning. It is worth noting that the largest earthquake does not necessarily generate the largest tsunami; even a relatively small magnitude earthquake can provoke a tsunami. Therefore, evaluations of an earthquake’s epicenter, scale, depth and location, energy direction and displacement of fault motion are used in designing a theoretical tsunami.

3. **Estimation of possible damages:** In order to protect life and property from the damage caused by a theoretical tsunami, the type and scale of potential damage must be estimated. This estimate is derived from evaluations of damage caused by past tsunamis, along with current land use, population, and agglomeration of buildings and industries in the at-risk community. These factors are then compared to the estimate of a theoretical tsunami’s inundation (calculated from the numerical analysis of approximate water height) and existing shore protection structures, the results of which can precisely indicate the extent of danger. This step enables planers to:

   a. Define vulnerable zones
   b. Calculate extent of floodable areas
   c. Calculate the number of people affected

4. **Early Warning System:** Once the basic survey, research and damage estimate have been carried out, the vulnerability of the targeted area can be assessed. Two basic protective measures that should be given consideration by planners are:

   1. Urban planning considering tsunami mitigation and preparedness; and
   2. An organizational system for dealing with tsunami response (to save lives)

Based on weaknesses found in these two areas, disaster managers will be able to determine and assess problem areas needing attention: Implementing a tsunami preparedness plan should form just one part of a local authority’s overall hazard mitigation plan.

An Early Warning System is by far more than the upstream part that consists of observing and monitoring networks and communication technologies. A critical part of any warning system is the readiness of the population to react and that is essentially an organizational problem that is in the hands of disaster management planners. An Early Warning System will consider communication mechanisms to receive warnings from the 24/7 National Early Warning Center. Most of tools and mechanisms for disaster response
to other natural coastal hazards (storm surges, tropical cyclones) are useful for tsunami but the timing of the response is much tighter. Drills and evacuation exercises are essential at all levels (from table top exercises to real scale evacuation) and should be used as an essential tool for tsunami.

5. Develop a Mitigation Plan: the last step is the one that would summarize several of the initiatives taken above and develop these in the mid-long term. A Mitigation Plan which includes:
   a. EWS
   b. Emergency system
   c. Simulations
   d. Urban Planning
   e. Investment Plan
   f. Structural and non-structural (education) mitigation measures

4.0 EXPERIENCES #2

4.1 Indian Ocean: Tsunami & coastal hazards warning system in the Indian Ocean - Sri Lanka and Indonesia. Dr. Juan Carlos Villagran, Institute for Environment and Human Security, UN University (UNU-EHS), Bonn, GERMANY.

This was a continuation of Dr. Villagran’s previous presentation. He noted that a tsunami affects Indonesia on an average of every five years. Following on from the points made in the earlier presentation, he stated that it is important to note the following:

1. The forecast depends on the direction of the wave, as well as land characteristics
2. Warning: designation of the institution responsible for giving the warning.
3. Anticipated response: develop response plans that include evacuation, search, rescue, appropriate shelters, among other aspects.

It is essential to inform when, how, and what to include in the warning message, so that it can be clearly understood by recipients and they will be able to comply with directions.
4.2 Central America: Tsunami disaster prevention measures for Masachapa, Nicaragua, María del Socorro Orozco, NICARAGUA.

María del Socorro Orozco reported that this project was implemented by the Nicaraguan Red Cross, the Nicaraguan Institute for Territorial Studies (INETER) and the Ministry of Education, the Municipality of San Rafael del Sur, and was financed by the Swiss Development Cooperation (SDC/COSUDE). It also involves the Ministries of Tourism and Health, the local police and civil defense committee, in addition to Hotel Montelimar, a private resort operated by Barcelo.

The principal hazards in Nicaragua, as is well known, are volcanic eruptions, earthquakes, landslides and hydrometeorological events. From 1500–2002 there have been 49 reported tsunamis in Central America. Of these, five affected Nicaragua, the most significant being in 1992, which caused 172 deaths. The community of San Rafael del Sur, located on Nicaragua’s Pacific coast and near the Coco Plate, is primarily dedicated to fishing and tourism. The area was severely affected by the 1992 tsunami, with wave heights between 6 – 8 meters high. Sixteen people lost their lives. In order to deal with fading memories of that time, and the scanty knowledge of tsunamis, a project was developed to strengthen local community knowledge and preparedness, provide training in disaster management, and develop an early warning system.

This project had the following objectives:
1. To strengthen the capacity of self-protection of the area’s inhabitants and visiting tourists through training and sensitization.
2. To disseminate information through mass communication for the public at large.
3. To assist the municipal government of San Rafael del Sur to regulate growth in tsunami prone areas.

Achievements during the 2006-2008 implementation period were:
- Linkage between national and local warning systems.
- Information produced for the community and tourists.
- Strengthening of community organizations
- Development of local hazard and evacuation maps
- Identification and signage of evacuation routes.
- Training for the community, including local authorities and natural leaders, within local schools, implementation of evacuation drills with pupils and teachers, and tests of the warning system.
Three similar projects are currently in progress, involving collaboration between the Nicaraguan National Disaster Prevention System (SINAPRED), German Development Cooperation and the Red Cross. Other projects are in development for both Pacific and Atlantic Coast communities.

Emilio Talavera, of INETER, described the relationship between the community-based system and the national monitoring system, which is housed at INETER. Nicaragua joined the Pacific Tsunami Warning System in 1995 and began the construction of its National Tsunami Warning System in 1996. Nicaragua has also consistently supported the development of a Regional Tsunami Warning System, which is still under discussion with the other members of CEPREDENAC. Mr. Talavera described the various components of the Nicaraguan system, from the provision of warning information, to communications systems and the interaction with local authorities. In terms of hazard mapping, a project funded by the Japan International Cooperation Agency developed mapping on a scale of 1:50,000, and in 2007, INETER developed detailed maps of 1:5000 based on high resolution Digital Elevation Models (DEMs), as well as participative mapping of evacuation routes.

Other achievements of the Nicaraguan system to date include:
- EWS in Masachapa (including sirens and radios) – the first of its kind in Nicaragua.
- Wireless communication system for monitoring and warning.
- Improvement of the monitoring system, including the installation of sea gauges and seismic stations (with digital accelograph).

4.3 Caribbean Sea: Caribbean Disaster Management Project: The Barbados Experience. Judy Thomas, Director, Department of Emergency Management (DEM), BARBADOS

Judy Thomas summarized the strategy, methodology and results of the Caribbean Disaster Management project (CADM) which had been implemented in three Caribbean communities (one each in St. Vincent, Trinidad & Tobago and Barbados). Her presentation focused on the community of Speighstown, Barbados, where a community-based flood management project had been conducted. The project involved collaboration among agencies at international, regional and national levels.

Project activities/outcomes:
- Flood Hazard Mapping - Preparation of flood hazard maps and a manual for Speighstown as well as creation of the Geographical Information Systems database.
Community Disaster Management - Assessment of the current status of Community Disaster Management (CDM) and preparation of CDM plans incorporating the hazard maps prepared by the model project. A Community Disaster Management Plan was also developed for Speightstown.

Information – Provision of hardware and reinforcement of the database and communication network.

Training – Delivery of training courses on hazard mapping and community disaster management planning for groups at the national and community level.

The following lessons were learned:

- Stakeholder collaboration at the community, national and regional level is key.
- Government support is instrumental for project implementation and sustainability.
- Building and enhancing capacity can effectively mitigate hazard impacts.
- Similar initiatives can be replicated at other sites.
- Such an initiative is an example of the Comprehensive Disaster Management Strategy in action.

**Future Activities**

- Develop scientific information to inform planning
- Develop the warning component of the Early Warning System
- Develop a school awareness program
- Develop a multi-media program using modern technology
- Create signage at the community-based level

**5.0 Questions and Commentary From Day 1**

**5.1 Lorna Inniss:** While not a disaster expert, she was struck by the number of documents regarding evacuation and emergency plans, among others. She recommended producing a list of plans/documents by the end of the workshop that would be useful for those who are putting together a national plan.
She further stated that participants should be working with politicians from the beginning, in order to get their support for these kinds of projects (tsunami, coastal hazards), which are very important because of the scope of potential loss of life and property.

5.2 **Julie Leonard**: She asked the presenters what types of obstacles had they encountered in implementing their plans.

*(1) Barbados Response:*
- It took 6 months to effectively involve some actors, particularly the scientific community and to incorporate the systems that they use.
- It also took a long time for signing agreements among agencies.

*(2) Sri Lanka Response*
- The country did not have a disaster management agency, so the UNDP had to help create this institution. That process took about a year.
- Another obstacle was/is the different local languages. Using translators meant a loss of credibility at the local level.
- Lack of human resource preparedness/capacity.

In terms of public awareness and information campaigns, this should be an essential part of any project.

5.3 **Julie Leonard summarized key points from the day as follows:**

- The protocols that were presented in flow chart form must pass through a process (agreement among stakeholders) with clear roles and responsibilities assigned.

- These processes must bring stakeholder organizations together regardless of staff rotations or changes at the political level.

- Identifying a champion has been very useful for moving preparedness and mitigation aspects forward.

- Participants should identify and build on already existing structures within their countries.

- Participants should work directly with the community when conducting research that will inform the development of tsunami warning plans in order to mesh science with community experiences. In this way the community will feel consulted and informed about what is being developed.

- Exchanges of this sort (workshop) are important because of the widespread impact of tsunamis.
• Strengthening of human resource capacity and public awareness needs to be included in all projects.

5.4 Participant Feedback from Day 1

Participants were asked to provide feedback on what they considered to be the most important points they had learned from the day. Main points included:

- The need to document concrete experiences (case studies) including local involvement.
- The need to build a network of TWS operators in Caribbean countries.
- Participants enquired whether the findings on Coastal Hazards/Tsunamis could be applied to large lakes or even hydrodams as they too have the potential to form a large wave.
- More information on different types of warning systems from the low-tech to the hi-tech is needed.
- Information on where and how systems and equipment can be procured is needed.
- There is a need for more technical details on the composition of a Tsunami EWS: cost of installation; trouble shooting / training manuals, role of different people in the EWS, procedures etc. This should be in a simplified format.
- The importance of education, not just for coastal communities but for the general public as well, was underscored. Participants agreed that they needed more information on current public education programs for coastal communities and others, tools used, what works, what does not work, particularly for the formal educational system.
- More information on conducting a successful evacuation, particularly guidance on how to do this at night is needed.
- In developing tsunami preparedness plans it is important to consider language, customs and culture of the particular community.
- Warning dissemination and protocols are needed
- It is critical to overcome the common place and engage in more interdisciplinary and inter-institutional dialogue and detailed vulnerability assessments.
- It is important to educate the national political system, including the bureaucracy in order, to get more support for an EWS.
- It was useful that many of the practices were presented in a step-wise format so that they could be more easily understood and replicated. These included the ISDR checklist and the IOC presentations.

- Participants agreed that evacuation maps should be prepared and vulnerable areas identified.

- The presentation on the British Virgin Island’s SOP for tsunamis was very helpful.

- In the event of a tsunami the following specific issues would be very relevant:
  1. Telephone communications tend to become fully congested
  2. Religious/cultural beliefs influence behavior and response

-Tsunami and coastal risk EWS proposals should be organized and conceived as complementary to other risk issues such as climate change and river basin floods.

- Puerto Rico’s practice of including tsunami warnings in its educational materials as part of the TsunamiReady program was insightful.

- Vulnerable groups should be identified.

- It is important to educate the public on “false alarms” and useful to discuss how these can be managed

DAY 2 – 12 AUGUST

6.0 EXPERIENCES #3

6.1 Caribbean Sea: Preparedness work done in Saint Lucia, and looking at how this can be expanded to include the Tsunami hazard. Dawn French, Director, National Emergency Management Organisation, SAINT LUCIA.

Dawn French provided a comprehensive overview of the disaster management system in Saint Lucia, an island which is vulnerable to a multitude of hazards. Since 2000, a law has been in effect in Saint Lucia to conduct evacuations and there are plans underway for inclusion of these hazards in the educational sector (according to Education Act. 41 from 1999). The plans, policies, guidelines and SOPs for Saint Lucia are supported by an operational framework that includes all aspects of the society as well as national and local agencies/persons.

Dawn French,
NEMO

Services that are offered to the community include:
1. Informational bulletins sent by e-mail.
2. A dedicated telephone line (24/7) providing information in English and Creole.
3. Information products for mass media (radio, television).

Although there is no specific tsunami plan, there are contingency plans for other events and the NEMO is seeking to incorporate tsunamis into its national disaster management plan. Saint Lucia has organized national and municipal committees that update its emergency plans every year.

Large earthquakes happen about every 54 years; the most recent— at the time of writing — occurred on 29 November, 2007 (near Martinique) at a magnitude of 7.3. Saint Lucia is a volcanic island, and therefore is vulnerable to tsunamis. Up until 2004, there was little public educational material on tsunamis, but since then the NEMO has incorporated tsunamis into its public information program a component of which is to distribute as much information material as possible throughout the island.

Next steps:
- Create communication strategy
- Provide information by cellular phone, television and radio
- Obtain economic support to generate database, maps, information products, etc.

6.2 Central America: National Oceanographic Service (NOS) of the National Territorial Studies Service of the Ministry of the Environment and Natural Resources of El Salvador. Jennifer Larreynaga, Servicio Nacional de Estudio Territoriales (SNET), EL SALVADOR

El Salvador experienced five tsunami events between 1859 – 1992. In 2006, SNET undertook the formation of The National Oceanographic Service (NOS), in response to:

1. The events in coastal areas including extreme wave events, storm surges and the experience of neighboring countries that suffered tsunami impacts, such as Nicaragua in 1992.
2. The Central America Tsunami Warning Program, a regional commitment made in 2003 by the members of CEPREDENAC to implement a TWS.
3. The need to provide information about oceanographic events to economically strategic activities such as ports and hotels located in coastal areas.

The NOS was inaugurated in May, 2008. It has two basic units: the Marine Meteorology Unit and the Marine Geology Unit. The main objective of the project is to contribute to the prevention of coastal hazards.
In order to process and provide information to the institutions mandated to provide rescue services (for example, civil protection), the program has developed a multi-phase protocol for both distant and close geological and hydrometeorological events:

1. Permanent monitoring of seismic events.
2. Pre-advisory for events from $6.5 < M < 7.5$ that might generate a tsunami in the Pacific.
3. Advisory for events from $7.5 < M < 7.9$ indicating a risk that a tsunami could affect the coast of Central America.
4. Watch for events greater than $7.9$ M indicating an elevated risk that a tsunami could affect the coast of El Salvador.
5. Warning of imminent danger of a tsunami affecting El Salvador.

The NOS has access to the sea level stations as well as meteorological and geologic stations from which reports are received every hour. Current activities of the NOS are: processing and study of existing oceanographic information; generation of oceanographic information; coordination between meteorology and geology to improve forecasting of events such as storm surge and tsunamis; development of professionals in oceanography. All products are available on the NOS web-site.

Future challenges for the NOS:
- Implementation of a national training program on tsunamis
- Development and implementation of a TWS.

### 6.3 Caribbean Sea: The St. Vincent and the Grenadines Experience

Howie Prince, National Disaster Coordinator, National Emergency Management Organization (NEMO). ST. VINCENT

Howie Prince provided an overview of the hazards to which St. Vincent and the Grenadines are vulnerable and the strategies and programs in place to mitigate the effects of these hazards. There has not been any significant tsunamis in the history of this group of islands, but St. Vincent and the Grenadines has been impacted by earthquakes, volcanic eruptions, hurricanes, storm surge and sea level rise due to climate change. Mr. Prince provided details on the current disaster management system and indicated where the system could be adapted to include the tsunami hazard.
Strategies and Programs:
* Disaster Risk Reduction Initiatives are rolled out from the Comprehensive Disaster Management Strategy for the Caribbean. Activities include a vulnerability assessment and mapping of major trading areas.
  - Structural Mitigational works to protect exposed infrastructure along the coast.
  - Community Mobilisation and Preparedness Program. This includes hazard and risk mapping at the community level, the establishment of Community Disaster Management Groups, training for communities, public education and project development.
  - Investment in scientific monitoring and forecasting including upgrading of the seismic monitoring network, establishment of Emergency Broadcast Protocol, a national network of HF radios and the addition of DataFM Emergency Alert Radios

Challenges
- Data availability and collection. Lack of synchronization of data collection, storage and distribution methods.
- The culture is such that people often return to live in dangerous areas after being evacuated.
- Lack of documentation of past successes and initiatives.
- Participation of political personages
- Most FM radio stations are automated from midnight to early morning...

6.4 Caribbean Sea: Media Relations in Education & Outreach Programmes. Stacey Edwards, Education Officer Seismic Research Centre, The University of the West Indies. TRINIDAD & TOBAGO

Stacey Edwards shared the Seismic Research Centre’s (SRC) experience with managing media relations. Primarily a scientific agency, the SRC is the official agency for providing information on earthquakes, volcanoes, and tsunamis for the English-speaking islands of the Eastern Caribbean. Although the Centre has been involved in public education informally since its inception in 1952, in recent years it has adopted a more strategic approach to education and outreach activities including management of its relationship with the media.

Challenges
Keeping the public educated on geo-hazards poses several challenges due to:
- Lack of awareness on geologic hazards.
• Miscommunication between scientists and the public due to overuse of technical terms and descriptions.
• Long periods between geologic events means that people often forget the impact of geo-hazards (earthquakes, tsunamis) or may not perceive them as a real threat since they occur relatively infrequently.

Strategies used for dissemination of information:
• The SRC supports the National Disaster Organisations in the region with their respective public education campaigns through development of information resources.
• Lectures – students, public, special interest groups
• Onsite visits to the SRC
• Information material
• Workshops – teachers
• Website
• Media – print and electronic

How is the media used as a channel for communication?
The SRC gives the largest quantity of information available to the media, especially that which they are interested in receiving. Written material is provided if available. The information which goes to the media needs to be accurate, relevant and should be easily accessible. To support this strategy the Centre has recruited an information specialist who fosters relationships with trusted journalists and ensures that information is clear and arrives in an understandable format to the target audience.

The results so far:
• Larger number of bulletins appearing in the media
• Broader public knowledge of the Centre and its staff which increases credibility of the Centre and fosters public trust.

Lastly, it is essential to use the appropriate media to be successful in the transmission of information, and if the media is used in a strategic fashion, we can do more than communicate, we can educate.

6.5 Central America: Tsunamis in Costa Rica: Research and Education. Carlos Ramírez, University of Costa Rica, School of Geology. COSTA RICA.

Workshop Report: Best Practice on Tsunami and Coastal Hazards Community Preparedness and Readiness in Central America and the Caribbean
This presentation focused on using scientific research as a base for developing educational and preparedness programs for the school system in communities with high exposure to tsunamis in Costa Rica.

The School of Geology has made a multi-million dollar investment in testing to measure the potential damages to Costa Rica in the event of an earthquake or tsunami, using the last 15 years as a baseline. The University is currently working on a project in the municipality of Puntarenas (Pacific Coast) with the support of the National Emergency Commission (CNE), the Seismological Network, the Japanese International Cooperation Agency (JICA), the Ministry of Education and local municipalities (San Jose and Puntarenas).

The project addresses the lack of sufficient information and understanding among teachers and students (and their families) regarding the threat of tsunamis in Puntarenas. It was implemented in 37 educational centers and high schools in Puntarenas in collaboration with the local emergency committees and the regional office of the Ministry of Public Education. The project beneficiaries (as of 2007) were 235 teachers and staff; 4500 students; and 22,500 family members.

The project’s objectives were to:
- Promote knowledge and information about the tsunami threat and how to respond in the case of a tsunami.
- Develop educational materials for teachers and students.
- Evaluate the perception of tsunami threat among teachers and students before and after an event.

Results obtained:
- Educational materials, including teacher and student guides, have been prepared and distributed.
- Educational and public outreach materials were developed for the community and family level, building on local knowledge and memory of tsunamis.
- Evacuation routes and signage were developed.
- Training for teaching staff was developed and implemented.

Lessons learned:
- Project implementation coincided with the 2007 Peru earthquake and tsunami, which provided project participants with an opportunity to apply their knowledge in real time.
- Dynamic methodology (educational material, audiovisual aids and teacher-student creativity, games) is supported by the Ministry of Education and scientific
professionals and allows for replication to other tsunami vulnerable zones of the country.

- The project is focused on imparting basic concepts and information, and should be followed by a program of community-based preparedness and prevention.
- Inter-institutional coordination (Ministry of Education, teaching staff, CNE and local committees, etc) strengthened the project and learning process. This coordination was sustained in all phases of the project from developing implementation methodology, to the transfer of information to teachers, students and family.

### 6.6 Indian Ocean: Rapid Assessment of Potential Impacts of a Tsunami: Lessons learned from the Port of Galle, Sri Lanka. Juan Carlos Villagrán, University of Bonn, Germany,

It is important to define tsunamis and to calculate the distance of sea level from land. With this information authorities can develop scenarios for the damages that a tsunami could cause when it arrives along the coast.

It is also critical to be able to deduce the impact that a tsunami could have on all sectors - education, economic, agriculture etc. This has to be taken into account in emergency planning.

Additionally, we need to take into account the type of structures that are present in the area. For example, we need to know the number of floors that buildings have in order to determine the possible impact and damages that a tsunami could produce as well as to be able to reduce the number of injuries and deaths.
7.0 Working Groups
Two working groups were formed to consider: 1) The necessary components and support for EWS and 2) effective coordination between the scientific community and local community practitioners.

7.1 Group 1 was asked to look at what is needed for the proper functioning of an early warning system for the Caribbean and Central America:

- What has worked well from the case studies?
- Who needs to be involved and how?
- Appropriate protocols and procedures
- What needs to happen to get the warnings down to the “last mile”?
- What capacities and synergies already exist at country levels that can be further developed?

Group 1 Report out:
What has worked well from case studies:
- Knowledge of all hazards specific to each country:
  - Enhancement of observation systems
  - People centered research agendas or scientific communities
  - Proper identification of the threat
- Public Awareness and Outreach Campaigns:
  - Education campaigns
  - Targeting school-aged children
  - Training for community groups (social clubs, religious organizations, etc.)
  - Town meetings between scientists and communities
  - Use of existing community structures
- Identification of people who are involved, their roles and responsibilities.
- Identification of traditional communication systems as well as ICT’s and redundancies.
- Use of traditional knowledge to explain past historical occurrences and influence the planning process or mitigation measures for future adequate management.
- Community-based people empowerment and participation.
- Make information easily available to the general public as well as other institutions.

Who needs to be involved:
- Political will and buy-in is critical
- Continuous international support and collaboration in hazard prevention and reduction projects, supported by UNESCO, ISDR, UNDP, USAID, DIFD, etc.
- Community-based organizations
- Functional national emergency management systems
  - Improve awareness and knowledge through drills, simulations etc.
- Institutionalize people-centered warnings through:
  - Teachers, students, formal institutionalization of the process as part of the educational material
  - Formal agreements between regional partners for the implementation of critical systems with support and follow-up
What capacities and synergies already exist:
- CDERA/CEPREDENAC/CAPRADE: regional knowledge base and support for member states
- ICG initiative to mitigate against the tsunami threat
- SRC’s/CASC/CAPRADE research and monitoring for Latin America and the Caribbean
- At the national levels there are:
  - Local government systems, Non-Government Organizations, Faith Based Organizations, Community Based Organizations e.g. social clubs
  - National technical research institutions
  - National response mechanism
  - Increased inter-sectoral and inter-institutional dialogue

What is needed:
- There is a need for regional support so that there can be a unification of systems
- Technical expertise to compile baseline studies.
  - Proper documentation of past hazard occurrences to allow for proper best practices.
  - There is a need for greater inter-sectoral and inter-institutional dialogue.
- Monetary support is needed to finance critical preventative projects
- Instruments, educational systems etc.
- Political commitment and formal agreements for the continuation of critical national policies.
- Strengthened or enhance communication between the scientific community, non-scientific institutions and the public.
- There is a gap between the tsunami alert and the warning therefore there should be formalized protocols and standard operating procedures at the national, regional and community levels to address these gaps.
- 24/7 centers at the national level available to deal with emergencies which occur outside the regular working hours.

7.2 Group 2 was asked to look at the communication between scientists and community practitioners, particularly relating to the development and use of scenarios and communicating risk:
- How well do science and community practitioners work together and how can this relationship be improved?
- What is the most effective way to communicate risk to the community?
- What capacities and synergies already exist at country levels upon which tsunami warnings can be built?

Challenges
- Difficulty in exchanging information between scientific agencies, especially in Latin America where there are more monitoring agencies than the Caribbean.
• Some agencies only conduct research that may not be applied to warning centers in a timely fashion which means that there may not be sufficient scientific information that can be accessed by community practitioners.

• There is need for a wider pool of people to communicate between scientists and the community particularly in rural, remote and/or low-education communities.

• Over-use of technical terms by scientists often creates a communication barrier between scientists and community practitioners. A glossary of technical terms is needed together with education on these terms.

• Information on tsunamis particularly related to the Caribbean/Latin America is not concentrated in one accessible repository which is a challenge for both scientists and community practitioners.

• Several issues exist within the telecommunications industry including differences of connectivity and licensing for software.

• Technology is often not user-friendly and cannot be transferred easily across regions.

Table 1: Available human resources to support the development of warning systems for tsunamis and other coastal hazards

<table>
<thead>
<tr>
<th>SCIENTISTS</th>
<th>PRACTITIONERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seismologists</td>
<td>Disaster managers</td>
</tr>
<tr>
<td>Hydrologists</td>
<td>Media</td>
</tr>
<tr>
<td>Oceanographers</td>
<td>Community leaders</td>
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<tr>
<td></td>
<td>• Religious</td>
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<tr>
<td></td>
<td>• Political</td>
</tr>
<tr>
<td></td>
<td>• Indigenous leaders</td>
</tr>
<tr>
<td>Geologists</td>
<td>Institutional memories – researchers</td>
</tr>
<tr>
<td>GIS specialists</td>
<td>NGOs</td>
</tr>
<tr>
<td>IT specialists</td>
<td>Communication specialists</td>
</tr>
<tr>
<td>Civil engineers</td>
<td>Educational institutions</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Volunteers</td>
</tr>
<tr>
<td>experts</td>
<td></td>
</tr>
<tr>
<td>Meteorologists</td>
<td>Military</td>
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<td></td>
<td>Health services</td>
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<td></td>
<td>Public transport</td>
</tr>
<tr>
<td></td>
<td>Tourism agencies</td>
</tr>
</tbody>
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DAY 3 - 13 AUGUST

8.0 THE ROLE OF REGIONAL INSTITUTIONS IN SUPPORTING COMMUNITY PREPAREDNESS

8.1 David Smith and Eric Chichaco - Center for the Prevention of Natural Disasters in Central America (CEPREDENAC)

A short history of tsunamis affecting Pacific and Caribbean coasts of Central America was presented. In some countries such as El Salvador and Costa Rica, tsunami events have occurred more than three times in the last 100 years.
Central America is highly vulnerable due to the number of fault lines in and around the region and the number of seismic events.

In 1998, INETER proposed the development of an early warning system for Central America but plans did not advance until a February 2005 meeting of CEPREDENAC representatives endorsed the creation of a regional system. Nonetheless, in 2001, INETER proposed a framework protocol for a Tsunami Warning System for Nicaragua’s National Disaster Prevention System (SINAPRED), which is triggered by earthquakes above 7.0 magnitude on the Richter scale. In this case, an automatic warning is sent immediately to both the Civil Defense and Radio Nicaragua.

A regional study was initiated in 1997 to obtain information for seismic data bases. Currently, there are many national institutions involved in similar studies in all Central American countries. Other goals that have been reached:

- Regional seismic catalogue spanning 1522 - 2007
- Definition of regional and national seismic zonification
- Regional hazard maps going back 2,500 years (focusing on coastal zones).

Professor Chichaco also made a presentation regarding Panama’s Institute of Geo-Sciences, which is the focal point for tsunami warning for Panama. Panama’s seismological network is still relatively new, with stations installed in David, Penonome and Colon in 1986 through the support of the Inter-American Development Bank (IDB). Additional telemetry stations were installed throughout the 1990’s. Professor Chichaco also reviewed the tsunami history affecting both Pacific and Caribbean coasts with documented tsunami events between 1621 – 1991.
8.2 Bernardo Aliaga - UNESCO/ TSUNAMI UNIT

UNESCO along with its team, national platforms and others, offers a link between science and application. When governments want to use scientific information to apply to their country, this is where UNESCO enters into action, providing information about tsunamis and other adverse events. The organization offers courses, seminars and research along with subject matter specialists, in addition to the support of colleagues that make up this network.

8.3 Julie Leonard – USAID/Office of US Foreign Disaster Assistance (USAID/OFDA)

OFDA works in response, preparedness and risk reduction activities around the world. OFDA’s regional office is located in San Jose, Costa Rica and has over 20 consultants working throughout Latin America and the Caribbean. OFDA supports risk reduction activities through technical assistance and training to national counterpart agencies working in disaster risk management, as well as through grants to implementing agencies, such as NGOs and regional organizations.

8.4 Alison Brome - Caribbean Disaster Emergency Response Agency\(^1\) (CDERA)

Based in Barbados, CDERA is responsible for responding to emergencies and disasters in Participating States in the English-speaking Caribbean, as well as Haiti. CDERA was established in 1991 and has 16 members. Currently CDERA is moving towards a more comprehensive role in disaster management, as well as joint implementation with other regional, international and national agencies. CDERA’s principal objective is to support the development of local and national capacities of Participating States so that they are less dependent on external support and more capable of responding to their own emergencies.

8.5 Xavier Castellano - International Federation of Red Cross and Red Crescent (IFRC); Panama Regional Office

The permanent challenge of the Red Cross at the international level is to support capacity development of national societies. One of the IFRC’s principal activities is to develop national response teams and to organize local community groups. They also seek to involve civil society, government, international organizations, etc, in support of their work at the community level. Some examples of their activities are:

- Climate change preparation/adaptation in 5 countries;
- Vulnerability and Capacity Assessments in 20 countries;
- Community disaster response teams in 15 countries;
- Disaster Assessment teams in 35 countries;
- Response and contingency plans in 35 countries;
- National Response teams in 25 countries;
- Community early warning systems in 5 countries.

\(^{1}\) Currently Caribbean Disaster Emergency Management Agency (CDEMA)

Workshop Report: Best Practice on Tsunami and Coastal Hazards Community Preparedness and Readiness in Central America and the Caribbean
The University of Peace offers a Master’s Degree Program in a number of areas, including Environmental Security, out of which grew the idea of offering a course in risk reduction. With the support of ISDR, the first course was offered in early 2008. The objectives of the course are to:

- Strengthen capacity in the area of vulnerability
- Analyze the capacity of communities for disaster risk management.

In the first course there were participants from Central America and the Caribbean. Some of the themes that were covered in this course were:

- The nature of risk
- Vulnerable groups
- Hyogo Framework
- Monitoring
- Skills for conducting educational workshops

Activities are interactive, and include lectures, tutorials, seminars and field visits.

9.0 Final Working Group Session

To improve the implementation of tsunami warning systems and risk reduction the following aspects need to be highlighted:

- Interaction with and involvement of the private sector and government institutions.
- Continuous training in risk reduction.
- Implementation of legislation and inter-government agreements
- Identification of vulnerable communities
- Technical support for government offices
- Creation of a warning center for the Caribbean, similar to the Pacific Tsunami Warning Center in Hawaii.
Julio Garcia - (EIRD)

→ Foster training programs in community-based preparedness.

→ Facilitate the transfer of technology as well as the follow-up with governments and academic institutions that can help to make human-centered early warning systems a reality.

→ Provide good information materials and examples on public awareness, work with media, and more.

How Can We Do Better
Providing support for a Multi-hazards Approach
Group One
Presented by
Alison Brome

Outline
• Public/Private Partnerships
• Hazard Related Training
• Corporate Responsibility
• Implementing Legislations
• Identification of Historical Events
• Sectoral Planning
• Identify Specific Needs and Concerns for particular community groups
• Technical Support from local Disaster Offices

Support for a Multi-hazard Approach
• Public/Private Partnerships
  • Community involvement in hazard response and mitigation activities.
  • Respected and Trusted Media Relationships
• Hazard Related Training
  • In-house training for Agency Staff
  • Engagement of local emergency management agencies to be involved and have support within local agencies/organization through workshops
• Corporate Responsibility
  • Public sector sponsorship of public awareness campaigns e.g signage for evacuation routes
  • Budget cycle of Corporate Private Agencies
  • Equal opportunity training segments for private citizens and public officials via private sector funding particularly if the hazard directly impacts the private sector.
  • Corporate Internship and volunteer programs for staff

Workshop Report: Best Practice on Tsunami and Coastal Hazards Community Preparedness and Readiness in Central America and the Caribbean
• Implementing Legislation
  • Transferring informal agreements into legislation e.g. Disaster Management Legislation in CDERA member states.

• Identification of Historical Events
  • Documenting Community knowledge to better understand country vulnerabilities
  • Universities and Institutional knowledge base

Support for a Multi-hazard Approach
• Sectoral Planning
  • Tourism
  • Manufacturing
  • Agriculture
  • Education
    • Student Internship programmes

• Identify Specific Needs and Concern for particular community groups
  • Community Groups
  • Faith-based Organizations
  • Non-Government Organisation

• Technical Support from local Disaster Offices

9.1 Recommendations for Member States and Coastal Communities
• Additional information is required from oceanographers on sea level monitoring and bathymetry.
• Greater attention needs to be paid to specifications and designs for the telecommunication aspect of an EWS. More meaningful engagement of telecommunication carriers is needed.
• Greater exchange of information is needed among seismic networks especially within Central America.
• Conduct risk assessments or scenario assessments in case of tsunamis so that this information may be shared as an example with other countries.
• Conduct training for regional scientists on tsunami research, management, techniques, creation of tsunami centers, modeling etc. Important that this training be conducted in the region i.e. Latin America/Caribbean.
• Inclusion of social scientists is important – anthropologists, psychologists etc. - so as to provide advice on how to change behavior e.g. getting people to evacuate even if there is a low perception of tsunami threat.
• Conduct training programs for practitioners on effective communication and education/outreach strategies and tools.
• Students should be the primary target group for public education programs on low frequency high impact events like tsunamis.
• In developing educational modules it is useful to include assignments that involve students working with their families so that information is transferred to adults.
• Tsunami education should be included within earthquake awareness activities since earthquakes occur more frequently than tsunamis.
• Implement a “National Tsunami Day” to maintain consistent awareness on tsunamis.