EARLY WARNING SYTEMS IN THE AMERICAN HEMISPHERE

Context, Current Status, and Future Trends.

Juan Carlos Villagrán de León,
John Scott
Camilo Cárdenas
Stacey Thompson

FOREWORD

In the spring of the year 2003, the International Strategy for Disaster Reduction (ISDR) convoked the nations of the various continents to share their experiences in relation to early warning. Following this proposal, the regional office of ISDR in Costa Rica, the Association of Caribbean States, (AEC), the Center for Disaster Prevention of Central America, (CEPREDENAC), the United Nations Development Program regional office in Panama, as well as, and the German Technical Cooperation Agency combined their efforts to carry out the Hemispheric Consultation of Early Warning.

The Consultation, the first event of this nature in the hemisphere, brought together experts from many nations, providing a unique opportunity to exchange ideas, experiences, lessons learned, and critical points regarding the various early warning systems in operation throughout the hemisphere. As a result, the Consultation was able to gather information on more than 30 early warning systems in operation throughout the hemisphere, offer a forum for ample discussions among personnel from technical and scientific institutions, personnel from civil defense or civil protection agencies, local authorities, as well as members from communities in which these systems are being operated.

This report, prepared for the Early Warning Conference II, which will take place in Bonn, Germany, later this year, includes the main outcomes from this consultation, as well as the Antigua Declaration which emanated from discussions held in an event that gathered 85 participants from 19 nations in the city of Antigua, Guatemala.

EARLY WARNING SYTEMS IN THE AMERICAN HEMISPHERE

INTRODUCTION

The American hemisphere, as many regions of the world, is prone to many types of natural phenomena which arise as a consequence of the dynamic nature of the planet and its atmosphere. In some cases, events of regional nature, as in the case of hurricanes, impact many countries of the Caribbean, Central and North America at once, devastating urban and rural communities, geographical areas dedicated to agriculture and farming, as well as lifelines. In other cases, regional phenomena manifest themselves individually in a single nation, something which must be understood as part of the dynamics of such regional processes such as the tectonic process, in which earthquakes, tsunamis, and volcanic eruptions are typical, as well as tropical floods due to local thunderstorms during the rainy season. Finally, there are some cases in which these phenomena manifests themselves only in a few regions of the hemisphere, such as the tornadoes in the United States, forest fires in many forests and protected areas, as well as landslides.

While Canada and the US lead the hemisphere in terms of early warning systems and disaster preparedness, the remaining countries are taking great steps along these lines, implementing early warning systems for floods, hurricanes, tsunamis, and other types of hazards, tailoring them to their needs and capacities. In a similar path, countries are advancing in terms of becoming less vulnerable to such events, creating better or more resistant structures which can withstand the force of these events. In the majority of cases, activities related to preparedness have been underway for many years, where early warning systems are essential elements to save lives.

The following table presents of short summary of the diverse nature of natural events which manifest themselves in the various regions of the hemisphere.

NATURAL PHENOMENA PRESENT IN THE HEMISPHERE

REGION	NATURAL PHENOMENA	SUB REGION
North America:	Hurricanes	Eastern coast of México and the US
	Floods	Coastal plains, flood plains
	Forest fires	Entire region
	Earthquakes	Pacific region, eastern Mexico, eastern region of the US.
	Volcanic eruptions	Pacific region
	Tsunamis	Pacific coast, Caribbean coast
	Snowstorms	Canada, Alaska, and northern US
	Landslides	Specific areas within each country
	Snow Avalanches	Mountain regions of Canada, Alaska, and Northern US
	Climate change	Entire region
	Drought	Some segments of the region
Caribbean	Hurricanes	Entire region
	Floods	Coastal plains, flood plains

	Forest fires	Entire region
	Earthquakes	Entire region
	Volcanic eruptions	Montserrat, some island volcanoes
	Lahars	Active volcanoes
	Tsunamis	Entire region
	Landslides	Mountain regions
	Climate change	Entire region
	Drought	Some segments of the region
Central America	Hurricanes	Entire region
	Floods	Coastal plains, flood plains
	Forest fires	Entire region
	Earthquakes	Entire region
	Volcanic eruptions	Pacific region
	Tsunamis	Entire region, more frequently in the pacific region
	Landslides	Mountain regions
	Lahars	Active volcanoes
	Climate change	Entire region
	Drought	Some segments of the region
South America	Floods	Coastal plains, flood plains
	Forest fires	Entire region
	Earthquakes	Pacific region
	Volcanic eruptions	Pacific region
	Lahars	Active volcanoes
	Tsunamis	Pacific region
	Landslides	Mountain regions
	Snow avalanches	Andean region, high mountains
	Climate change	Entire region
	Drought	Some segments of the region

THE CONTEXT OF EARLY WARNING

Participants in the American Hemispheric Consultation on Early Warning concluded that early warning is a process which involves three types of actors:

Scientific & Technical institutions, which are in charge of studying and monitoring natural events to provide models which can be used to forecast events in terms of intensity, time, and geographical span.

Authorities and Civil Protection Agencies, which are in charge of establishing operations frameworks related to preparedness and response in case of events.

Communities, which must understand the nature of the hazards, their possible intensities and ranges, and react according to preset guidelines provided by the civil defense institutions in conjunction with authorities.

In this context, early warning systems are then conceived as multi-sectorial, multi-institutional and multi-level structures which make use of forecasts to respond in an efficient manner in case of an event of large intensity.

One of the main goals of the Hemispheric Consultation was to gather information concerning early warning systems for multiples types of natural phenomena. To accomplish this goal the consultation gathered actors from the scientific/technical and from the social sectors, who participate in early warning systems of various kinds.

The consultation was organized in a format which encompassed two parallel tasks:

1. The request for technical and social information concerning early warning systems currently in operation in the hemisphere, which was handled through a questionnaire that was sent to experts and key personnel in institutions operating early warning systems throughout the hemisphere.

2. The execution of a seminar-type event, held in Antigua city, in Guatemala, from June 3 to 5, which gathered 85 participants and was arranged in such a way so as to provide participants with in-depth comments concerning several aspects related to early warning:

   - *Status of early warning systems operated throughout the hemisphere*
   - *Scientific, technical, and social advances and limitations related to the various early warning systems in operation at this time*
   - *Spin-offs and future trends in early warning*
   - *Current needs at the national and regional levels related to early warning.*

While the questionnaire targeted aspects related to the implementation and routine operation of EWSs, the seminar focused on issues related to the social aspects of the systems, critical aspects concerning functionality and recommendations on how to proceed. The integration of both tasks provided information concerning the types of early warning systems operated in the hemisphere+, current trends and needs concerning early warning, as well as recommendations at national and regional levels concerning such systems.

As expected, the event brought together actors from the scientific/technical communities, as well as from the social sectors, including local authorities, civil defense personnel, as well as representatives from various regional agencies including the Caribbean Disaster Emergency Response Agency, (CDERA), the Center for Disaster Prevention of Central America, (CEPREDENAC), the Federation of Municipalities of the Central American Isthmus, (FEMICA), the Global Fire Monitoring Center, (GFMC), as well as from various international Non-Government Organizations such as the Red Cross, and international agencies such as the Pan American Health Organization (PAHO), the Organization of American States (OAS), and the Association of Caribbean States, (AEC), and the United Nations Development Program, (UNDP).

CURRENT TRENDS IN EARLY WARNING

The *Hemispheric Consultation on Early Warning* identified that floods and hurricanes are hazards for which early warning is rather well advanced throughout the hemisphere. The countries which are affected by these phenomena have devised and implemented different types of early warning

systems, and make use of a diverse spectrum of instruments and methodologies which include authorities, members from various institutions, as well as volunteers from the communities. Such systems arise as a consequence of the yearly frequency of these phenomena.

Early warning systems have also been implemented for such phenomena as tsunamis, forest fires, and in some cases for volcanic eruptions, and volcanic related lahars which are triggered by high-intensity rainfalls. Additionally, in the particular case of Mexico City, there is an early warning system in operation for earthquakes with epicenters in the pacific coast, which provides a fraction of time to warn people and authorities.

In contrast to such existing systems, the *Consultation* provided opportunities to understand the current limitations which impede the deployment of early warning systems for other types of phenomena such as landslides, earthquakes, climate change, and El Niño. In the majority of these cases, the main problem is related to the poor understanding of the phenomena, which does not allow for precise forecasts, and the lack of resources to implement and operate them.

It was generally agreed that in some regions early warning systems have been implemented after disasters, in particular in Central America after hurricane Mitch in 1998. In the wake of Mitch, more than 25 EWS were implemented targeting floods, and national capacities were strengthened via the establishment of Emergency Operation Centers (EOCs).

In the case of floods, two different types of systems have emerged; *centralized, telemetric systems*, which make use of sophisticated instrumentation to monitor rainfall and flow (river levels) and to model floods in real time using computerized hydrological models. These systems are finding applications in large basins, and make use of the national civil defense or protection organization to respond in case of floods. The other type of systems are rather simple, and involves the use of volunteers in rural areas and communities to operate all phases of these systems. Such systems, tailored for small basins, are common throughout Central America and the Caribbean, where resources are scarce.

In contrast to these systems which make use of data gathered locally, other types of systems use satellites to gather information which is then processed to generate forecasts. Although hurricanes were the traditional examples of satellite-based EWS, forest fires and El Niño are making use of such high technology. At this time, forest fire early warning systems using satellite technology are in place in Canada, United States, Mexico, and Brazil. Trial versions are being developed in Nicaragua and in other countries.

REGIONAL PHENOMENA

There are several natural phenomena which have a truly hemispheric presence, spanning various regions, such as climate change, El Niño or ENSO, and tsunamis. At this time, there is one truly hemispheric early warning system currently operated in the Pacific ocean for tsunamis, which spans from Alaska to Chile. The system has an Information Center based in Hawaii many South American countries are linked to it.

In the case of climate change, the Hemispheric Consultation provided a forum for the discussion, which concluded that all nations should implement programs through agencies like the Caribbean Climate Change Center (CCCC) and the Center for Tropical Water of Latina America and the Caribbean (CATHALAC), that are related to adaptation, rather than pursuing early warning

systems, as changes can be uncertain and there are no accurate forecasting procedures to be applied.

In the case of El Niño, several regional institutions are devoting efforts to understanding its nature in order to develop adaptation frameworks, as well as some kind of early warning such as the International Center for Research on El Niño Phenomena, CIIFEN, which is operated in Ecuador, and the Central American Hydrologycal Resources Committee, CRRH. However, it was interesting to note that in this case of El Niño the use of internet information without proper care can lead to unwanted responses. For example, if an El Niño event is reported via internet in Australia without mentioning that the lead time spans several months between its impacts in Australia and in the pacific coast of the South American region can trigger the wrong response in many sectors, provoking unnecessary losses. Hence, the experts present at the consultation stressed the importance of using internet information with the proper care in order to avoid the wrong type of responses at the community level.

In the case of hurricanes which span the Caribbean, Central, and North America, the consensus reached is that most nations already operate national-type early warning systems, in which the national meteorological agencies provide the forecasts and the civil protection agencies coordinate an inter-institutional and inter-sectorial response spanning from the national to the local levels. In this case the warnings are transmitted throughout the country via massive media (newspapers, radio, TV). In contrast to the case of El Niño, the use of internet to transmit satellite information concerning the location and magnitude of hurricanes is wide-spread and used throughout the hemisphere with great success.

SPINOFFs

Several of the participants in the Hemispheric consultation concluded that the implementation of early warning systems has provided a window to introduce the concepts related to risk and disaster management. The workshops which accompany the implementation of early warning systems usually present EWS in the context of risk management, providing an opportunity to spread these concepts and models in disaster-prone areas, especially in high-risk communities.

In the case of community-operated early warning systems, especially in remote rural towns, the radio-network on which the EWS relies for communications regarding the weather is solving many local social problems, such as the coordination and provision of medical assistance, as well as providing information concerning relatives, or even the status of a road which crosses rivers to link various communities. In the case of Central America, such local radio networks are aiding the national civil defense institutions to pin-point the location of earthquakes and the impact of other phenomena such as volcanic eruptions. In this respect, the fact that the radio transmission is made by people offers a great advantage in relation to the diverse information which can be transmitted when compared with the telemetric systems where the radio unit can only transmit one or a few prefixed climatic parameters.

Finally, the exchange of technical information concerning specific issues related to EWSs is opening the window for extensions and expansions of systems throughout the hemisphere. The Hemispheric Consultation was in itself an example of such an exchange, as it provided an opportunity for experts from diverse types of early warning systems to exchange ideas and experiences concerning approaches to early warning. The general recommendation concerning the hemispheric exchange of information is now being addressed via the implementation of an

internet-based virtual forum, as well as a web page where experts and institutions can present their experiences and systems.

PRODUCTS

The Hemispheric Consultation on Early Warning was designed with the purpose of producing three types of products:

I. *Blueprints of systems currently in operation in the hemisphere.*
II. *A document containing detailed information concerning early warning systems currently operated in the hemisphere for various types of phenomena, which included such aspects as design, instrumentation, lessons learned, critical points, and added values.*
III. *A list of key contacts regarding early warning systems for various types of phenomena.*

For example, blue-prints were developed for those systems which had been already implemented and successfully tested in various countries, and presented in a generic fashion. At this time, blueprints have been developed for hurricanes, floods (both the centralized as well as the community-operated systems), and forest fires.

In the case of the documentation, a CD ROM was elaborated by the Regional Center of Disaster Information, CRID, which is based in Costa Rica. The CD ROM contains many articles regarding early warning systems which were gathered prior to the seminar, as well as during or after the seminar. This CD will be distributed to all civil defense institutions of the hemisphere, as well as to institutions which participate in early warning systems.

Finally, a database of experts and consultants on early warning was created and distributed among the participants to the event, as well as to the institutions for their use in the near future.

EARLY WARNING AND PUBLIC POLICIES

While the Hemispheric Consultation documented the lack of public policies specifically dedicated to early warning, the consensus is that there are public policies devoted to disaster reduction which encompass early warning. As such, Civil Defense or Civil Protection Agencies, which are in charge of implementing these policies, already promote the implementation and participate in the operation of early warning systems for various types of hazards.

In the regional perspective, the Strategic framework for vulnerability and disaster reduction in Central America, contained within the Declaration subscribed by the Presidents in Antigua, in 1999, states that efforts should be implemented in areas related to monitoring of natural and anthropogenic phenomena in order to promote early warning. The Basic Plan elaborated by CEPREDENAC by the mandates of this declaration, contains six basic areas, one of which is the Area of Early Warning and Specific Plans, which focuses on disaster preparedness.

Therefore, it is possible to conclude that there are policies which implicitly promote the subject of early warning, giving national and local institutions the degree of freedom to design and

implement various types of systems according to the needs and capacities available at these levels.

RECOMMENDATIONS

Among the main recommendations which emanated from the Hemispheric Consultation, the following deserve special attention:

1. During recent years there has been increased interest expressed by national leaders throughout the hemisphere to strengthen economic ties among and between each other. Economic and political stability, both affected by vulnerabilities to natural hazards, is important to each country to ensure that they can take best advantage of market opportunities. Attention should be given to developing a strong argument, backed by sound research and specific examples, that investment in development and implementation of adequate EW, along with other Disaster Management Systems reduces economic loss, fosters economic security and supports short and long-term economic development. Hence, promote the development of instruments to display the Cost / benefit relationship of EWS.

2. Considering the successes gathered through the implementation of EWS, these should be promoted as priority topics on agendas of preparatory processes and initiatives on Disaster Reduction. Therefore, cross cutting commitments for incorporation of EW support within global dialogue (Yokohama, SIDS + 10, World Summit on Sustainable development, Millennium Declaration) should be promoted in all regions and policy sectors.

3. As global or regional frameworks are developed to promote and support early warning research and applications, liaisons should be identified amongst professional organizations that can contribute to early waning. These include the World Meteorological Organization, International Union of Geologists and Geophysicists, IAAHS, Global Fire Monitoring Center, the International Tsunami Information Center, the International Global Observing Systems, etc.

4. Industrialized countries have often been the driving force behind research and application of science and technology with the goal of improved early warning of natural hazards. Frequently, funding and technical support has been made available by these countries to share experience with other nations as well as international organizations and professional associations on a global or regional basis. This support should be increased and sustained -- and not be dependent on the vagaries of politics or short-term economic climate -- particularly because of its importance to many countries currently unable to fully sustain adequate technical and human infrastructure to provide life and property-saving warnings.

5. Recognizing the fact that there are many types of hazards which generate disasters throughout the hemisphere, all countries should consider participating in and contribute to developing and implementing a rationale for common and constant funding strategy

whereby support for Early Warning research and applications can be administered through regional and national coordinating mechanisms.

6. The definition of terminology, common acceptance, and usage of terms and concepts related to Early Warning needs to be improved and encouraged so that Early Warning will be better understood in its own context and as it relates to other phases of risk management and disaster preparedness.

7. Many advances in early warning have been made possible by the exchange of information and experiences. Thus it is important to support mechanisms for Inter and Intra-Regional exchange of technical/scientific and social information, experiences and technology applications, as well as interactions among scientific/technical and social actors involved in the design and operation of Early Warning Systems.

8. Considering the successes gathered via the insertion of local communities into the framework of early warning systems in some countries, it is important to stimulate educational processes oriented towards the construction of a common vision of Disaster Preparedness which encompasses early warning as an essential element; provide support for countries of the region in the implementation of action plans involving early warning, support programmes for hazard mapping and vulnerability assessment as a basis for EWS, strengthen national and local capacities to allow for broader citizen participation, and promote the active participation of the media in early warning systems.

9. Early warning systems rely on the precise forecast of events which can provoke disasters. Therefore, it is important to strengthen technical/scientific institutions which play a role in early warning systems via the promotion of relations with academic research centers to understand the dynamical nature of the hazards, and equip such institutions with similar o same equipment networks related to monitoring of such hazards in the sub-regions of the hemisphere.

10. Efforts should be undertaken at the national level to analyze whether EWSs should be inserted within the national systems responsible of planning, coordination, risk management, and disaster preparedness. However, early warning systems should also be conceived to involve many institutions, sectors, and representatives of the communities. Therefore, a clear definition of responsibilities through an adequate legal framework which recognizes existing capacities and limitations must be established as a means to promote ample and inter-institutional participation.

CONCLUSIONS:

The Consultation provided the first opportunity to link scientific/technical personnel with social actors, such as local authorities and personnel from civil defense or civil protection agencies from all regions of the hemisphere.

The Consultation also gathered for the first time experts and operators of early warning systems for many types of hazards: floods, hurricanes, tsunamis, landslides, volcanic eruptions, El Niño, Climate Change, forest fires, earthquakes, as well as earthquakes. This proved to be very useful in exchanging experiences and approaches related to early warning systems.

Sessions were organized so as to provide a framework for the discussion of all aspects related to early warning systems: technical aspects, social aspects, as well as institutional aspects. Thus, it opened an opportunity for the exchange of knowledge, as well as promoted an exchange of ideas on how best to link all these sectors to improve such systems.

Among the preliminary results which can be identified, the following deserve special attention:

The regional tsunami information and warning center based in Hawaii strengthen relationships with participants from technical institutions of Central American nations, particularly Costa Rica, Nicaragua, and El Salvador, thus opening the opportunity to reinforce the hemispheric early warning system already in operation in the US and South America.

The Organization of American States had been pursuing the idea of a regional platform for early warning. This seminar became such a platform at the hemispheric level, being able to link participants from 19 nations of all regions of the hemisphere, as well as actors from the scientific community as well as from the social and institutional sectors.

Central American participants we able to exchange experiences and information with members from South America, thus opening the opportunity for enhanced exchanges in the future. This is particularly important considering the similarity between cultures and social problems in contrast to that between Central America and North America.

The consultation will allow for the first hemispheric inventory of early warning systems encompassing many types of hazards, as well as information on those hazards for which early warning is not yet feasible.

The consultation allowed an opportunity for the participants to gather information concerning some of the most successful systems, such as the Cuban system for hurricanes, as well as with respect to very advanced systems such as the satellite-based Brazilian system for forest fires in the Amazon basin.

The consultation allowed for the exchange of impressions among the different participants on the roles which regional agencies should play in relation to early warning.

Hemispheric Consultation on Early Warning

Antigua Declaration

Antigua, Guatemala, June 5, 2003.

First Part

In the city of Antigua, in the Republic of Guatemala, eighty five participants from nineteen nations of the hemisphere, including experts in early warning, public authorities, sub-regional, regional, and international organizations, NGOs, community leaders, and media met to discuss diverse aspects related to Early Warning Systems and multiple hazards which manifest themselves in all regions of the hemisphere. The Hemispheric Consultation in Early Warning was the first major event at the hemispheric level dedicated to the topic of integrating Early Warning Systems into public policy

The consultation was promoted by the International Strategy for Disaster Reduction of the United Nations (ISDR-UN), supported by the Ministry of Foreign Affairs of the Federal Republic of Germany through the German Technical Cooperation Agency, GTZ, by the Association of Caribbean States, (ACS), and benefited from the support provided by the United National Development Program, UNDP. The consultation was planned by a Steering Committee comprised of representatives of ACS, the Caribbean Disaster Emergency Response Agency, CDERA, the Coordination Center For Natural Disasters Prevention in Central America, CEPREDENAC, National Coordinator for Disaster Reduction of Guatemala, CONRED, GTZ, UNDP, and UN-ISDR.

This Consultation has been a part of the preparatory process leading to the Second International Conference on Early Warning Systems (EWCII), to be held in Bonn, 16-18 October, 2003.The main objectives of the consultation have been the identification of early warning blueprints for Latin America and the Caribbean, including best practices, gaps and shortfalls in early warning applications and effectiveness, make regional recommendations on strategies for dissemination of early warning knowledge, as well as technical recommendations to be presented at the EWCII.

The Hemispheric Consultation provided an opportunity for enhanced dialogue among regional, national, and local stakeholders, and among different sectors, effectively strengthening the coordination and cooperation amongst the various groups involved in the early warning process.

The participant to this Hemispheric Consultation, considering:

- *The First International Conference on Early Warning which took place in Potsdam, Germany, in 1998.*

- *The Summit of Presidents held in Quebec, Canada in 2001 within the Strategic Platform for disaster and vulnerability reduction.*

Has concluded that Early Warning has a strategic relevance of inter-sectorial and inter-institutional character, and it must span all levels of organization from the hemispheric to the local levels; additionally, Early Warning is a process which must involve Civil Protection or Civil Defense Institutions in all nations, and should be inserted within the context of risk management, including public policies with the goal of contributing to the reduction of disasters and fatalities, as well as sustainable development.

In relation to what has been exposed above, the participants manifest:

I. That all over the world the frequency and severity of natural disasters have increased in recent years, , and these trends are expected to continue in the future. Hurricanes George and Mitch, disasters provoked by the El Niño event which took place in 1997-98, massive landslides in Venezuela in 1999, forest fires in the Amazon basin in Brazil in 1998, massive eruptions in Montserrat in 1997, as well as earthquakes of El Salvador and Arequipa in 2001 are the most recent reminders of the devastation caused by natural hazards. These and many other tragic events have demonstrated the cost of inadequate Early Warning Systems. In contrast, the successful application of forecast information, local preparedness activities, and coordination at all levels, can save lives and property, as demonstrated by the example of hurricane Michelle which hit Cuba and Honduras in 2001.

II. That the Hemispheric Consultation identified the major strengths and weaknesses in Early Warning capacities throughout the Americas. Participants emphasized the multidisciplinary and multi-sectorial character of the Early Warning process. Although based on science and technology, Early Warning must be tailored to serve communities needs, their environments, their resources and their culture. Traditional knowledge emanating from communities should also be taken into account.

III. That Early Warning is effective only to the extent that policy makers at the national and local levels of authority have the will, and make sustained commitment of both financial and human resources.

Second Part

Recommendations

1. *During recent years there has been increased interest expressed by national leaders throughout the hemisphere to strengthen ties among and between each other. Economic and political stability, both affected by vulnerabilities to natural hazards. The Hemispheric Consultation considers important to ensure that each country takes the best advantage of market opportunities. Therefore, attention should be given to developing a strong argument, backed by sound research and specific examples, that investment in development and implementation of adequate EW, along with other Disaster Management Systems reduces economic loss, fosters economic security and supports short and long-term economic development. Hence, the Hemispheric Consultation promotes the development of instruments which display the Cost / benefit relationship of Early Warning Systems.*

2. *Considering the successes gathered through the implementation of Early Warning Systems, the Hemispheric Consultation recommends that these issues be promoted as priority topics on agendas of preparatory processes and initiatives focusing on Disaster Reduction. Therefore, cross cutting commitments for incorporation of EW support within global dialogue (Yokohama, SIDS + 10, World Summit on Sustainable development, Millennium Declaration) should be promoted in all regions and policy sectors. In a parallel fashion, it reiterates the need of supporting processes associated with the compilation and dissemination of all aspects linked with Early Warning and respective systems.*

3. *As global or regional frameworks are developed to promote and support Early Warning research and applications, the Hemispheric Consultation recommends that liaisons be identified amongst professional organizations that can contribute to Early Warning. These include the World Meteorological Organization, International Union of Geology and Geophysics, the International Association of Hydrological Science, the Global Fire Monitoring Center, the International Tsunami Information Center, the International Global Observing Strategy, etc.*

4. *Often, industrialized countries have been the driving force behind research and application of science and technology with the goal of improving Early Warning in relation to natural hazards. Frequently, funding and technical support has been made available by these countries to share experience with other nations as well as international organizations and professional associations on a global or regional basis. the Hemispheric Consultation recommends that such support should be increased and sustained -- and not be dependent on the vagaries of politics or short-term economic climate -- particularly because of its importance to many countries currently unable to fully sustain adequate technical and human infrastructure to provide life and property-saving warnings.*

5. *Recognizing the fact that there are many types of hazards which generate disasters throughout the hemisphere, the Hemispheric Consultation recommends that all countries should participate in, and contribute to developing and implementing a rationale for common and constant funding strategy whereby support for Early Warning research and applications can be administered through regional and national coordinating mechanisms.*

6. *The definition of terminology, common acceptance, and usage of terms and concepts related to Early Warning needs to be improved and encouraged so that Early Warning will be better understood in its own context and as it relates to other phases of risk management and disaster preparedness.*

7. *Many advances in Early Warning have been made possible by the exchange of information and experiences. Thus, the Hemispheric Consultation deems important to support mechanisms for Inter and Intra-Regional exchange of technical/scientific and social information, experiences and technology applications, as well as interactions among scientific/technical and social actors involved in the design and operation of Early Warning Systems.*

8. *Considering the successes gathered via the insertion of local communities into the framework of Early Warning Systems in some countries, the Hemispheric Consultation suggests that it is important to stimulate educational processes oriented towards the construction of a common vision of Disaster Management, which encompasses Early Warning as an essential element of risk management to promote a more sustainable development.*

9. *Early Warning is based on the knowledge of the various components of risk, therefore the Hemispheric Consultation considers useful supporting programs for hazard mapping and vulnerability assessment as a basis for Early Warning Systems, strengthen national and local capacities to allow for broader citizen participation, and promote the active participation of the media in Early Warning Systems.*

10. *Early Warning Systems rely on the precise forecast of events which can provoke disasters. Therefore, the Hemispheric Consultation recommends strengthening technical/scientific institutions which play a role in Early Warning Systems via the promotion of relations with academic research centers to understand the dynamical nature of the hazards, and equip such institutions with similar or same equipment networks related to monitoring of such hazards in the sub-regions of the hemisphere.*

11. *The Hemispheric Consultation recommends that Early Warning Systems should be inserted within the national systems responsible of planning, coordination, risk management, and disaster preparedness. However, Early Warning Systems must also be conceived to involve many institutions, sectors, and representatives of the communities. Therefore, the Hemispheric Consultation promotes a clear definition of responsibilities through an adequate legal framework which recognizes existing capacities and limitations must be established as a means to promote ample and inter-institutional participation.*