



Economic and Social Commission for Asia and the Pacific
 Committee on Disaster Risk Reduction
Fourth session

Bangkok, 27-29 October 2015

Item 5 of the provisional agenda*

Regional multi-hazard early warning systems
Strengthening regional multi-hazard early warning systems
Note by the secretariat
Summary

The present document discusses the role of multi-hazard early warning systems in building resilience to natural disasters, and takes stock of the progress made in strengthening early warning systems in Asia and the Pacific. It highlights specific gaps in early warning in the region, especially in high-risk, low-capacity countries and at the local level, and outlines regional priorities for achieving the global target of the Sendai Framework for Disaster Risk Reduction 2015-2030 to substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030. In the document, many issues are presented that the Committee may wish to consider.

Contents

	<i>Page</i>
I. Introduction.....	2
II. ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness	3
III. Status of multi-hazard early warning in Asia and the Pacific	5
IV. Regional gaps and priorities.....	6
V. Issues for consideration by the Committee	9

* E/ESCAP/CDR(4)/L.1.

I. Introduction

1. Early warning is an essential public good, and a key component of effective disaster risk reduction. This is especially the case in Asia and the Pacific, a region that is facing a wide range of natural hazards and experiencing increasingly large and complex disasters. In many situations, the performance of an early warning system, and especially whether the warning leads to appropriate early action, influences to what extent a hazard may trigger a large disaster. Nevertheless, the potential of early warning systems to reduce human and material losses often receives limited attention, and tends not to be translated into national policy- and decision-making, despite a growing body of evidence documenting lives saved as well as significant economic benefits.

2. The role of early warning systems in building resilience and thus mitigating the impact of disasters is recognized in the Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework), as indicated in its seventh global target, which reads as follows: “Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030”.¹

3. Accurate forecasts and appropriate on-the-ground responses are necessary in order to realize the full benefits of an early warning system. An effective warning system combines science and technology with practical local approaches, and brings the two into a coherent framework. Based on the experiences of Asia and the Pacific, early warning is most effective when fully integrated into broader regional and national strategies for building resilience and reducing disaster risk.

4. Early warning is the responsibility of each national Government. However, it is also an area in which intergovernmental, regional cooperation can be highly effective, as hazards are often transboundary in nature and tend to affect multiple countries simultaneously. Countries that share a coastline, mountain range or river tend to face similar challenges. As a result, in Asia and the Pacific, regional early warning mechanisms have been set up, especially for tsunamis and tropical cyclones, and there is a general trend towards strengthened regional and South-South cooperation.

5. Recognizing the benefits of regional cooperation in early warning as well as the effective intergovernmental platform offered by the Economic and Social Commission for Asia and the Pacific (ESCAP), the member States through Commission resolution 71/12 of May 2015 requested ESCAP to guide actions at the regional level related to multi-hazard early warning for common and transboundary disasters by deepening existing regional cooperation mechanisms for hazards such as those related to tropical cyclones and drought, and extending such cooperation for floods, glacial lake outburst floods and landslides.

6. Well-functioning, people-centred early warning systems save lives. Conversely, gaps in this area can prove costly in terms of the human and economic impact of a particular hazard. In October 2013, timely and accurate warnings combined with pre-emptive evacuations of more than 550,000 people helped to minimize the number of casualties from Cyclone Phailin, the second strongest storm to make landfall in India. Systems for geophysical hazards have similar benefits. In a study conducted for ESCAP,

¹ A/RES/69/283, annex II.

it was estimated that the Indian Ocean Tsunami Warning and Mitigation System would save at least 1,000 lives per year, on average, over the next 100 years.²

7. Early warning systems can also be cost-effective, especially in the case of frequent hazards, such as cyclones and floods, which can be predicted with sufficient lead time to not just protect lives, but also to preserve livelihoods. According to research undertaken by the World Bank, investments in hydro-meteorological warning services in developing countries have a cost-benefit ratio between 4 and 36, meaning that every dollar invested produces between 4 and 36 dollars in benefits.³ This is achieved by saving lives, protecting assets and allowing for the optimization of economic production in weather-sensitive sectors.

8. It is important to note that the benefits of early warning outlined above can only be realized if the investments are well directed and informed by the priority needs of a given region or country. In that regard, a World Bank report on the economics of prevention cautioned against an overemphasis on expensive technologies with high operating and maintenance costs.⁴ Instead, the report suggested that addressing practical needs, such as estimating and calibrating models, carrying out hazard analysis, digitizing older data and improving data from ground observations would strengthen short-term and seasonal forecasts, and thus provide high returns.

II. ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness

9. The secretariat has supported a wide range of activities aimed at strengthening early warning systems in Asia and the Pacific, especially through the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness.⁵ The Trust Fund was established in 2005 following the devastation wrought by the Indian Ocean tsunami. Its original mission was to support tsunami early warning systems in the Indian Ocean and South-East Asian countries. In 2010, following an independent review, its scope was expanded to include overall disaster and climate preparedness, while retaining a focus on end-to-end early warning for coastal hazards. This adjustment was made against the backdrop of an increasing impact of extreme weather events in the region, and growing recognition of the benefits of early warning systems covering multiple hazards.

10. The Trust Fund supports the strengthening of early warning for coastal hazards, such as tsunamis, typhoons and storm surges, while applying a regional approach. It contributes to the narrowing of capacity gaps through regional and South-South cooperation, sharing of resources and the

² Thomas J. Teisberg, "Potential life saving benefits of a tsunami early warning system in the Indian Ocean", paper submitted to ESCAP, 2011.

³ Stéphane Hallegatte, "A cost effective solution to reduce disaster losses in developing countries: hydro-meteorological services, early warning, and evacuation", Policy Research Working Paper, No. 6058 (Washington, D.C., World Bank, 2012). Available from <https://openknowledge.worldbank.org/bitstream/handle/10986/9359/WPS6058.pdf?sequence=1>.

⁴ World Bank, *Natural Hazards, Unnatural Disasters: The Economics of Effective Prevention* (Washington D.C., 2010).

⁵ More information on the Trust Fund for Tsunami, Disaster and Climate Preparedness can be found at www.unescap.org/disaster-preparedness-fund.

development of an integrated regional warning system comprising a network of collaborative centres.

11. The Trust Fund's strategy for 2013-2016 has three pillars:

- (a) Regional intergovernmental mechanisms;
- (b) Specific country needs;
- (c) Civil society innovations and business sector initiatives.

12. The Trust Fund's main decision-making body is the Advisory Council. The Council is comprised of the secretariat and the largest donors (Germany, Sweden and Thailand). Other donors (Bangladesh, Japan, Nepal, the Philippines and Turkey) and United Nations agencies (the Office for the Coordination of Humanitarian Affairs, the United Nations Development Programme (UNDP), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Environment Programme, the United Nations Office for Disaster Risk Reduction (UNISDR) and the World Meteorological Organization (WMO)) act as observers on the Council, which meets 1-2 times per year.

13. A central feature of the Trust Fund is the Inter-Agency Task Force. Members of the Task Force review projects, advise on technical matters and make recommendations to the Council. The Task Force is chaired by ESCAP Information and Communications Technology and Disaster Risk Reduction Division and composed of technical experts from UNESCO, UNDP and UNISDR, as well as from the Social Development Division and the Environmental Development Division of ESCAP.

14. As of August 2015, the Trust Fund had approved 26 projects with a combined budget of approximately \$13.7 million, directly benefitting 19 countries. Five projects were currently under implementation, with a combined budget of \$3.2 million. In May 2015, the Commission in its resolution 71/12 requested the Executive Secretary to further strengthen the Trust Fund and expand its geographic scope to include Pacific small island developing States, in addition to Indian Ocean and South-East Asian countries.

15. The establishment of the Indian Ocean Tsunami Warning and Mitigation System is among the key regional initiatives supported by the Trust Fund. The System, which became operational in 2011, is a regional early warning mechanism that provides tsunami warning products and services for 28 countries around the Indian Ocean. In 2009, the Trust Fund also established the Regional Integrated Multi-hazard Early Warning System (RIMES), an intergovernmental institution that focuses on the generation and application of early warning information and the provision of capacity-building support. By 2015, RIMES had grown to include 12 member States and 19 collaborating countries.

16. The Trust Fund is a catalyst for innovation in early warning. It has provided financial support to RIMES and WMO to strengthen the national meteorological and hydrological services in five high-risk countries and assist in developing downscaled and user-friendly forecasts for the monsoon season. This pilot project targets Bangladesh, India, Myanmar, Maldives and Sri Lanka, where national biannual monsoon forum were established as platforms for effective interaction between the generators and the users of the forecasts.

17. In advance of each monsoon forum, RIMES and WMO work with the national authorities to develop the seasonal forecast and related products, and to train users, such as line ministries, local governments and their partners, on how to use the information. At the forum, the users discuss what preparedness and mitigation measures to take based on the information presented by the forecaster. In this way, the monsoon forum plays an important role in bridging the gap between forecasters and end users, and between early warning and early action.

18. The Trust Fund has also supported the strengthening of the ESCAP/WMO Typhoon Committee and the Panel on Tropical Cyclones, two regional mechanisms for early warning. Specifically, the Trust Fund supported these mechanisms in jointly developing multi-hazard, “synergized” standard operating procedures for early warning. The resulting manual was finalized in May 2015, and is in the process of being rolled out by the ESCAP/WMO Typhoon Committee and the Panel on Tropical Cyclones.⁶

III. Status of multi-hazard early warning in Asia and the Pacific

19. Across Asia and the Pacific, technology to assess hazards and risks and detect approaching threats has generally reached a high degree of sophistication. However, innovations and more widespread use could increase the performance of early warning systems. The main bottlenecks in saving more lives are frequently related to gaps in (a) ensuring rapid and reliable dissemination of warnings to all concerned and (b) building the knowledge and capacity of communities to act appropriately.

20. Early warning is often broken into four elements: risk knowledge; monitoring and warning; communication; and response capacity. ESCAP research shows that, in Asia and the Pacific, risk knowledge and monitoring and warning have reached a relatively high level of maturity across the region, despite uneven progress by country and hazard. However, the communication and response capacity elements represent greater challenges for most countries.

21. A common challenge in the region is that early warning tends to be seen primarily as a science initiative, and thus it is easily isolated from policy- and decision-making in other related areas, including disaster management. As a result, there is often limited contact between forecasters and disaster managers, a state of affairs that prevents countries from creating effective end-to-end warning systems. In addition, there is limited use of warning and risk information in various vulnerable sectors of the economy, including fishing and agriculture, despite the potential economic benefits. Bridging such gaps is essential for achieving the goals of the Sendai Framework.

22. Regional cooperation in early warning was significantly enhanced following the 2004 Indian Ocean Tsunami. This collective effort led to the establishment of the Indian Ocean Tsunami Warning and Mitigation System in 2011, as mentioned above. Australia, India and Indonesia have assumed the roles as service providers for the System responsible for issuing tsunami bulletins to member States. In addition to the development of this System, national tsunami warning centres were established in 24 countries around the Indian Ocean. These national centres participate in region-wide

⁶ Available at http://typhooncommittee.org/SSOP/FINAL_MANUAL.html.

communication tests twice a year, and full-scale regional exercises every two to three years.

23. As part of the development of the Indian Ocean Tsunami Warning and Mitigation System, great investments have been undertaken, especially in the science and technology required to strengthen tsunami observation systems and information sharing through regional and global networks. As a result, the number of Indian Ocean broadband seismometers (detecting tsunamigenic earthquakes) and sharing data in near real-time grew from 13 in 2004 to more than 140 in 2014.⁷ During the same period, the number of deep ocean tsunameters sharing data in near real-time and available for tsunami warning purposes grew from zero to nine, while the number of coastal sea level gauges grew from 4 to more than 100. Taken together, these new resources being networked through the System represent a major improvement to the region's preparedness for future disasters.

24. Enhanced regional cooperation is also reflected in how the Asia-Pacific region deals with tropical cyclones (known as typhoons if they originate from the Western Pacific Basin. In particular, regional intergovernmental platforms, such as the ESCAP/WMO Typhoon Committee and the Panel on Tropical Cyclones have expanded and strengthened their activities since 2004, bringing about closer regional cooperation in early warning and better integration in the fields of meteorology, hydrology and disaster risk reduction.

25. The ESCAP/WMO Typhoon Committee, covering storms emerging from Western Pacific Basin, and the Panel on Tropical Cyclones, covering the Bay of Bengal and the Arabian Sea, are unique in bringing together a wide range of experts in meteorology, hydrology and disaster risk reduction to build capacities and develop joint strategies across countries and professional fields. Both of them also undertake original research and pilot projects to further improve the understanding of tropical cyclones and related hazards. In February 2015, ESCAP hosted the Third Joint Session on Tropical Cyclones and the Typhoon Committee, which led to the establishment of a new cooperation mechanism between the two platforms, involving joint training, research and projects.

IV. Regional gaps and priorities

26. While the early warning requirements and the areas in need of attention vary by country, certain priorities are common across the Asia-Pacific region. They include:

- (a) Increasing the use of vulnerability and risk assessments;
- (b) Updating and expanding coverage of hazard and risk maps, taking into account societal and environmental changes;
- (c) Strengthening end-to-end early warning systems of countries that are at high risk but have low capacity;
- (d) Educating communities and local authorities on the evolving risks, including those that could be exacerbated by climate change;
- (e) Reaching the most vulnerable people and remote communities with timely warnings at the "last mile";

⁷ United Nations Educational, Scientific and Cultural Organization, The Indian Ocean Tsunami Warning and Mitigation System (IOTWS), 2005-2014: Quick Fact Sheet, November 2014 (Jakarta, 2014).

- (f) Effective messaging: interpreting scientific information and translating it into messages that the end users understand and know how to act upon;
- (g) Regularly testing and updating standard operating procedures and contingency plans;
- (h) Ensuring adequate monitoring and warning services;
- (i) Ensuring financing sustainability of early warning systems.

27. Progress in early warning is uneven across the region, with some high-risk, low-capacity countries falling behind. There is also uneven progress by hazard type and subregion. While significant progress has been achieved in strengthening early warning for tsunami and tropical cyclones, important gaps exist for other hazards even though the necessary technology is increasingly more available.

28. Consequently, many countries in the Asia-Pacific region are calling for regional early warning systems as an effective means of addressing many of the gaps identified above, in particular in sharing scientific knowledge and applications, sharing costs, and addressing transboundary disasters.

29. A regional early warning system is an example of a public good for the region. The use of such a system by one country does not prevent other countries from using the same system and benefitting from it in a similar way. On the contrary, greater participation in regional warning systems tends to lower the cost, strengthen the sustainability and thus enhance the value for all members, as a single country would normally not be able to implement such a complex system without the cooperation of other countries and relevant regional and international organizations. Through regional cooperative mechanisms on early warning, member States share good practices, expertise and capacities in assessing risks, developing sustainable monitoring and warning services, creating proper dissemination and communication systems, and coordinating with communities to increase response capabilities.

30. Strengthened regional cooperation would be especially valuable in covering hazards, such as landslides, glacial lake outburst floods and transboundary river basin floods. These hazards continue to cause high death tolls and economic losses in certain countries, despite the availability of tools to predict the risk. Setting up adequate warning systems is therefore a priority.

31. There is a particular need for strengthened regional cooperation in early warning for transboundary river basin floods stemming from the Hindu Kush Himalayan region. Some 1.3 billion people in 15 countries depend on this natural “water tower”, which feeds water into nine large river basins. At the same time, the area is prone to floods. Given the transboundary nature of this hazard, regional cooperation holds the key to greater disaster resilience as no country can ensure effective early warning on its own.

32. A future regional cooperation mechanism for transboundary river basin floods could involve the sharing of data, knowledge and innovations, such as nested modelling solutions that couples climate scenarios, river basin hydrology and flood forecasting, as well as dialogues and institutional partnerships based on an integrated flood management approach. Past initiatives have been taken by actors including, among others, the International Centre for Integrated Mountain Development, the Panel of

Tropical Cyclones and WMO; however, there is a need to re-energize and consolidate such efforts into a regional warning mechanism, reflecting the transnational nature of the river basin flood hazard.

33. Furthermore, there is need for initial pilots in warning systems for glacial lake outburst floods, landslides and flash floods to be scaled up and replicated. In Bhutan, early warning systems have been established for glacial lake outburst floods with support from the Japan International Cooperation Agency (JICA); however, these systems must be strengthened further. In the Philippines, a pilot landslide early warning system was successfully set up in 2012 in the municipality of Saint Bernard in the province of Southern Leyte, with support from Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). This landslide early warning system is among the first of its kind to be established in the Philippines, and has been integrated with existing landslide and tsunami warning systems.

34. Effective community-based flood early warning systems have also been established by the Government of Nepal and a wide range of partners are participating in the Nepal Risk Reduction Consortium. Such initiatives offer important advances that could be shared and further scaled up nationally and regionally.

35. Across the region, gaps exist in the extension of the warning chain down to the local level. This challenge is often referred to as the “last mile” of early warning systems, but it could be equally referred to as the “first mile”, given the importance of reaching the most vulnerable people at the forefront of any disaster. Based on the experience of countries in Asia and the Pacific, unless the most vulnerable people can be reached with timely and understandable warning information, and have the capacity to act on the information, the early warning system as a whole fails.

36. The geography of certain countries, such as small island developing States, makes warning dissemination to the “last mile” particularly difficult. External assistance may thus be required to support long-term solutions, including satellite communications. Additionally, some countries have large and diverse populations with a wide variety of languages, creating additional challenges in terms of messaging and communication. Such countries may also require targeted support in order to address constraints at the “last mile”.

37. The sustainability of early warning systems is a concern in Asia and the Pacific, especially with regard to infrequent hazards, such as tsunamis. Governments have many competing priorities and, over time, the value of continuing to invest in relatively expensive systems may be called into question. In that regard, strategies, such as making warning systems multi-hazard and engaging in regional cooperation, can enhance the sustainability as well as the performance of early warning systems.

38. Integration of existing warning systems for various hazards, such as tsunamis and storm surges, may also enhance sustainability. Early warning systems for geophysical and hydro-meteorological hazards have many components in common, which may be shared and further enhanced in an integrated multi-hazard system. This is the case for human resource components as well as for more technical system components. Therefore, potential cost savings and performance enhancements may emerge when integrating warning systems, if institutional obstacles can be overcome.

39. In conjunction with the Third World Conference on Disaster Risk Reduction, which was held in Sendai, Japan, in March 2015, ESCAP

partnered with WMO and other international organizations and non-governmental organizations to launch the International Network for Multi-Hazard Early Warning Systems (IN-MHEWS). The objective of this multi-stakeholder partnership is to facilitate the sharing of expertise and best practices on early warning as part of the effort to support the implementation of the Sendai Framework. Going forward, there is a need to activate and operationalize this Network in Asia and the Pacific. With its established platform for regional cooperation, ESCAP could play a key role in taking IN-MHEWS forward in the region.

V. Issues for consideration by the Committee

40. To achieve the seventh global target of the Sendai Framework by 2030, early warning systems and services must be considered public goods, which should be widely available and adequately financed by public investment. As outlined above, such investments have high returns for society as a whole in terms of building resilience, minimizing loss of life and preparing for an accelerated recovery.

41. In Asia and the Pacific, the immediate priority in the field of early warning is to improve people's access to timely and relevant warning information and to enable them to take life-saving actions early. To this end, the growing accumulation of people and wealth, especially in urban areas, require that continued investments in early warning be made and existing systems are updated. Where possible, Governments should expand early warning systems to cover additional hazards, such as transboundary river basin floods, landslides and glacial lake outburst floods. In this regard, regional cooperation and information sharing are essential.

42. While considering the issues raised above, the Committee may wish:

(a) To support and contribute to the work towards the establishment of a regional cooperation mechanisms for early warning of transboundary river basin floods as mandated by the Commission in its resolution 71/12;

(b) To recommend work towards the establishment of a research network on early warning for glacial lake outburst floods, flash floods and landslides;

(c) To support the efforts by ESCAP and WMO to strengthen the ESCAP/WMO Typhoon Committee and the Panel on Tropical Cyclones and the linkages between those two platforms;

(d) To support and contribute to the establishment of a regional platform mirroring the ESCAP/WMO Typhoon Committee and the Panel on Tropical Cyclones in the Pacific;

(e) To support the further strengthening of the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness and the extension of its geographic scope to include the Pacific;

(f) To ensure sustained funding for multi-hazard early warning systems, including initiatives by ESCAP.

(g) To share through ESCAP platforms, the experience, technological know-how and training facilities of member States in early warning with those countries that are at high risk but have low capacity to cope with disasters.