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

Bangkok, 10-12 October 2017

Item 6 of the provisional agenda\*

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

The inclusion of a dedicated target to substantially increase the availability of and access to multi-hazard early warning systems in the Sendai Framework for Disaster Risk Reduction 2015-2030 is a strong endorsement of the value of early warning systems as a part of a broader disaster risk reduction strategy. Furthermore, with disaster risk reduction and resilience embedded in the 2030 Agenda for Sustainable Development, early warning systems have a critical role to play in achieving the Sustainable Development Goals.

Actions need to be taken to increase the availability of and access to multi-hazard early warning systems. The present document is focused on strengthening regional mechanisms in this regard, as emphasized by the Commission in its resolutions 71/12 and 73/7. The present document includes a review of the progress achieved in setting up hazard-specific early warning mechanisms, including the International Network for Multi-Hazard Early Warning Systems of the World Meteorological Organization, and the initiatives supported at the regional level by the Economic and Social Commission for Asia and the Pacific (ESCAP) Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries. The document also includes an outline of the proposed role of ESCAP as a regional platform for multi-hazard early warning systems that reinforces coherence across the 2030 Agenda and the Sendai Framework. The platform, which positions ESCAP strategically as a key player in addressing shared vulnerabilities and disaster risks, is envisaged to serve as an important initiative to support the regional road map for implementing the 2030 Agenda in Asia and the Pacific. The Committee on Disaster Risk Reduction is invited to consider the issues outlined in this proposal and endorse the proposal of ESCAP serving as a regional platform on multi-hazard early warning.

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\* E/ESCAP/CDR(5)/L.1.

## I. Introduction

1. Disasters caused by natural hazards are often transboundary in their origins and impacts. Disasters emanating from shared river basins and seismically active fault lines can affect multiple countries, disregarding existing geopolitical borders. In addition to these types of disasters, transboundary natural hazards emanating from the sea, such as tsunami waves or tropical cyclones developing in the major ocean basins, can also affect multiple countries at the same time. In such cases, the activities involved in producing early warning information to put people out of harm's way – monitoring, forecasting and communicating – frequently are beyond the capabilities of individual countries to carry out, and require regional-level action.

2. Disasters are becoming more complex with cascading effects in terms of geography and sector. Earthquakes can cause landslides, and storm surges can lead to coastal erosion. Cyclones often trigger urban flooding, landslides, coastal erosion and related disasters. For example, Tropical Cyclone Komen, which hit India, Bangladesh and Myanmar in 2015, brought floods and then landslides. A 6.5-magnitude earthquake hit Leyte, Philippines on 6 July 2017, causing severe damage to the Tongonan geothermal power plant, which, in turn, led to widespread electricity shortages and afflicted hardships on the young and elderly, in particular.<sup>1</sup>

3. A multi-hazard approach to early warning systems is more effective in dealing with multiple, sometimes concurrent, hazards with cascading impacts, and provides economies of scale and eventually sustainability of the system. Multi-hazard early warning systems can also be enhanced through regional cooperation, particularly in the case of disasters with transboundary origins and impacts.

4. One of the seven targets of the Sendai Framework for Disaster Risk Reduction 2015-2030 aims to “substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030”.<sup>2</sup> In line with this, efforts have been undertaken to develop regional strategies and plans for the implementation of the Sendai Framework. The Asia Regional Plan for Implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted at the seventh Asian Ministerial Conference on Disaster Risk Reduction, held in New Delhi from 2 to 5 November 2016. In the Asia Regional Plan, priorities are identified and regional activities to guide and support the implementation of the framework are set. Specifically, the Asia Regional Plan calls for an increase in the exchange of good practice, knowledge and information among governments and stakeholders, in addition to strengthening regional cooperation to effectively mitigate disaster risks and contribute to greater resilience in the region.<sup>3</sup> In the two-year action plan (2017-2018) of the Asia Regional Plan, regional cooperation and related North-South, South-South and triangular cooperation mechanisms are recognized as being crucial.

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<sup>1</sup> Philippines, National Disaster Risk Reduction and Management Council, “NDRRMC update”, 13 July 2017. Available from [www.ndrrmc.gov.ph/attachments/article/3117/Update\\_SitRep\\_No10\\_re\\_Magnitude\\_6.5\\_Earthquake\\_in\\_Ormoc\\_City\\_Leyte\\_as\\_of\\_8AM\\_13JULY2017.pdf](http://www.ndrrmc.gov.ph/attachments/article/3117/Update_SitRep_No10_re_Magnitude_6.5_Earthquake_in_Ormoc_City_Leyte_as_of_8AM_13JULY2017.pdf).

<sup>2</sup> General Assembly resolution 69/283, annex II.

<sup>3</sup> See [www.ndmindia.nic.in/AsiaRegionalPlan.pdf](http://www.ndmindia.nic.in/AsiaRegionalPlan.pdf).

5. In the United Nations Plan of Action on Disaster Risk Reduction for Resilience: Towards a Risk-informed and Integrated Approach to Sustainable Development, cooperation mechanisms are promoted as playing a vital role in achieving goals and targets relating to disaster risk reduction.

6. The Commission in its resolution 73/7 on enhancing regional cooperation for the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 in Asia and the Pacific requested the secretariat to, among other things, (a) accord priority to synchronizing multi-disciplinary support to member States in the mainstreaming of disaster risk reduction in their development strategies, in line with the Sendai Framework and with the Sustainable Development Goals and targets relating to disaster risk reduction; and (b) continue to support and facilitate multi-hazard early warning systems, impact-based forecasting and disaster risk assessment to strengthen regional cooperation mechanisms.

7. In the regional road map for implementing the 2030 Agenda in Asia and the Pacific, one option cited as being an opportunity for regional cooperation with regard to disaster risk reduction and resilience is to promote effective regional and subregional efforts to strengthen disaster risk modelling, assessment, mapping, monitoring and multi-hazard early warning systems for common and transboundary disasters.

8. In the implementation of the above-identified action plans, the following sections present the progress made in the region on multi-hazard early warning and an outline of an initiative for a regional platform that would help countries coordinate their multi-hazard early warning systems more effectively through regional cooperation.

## II. Progress made in regional cooperation for early warning

9. Well-functioning end-to-end early warning systems play vital roles in reducing disaster risks by facilitating early actions in areas that are at risk. The significant reduction of cyclone-related casualties in Bangladesh (see box 1) is credited to improvements in cyclone early warning, which is being used to trigger evacuation to cyclone shelters and safer locations. Similarly, early warning for typhoons have played a critical role in the reduction of casualties in Hong Kong, China, in conjunction with the adoption of building codes. The achievement of “zero casualties” — a specific policy goal in Albay Province in the Philippines, an area frequently hit by super typhoons, is also attributable to early warning coupled with strong community preparedness measures.

10. Advances in science and technology have led to more accurate forecasts, which are the most critical inputs to early warning. Societies can further leverage improvements in predicting weather and climate to enhance preparedness — a five-day forecast today is as good as the three-day forecasts 25 years ago;<sup>4</sup> El Niño predictions have also improved — a six-month prediction today is as good as a five-month prediction 20 years ago, when El Niño was first predicted.<sup>5</sup> These improvements in making predictions provide a

<sup>4</sup> European Centre for Medium-Range Weather Forecasts, “The ECMWF Ensemble Prediction System: the rationale behind probabilistic weather forecasts” (2012). Available from [www.ecmwf.int/sites/default/files/elibrary/2012/14557-ecmwf-ensemble-prediction-system.pdf](http://www.ecmwf.int/sites/default/files/elibrary/2012/14557-ecmwf-ensemble-prediction-system.pdf).

<sup>5</sup> Lisa Goddard, “The evolution and outstanding challenges for El Niño modelling and prediction”, presentation made at the El Niño 2015 Conference, New York, November 2015. Available from [http://iri.columbia.edu/wp-content/uploads/2015/11/Goddard\\_talk.pdf](http://iri.columbia.edu/wp-content/uploads/2015/11/Goddard_talk.pdf).

significant amount of lead time for governments, sectoral and humanitarian agencies and communities-at risk to take action and prepare for potential impacts.

11. However, not all countries have the capacity to translate these scientific advances into actionable early warning information on the ground. To a great extent, improving early warning systems is tied to access to the required technology, technical capacity and resources. Investments are needed to translate the scientific advances in hazard monitoring, prediction and communications to improvements in early warning systems.

12. While the most critical investments and actions need to be undertaken at the national level, such efforts would benefit significantly from strengthened regional intergovernmental cooperation and inter-agency coordination for risk assessment and early warning services. For low-capacity high-risk countries to benefit from scientific and technological advances, the establishment and operation of regional cooperation mechanisms on multi-hazard early warning systems is essential.

#### **A. Tropical cyclones and typhoons**

13. The ESCAP/WMO Typhoon Committee and the WMO/ESCAP Panel on Tropical Cyclones continue to facilitate regional cooperation among their member States through promoting capacity-building in forecasting and monitoring of tropical cyclones and typhoons.

14. The ESCAP/WMO Typhoon Committee, at its forty-ninth session, held in Yokohama, Japan, from 21 to 24 February 2017, adopted the New Strategic Plan 2017-2021, which is well-aligned with the targets of the Sendai Framework on reducing the loss of lives and economic impacts from disasters in its member countries. The Strategic Plan presents an innovative approach for monitoring and forecasting typhoons through regional cooperation, while addressing shared vulnerabilities and risk.

15. Following up on a recommendation made by the Committee on Disaster Risk Reduction at its fourth session in 2015,<sup>6</sup> the Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Meteorological Organization (WMO) proposed extending these subregional intergovernmental mechanisms to the countries and territories in South-Western Pacific at the sixteenth session of the WMO Regional Association V Tropical Cyclone Committee for the South Pacific and South-East Indian Ocean, held in Honiara from 29 August to 2 September 2016. The Pacific member States recognized that the partnership between ESCAP and WMO could contribute to enhanced operational capacity in cyclone early warning and preparedness and could serve as an important means of sharing experiences from Asia with the Pacific. This subject will be taken up again at the next session of the Tropical Cyclone Committee in 2018.

16. Progress has been made in extending the geographic scope of the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries to include Pacific small island developing States, as requested by the Commission in its resolution 71/12.<sup>7</sup> A project funded by the ESCAP Multi-Donor Trust Fund is currently being implemented in the South-West Pacific area to support the

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<sup>6</sup> E/ESCAP/CDR(4)/6, para. 11.

<sup>7</sup> Commission resolution 71/12, para. 4(g).

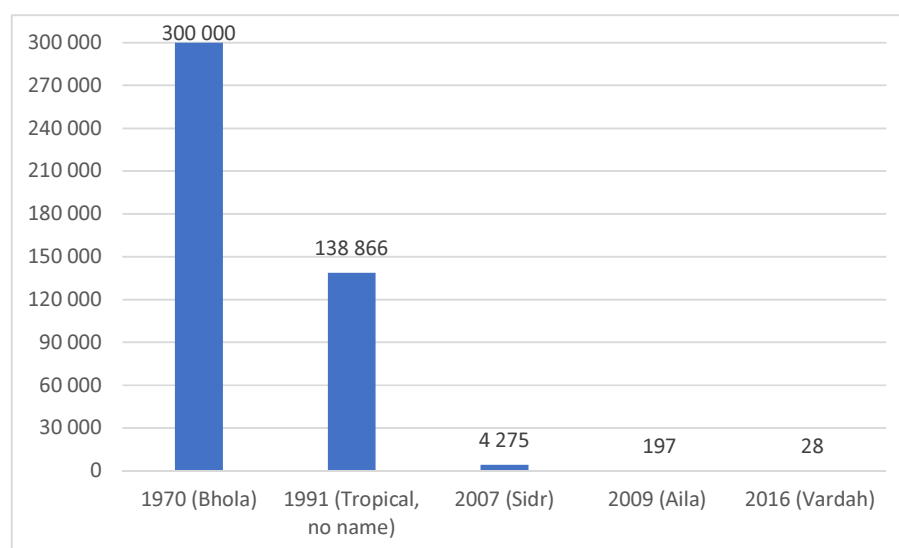
establishment of national climate outlook forums, based on the experience of monsoon forums in Asia. In January 2017, the Regional Integrated Multi-hazard Early Warning System for Africa and Asia and WMO set up a joint project to enhance weather and climate resilience through capacity-building on impact forecasting. The project is intended to strengthen the framework for tailoring climate information and data for community-level applications in its pilot countries, namely Fiji, Papua New Guinea and Samoa.

#### Box 1

##### Forecasting and monitoring tropical cyclones

Many cases can be cited to show the benefits of regional cooperation in tropical cyclone forecasting and monitoring. The WMO/ESCAP Panel on Tropical Cyclones covering the Bay of Bengal has helped to integrate the fields of meteorology, hydrology and disaster risk reduction by building capacities and developing joint strategies across countries and professional fields for more than 40 years in countries in the Bay of Bengal. The improvements in early warning systems and development of regional standard operating procedures for early warning have helped to mitigate the impacts from tropical cyclones, reducing the number of lives lost between 1970 and 2016 from tropical cyclones.

##### Reduction in deaths from tropical cyclones in Bangladesh (1970-2016)



*Source:* ESCAP calculations based on EM-DAT. Available from [http://emdat.be/emdat\\_db/](http://emdat.be/emdat_db/) (accessed on 3 July 2017).

Similarly, the ESCAP/WMO Typhoon Committee, which covers the Pacific basin, can also cite several success stories. Typhoon Meranti, which hit the Philippines, Taiwan Province of China and eastern China in September 2016, was the strongest tropical cyclone in the world during that year. Its estimated peak intensity was 305 km/h, surpassing Cyclone Winston in February 2016, which killed more than 40 people in Fiji. Despite the strength of Typhoon Meranti, the damage was minimal because of many factors, including the precise tracking of its speed, intensity, and movement. This was made possible by the joint monitoring operations undertaken by the members of the ESCAP/WMO Typhoon Committee.

## B. Drought and slow-onset disasters

17. During the past two years, many countries in the Asia-Pacific region were affected by severe drought. Many of the droughts were induced or intensified by the recent El Niño phenomenon, which particularly affected the Marshall Islands and Viet Nam. However, despite El Niño being a harbinger of disasters, it also offers an opportunity to proactively manage risks because seasonal climate is much more predictable during the El Niño years. Depending on the location and season, El Niño can be predicted from three to six months in advance. As mentioned in the introduction, the ability to predict El Niño has improved by an additional month. If acted upon, this additional window of opportunity can make a critical difference in planning and preparedness on the ground.

18. The response of United Nations entities, including ESCAP, to the 2015-2016 El Niño showed the potential of early warning-based risk mitigation strategies and inter-agency coordination. To support the efforts of countries that were at risk to El Niño impacts, ESCAP and the Regional Integrated Multi-hazard Early Warning System for Africa and Asia jointly issued advisory notes to explain what global El Niño predictions mean for various parts of the region. Furthermore, ESCAP, together with the Regional Integrated Multi-hazard Early Warning System for Africa and Asia and the United Nations Development Programme, has developed a methodology that helps to assess the risk brought about by El Niño and has facilitated efforts to translate global El Niño predictions to concrete preparedness measures on the ground.<sup>8</sup>

19. Early warning information for slow-onset disasters is not always used to spur early action because of a lack of understanding of the action required by the warning at the ground level and the absence of institutional mechanisms to consider such information on a regular basis. To help overcome those challenges, ESCAP, through the ESCAP Multi-Donor Trust Fund, has supported activities aimed at building capacities for climate preparedness in highly vulnerable countries, such as Cambodia, Myanmar and Sri Lanka. As a result, those countries' national climate outlook forums, which are referred to as monsoon forums, are being strengthened. National climate outlook forums are regular dialogues (at least biannually, around the onset of monsoon seasons) involving users and producers of seasonal forecast information to understand potential impacts and to develop corresponding preparedness plans based on available information.

20. The national climate outlook forums began as platform to communicate potential disaster risks that are growing into a regional norm, enabling countries to bring together government agencies and other institutions that manage risks across many climate-sensitive sectors, such as water management, energy generation, agriculture and health. Today, these forums are an established institutional mechanism in at least 14 countries in the Asia-Pacific region. In most countries, the national climate outlook forums are held only at the national level but some, such as India, Myanmar, and the Philippines, have started to convene subnational forums with the objective to more precisely forecast ground-level impacts.<sup>9</sup>

21. The holding of the monsoon forums is sequenced with the WMO-led regional climate outlook forums to ensure that the national monsoon forums

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<sup>8</sup> See E/ESCAP/CDR(5)/INF/2.

<sup>9</sup> See ESCAP, *Asia-Pacific Disaster Report 2017* (United Nations publication, forthcoming) for a discussion on the mechanics of these forums.

receive inputs from the regional forums. This has proven to be particularly useful. For example, by acting on the seasonal climate outlook received from the South Asian Climate Outlook Forum in 2015, through its national monsoon forum, the Department of Irrigation of Sri Lanka saved the equivalent of about six billion Sri Lankan rupees (\$39,000). The savings were made possible by regulating water in dams and reservoirs in various areas in the country which prevented a potential flood disaster.<sup>10 11</sup>

22. The regional climate outlook forums bring together climate experts from areas that are climatologically similar. Serving as the regional component for the implementation of the WMO Global Framework for Climate Services for countries that do not have the infrastructure or capacity to create climate outlooks on their own, the regional climate outlook forum is an important source of climate model outputs and forecasts from leading global climate centres. It also serves as a platform for peer learning in terms of interpreting information and translating it into country-specific outlooks.

23. The ESCAP Regional Cooperative Mechanism for Drought Monitoring and Early Warning, which operates under the guidance of the secretariat's Regional Space Applications Programme for Sustainable Development, brings together regional resources for space and geographic information system applications. It enhances capacities in conducting integrated analyses of space and ground data and information, and helps build resilience of agricultural communities that are perennially affected by drought. By incorporating satellite-derived information generated by and shared among partners of the Regional Space Applications Programme for Sustainable Development and offering its members a range of tools that can be adapted to suit local situations, the Regional Cooperative Mechanism enhances seasonal forecasts, longer-term risk analysis, impact-based forecasting and other tools used to manage and cope with drought.

24. For example, beyond the drought monitoring and early warning system developed by partners of the National Remote Sensing Centre of the Indian Space Research Organization or the Chinese Academy of Sciences, a range of sophisticated tools have been developed in Australia. These tools, which are for seasonal forecasts, water modelling and water accounting, can be adapted to the needs of developing countries to help manage the water resources in a drought-prone year. eWater Source, the national hydrological modelling platform of Australia, is designed to simulate all aspects of water resource systems to support integrated planning, operations and governance from catchment to river basin scales, including human and ecological influences. The tool accommodates diverse climatic, geographic, water policy and governance settings, which can be adapted to various climatic conditions. Fundamental to this design is its flexibility, which makes it readily customizable and easy to update as new scientific innovations become available. New capabilities can be incorporated via plugins developed to suit particular needs while maintaining the overarching decision and policy framework.

25. ESCAP is aligning its ongoing activities under the Regional Cooperative Mechanism for Drought Monitoring and Early Warning with the national climate outlook forums and the WMO-led regional climate outlook

<sup>10</sup> Minutes of the Forty-third session of the Panel of Tropical Cyclones; Regional Integrated Multi-hazard Early Warning System for Africa and Asia.

<sup>11</sup> Ruby Rose Policarpio, Seasonal forum in Asia and the Pacific. Presentation at the Regional Integrated Multi-hazard Early Warning System for Africa and Asia. Bangkok, 30 March 2017.

forums.<sup>12</sup> Products and services produced by the Regional Cooperative Mechanism are being introduced to countries through the monsoon forums in Cambodia, Myanmar and Sri Lanka.

### **C. Transboundary floods, flash floods, landslides and glacial lake outburst floods**

26. Floods have been the most devastating natural disasters to affect poor people at the global level. The same holds true for the Asia-Pacific region: in 2016, 3,250 lives were lost and more than 13 million people were affected by floods.<sup>13</sup> In particular, floods in transboundary river basins have led to severe damage and loss in the region. Between 2000 and 2010, floods in the Indus, Ganges and Brahmaputra-Meghna river basins, among others, resulted in more than 20,000 fatalities with combined damage of about \$30 billion. During the same period, in the Mekong river basin, flooding caused nearly 3,000 fatalities and \$2.7 billion in damage. These river basins are also home to large poor populations, which are chiefly dependent on agriculture as their primary source of income and livelihood.<sup>14</sup>

27. In this regard, it is critical to improve regional cooperation for operational flood forecasting and early warning systems in shared river basins. In recognition of its importance, the Committee on Disaster Risk Reduction, at its fourth session, held in Bangkok from 27 to 29 October 2015, recommended that the secretariat work towards the establishment of a regional cooperation mechanism for early warning for transboundary river basin floods, and requested the secretariat to collaborate with partners to take this priority forward in line with Commission resolution 71/12. It also recommended that the secretariat address gaps in early warning for glacial lake outburst floods, flash floods and landslides.<sup>15</sup>

28. Towards this end, ESCAP is conducting three feasibility studies with funding support from the Government of Germany through the Deutsche Gesellschaft für Internationale Zusammenarbeit. The objectives of the studies are to analyse the status and potential for regional cooperation for early warning of transboundary river basin floods, flash floods and landslides. The results will be presented in an expert group meeting to be held in October 2017, during which experts and representatives from member States will review the findings and discuss steps to promote regional cooperation for early warning of these hazards.

## **III. The ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries**

29. The ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries continues to provide financial and technical support to address unmet needs and gaps in early warning systems in the Asia-Pacific region. It has been used to promote innovative pilot initiatives, scale up successful early warning systems and facilitate regional cooperation by leveraging the convening power

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<sup>12</sup> See [www.wmo.int/pages/prog/wcp/wcasp/clips/outlooks/climate\\_forecasts.html](http://www.wmo.int/pages/prog/wcp/wcasp/clips/outlooks/climate_forecasts.html).

<sup>13</sup> Centre for Research on the Epidemiology of Disasters, EM-DAT: The OFDA/CRED International Disaster Database. Available from [www.emdat.be](http://www.emdat.be) (accessed 4 July 2017).

<sup>14</sup> Ibid.

<sup>15</sup> E/ESCAP/CDR(4)/6, para. 10.



of ESCAP. Advocating a multi-hazard people-centred approach, the Trust Fund works with key partners of the United Nations system, regional intergovernmental institutions, member States, non-governmental organizations and academic institutions in the area of early warning. As of February 2017, it had received contributions totalling \$15.5 million.<sup>16</sup>

30. Since its establishment in 2005, the Trust Fund has supported 26 projects with the contributions it has received, directly benefiting 19 countries. Despite these achievements, sustaining the funding needed for disaster risk reduction is a concern in Asia and the Pacific, especially for low frequency but high impact hazards, such as tsunamis. The Trust Fund is therefore intensifying efforts to mobilize resources and exploring innovative methods to secure funding.

31. Learning from the progress made in regional and national early warning systems and applying recommendations from independent reviews, the Trust Fund is now entering a new strategic phase covering the period 2017-2020. Fully integrated with the ESCAP programme of work and strategic priorities for implementing the Sendai Framework and the 2030 Agenda, the pillars of this strategy of the new phase is to focus on: (a) regional cooperation by interlinking partnerships between the Regional Integrated Multi-hazard Early Warning System for Africa and Asia, the Typhoon Committee, the Panel on Tropical Cyclones and others; (b) the extension of the ESCAP Multi-Donor Trust Fund; (c) investment in climate risk management, including a possible partnership with the Climate Risk Early Warning Systems Initiative, which is a global initiative supported by WMO, the World Bank, the United Nations Office for Disaster Risk Reduction and the Global Facility for Disaster Reduction and Recovery; and (d) incorporation of financial innovations from non-traditional donors, civil society and the private sector, including those related to disaster risk transfer mechanisms and parametric insurance.

32. This newly proposed ESCAP Multi-Donor Trust Fund Strategy 2017-2020 is in line with the resource mobilization strategy of ESCAP. The Advisory Council of the Trust Fund will review the strategy on 22 August 2017. Recently, the Trust Fund participated in the 2017 Global Platform for Disaster Risk Reduction and the Multi-Hazard Early Warning Conference, held in Cancun, Mexico, in May, and the fifty-fifth session of the Committee on the Peaceful Uses of Outer Space, organized by the Office for Outer Space Affairs on 6 and 7 June 2017. At these events, the Trust Fund met with donors and potential new donors to discuss its work. As a result of these meetings, a possible working arrangement with the United Kingdom Space Agency emerged and discussions are under way to formalize a partnership.

#### **IV. Looking forward: addressing remaining gaps in early warning systems**

33. To further address gaps in regional cooperation for early warning pertaining to the range of disasters described above and to strengthen coherence between the 2030 Agenda and other internationally agreed frameworks, the secretariat proposes to bring the efforts of ESCAP pertaining to disaster risk reduction and resilience together under an Asia-Pacific disaster resilience network.<sup>17</sup> Box 2 contains further details.

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<sup>16</sup> E/ESCAP/72/18, para 18.

<sup>17</sup> See E/ESCAP/CDR(5)/1 for more details.

34. As part of this network, the regional platform for multi-hazard early warning system aims to integrate the initiatives that have been discussed above in a cohesive and mutually supportive manner. The regional platform presents a systems approach aligned with the strategic role of ESCAP in multi-hazard early warning systems. The following information is being presented to the Committee for further consideration of implementation of the initiative:

(a) The platform is envisaged as a multimodal virtual and real system, depending on ground realities, for expert synthesis and consolidation of the substantive work of ESCAP on disaster risk reduction and policy coherence across the region.

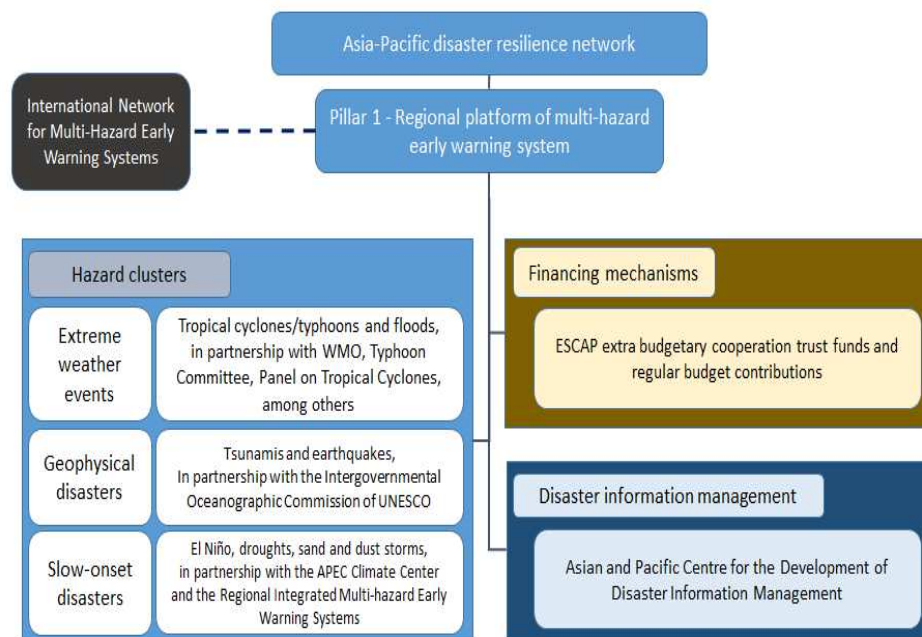
(b) The platform presents an approach to strengthen the linkages between early warning service providers and disaster risk reduction and sustainable development policymakers at the regional level. It thus combines immediate needs with long-term imperatives that strengthen coherence between the Sendai Framework and 2030 Agenda. In line with these temporal perspectives, the platform will be organized as the situation demands, but will meet at least once a biennium and prior to each Committee session so as to feed into the substantive components of multi-hazard early warning systems discussions of the Committee, while maintaining a firm foothold in operational perspectives as disasters hit in future. In this regard, the expert group meeting on multi-hazard early warning system organized prior to the current session of the Committee is an important step towards its realization.

(c) The platform will take stock of unmet needs of multi-hazard early warning, including requirements for capacity development, and address them through ESCAP work programme activities and partnership strategies. This includes aligning the activities and initiatives of ESCAP and the ESCAP Multi-Donor Trust Fund with the Climate Risk and Early Warning Systems initiative and the International Network of Multi-Hazard Early Warning Systems. The stocktaking will also take into account the outcomes of the annual sessions of the ESCAP/WMO Typhoon Committee and the WMO/ESCAP Panel on Tropical Cyclones, the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Regional Integrated Multi-hazard Early Warning System for Africa and Asia and the Advisory Council meetings of the ESCAP Multi-Donor Trust Fund.

## Box 2

**Regional platform on multi-hazard early warning systems**

To support the regional road map for implementing the 2030 Agenda in Asia-Pacific, ESCAP is proposing to establish the Asia-Pacific disaster resilience network, which has the platform for multi-hazard early warning systems as one of its pillars (see figure II).

**The Asia-Pacific disaster resilience network**

*Abbreviations:* APEC, Asia-Pacific Economic Cooperation; UNESCO, United Nations Educational, Scientific and Cultural Organization; WMO, World Meteorological Organization.

The platform is based on a multi-hazard cluster approach that includes extreme weather events, geophysical disasters and slow-onset disasters supported by the respective enabling mechanism and led by ESCAP and partners. The key enablers to implement the work of this regional platform involve (a) financing partnerships that include the ESCAP extra-budgetary cooperation trust funds, including the ESCAP Multi-Donor Trust Fund and ongoing work on assessing risk transfer mechanisms, in addition to the regular budget resources of ESCAP; (b) technical partnerships with WMO for extreme weather events, the Office for Outer Space Affairs for multi-hazard space-derived information management, the Intergovernmental Oceanographic Commission for tsunamis and earthquakes, the Asia-Pacific Economic Cooperation Climate Centre and the Regional Integrated Multi-hazard Early Warning System for Africa and Asia for slow-onset disasters; and (c) information management through the Asian and Pacific Centre for the Development of Disaster Information Management. Its core programme consists of capacity development and knowledge-sharing, with a focus on multi-hazard risk assessment and early warning systems, including sand and dust storms, drought and desertification.

By bringing together various disciplines under one integrated network, the secretariat will be in a position to “accord priority to synchronizing multi-disciplinary support to member States in the mainstreaming of disaster risk reduction in [...] development strategies” as emphasized by the Commission in its resolution 73/7, and implement its work on multi-hazard early warning systems in accordance with the Sendai Framework and the 2030 Agenda.

## A. Impact-based forecasting and risk-informed early warning

35. In recent years, the occurrence of drought in almost all the Asia-Pacific subregions has been inching higher, along with increasing concerns over large-scale El Niño-induced drought. Assessments of these hazards are available, but they are traditionally made in terms of rainfall shortfall and other weather and climate-parameters. The lack of information on potential impacts constrains early action. While this traditional approach to forecasting and early warning is understandable to professionals, policymakers have increasingly stressed the need for impact scenarios to target physical and financial interventions.

36. To meet this demand, early warning systems are evolving into systems that incorporate the impact scenarios and time-critical risk-information. This shift had been made possible by improved forecasting and advanced geospatial modelling of exposure and vulnerability. Its methodology involves translation of hazard information to impact estimation with the specific risk scenarios, for short-term response, midterm interventions, and long-term mitigation actions. While a traditional forecast focuses solely on the hazard, an impact-based forecast combines this information with exposure and socioeconomic vulnerabilities. This lies at the centre of what is meant by “people-centred” early warning systems.

37. Recognizing the transformative role of impact-based forecasting in disaster risk reduction, building capacity and facilitating cooperation in these emerging trends forms the core of the work of ESCAP. In this regard, the workplan of the Asian and Pacific Centre for the Development of Disaster Information Management is expected to increase the focus of ESCAP on delivering actionable multi-hazard risk information, particularly for disasters with transboundary origins and impacts.<sup>18</sup>

38. The Centre will organize regional capacity development training on seismic microzonation, with a scenario-based impact assessment for earthquakes of different magnitudes. This service line is being offered in recognition of the specificity of earthquake hazards, which unlike water-related hazards, provide just a few minutes of warning lead time.

## B. Combating sand and dust storms

39. There are concerns that the frequency and intensity of sand and dust storms have increased over the past a few decades. Sand and dust storms have significant impacts on human health, the environment and economies. Such storms may significantly contribute to a range of human illnesses, as well as damage buildings, paralyse the operations of certain infrastructure, such as the operation of transportation hubs, in particular airports, communication networks, and power and water supply systems.<sup>19</sup>

40. Sand and dust storms are transboundary phenomena, as their sources and affected areas can be situated far from each other. Therefore, to effectively manage them, coordination across various intercountry political, legal and institutional settings is required and different disaster information management approaches need to be used.

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<sup>18</sup> The Centre was established in Tehran by the Commission to contribute to the ESCAP programme of work in the area of information and communications technology and disaster risk reduction.

<sup>19</sup> Woosuk Jung, “Environmental challenges and cooperation in Northeast Asia”, *Focus Asia Perspective and Analysis*, No. 16 (March 2016). Available from <http://isdpc.eu/content/uploads/2016/05/2016-jung-environmental-challenges-cooperation-northeast-asia.pdf>.

41. In this regard, ESCAP member States, in Commission resolution 72/7, requested the secretariat to accord priority focus on the work of the Commission relating to sand and dust storms as a great transboundary challenge. Combating sand and dust storms in South and South-West Asia and in Central Asia will be one of the initial focus areas of work of the Asian and Pacific Centre for the Development of Disaster Information Management, in line with several global, regional and national policy actions and action plans. The Centre will work in close collaboration with the Government of the Islamic Republic of Iran and United Nations programmes and funds. Through a wider partnership network, the Centre will mobilize information and knowledge-sharing across several countries in Asia that are affected by sand and dust storms.

42. During the International Conference on Combating Sand and Dust Storms, held in Tehran from 3 to 5 July 2017, experts and regional representatives shared experiences and best practices on combating sand and dust storms. The Conference adopted the Tehran Ministerial Declaration, in which the need for concerted and collaborative global, regional and subregional as well as national responses to address sand and dust storms was recognized. Also in the Declaration, the role of the United Nations in promoting international cooperation and partnerships among countries and other relevant stakeholders in dealing with natural disasters, with specific focus on combating sand and dust storms, was underlined.

### **C. Tsunami early warning**

43. In the aftermath of the human toll and massive destruction caused by the 2004 Indian Ocean tsunami, significant progress has been made in improving early warning and raising awareness in the affected areas. The positive effects of the progress was substantiated during the recent occurrence of submarine earthquakes during which warning alerts and evacuations averted the worst-case scenarios from happening.

44. In comparison, limited attention and resources have been directed towards preparing other areas in the eastern Indian Ocean for potential tsunami impacts. For example, coastal communities and major cities along the Makran subduction zone, in the north-west Indian Ocean, are at increased threat from a tsunami. Because of the short distance between the fault line and the coast, locally generated tsunami waves could potentially inundate coastlines within 20 minutes after a powerful earthquake.<sup>20</sup>

45. In partnership with the Intergovernmental Oceanographic Commission and other organizations, the ESCAP Multi-Donor Trust Fund has facilitated scientific and field studies and projects to increase awareness among key stakeholders and communities in India, the Islamic Republic of Iran and Pakistan. A network of experts from India, the Islamic Republic of Iran, Oman and Pakistan was established, alongside an international support network for research, with participation from Chile, Indonesia, Sri Lanka, Thailand and the United States of America. This network will work towards closing gaps in regional cooperation.<sup>21</sup>

46. It is clear, however, that funding constraints for disaster risk reduction or prevention are very large. Countries in the Makran subduction zone are under funding constraints. In line with the argument of the present report,

<sup>20</sup> See E/ESCAP/73/21.

<sup>21</sup> Ibid.

sustainability and effectiveness of early warning systems, particularly for high-risk and low-capacity countries can be enhanced through the application of a multi-hazard approach.

47. Notwithstanding the above, continued investment in tsunami risk reduction remains necessary to ensure a sustainable solution for the countries exposed to the threat of tsunamis. ESCAP, within its limited resources, plans to continue to promote cooperation in tsunami early warning with a focus on last-mile connectivity, particularly by supporting the regional Indian Ocean tsunami wave exercise.

#### **D. Benefits of early warning investments for risk financing and sharing mechanisms**

48. Benefits from investments in early warning are often presented in terms of lives saved and damages avoided. New trends in risk financing and risk sharing mechanisms show that investments in improving early warning infrastructure – from data collection, monitoring, and processing of information – can also have collateral benefits for risk financing and sharing mechanisms.<sup>22</sup>

49. In 2015, the World Food Programme and the International Federation of Red Cross and Red Crescent Societies, together with the German Red Cross, rolled out a forecast-based approach, which could potentially transform the humanitarian system to be more proactive. This new approach will allow for the release of funds for disaster preparedness and response before a crisis occurs and for resilience-building activities.

50. The mechanism was successfully activated by the Red Cross in several countries, including in Guatemala, Uganda and Zimbabwe, in the light of the predictions of El Niño and extreme weather in 2015. Analyses conducted in Sudan and Niger show that an anticipatory, rather than reactive strategy is cost effective – with forecast-based financing lowering the cost of the humanitarian response by as much as 50 per cent. In Asia, the World Food Programme and the Red Cross Society have put this mechanism in place in Bangladesh, Nepal and the Philippines.<sup>23</sup>

51. Furthermore, parametric insurance is an innovative solution that can potentially be used to tackle problems associated with traditional insurance. It overcomes many of the barriers that have prevented traditional insurance from firmly taking root in many parts of the world, including in many Asian and Pacific countries. A potentially game-changing feature of parametric insurance if properly designed with a balance between sustainability and inclusiveness is that the payout is tied to an agreed parameter threshold, such as wind speed and rainfall levels, between the buyer and insurer prior to the disaster taking place and independent of the actual damage. To date, evidence suggests that when actual damages are higher than the threshold suggested, redesigns of the parametric insurance are necessary, particularly when the poor are affected.

52. To a certain extent, the success of parametric insurance will be facilitated by the same data, infrastructure, and technical capacities that are used for improving early warning systems. For example, the index-based flood insurance introduced for smallholder farmers in Bangladesh and India by the

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<sup>22</sup> See ESCAP, *Asia-Pacific Disaster Report 2017* (United Nations publication, forthcoming), chapter 7. The wide variety of risk transfer and sharing tools is discussed in E/ESCAP/CDR(5)/3.

<sup>23</sup> See <http://ibfi.iwmi.org>.

International Water Management Institute, the Indian Council of Agricultural Research, the Department of Disaster Management, the Institute of Water Modelling, the SwissRe and non-governmental organizations combines hydrological and hydraulic modelling and newly available 10-meter resolution satellite images. Rainfall data for a river catchment area are first added to the model, which shows how run-off will travel and collect. If a trigger water-level is reached – calculated using 35 years of hydrological data – satellite images are used to verify the depth and duration of the flood. This can accurately identify farmers that are eligible for compensation who will be notified of this through a text message.<sup>24</sup>

## V. Issues for consideration

53. Availability of and access to a multi-hazard early warning system has a specific target under the Sendai Framework. It is also a critical enabler for achieving the goals and targets related to disaster risk reduction and resilience in the 2030 Agenda, and in ensuring that progress in the implementation of the 2030 Agenda is not reversed by natural hazards.

54. Many of the transformational improvements in early warning systems are enabled by scientific and technological advances in hazard observation systems, modelling, computing, data assimilation and storage. Information and communications technology (ICT) is also making science-informed tools accessible through easy-to-use web interfaces.

55. However, access to technologies and information, and the ability to use them for disaster risk reduction are not the same across countries. Thus, leaving no one behind in the Asia-Pacific region means ensuring that populations and countries with low capacity are supported to maximize the use of those technologies to improve early warning systems through partnerships and regional cooperation. As such, ESCAP will continue to work on strengthening and extending regional cooperation mechanisms for early warning of multiple natural hazards.

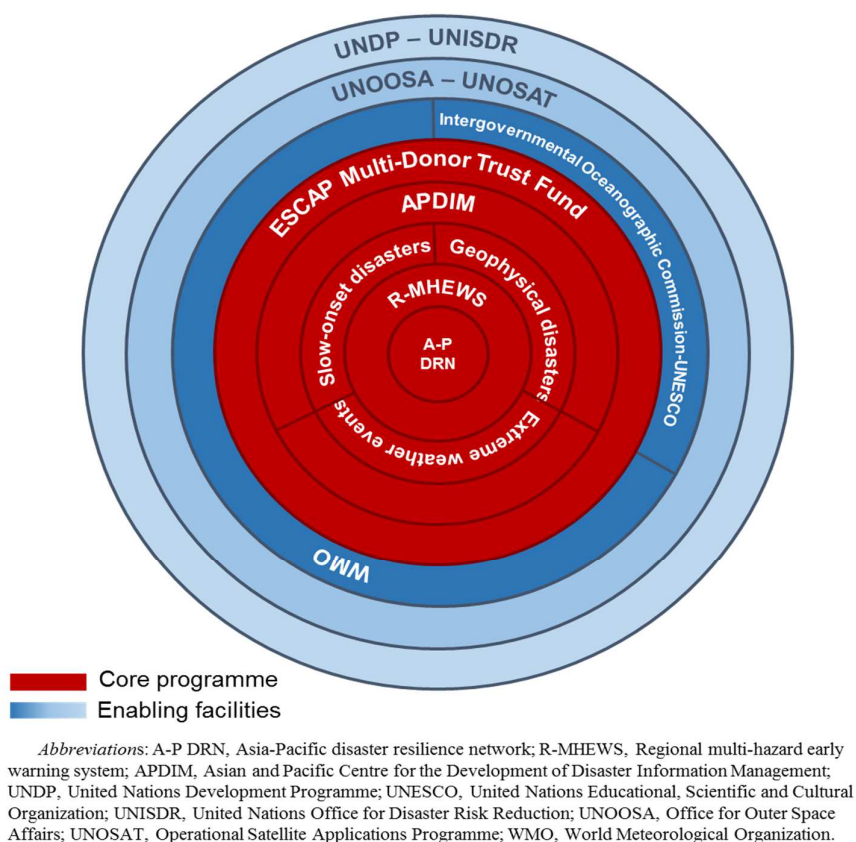
56. In implementing those initiatives, the secretariat will draw from a number of facilities and platforms (see figure I). The Asia-Pacific Regional Coordination Mechanism, through its Thematic Working Group on Disaster Risk Reduction and Resilience, will serve as a mechanism for ensuring a One United Nations approach to supporting countries in building resilience to natural disasters.<sup>25</sup>

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<sup>24</sup> Ibid.

<sup>25</sup> See E/ESCAP/CDR(5)/INF/2 for more details on the implemented activities and future direction of the Thematic Working Group on Disaster Risk Reduction and Resilience.

Figure I  
**The enablers of Asia-Pacific disaster resilience network with the regional multi-hazard early warning systems at its core**



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

(a) Guide the work towards enhancing regional cooperation for multi-hazard early warning systems in the Asia-Pacific region, in line with Commission resolution 73/7;

(b) Recommend strengthening the work on regional cooperation mechanisms by putting in place a regional platform on multi-hazard early warning systems – as an integral component of the Asia-Pacific disaster resilience network – to bring together the various hazard-specific platforms to support policy coherence;

(c) Support the further strengthening of the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries by contributing financial and other relevant support, as well as identifying new partners, including non-traditional ones, to strengthen people-centred multi-hazard early warning systems in the region;

(d) Recommend actions to strengthen sharing of experiences, expertise and training facilities on early warning for multiple hazards with high-risk countries that have low capacity to issue early warning through, among others, the work of the Asian and Pacific Centre for the Development of Disaster Information Management.