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Review of implementation of the 2030 Agenda for Sustainable Development in Asia and the Pacific: disaster risk reduction

Addressing disaster resilience through digital and geospatial innovations

Note by the secretariat

Summary

Since the Commission met at its seventy-fourth session in 2018, the region witnessed a spate of disasters that revealed gaps in resilience and underlined the policy challenges that remain to be addressed for disaster risk reduction and management systems across many countries. Several of the hazards that triggered disasters in Asia and the Pacific are beyond anything the region has seen in terms of the complexity of risk. Notwithstanding this, the lessons that emerge from these disasters provide valuable insights into how future efforts can make countries in the region more resilient. Innovations driven by digital and space technology can provide promising tools.

The regional road map for implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific provides a solid foundation for cooperative regional actions to address gaps in resilience, but efforts may need to be intensified in light of recent disasters, which posed challenges even to countries with robust disaster management systems. The Economic and Social Commission for Asia and the Pacific aims to improve risk knowledge, risk assessment and early warning with a focus on geospatial data and innovations in space and digital technology applications. This requires a people-centred approach that captures differences in vulnerabilities to disaster risk among the most marginalized population groups. The present document includes a discussion of the key challenges that need to be addressed to harness the potential and improve the effectiveness of disaster risk reduction strategies.

The Commission is invited to deliberate on the issues presented in the present document and to provide guidance on the future work of its subsidiary bodies, regional institutions and the secretariat.

* ESCAP/75/L.1.

I. Introduction

1. Disasters over the past year brought to light key resilience gaps, reinforcing the long-term trend that disaster risks are outpacing resilience. Several of the hazards[1] that triggered disasters in 2018 were beyond anything the region had seen in terms of probability, intensity and behaviour. These events caught authorities and the public by surprise, even in jurisdictions with robust systems for managing extreme hazards. Whether they represent a "new normal" is a matter for scientific verification, but what is clear is the need to intensify actions to prevent risks from turning into bigger future disasters.

2. The present document contains a review of the resilience gaps that were revealed by the disasters in 2018 in Asia and the Pacific.[2] It shows that the regional road map for implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific provides a solid foundation for cooperative regional actions to address these emerging issues. However, actions need to be scaled up to better prepare countries for future disasters, particularly in view of an increasingly complex dynamics of risks arising from climate and other large-scale environmental and social changes.

II. A year of surprises that revealed resilience gaps

3. The disasters in 2018 revealed deficiencies in the ability of risk assessment tools in the region to provide early warnings for disasters and hazards that evolve dynamically. They also revealed wider capacity and vulnerability gaps as people struggled to cope with this increased complexity.

A. Gaps in risk knowledge

4. In general, the evolution of early warning systems and disaster risk management systems is driven by knowledge of the hazards and their complex interactions with exposure and vulnerabilities. Many countries and subnational locations, even those beset by low capacities, have made remarkable system improvements, as proven by the overall decline of disaster-related deaths across the region. However, even the jurisdictions with robust early warning and disaster risk management systems, such as Japan, Odisha State, India, and Bicol, Philippines, sustained heavy losses in 2018 the face of surprise disasters, which are events that are rare and/or deemed highly unlikely. [3]

5. Tsunamis are generally triggered by the vertical movement of tectonic plates at the sea floor. The deadly Sulawesi tsunami in September 2018, however, was triggered by a strike-slip earthquake, which is characterized by horizontal rather than vertical movements and is not known to generate large tsunamis.[4]

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[1] A natural hazard is predominantly associated with natural processes and phenomena while a disaster is a result of hazardous events interacting with conditions of exposure, vulnerability and capacity. See A/71/644.

[2] More detailed discussion of the impacts and origins of the major disasters in 2018 will be available in the *Asia-Pacific Disaster Report 2019* (United Nations publication, forthcoming).

[3] See Geoff O'Brien and Phil O'Keefe, *Managing Adaptation to Climate Risk: Beyond Fragmented Responses* (London, Routledge, 2014).

[4] Mohammad Heidarzadeh, Abdul Muhari and Antonius B. Wijanarto, "Insights on the source of the 28 September 2018 Sulawesi tsunami, Indonesia based on spectral analyses and numerical simulations", *Pure Applied Geophysics*, vol. 176, No. 1 (January 2019), pp. 25–43.

6. High-impact hydro-meteorological disasters are frequent in the region but even so, 2018 saw unexpected behaviour and record-breaking intensity. The former was evidenced by tropical cyclone Titli that struck the coastal state of Odisha, India in October 2018. It was described by the India Meteorological Department as a rarest of rare occurrences based on 200 years of cyclone records, because it intensified very rapidly, retained its destructive potential even after landfall and recurved away from the coast and towards the interior districts where cyclones were not normally expected. [5] Record-breaking weather events were also witnessed in the South Pacific with Cyclone Gita (February 2018) being the most intense to ever hit Tonga.[6] The flooding in south-western Japan in July 2018 was triggered by rains surpassing the average monthly rainfall for July by two to four times in many locations.[7]

7. Climate change will continue to add a new layer of risk and uncertainties. According to the latest report of the Intergovernmental Panel on Climate Change, a warming of 1.5°C to 2°C above pre-industrial levels will increase the odds of more weather and climate extremes in many locations in the region.[8] Some countries in the Asia-Pacific region are already experiencing temperature increases, which exceed the dangerous threshold of 1.5°C to 2°C.

B. Gaps in risk assessment and early warning

8. The 2018 disasters showed the difficulty of forecasting the dynamic interplay of hazards, exposure and vulnerability. Furthermore, events in 2018 showed that even minor hazards can turn into high-impact disasters when they combine with other hazards, hit locations that are predisposed to adverse impacts and affect vulnerable populations.

9. For example, tsunami early warning systems normally cover only tectonic plate movements. The December tsunami in the Sunda Strait in Indonesia, however, was caused by an undersea volcanic eruption.[9] Furthermore, the high death toll caused by the September Sulawesi tsunami highlighted the risk posed by a convergence of unfavourable physical conditions. The Sulawesi tsunami was a near-field tsunami, one with a travel time of 30 minutes or less, which significantly reduced the warning lead time. While a strike-slip quake typically does not generate a large tsunami, the narrow and deep shape of the bay played a role in amplifying the waves as they moved towards the city of Palu.[10]

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[5] India Meteorological Department, "Very severe cyclonic storm 'Titli' over east central Bay of Bengal (8–13 October 2018): summary". Available at www.rsmcnewdelhi.imd.gov.in/images/pdf/publications/preliminary-report/titli.pdf.

[6] World Meteorological Organization, "WMO climate statement: past four years warmest on record." 29 November 2018. Available at https://public.wmo.int/en/media/press-release/wmo-climate-statement-past-4-years-warmest-record.

[7] World Meteorological Organization, "July sees extreme weather with high impacts", 1 August 2018. Available at https://public.wmo.int/en/media/news/july-sees-extreme-weather-high-impacts.

[8] Intergovernmental Panel on Climate Change, *Global Warming of 1.5°C* (Geneva, 2018).

[9] United States of America, National Oceanic and Atmospheric Administration, National Geophysical Data Center/Wireless Data Service Global Historical Tsunami database. Available at https://ngdc.noaa.gov/hazard/tsu_db.shtml (accessed on 14 March 2019).

[10] Maya Wei-Haas, "The science of Indonesia's surprise tsunami", *National Geographic*, 1 October 2018. Available at www.nationalgeographic.com/environment/2018/09/indonesia-tsunami-sulawesi-explained-science-geology/.

10. Predicting the path of tropical cyclones has improved significantly in recent years, but in general, risk assessment models are not good at predicting the secondary hazards that tropical cyclones could cause, for example storm surges, heavy rainfall, landslides and flooding. In fact, many of the public warning systems for typhoons are predominantly based only on wind speed. Most of the deaths caused by Cyclone Titli in Odisha State in India and Typhoon Mangkhut in northern Philippines were caused by landslides. The probability of landslides increased following successive days of rain before the tropical cyclones made landfall. Tropical storm Usman was a very minor weather disturbance over central and northern Philippines in December 2018, but it intensified the monsoon rains over a large geographical area leaving 122 people dead and affecting 680,000 people due to large-scale flooding and landslides.[11]

C. Gap in understanding differentiated needs and vulnerabilities

11. The past few years have seen significant progress made in developing forecasts that provide information on location-specific potential impacts on people and economic assets in addition to routine hazard forecasts. However, the 2018 disasters showed the difficulty of forecasting the impacts on affected communities by demographic profile. Seventy per cent of the flood victims in western Japan were 60 or older.[12] After bearing the brunt of a 7.5 magnitude quake in March 2018, people living in remote highland locations of Papua New Guinea were exposed to the risk of disease outbreaks, affecting children in particular.[13] The inclusion of more targeted vulnerability information in forecasts will more precisely identify at-risk groups, including people who cannot be reached by electronic weather and climate warnings or who have limited mobility to respond to warnings, such as those who are very young, older persons or persons with disabilities.

12. The success of the region in fostering inclusive and equal societies and empowering people appears to hinge to an increasing extent on its ability to reduce current and future disaster risk and impacts. Poor and vulnerable populations regularly bear the brunt of disasters, suffering five times more deaths from disasters. The impact of disasters on poor people is directly relevant to progress on Sustainable Development Goal 1 on ending poverty by not only perpetuating the cycle of poverty, but also pushing near-poor people into poverty. For example, it is estimated that the Gorkha Earthquake in Nepal in 2015, pushed an additional 2.5 to 3.5 per cent of the population, or around 700,000 Nepalis, into poverty.[14]

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[11] Philippines, Department of Social Welfare and Development, "Department of Social Welfare and Development, Disaster Response Operations Monitoring and Information Center report #4 on tropical depression 'Usman'", 29 December 2018. Available at https://reliefweb.int/sites/reliefweb.int/files/resources/DSWD-DROMIC-Report-4-on-TD-%E2%80%9CUSMAN%E2%80%9D-as-of-29-December-2018-4PM.pdf.

[12] "70% of rain victims in west Japan were 60 or older, death tallies show", *Japan Times* (Kyodo), 16 July 2018. Available at www.japantimes.co.jp/news/2018/07/16/national/elderly-accounted-70-victims-died-torrential-rains-western-japan-tally/.

[13] Papua New Guinea, National Disaster Centre and Office for the Coordination of Humanitarian Affairs, "Papua New Guinea: highlands earthquake situation report no. 7", 13 April 2018. Available at https://reliefweb.int/sites/reliefweb.int/files/resources/png_earthquake_situation_report_no._7_13_april_2018.pdf.

[14] Nepal, National Planning Commission, *Nepal Earthquake 2015. Post-Disaster Needs Assessment. Executive Summary* (Kathmandu, 2015). Available at www.worldbank.org/content/dam/Worldbank/document/SAR/nepal-pdna-executive-summary.pdf.

13. An analysis of 86 countries globally from 1965 to 2004 found that the Gini coefficient – a measure of income inequality – increased by 0.01 percentage points in the year following a disaster caused by natural hazard. In 2017, an analysis of 19 countries in Asia and the Pacific suggested that existing inequalities were worsening with an increase in the Gini coefficient by 0.13 percentage points.[15] The impact of disasters is also transmitted through social sectors. Nearly 69 per cent of social expenditure in the Philippines goes to losses from disasters, compared to more than 50 per cent in Tonga and Vanuatu.[16]

14. A comprehensive portfolio of strategies is needed to address resilience gaps: what partnerships, resources and experiences can the region draw from?

III. Addressing resilience gaps through the regional road map for implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific

15. The regional road map identifies disaster risk reduction and resilience as a thematic area and provides a solid foundation for the countries in the region to collectively address the resilience gaps revealed by disasters in the past year. Advances in hazard science and innovations in space data and their digital applications provide promising tools. The present section highlights emerging opportunities and actions of the Economic and Social Commission for Asia and the Pacific (ESCAP) to demonstrate proof of concept and ensure that high-risk low-capacity countries have access to data and tools, expertise and capacity-building support.[17]

A. Improving risk assessment and early warning

16. Disaster risk reduction strategies, including early warning and risk assessments, have been augmented by rapid innovations in the application of digital and space technologies. For example, satellite images have become more available at affordable prices, which has increased their contribution to real-time monitoring of hazards, while historical satellite data can also be useful for long-term planning for a variety of purposes that range from land-use assessment to urban and infrastructure planning.[18] Information collected from remote sensing can also provide high-resolution data for topographic maps that can be used for flood management and coastal vulnerability analysis. Unmanned aerial vehicles, or drones, are fast emerging as complements to traditional satellite-based and remote sensing methods for producing high-resolution base topographic maps for rapid disaster risk assessment, risk monitoring as well as damage assessment.[19] Increasingly, drones may also be

[15] *Asia-Pacific Disaster Report 2017: Leave No One Behind Disaster Resilience for Sustainable Development* (United Nations publication, Sales No. E.17. II.F.16).

[16] Global Assessment Report on Disaster Risk Reduction (GAR), GAR Risk Data Platform. Available at https://risk.preventionweb.net/capraviewer/main.jsp?countrycode=g15 (accessed on 14 March 2019).

[17] A detailed discussion on how advances in space observation and the convergence of data science, artificial intelligence and machine learning can be harnessed to empower decision makers and people to address disaster risk and inequality will be available in the *Asia-Pacific Disaster Report 2019* (United Nations publication, forthcoming).

[18] *Asia-Pacific Disaster Report 2017*.

[19] Ibid.

put to use for social good and community empowerment that builds resilience to multiple threats (see box).

17. In line with paragraph 26 (a) of the regional road map, the efforts of ESCAP to advance regional cooperation aim to "promote effective regional and subregional efforts to strengthen disaster risk modelling, assessment, mapping, monitoring and multi-hazard early warning systems of common and transboundary disasters". Those efforts contribute to enhancing the capacity of countries to generate short- and long-range information for risk reduction, which are based mainly, but not solely, on geospatial data.

Box

Drones for community empowerment and resilience

Vanuatu, an archipelago of 83 islands across 1,600 kilometres, presents considerable logistical challenges to reach, engage with and provide humanitarian support to remote communities. Logistics for disaster relief, vaccine and health supply are expensive, risky and unreliable. Mobile teams are frequently required to walk to villages and communities in remote and hard-to-reach areas, carrying temperature-sensitive vaccines and equipment. If the cold chain is disrupted, vaccines rapidly degrade and those in need, particularly children, will not receive the required immunization.

To overcome such challenges, the United Nations Children's Fund (UNICEF) and the Government of Vanuatu have begun to use drones to bring life-saving vaccines to children living in the most remote rural islands of Vanuatu.

In December 2018, one-month old Joy Nowai became the world's first child to be given a vaccine delivered to her community by a drone. The community in Cook's Bay is small and scattered. It does not have a health centre or electricity, and it is only accessible by foot or by small local boats. The drone covered almost 40 kilometers of rugged mountainous terrain from Dillon's Bay on the west side of Erromango Island to the east landing in remote Cook's Bay, where 13 children and five pregnant women awaited vaccination. This example demonstrates how drones can be used commercially for community empowerment and social good and to increase resilience to multiple threats.

Source: Provided by the UNICEF East Asia and the Pacific Regional Office in Bangkok.

18. Under the operational arm of the Regional Space Applications Programme for Sustainable Development, the Regional Cooperative Mechanism for Drought Monitoring and Early Warning, through various service nodes in Australia, China, India, the Russian Federation and Thailand, supports developing countries at risk of drought through a range of geospatial data and tools. In 2018, the customized drought monitoring system called DroughtWatch-Mongolia, was operationalized. The system was developed by the Institute of Remote Sensing and Digital Earth under the Chinese Academy of Sciences, in collaboration with the National Remote Sensing Centre of Mongolia. The National Remote Sensing Centre of India developed a drought monitoring tool for Myanmar, which is now being used in the dry zone of the country to produce 5- to 15-day drought-outlook reports. Geoscience Australia and the Bureau of Meteorology of Australia have developed a comprehensive water accounting system pilot for Cambodia along with a data cube to better store and process space, hydrometeorological, census and ground-level data.

19. Capitalizing on advances in weather and climate science and forecasting, work is underway to improve the capacity of countries in the use of long-range climate information (one to three months) to mitigate the potential impacts of hazards, such as dry and wet spells and drought. More than a dozen countries have or are still receiving support from the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries to improve the production and applications of seasonal climate outlooks for managing climate risk.

20. To provide a refined assessment of risk for the subseasonal timescale (two to four weeks) for South-East Asia, ESCAP is working jointly with the Association of Southeast Asian Nations (ASEAN) Specialized Meteorological Centre/Meteorological Service Singapore and the Regional Integrated Multi-hazard Early Warning System for Africa and Asia (RIMES) on innovative research and capacity-building. The ability to provide a subseasonal forecast is a relatively new scientific breakthrough, and it is important because many of the critical decisions in weather and climate-sensitive sectors, such as agriculture, water, disaster management and health, are made during this timescale.

21. More data and information do not automatically translate into risk reduction. While it is useful to have early warning of a probable hazard, a forecast of the impact on specific areas, communities, and assets that are at risk and likely to be affected is more valuable for decision makers.

22. Through the production of the El Niño impact outlooks, ESCAP, the Regional Integrated Multi-hazard Early Warning System for Africa and Asia and the United Nations Development Programme (UNDP) have demonstrated how to translate a hazard forecast (i.e. El Niño) into impact outlooks for various sectors and locations. This has helped inform contingency planning and preparedness. The 2018/2019 editions of the impact outlook were able to robustly incorporate climate risk exposure of various locations in our region by using the information in the Asia-Pacific disaster risk atlas, a geospatial database repository on hazards, exposure and risks that was developed under the work programme of the Asian and Pacific Centre for the Development of Disaster Information Management.[20]

23. Looking forward, with the exponential increase in the use of digital technologies and the pervasive Internet of things, there is potential to partially automate the production of impact outlooks as follows: using Internet bots to gather information from the web on the status of El Niño; and using machine learning to develop large-scale patterns of the regional impacts of past El Niño events, including those captured through the Sendai Framework monitor managed by the United Nations Office for Disaster Risk Reduction. The increasing availability of big data and analytics can be expected to improve the accuracy of future impact scenarios.

24. On a pilot basis, the ASEAN Dynamic Risk Assessment Guidelines and Experiences is being developed to promote dynamic risk assessments in ASEAN countries by providing a framework for dynamic risk assessment and

[20] ESCAP and RIMES, "2018/2019 El Niño Asia-Pacific Impact Outlook for December 2018 to February 2019", 6 December 2018. Available at www.unescap.org/sites/default/files/ESCAP-RIMES%20El%20Ni%C3%B1o%20Advisory_6%20December.pdf; ESCAP, RIMES and UNDP. "2018/19 El Niño Asia-Pacific Impact Outlook for March to April 2019", 1 March 2019. Available at www.unescap.org/resources/201819-el-ni-o-asia-pacific-impact-outlook-march-april-2019.

operational examples.[21] There is a scope for developing this further by providing more case studies from future operational applications that incorporate digital and space innovations for data analytics.

25. Countries in the region are leveraging existing regional cooperation mechanisms to improve disaster risk assessment, early warning systems and risk knowledge. As envisaged in regional road map paragraph 26 (c), these efforts should "maximize the efficiency of existing regional cooperation mechanisms, including the World Meteorological Organization/ESCAP Panel on Tropical Cyclones and the Regional Cooperative Drought Mechanism for Drought Monitoring and Early Warning."

26. Responding to the observed trend of an increase in the frequency of intense tropical cyclones over the Arabian Sea, four new members joined the World Meteorological Organization/ESCAP Panel on Tropical Cyclones in 2018. The Islamic Republic of Iran is the newest member from the ESCAP region.

27. Through the long-standing Regional Space Applications Programme for Sustainable Development of ESCAP, countries have access to Earth observation data and geospatial tools for both pre- and post-disaster assessment and response. The collaboration of partners in the Regional Space Applications Programme for Sustainable Development, including China, India, Japan, Republic of Korea, Thailand and Viet Nam, along with agencies and programmes, such as the United Nations Institute for Training and Research Operational Satellite Applications Programme, the Office for Outer Space Affairs and its United Nations Platform for Space-based Information for Disaster Management and Emergency Response, the Group on Earth Observations and the Sentinel Asia, is instrumental in bringing the tools and expertise of spacefaring countries to assist high-risk low-capacity countries in the region.

28. The adoption of the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018–2030)[22] by ESCAP member States in 2018 represents a significant step to advance the use of geospatial tools for disaster risk reduction and resilience. Fifty out of the 188 actions contained in the Plan of Action are related to innovations in space applications for disaster risk management, risk reduction, disaster assessment, emergency response, resilient food production and agroecosystem resilience, and climate hazards. Similarly, the designation of ESCAP as the secretariat of the Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific will contribute towards strengthening the capacity of member States in geospatial information management and will strengthen the implementation of Economic and Social Council resolution 2016/27 entitled "Strengthening institutional arrangements on geospatial information management".

B. Improving risk knowledge

29. ESCAP and its partners are conducting an analysis to enhance regional knowledge on disaster risk and resilience in accordance with paragraph 26 (d) of the regional road map. The analysis focuses on potential disaster risks that are less understood, such as near-field tsunamis, drought, and sand and dust

[21] The beta version is available at https://sites.google.com/view/adage-approach/home.

[22] ESCAP/75/10/Add.2.

storms. ESCAP is also deepening its analytical work to highlight the social dimensions of disaster impacts.

30. The catastrophic Sulawesi tsunami in 2018 highlighted the urgency of improving the understanding of and early warning systems for near-field tsunamis. In recognition of this urgency, the Advisory Board of the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries acted decisively by approving a project entitled "Strengthening tsunami early warning in the North West Indian Ocean region through regional cooperation" at its nineteenth session in November 2018. The project will be implemented by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO).

31. Jointly with the ASEAN secretariat and the ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management, ESCAP conducted a study on the drought situation in South-East Asia. The study, provisionally entitled *Ready for the Dry Years: Building Resilience to Drought in South-East Asia*, analyses the impacts and the expected changes of drought risk in terms of intensity and geography. Its key message is that while drought may be inevitable, more suffering is not if timely interventions are made. Conducted under the auspices of the ASEAN Committee on Disaster Management, the study aims to inform its deliberations and to guide individual country responses to long-term drought risk reduction. The study will be released at the thirty-fourth meeting of the Committee in April 2019.

32. The ESCAP/Asian and Pacific Centre for the Development of Disaster Information Management report entitled *Sand and Dust Storms in Asia and the Pacific: Opportunities for Regional Cooperation and Action* provides the analytical evidence base for formulating regional cooperation mechanisms for combating sand and dust storms.[23] The priority in this regard is the development of a regional alert system anchored mainly on geospatial data through a partnership network where national systems will be linked with the Regional Specialized Centre for Sand and Dust Storm of the China Meteorological Administration, the Environment Monitoring and Research Centre of the India Meteorological Department, the Asian Disaster Reduction Centre of Japan, Geoinformatics Centre of the Asian Institute of Technology, and the International Water Management Institute, the International Strategy for Disaster Reduction and UNDP. Supported by the work programme of the Asian and Pacific Centre for the Development of Disaster Information Management, the initiative is being piloted in South-West and Central Asia and will form an integral part of the United Nations coalition on sand and dust storms.

33. The solutions are to be found in better anticipating the changing geography and intensification of disaster risks in the region and better understanding its localized impacts. Policy innovations powered by emerging technologies, such as big data, machine learning and artificial intelligence, will be game changing in managing complex risk scenarios. The *Asia-Pacific Disaster Report 2019*, which will serve as the basis for the deliberations of the sixth session of the Committee on Disaster Risk Reduction in August 2019, will provide insights to the Committee on how to drive regional cooperative actions and strategies that are responsive to the differential needs and capacities of the member States.

[23] ESCAP, *Sand and Dust Storms in Asia and the Pacific: Opportunities for Regional Cooperation and Action* (ST/ESCAP/2837).

C. Improving understanding of differentiated needs and vulnerabilities

34. To leave no one behind, as called for by the 2030 Agenda for Sustainable Development, requires governments to better understand the characteristics of the poor and how this is linked to their specific disaster exposure and vulnerabilities. In the past two years, ESCAP has stepped up its efforts to understand how the absolute poor, the near poor and marginalized populations are vulnerable to disasters. Results were reported in the theme study for the seventy-fourth session of the Commission and the *Asia-Pacific Disaster Report 2017*.

35. The *Asia-Pacific Disaster Report 2019* deepens the analysis by geolocating people who have been left behind or the most vulnerable populations, and this analysis goes beyond wealth and income factors to include risk exposure, gender, age and other factors.

IV. Challenges to harnessing the benefits of geospatial tools and digital connectivity for reducing disaster risk

36. The previous section demonstrated the ways in which disaster resilience gaps can be addressed by innovations in digital and space technology applications. It also outlined responses by ESCAP and its partners that aimed at enhancing disaster resilience objectives of the regional road map. Responses at national, subregional and regional levels are based on insights drawn from the challenges identified in technical studies conducted by ESCAP and its partners and supported by the intergovernmental forums of ESCAP as well as global development frameworks. The present section contains a discussion of the key challenges that need to be addressed if the region is to harness the transformative potential of these innovations to reduce disaster risks.

A. Data and technical challenges in improving risk knowledge, risk assessment and early warning

37. Scientific advances have improved the understanding of natural hazards, which together with advances in monitoring technologies, increase the availability of data from various sources, including big data and traditional data. However, while hazard data are widely available, vulnerability and exposure data are limited. This explains the difficulty of quantifying differentiated vulnerability in disaster risk assessment. Addressing this means that countries need to intensify efforts to produce regional data sets that merge multi-hazard characteristics with the geolocation of the poorest people in the region and their differentiated vulnerabilities and exposure. As mentioned in the previous section, there is a scope for adding these vulnerability layers to the geospatial data sets in the Asia-Pacific disaster risk atlas.

38. The analytical work of ESCAP on understanding regional risk and resilience is increasingly applying a combination of traditional statistics and Earth observation data and geospatial information. These merged data sets can also be used to monitor and visualize progress on disaster risk reduction. For example, drivers of risk accumulation over time can be monitored by data on land use, land cover, elevation, and topography. ESCAP work in this regard is being carried out in Azerbaijan, Kyrgyzstan, Tajikistan and Uzbekistan with support from the Government of the Republic of Korea for country-led monitoring and reporting of progress in the implementation of disaster-related Sustainable Development Goals.

B. Aligning data and information with user needs

39. Advances in technology or technical human capabilities will only deliver their potential as part of integrated systems that align the flow of information with the shifting needs and demands of users. A second group of challenges concerns making data usable for sectoral decision-making. Digital innovations to improve user-friendly interfaces and bring together data from various sources under one integrated platform have the potential to be scaled up to widespread use. There are several good practices from ESCAP initiatives, but additional investments are needed to localize the indicators and scale them up to their true potential.

40. The customized geoportals built at the disaster management authorities in Fiji, the Federated States of Micronesia, Solomon Islands and Tonga provide various early warning information to users. With support from the Government of Japan and other partners, such as the Indonesian Agency for Meteorology, Climatology and Geophysics, capacity-building activities for disaster forecasting and early warning were also carried out alongside the development of the portals.

41. Another way of aligning geospatial information with the needs of users is through customized decision support tools. An example of an automated decision support system is the Specialized Expert System for Agro-Meteorological Early Warning, a phone and web-based application which can assimilate real-time weather and climate information and generate timely advisories and early warning for agricultural extension technicians and farmers. It is now being used in India and the dry zone region of Myanmar. While the system development was supported by the ESCAP Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness in Indian Ocean and Southeast Asian Countries and implemented by the Regional Integrated Multi-hazard Early Warning System for Africa and Asia, the customization of the application for other locations is being supported by Governments themselves and development agencies.

C. Cross-cutting challenges

42. A third set of challenges cuts across sectors. Computing and information technology infrastructure, which provides affordable high-speed broadband Internet to all, is a critical element to facilitate data flow, analysis and delivery to users.[24] In Asia and the Pacific, the gap between risk and resilience-building is growing in those countries with the least capacity to prepare for disasters. This is the same group of countries that is impacted by the widening digital divide. The convergence of these divides is a key concern because digital connectivity is a prerequisite for putting digital innovations into use, such as geospatial information and big earth data analytics. Towards this end, in line with Commission resolution 73/6, ESCAP launched the Asia-Pacific Information Superhighway initiative, with one of its four pillars dedicated to e-resilience.

43. Mobilizing and sustaining investments over time across all sectors represents another challenge. Risk mapping needs to capture the dynamic processes of risk generation and risk accumulation over time. Systemic improvement of risk assessment will require collection, analysis and management of data on hazards, vulnerability, exposure and capacity at all

[24] Gregory Guiliani and others, "Spatially enabling the Global Framework for Climate Services: reviewing geospatial solutions to efficiently share and integrate climate data and information", Climate Services, vol. 8 (December 2017), pp. 44–58.

levels, real-time access to reliable data, strengthening baselines, strengthening technical and scientific capacity, and investments in innovation and technology development. Taking advantage of new data sources and technologies will require investments in systems and staff training for integrating geospatial and Earth observation data and ensuring interoperability.

44. Finally, notwithstanding the progress made in building capacity for disaster risk reduction, awareness raising and capacity development across all levels of government is a growing need given the speed at which innovations are unfolding. Notably, for geospatial tools to make a measurable difference in reducing disaster risk, they have to be mainstreamed within e-government frameworks. This is a whole-of-government undertaking and it requires a policy basis and budget allocation. For this to happen, government authorities need to be increasingly aware of how emerging technologies, such as the Internet of things, big data and cloud computing, and their applications for disaster risk reduction, can improve the delivery of government functions, including reducing the risk of disasters in all sectors.[25]

V. Issues for consideration by the Commission

45. The Commission may wish to do the following:

(a) Reflect on emerging resilience gaps and provide guidance on how collaborative regional efforts could be better aligned and targeted to complement national efforts in addressing these gaps;

(b) Share experiences on how geospatial data and digital innovations are helping with disaster risk reduction at the national and subnational levels and identify policy, capacity and budgetary challenges to further mainstream and use these technologies and innovations.

46. In the context of the Asia-Pacific Disaster Resilience Network, which was formed by the Committee on Disaster Risk Reduction at its fifth session, the Commission may also wish to identify priority areas and to propose partnerships to accelerate actions on those areas.

[25] *United Nations E-Government Survey 2018: Gearing E-Government to Support Transformation Towards Sustainable and Resilient Societies* (United Nations publication, Sales No. E.18.II.H.2).