Staff working paper series
Information and Communications Technology and
Disaster Risk Reduction Division

Good practices and emerging trends on geospatial technology and information applications for the Sustainable Development Goals in Asia and the Pacific

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ESCAP

December 2018

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Acknowledgements

This working paper was prepared by Ayeisha Sheldon, of Space Applications Section. Substantive comments were provided by Keran Wang Chief, Space Applications Section, Kelly Hayden, Ingrid Dispert, Syed T. Ahmed, Rishiraj Dutta, and Eric Roeder, under the general guidance of Tiziana Bonapace, Director, Information and Communications Technology and Disaster Risk Reduction Division of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). Patricia Budiyanto provided administrative support.
## Abbreviations

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<tr>
<td>AI</td>
<td>Artificial Intelligence</td>
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<td>APRSAF</td>
<td>Asia-Pacific Regional Space Agency Forum</td>
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<td>APSCO</td>
<td>Asia-Pacific Space Cooperation Organization</td>
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<td>ASEAN</td>
<td>Association of Southeast Asian Nations</td>
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<td>CNSA</td>
<td>China National Space Administration</td>
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<td>DRM</td>
<td>Disaster Risk Management</td>
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<td>DRR</td>
<td>Disaster Risk Reduction</td>
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<td>EO</td>
<td>Earth Observation</td>
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<td>ESCAP</td>
<td>United Nations Economic and Social Commission for Asia and the Pacific</td>
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<td>EWS</td>
<td>Early Warning Systems</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GIS</td>
<td>Geographic Information Systems</td>
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<td>GISTDA</td>
<td>Geo-Informatics and Space Technology Development Agency – Thailand</td>
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<td>GNSS</td>
<td>Global Navigation Satellite Systems</td>
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<td>ICC</td>
<td>Intergovernmental Consultative Committee</td>
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<td>ICT</td>
<td>Information and Communications Technology</td>
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<td>IoT</td>
<td>Internet of Things</td>
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<td>ISRO</td>
<td>Indian Space Research Organisation</td>
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<td>ITU</td>
<td>International Telecommunication Unit</td>
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<td>JAXA</td>
<td>Japan Aerospace Exploration Agency</td>
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<td>KARI</td>
<td>Korea Aerospace Research Institute</td>
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<td>LDCs</td>
<td>Least Developed Countries</td>
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<td>LLDCs</td>
<td>Land-Locked Developing Countries</td>
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<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<td>NGO</td>
<td>Non-governmental organization</td>
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<td>PIC</td>
<td>Pacific Island Countries</td>
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<td>RESAP</td>
<td>Regional Space Applications Programme for Sustainable Development</td>
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<td>SAARC</td>
<td>South Asian Association for Regional Cooperation</td>
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<td>SAFE</td>
<td>Space Applications for Environment</td>
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<td>Abbreviation</td>
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<td>SDGs</td>
<td>Sustainable Development Goals</td>
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<td>SFDRR</td>
<td>Sendai Framework for Disaster Risk Reduction</td>
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<td>SIDS</td>
<td>Small Island Developing States</td>
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<td>UAV</td>
<td>Unmanned Aerial Vehicle</td>
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<td>UN OCHA</td>
<td>United Nations Office for the Coordination of Humanitarian Affairs</td>
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<td>UN-GGIM</td>
<td>United Nations Committee of Experts on Global Geospatial Information Management</td>
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<td>UNISDR</td>
<td>United Nations Office for Disaster Risk Reduction</td>
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<td>UNITAR</td>
<td>United Nations Institute for Training and Research</td>
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<td>UNOOSA</td>
<td>United Nations Office for Outer Space Affairs</td>
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<td>UNOSAT</td>
<td>United Nations Institute for Training and Research (UNITAR) Operational Satellite Applications Programme</td>
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Space applications for sustainable development

Geospatial services, stemming from space applications and geospatial data, are defined as services provided by geographic components, such as data and information. Geospatial services play a large role in all parts of our lives and are deeply embedded in everyday activities, from weather forecasting maps to navigation systems to ordering online deliveries. These services have a significant impact on all aspects of everyday life and were recognised at the 2018 United Nations World Geospatial Information Congress for their utility in service of social, economic and environmental development\textsuperscript{1}.

The Asia-Pacific has become a hub of innovation which is transforming the way we live, work, and relate to one another. Digital innovation such as artificial intelligence, big data, the Internet of things and cloud computing brings new and innovative solutions to pressing global problems. Faster and more versatile digital connectivity, satellite data, geographic information systems and spatial analysis have become increasingly accessible and available, generating more evidence-based data to support real-time decision-making. Geospatial information is also seeing increased incorporation into development planning, leading to more accurate monitoring and evaluation of development interventions.

Although many governments have realised the value that geospatial services play, developments in geospatial services are still focused on traditional applications and methods. A number of countries lack human, technical and financial resources required to undertake the most basic space-related activities. With increasing importance in transforming our world and working towards a more sustainable future, the need to provide geospatial benefits has grown in importance. Geospatial services are recognized as innovative technologies in supporting the implementation of the global development agendas, including Transforming our World: the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) and the Paris Agreement.

\textsuperscript{1} United Nations World Geospatial Information Congress (UNWGIC) in Deqing, Zhejiang Province, China from 19-21 November 2018
Space applications provide a unique perspective that can provide far-reaching solutions to pressing issues facing humanity; ranging from health, education, food security, agriculture, climate change, energy and natural resources management to disaster risk reduction and resilience-building, by enhancing information for evidence-based decision-making.

Countries in the Asia-Pacific are increasingly integrating space technology such as Earth-observation (EO) and geospatial data and combining their outputs with statistical and demographic data for real-time spatial analysis of conditions and modelling of complex and dynamic scenarios. These digitally driven innovations have a significant impact on the development of geospatial information services in the region. Such innovative technologies can accelerate the implementation of global development agendas and have a transformational impact on the most significant challenges facing the Asia-Pacific region.

Leaders of member States have recognized the importance of pursuing harmonized efforts to accelerate the use of geospatial applications in the region. On 10 October 2018, Ministers and the heads of the space community met in Bangkok for the Third Ministerial Conference on Space Applications for Sustainable Development in Asia and the Pacific. The Ministerial Conference adopted two documents that will guide work in Asia-Pacific for the next decade: 1) the Ministerial Declaration on Space Applications for Sustainable Development in Asia and the Pacific, and 2) the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018 – 2030).

The Asia-Pacific Plan of Action on Space Applications for Sustainable Development is a regionally-coordinated, inclusive and country-needs driven blueprint that harnesses space and geospatial applications, to achieve the 2030 Agenda for Sustainable Development. The Plan of Action is fully aligned with the Economic and Social Commission for Asia and the Pacific’s (ESCAP) Regional Roadmap for Implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific. It maps the sectoral needs and resources at national and regional levels and promotes multi-sectoral coordination which would be voluntary and depends on each country’s national circumstances and development priorities.

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2 Available at: [https://www.unescap.org/sites/default/files/MCSASD_2018_2E_Final_25102018.pdf](https://www.unescap.org/sites/default/files/MCSASD_2018_2E_Final_25102018.pdf)
a. Emerging trends

Space applications and geospatial technology are evolving and the usage of these geospatial services is expected to dramatically increase in the coming years. An article published at the 9th Annual Geospatial Intelligence conference in 2017, highlighted the following reasons as to why geospatial services are evolving so rapidly, some of these include:

- An unprecedented increase in the number of devices that produce geospatial information. These could include credit cards, Global Navigation Satellite Systems (GNSS), smartphones and tablets, IoT and AI devices.
- Advances in open-source software, catering for a wider audience.
- Advances in hardware, such as GNSS receivers.
- More sophisticated GIS data and databases.
- Increased accuracy of data and spatial information.
- Rapid urbanisation of cities, especially in Asia, which pushes for a need to plan and develop in order to accommodate dense spaces which people live and work in.

In recent years, more countries within the Asia-Pacific have invested money into national space agencies, training and capacity building and research into space applications and geospatial services. It was estimated that in 2016 the geospatial industry generated a revenue of approximately US$400 billion, with the Asia-Pacific region accounting for over 18 per cent with a total revenue of US$73 billion. Further, the Asia-Pacific region was ranked first in total estimated consumer benefit for digital map usage, amounting to US$166 billion (see figure 1). This shows the ongoing benefits that geospatial services play within the region and highlights the need for these applications to be further utilized within all countries.

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3 Geospatial Intelligence, Cities Transformed: How Geospatial analytics have successfully transformed urban living, 2017. Available at: https://ginsasia.iqpc.sg/downloads/cities-transformed-three-examples-how-geospatial-analytics-have-successfully-transformed-urban-living-ty-m

Figure 1: Global users value digital maps at US$105 per person, which results in total consumer benefits of US$147 billion per year (Source: Alphabeta, 2017).

Advancement in geospatial services is allowing more countries to leverage existing geospatial technology and explore emerging applications in geospatial data. This opens opportunities for countries to maximise the technology for consumers, businesses and societies. Governments for example, can enable, facilitate and promote the adoption and implementation of emerging applications of geospatial technologies through supporting geospatial policies, encouraging development and enabling access to geospatial data.

b. Innovations

Every year more Asia-Pacific countries contribute to the geospatial services economy, not only through data use and knowledge but also through innovative research and applications. In 2018, China set a new national record for the most satellite launches, per country, into space in a single year, with a total of 23 launches. In May 2018, Bangladesh launched its first
geostationary communications satellite, the Bangabandhu 1 (BD-1), which will provide broadcasting and telecommunication services to rural areas within Bangladesh. In June 2018 Bhutan took a step forward, being one of the first landlocked, developing countries, to build and launch its first satellite, the Bhutan-1 CubeSat, into orbit.

The increase in satellite and spacecraft launches will further understanding of our world through increased data and knowledge, in areas such as climate change, natural disasters, more sustainable agricultural production, ice cover and ocean salinity. This increase in satellite services and EO imagery will enable advances in space applications and geospatial technologies.

**ESCAP’s initiatives**

ESCAP has continuously made concerned efforts to promote the use of space applications and geospatial technologies through its long-standing Regional Space Applications Programme for Sustainable Development (RESAP), which was developed over twenty years ago. In recent years, the programme has placed renewed emphasis on the importance of countries to collect and use high-quality, timely, reliable and accurate data, including EO and geospatial information, to advance the 2030 development agenda of “leaving no one behind”.

Additionally, ESCAP in collaboration with spacefaring countries in the region, has continued to provide timely services and support on space-derived data and products to countries affected by disasters. During the past decade, an average of more than 400 high-resolution satellite images and products have been provided annually to disaster-affected developing countries to support damage assessment on drought, cyclones, earthquakes and floods. There are now over 150 RESAP member country experts available to provide data services and support.

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With the on-going advancements in space applications, countries require not only better technology, tools and infrastructure, but also the human capacity to operate these systems. Many developing countries, including small island developing States (SIDS), may not have sufficient human resources and experts to fully take advantage of these innovative technologies. Through the RESAP, as well as regional and international partnerships, countries can build capacity and strengthen their human resources base.

Furthermore, the Asia-Pacific Space Leaders Forum, which was held in New Delhi, India on 2 November 2016, highlighted the role of space applications in the implementation of the Sustainable Development Goals (SDGs). Participants of the Leaders Forum expressed support for the preparation of a new Plan of Action by the ESCAP secretariat in follow-up to the successful implementation of the Asia-Pacific Plan of Action for Applications of Space Technology and Geographic Information Systems for Disaster Risk Reduction and Sustainable Development, 2012–2017.

Thus, with inputs from a number of member States, the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018-2030)\(^8\) was adopted at the third Ministerial Conference on Space Applications for Sustainable Development in Asia and the Pacific, held in Bangkok, Thailand on the 10 October 2018. Regionally coordinated, this latest Plan of Action calls for the harnessing space applications and digital innovations to help countries in the Asia-Pacific, particularly those with special needs, to achieve the SDGs.

The Plan of Action drafted through extensive and inclusive consultation, consisted of an open-ended Drafting Committee comprising senior technical experts, nominated by Governments of member and associate members of ESCAP, as well as the Intergovernmental Consultative Committee (ICC) at its twenty-first and twenty-second sessions. The Plan of Action aims to further the use of space applications and geospatial information to achieve the ESCAP Regional

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Road Map for Implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific\(^9\), referred to as ESCAP’s Regional Road Map.

Through the formation of the Plan of Action, 14 SDGs along with the SFDRR, and 37 SDG targets were identified as areas of high priority where space applications can significantly contribute. The highlighted goals and targets contribute to the priority thematic areas outlined in ESCAP’s Regional Road Map, in the following order: (a) Disaster Risk Reduction and Resilience, (b) Natural Resource Management, (c) Social Development, (d) Connectivity, (e) Energy and (f) Climate Change. Modalities associated with these thematic areas were also provided, these include: (a) research and knowledge-sharing; (b) capacity-building and technical support; and (c) intergovernmental discussions and regional practices. Through these cross-cutting themes and modalities over 188 individual actions\(^{10}\) were established in

\(^9\) ESCAP, Regional Road Map for Implementing the 2030 Agenda for Sustainable Development in Asia and the Pacific. Available at: [https://www.unescap.org/sites/default/files/publications/SDGs-Regional-Roadmap.pdf](https://www.unescap.org/sites/default/files/publications/SDGs-Regional-Roadmap.pdf)

\(^{10}\) Individual actions can be found in Annex 1 of ESCAP, The Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018-2030).
response to how space applications and geospatial data can directly contribute to the Plan of Action.

Figure 3: Total 188 actions under both the priority themes and modalities.

The Plan of Action’s comprehensive framework will help guide the work of United Nations agencies and international and technical organizations to support national efforts in enhancing the use of space applications for sustainable development. The Plan of Action will also provide a consolidated needs-assessment for the Asia-Pacific region to better harmonize and coordinate development efforts.

**Thematic areas - Good Practices and emerging trends within the Asia-Pacific region**

Good practices have been shared between countries in the Asia-Pacific region. As space applications have become more easily accessible, an increasing number of countries are now utilizing these services to fit their individual sustainable development needs. However, despite advances in the availability and quality of space-derived information, several gaps and challenges remain. Identified under the Plan of Action six thematic areas have been highlighted as priority areas at the regional, national and international levels (see figure 3).
a. Disaster Risk Reduction and Resilience

The Asia-Pacific region is one of the most disaster-prone regions in the world. Natural disasters such as typhoons, floods, droughts and earthquakes have led to the loss of countless lives and property damage. Given the inter-regional nature of natural disasters, the SDGs and the SFDRR have both highlighted the urgent need for countries to work together to increase regional cooperation in disaster management. The SFDRR directly relates to all of the SDGs aims to significantly contribute to the ongoing implementation of these goals. These linkages can be seen throughout Figure 4.
Figure 4: Linkages between the SDGs and the SFDRR (Source: UNISDR, Disaster Resilient Scorecard for cities, 2017)
Space applications and geospatial data have demonstrated to be effective tools in post-disaster relief and pre-disaster capacity building. The SFDRR specifically highlights the use of space applications, including GIS, to enhance measurement tools, data collection, data analyses and dissemination of data\textsuperscript{11}.

Over the past decade ESCAP has continuously promoted the regional exchange and capacity building of the effective use of these innovative technologies in disaster management. Disaster risk reduction and resilience is one of the major priority themes highlighted in the Plan of Action, as it seeks to strengthen integrating digital innovations for disaster risk reduction, damage assessment and emergency response, as well as in monitoring multi-hazards related to agriculture and climate.

Space applications and geospatial data is vital to modern day disaster management and can play a key role in all stages of the disaster cycle, pre, present and post. In disaster response and recovery, EO satellites can provide timely and accurate information to aid in rapid-mapping for mitigation of potential risks, preparedness of disasters, immediate response and recovery efforts. For example, more specifically, spatial data can support efforts in impact assessments, damage assessments and inform the planning and delivery of humanitarian relief; supporting reconstruction efforts to ensure resilient planning and monitor on-going reconstruction efforts.

Other important tools within the disaster management cycle include geoportals for disaster risk to ensure that the right information is readily available to the right people making decisions during times of an emergency. This information can help to speed up the disaster response and accuracy rate.

GNSS can also assist all phases of the disaster cycle by providing precise location and navigation data. This can not only pin point exact, accurate locations in real time, but also help manage the surrounding land and infrastructure, aiding in rescue crews by allowing them to coordinate search efforts.

Although space applications have the capability to provide on-demand data in response to a disaster, countries may lack the technical capacity to access and process this data. This is why

\textsuperscript{11} General Assembly resolution 69/283.
it is vital that countries within the region are building partnerships and cooperation, especially between non-space faring and space faring countries. Such partnerships, can strengthen capacity, build resilience and improve technical capabilities.

The Japan Aerospace Exploration Agency (JAXA), in 2015, launched Himawari-8 weather satellite, which uses an imager to capture visible light and infrared images of the Asia-Pacific region. This earth observation data is uploaded to an online data-sharing platform for National Meteorological and Hydrological Services to help improve weather forecasting and enable them to register potential natural disasters\textsuperscript{12}. Alongside this, JAXA has developed the “JAXA Realtime Rainfall Watch” website and the product “GSMaP\_NOW”, which provides real-time rainfall information within the GEO-satellite Himawari domain. This service can provide countries with a comprehensive weather forecast, especially in countries that lack their own services. In 2018, JAXA extended the GEO-satellite Meteosat domain of the rainfall watch to now cover all areas in the world\textsuperscript{13}.

![Figure 5: Before and after domain of GSMaP\_Now (Source: JAXA).](image)

Another example, in July 2018 a hydroelectric dam collapsed causing flash flooding in the Attapeu province of Lao People’s Democratic Republic. Through ESCAP’s RESAP mechanism, a number of space-faring countries were able to provide EO and geospatial support to the country. UNITAR-UNOSAT, Thailand’s GISTDA and the China Satellite Disaster Reduction Application Centre along with other stakeholders, worked together to provide on-

\textsuperscript{12} JAXA, Himawari Real-time. Available at: https://himawari8.nict.go.jp

demand updated data to Lao People’s Democratic Republic in order to provide necessary information regarding the disaster affected region. The details of this event are outlined in Box 1.

**Box 1 - Lao People's Democratic Republic, Flood Incident July 2018**

Heavy monsoon rain caused a hydroelectric dam to collapse in the Attapeu province in Lao People’s Democratic Republic. Flood waters inundated six villages and left more than 6,000 people homeless and hundreds of people unaccounted for.

In extreme disaster situations, such as these, the help of satellite EO imagery can provide crucial data, unattainable elsewhere, which can determine the flooded region, the estimated number of affected people and pin point locations where houses and communities are most vulnerable and at risk.

During the disaster, UNITAR-UNOSAT activated the International Disaster Charter to utilise space agencies around the world, to aid in providing EO imagery to undertake analysis of the situation and help support disaster risk management. UNITAR-UNOSAT provided on demand satellite imagery data analysis of the flooded area as the disaster struck, with constant updated information.

Through ESCAP’s RESAP mechanism, ESCAP made sure that all relevant information and data was directly provided to the representative from Lao People's Democratic Republic, and coordinated with them to provide necessary assistance, in terms of information and data.

Thailand’s GISTDA helped to provide on demand satellite imagery and analysis of the flooded region to help disaster management on the ground in Lao People’s Democratic Republic. The Lao People’s Democratic Republic, member of the Drafting Committee for the Asia-Pacific Plan of Action on Space Applications for Sustainable Development, gave appreciation to GISTDA for their support and assistance by providing satellite imagery in the affected flood region. Lao People’s Democratic Republic also requested that GISTDA also continue to support the country in providing satellite imagery in the affected areas in order to recover lives and assist affected communities.

ESCAP also engaged other regional space agencies, including the Ministry of Emergency Mapping, Satellite Disaster Reduction Application Centre of China which provided several on demand maps to aid the situation in Lao People’s Democratic Republic. Three maps were produced showing the flooding of the disaster in the surrounding areas. These maps were collected and translated through ESCAP’s RESAP.

By engaging regional cooperation, especially through strong regional mechanisms such as RESAP, satellite imagery can provide timely and accurate information, which can be

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disseminated quickly in disaster situations to save lives and guide disaster response. This is especially necessary in developing spacefaring nations which do not have their own earth observation satellites, access to such on-demand data, and experts to analyse this data. Therefore, ESCAP’s regional mechanisms can bring these stakeholders together, providing unique benefits these countries wouldn’t be able to gain otherwise.

Given the transboundary nature of natural disasters, no single country can have all the data necessary for impact analysis and recovery information. Therefore, it is important for countries to engage in regional platforms to share knowledge and experience on utilizing these tools.

b. Natural Resource Management

The world has seen rapid population growth and urbanization during the last decade, today more than 55 per cent of the world’s population lives in urban areas, a proportion which is expected to increase to over 60 per cent by 2050. From 1950 to 2018 the urban population rapidly increased from 751 million to 4.2 billion and Asia, despite its relatively low levels of urbanisation, is now home to over 54 per cent of the world’s urban population. Rapid growth and rural to urban migration are increasing pressure on urban infrastructure, and straining the provision of city services. Economic progress translates into increased demand for food, together with demand from other competing uses. For example, it is projected that food production will increase by 70 per cent in the world and by 100 per cent in developing countries. Yet natural resources, both land and water that are the basis of our food production, are finite and already under heavy stress.

Currently, the Asia-Pacific region consumes more than half of the world’s natural resources with increasing rates of absolute resource use and increasing resource use per person. This is putting more pressure on countries to work towards more sustainable consumption and production. The exploitation of high-value natural resources, further aggravated by environmental degradation, population growth and climate change endangers human development, provision of basic services and poverty eradication and weakens the capacity of communities especially poorer areas to adapt.

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Through the use of space applications, large scale spatial data can be used to support sustainable natural resource management and conservation. EO imagery can provide a better overview of the situation on the ground, which when fused with additional information can provide accurate on-demand maps. Space-based technologies, such as remotely sensed data, have enhanced scientific understanding of water cycles, air quality, forests, land use patterns, sand and dust storm source areas, support estimation of crop yields, more intensive and efficient cultivation practices, and other aspects of the natural environment. These surveying and monitoring tools provide valuable information on the state of ecosystems, which offers objective support for positive environmental action, including conservation and sustainable resource management.

Space technologies can also provide an important asset in information decision making through assessing the state of conservation ecosystems and biodiversity for food and agriculture. These can help to estimate the health status of ecosystems, predicting threats from climate change etc. Land classification mapping for identifying land-use and land-cover is another example of an essential tool for decision makers. These maps can aid in forming policies for sustainable land development and resource management by providing additional up to date and on-demand sources of data and information.

In the Asia Pacific region the Space Research and Remote Sensing Organization (SPARRSO) of Bangladesh is utilizing GIS and remote sensing to monitor forests and coastal afforestation to identify the changes and links to global climate change\(^\text{15}\). In Thailand, the Geo-Informatics and Space Technology Development Agency (GISTDA), is utilizing geospatial technology for water quality improvement to aid in drainage and flood mitigation in Phetchaburi Province. Thailand is also utilizing EO data in their deforestation detection system and geospatial data for maritime, oil and coastal management. In the Russian Federation, deforestation control and agricultural mapping are some of the main activities undertaken by the Russian Space Systems natural resource management category\(^\text{16}\). Australia is also working toward natural resource


management, and social development, through the creation of technical online maps, which is outlined in Box 2.\(^\text{17}\)

New innovative technologies such as unmanned aerial vehicles (UAVs), drones and other image analysis and processing techniques can add additional remote sensing capabilities, through fast acquisition of on-demand high-resolution imagery. The Maritime and Port Authority of Singapore (MPA) is developing new technology, through the use of UAVs, to identify spills at seas piloting deployment of waterproof UAVs from patrol boats. UAV technology gives a comprehensive overview of the extent of oil spills, supporting deployment

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of other equipment in a more efficient manner. Through traditional methods vision is limited to surface line of sight, however through capturing imagery through a UAV this line of sight is dramatically increased\textsuperscript{18}.

Improving natural resource management and protection of ecosystems is a key priority in the Asia-Pacific region. Space applications can add valuable information to support conservation and sustainable resource management and development. Many activities undertaken in natural resource management have cross cutting benefits to other sectors, such as water management, sustainable marine and coastal ecosystems, forests resources, urban planning and land degradation and desertification and will contribute widely to the implementation of global development agendas.

\textbf{c. Connectivity}

Seamless connectivity across transport, information and communications technology, and trade sectors is a key area highlighted under the ESCAP Regional Road Map and Plan of Action. Connectivity is important for achieving many SDGs related to health, industry, reducing inequalities, cities and infrastructure.

Space applications and geospatial data are a key component for optimizing the expansion and integration of infrastructure such as highways, railways, dry port networks and digital connections, which make connectivity more inclusive, spreading the benefits extensively to marginalized communities. Improvements in regional connectivity in terms of transport, information and communications technology (ICT) and trade will help boost economic growth within the region\textsuperscript{19}.

However, despite the rapid growth in ICT and internet services within the Asia-Pacific region, in a study undertaken by ESCAP, it was found that broadband capabilities and access is not evenly spread throughout the region. Fixed broadband subscriptions are highly concentrated with 75 per cent driven by East and North-East Asia. This is followed by South and South-


\textsuperscript{19} E/ESCAP/73/31, annex II.
West Asia (9.77 per cent), North and Central Asia (7.68 per cent), South-East Asia (5.74 per cent) and the Pacific (1.93 per cent). Figure 5 shows the data from the ITU ICT Development Index (IDI), which is a unique benchmark of the ICT development level across countries. The IDI is calculated on the combination of eleven indicators on ICT access and use and skills, which capture the key aspects of ICT development in one measure.

This map shows the digital divide that the Asia-Pacific region is faced with. A report produced by ESCAP in 2016 highlights this digital divide and that the gap between advanced and developing ICT countries in fixed broadband access is widening. Connectivity and access to broadband connectivity is a critical foundation for the digital economy and the achievement of the SDGs. As a result of this digital divide, millions of people don’t have access to transformative digital opportunities in education, health, business and finance.

20 ESCAP, State of ICT in Asia and the Pacific 2016. Available at: https://www.unescap.org/sites/default/files/State%20of%20ICT%20in%20Asia%20and%20the%20Pacific%202016_0.pdf


In response to this widening gap, ESCAP has administered the Asia-Pacific Information Superhighway initiative, which aims to increase the availability and affordability of broadband internet across the Asia and the Pacific by strengthening the underlying internet infrastructure in the region\textsuperscript{24}. 

\textsuperscript{23} ICT Development Index 2017. Available at: \url{http://www.itu.int/net4/ITU-D/idi/2017/index.html#idi2017map-tab}.

\textsuperscript{24} ESCAP, Asia Pacific Information Superhighway. Available at: \url{https://www.unescap.org/our-work/ict-disaster-risk-reduction/asia-pacific-information-superhighway/asia-pacific-information-superhighway-maps}.
The Pacific region, the lowest digitally connected region, is seeking to advance the development of its satellite ICT technology for broadband access. A Pacific case study is highlighted in Box 3.

**Box 3 – Broadband connectivity in Pacific Island Countries**

The Pacific region is made up of 27 countries and territories scattered across 33 million square km in the world’s largest ocean, the Pacific Ocean. These countries and territories face unique challenges in terms of telecommunication because of their isolation and economic status.

As each Pacific country and territory is unique and distinct in their demography, geography and governance structures, it can affect regional cooperation and development, especially in ICT. The Pacific region is a dynamic geographical region that already faces a range of challenges, such as bearing the brunt of natural disasters, high vulnerability to climate change, increasing digital divides, and economic isolation and remoteness, making connectivity difficult. Because of this, national and regional cooperation is vital for the progression and development of Pacific Island Countries (PICs).

While mobile broadband connectivity has improved significantly in recent years, the access to affordable, resilient broadband connectivity is alarmingly varied among PICs. The level of economic development within countries was highlighted as a key influential factor in determining access to broadband connectivity (both mobile and fixed-broadband services), along with the availability of an affordable and reliable electricity source. Many countries within the Pacific lack adequate access to these key services. These restrictions impede technical growth within countries as they are important drivers of broadband access.

By providing access to ICT knowledge and opportunities, broadband connectivity has the capability to transform lives of Pacific islanders, particularly youth, and work towards sustainable development and global agendas.
An example from South Asia highlights improving work on the China-Pakistan Economic Corridor which is underway, with a view to expand economic opportunities through trade and infrastructure. Geospatial technologies have been used to determine the viability of the highway network through three key aspects: (a) vulnerability of the highway trade route to violence and threats; (b) the number of people living in close proximity to the trade route; and (c) the extent to which emerging economic regions in Pakistan will be connected via the trade route. The second aspect was calculated using geospatial statistics such as zonal statistics, and it was found that 25 per cent or more of the population lives within a 5-kilometre radius of the highway network and that in almost all regions more than 80 per cent of the population lives within a 50-kilometre radius, indicating that the route provides connectivity to the majority of the population in Pakistan. With regard to the third aspect, it was found that 85 per cent of areas that had experienced growth of between 0 and 50 per cent from 1993 to 2013 were within a 10-kilometre radius of the trade route, making the highway network a viable location for economic growth.

Together with physical connectivity, knowledge-sharing and improved communication technologies can help to narrow the digital divide. This has been demonstrated in Fiji, as satellite connectivity has allowed the University of the South Pacific to expand its online programmes to a dozen other countries in the region, with half of its student body using online distance education tools.

Looking forward, GIS and satellite data will be key to not only optimize the expansion and integration of highway, railway and dry port networks across the region but also to provide advanced and increased internet connectivity contributing to improved social and economic development within the region.

25 Usman Mohammad, The Promise of a Silk Road, 2016. Available at: https://sites.tufts.edu/gis/files/2016/01/Usman_Mohammad_DHP207_2016.pdf

d. Social Development

The Asia-Pacific region has seen remarkable achievements in poverty reduction and impressive economic growth with the region doubling its per capita GDP between 1990 and 2014. This rapid economic growth in turn created job opportunities and helped lift millions out of extreme poverty. However, despite this, some 400 million people remain trapped in extreme poverty ($1.90 a day) and 1.2 billion people remaining in lower middle income status ($3.20 a day).

Key challenges have been outlined in ESCAP’s Sustainable Social Development in Asia and the Pacific: Towards a people-centred transformation and include the following:\textsuperscript{27}

- Rising inequality in income – high inequality still exists in economic growth and increases the propensity for unrest, crime and instability.
- Missing education opportunities – countries need to address education gaps and challenges.
- Health disparities – health disparities still exist between rich and poor, and many countries are still without universal access to health care.
- Inadequate water, sanitation and electricity – these are marked inequalities between rich and poor, as there are 1.5 billion people without access to these services within the region.
- Pursuing gender equality – gender gaps still exist and achieving gender equality is critical for the SDGs.
- Ageing populations – by 2050 the proportion of older people is expected to double within the region causing emerging challenges.
- Disability discrimination – one in every six persons within the region has some form of disability, which totals 650 million people.
- International migration – currently 98 million people from within the Asia-Pacific region live outside their countries of birth.

Social development is a cross-cutting issue that impacts multiple SDGs and global agendas. Working towards improving social development directly impacts the social demographics of a country and focuses on ameliorating disparities in income and wealth across all communities.

Geospatial data can be used in a wide variety of ways to improve social support systems and planning. Geospatial information integrated with planning, census and other social information enables efficient and effective allocation of facilities and resources. Many countries already use this data for infrastructure, town planning, telemedicine and tele-education, and poverty mapping. Spatial data also links to hazard maps and cultural heritage site maps, used to inform stakeholders and governments of the best locations for services and facilities, such as transportation systems, schools and hospitals.

For example, in Indonesia the Ministry of Health is using available satellite communication systems to implement e-health. E-health is a health management information system supported by electronic processes and communications, it includes: electronic medical records, surveillance systems, health knowledge management, telemedicine, consumer health informatics, e-learning in health sciences and medical research. Implementing this system can help improve the overall aspects of patient care, as it establishes and maintains effective clinical workflows.

Similarly, India, since 2001, has implemented a telemedicine programme which utilizes satellite links to provide medical diagnosis and consultation by specialised doctors to patients located in remote and rural areas. Since its implementation over 380 nodes have been set up across the country, with 60 speciality hospitals connected to over 306 remote, rural or district hospitals and medical colleges. By utilizing this programme it provides many benefits such as improved connectivity in remote and rural areas for healthcare services, reduced costs and provided accurate, timely advice to help save lives.

28 Department of Space, Indian Space Research Organisation: https://www.isro.gov.in/applications/tele-medicine

29 ISRO, Tele-medicine and tele-education., Available at: http://www.sac.gov.in/SACSITE/TELEMEDICINE%20&%20TELE-EDUCATION.pdf
In Australia the Bureau of Meteorology (BOM) provides a comprehensive online weather research and forecasting website, which is used frequently by both the general public, government departments and research organisations. The BOM website provides free open source data to the public, to help in disaster situations for preparedness and response. The BOM

**Box 4: Geospatial Data and Space Applications in Singapore**

The Government of Singapore promotes the use of geospatial data and space applications through a range of public applications developed by various departments. One of the main applications, OneMap, includes a detailed and compressive online map developed by the Singapore Land Authority with other government agencies, which shows updated day-to-day information and services, such as bus times, land queries, school queries and traffic data. This data has been made available through a free application with a range of features including intelligent search, navigation, timely updates and extra information. Accessible at [https://onemap.sg/main/v2/](https://onemap.sg/main/v2/). Other applications developed by the Government of Singapore include an emergency application which connects first responders to people experiencing a medical emergency. When an alert signal is activated, nearby first responders can respond using the shortest route mapped to the first aid seeker, before the ambulance arrives. The Singapore Police Force has also developed a security application, Police@QG, that informs users of safety-related issues in their neighbourhood (for example, crime incidents, police appeals and missing people) and allows them to search for and locate police stations ([www.sgsecure.sg/e-learning](http://www.sgsecure.sg/e-learning)).

![Figure 8: Screenshot of the online One Map interface (Source: Singapore OneMap).](image)
weather forecasting website is the most viewed Australia Government website, with over 1.5 billion unique views in 2015, which reflects the Bureau’s important role as an essential public source of weather information.

e. Energy

Ensuring that supplies of energy are adequate to meet rapid economic and population growth in the Asia-Pacific region in ways that are socially, economically and environmentally suitable is creating a new set of challenges for the region.

Tackling these multiple energy-related challenges will necessitate a transition in which energy is generated, transmitted and consumed. Major components of this transition are enhanced energy efficiency, increased renewable energy and improved energy access. While the energy sector in many countries is slowly being transformed, the pace of the change needs to be accelerated, in order to meet demands of the growing population.

Energy efficiency and sustainability outlined through the SDGs, have set global targets for energy development. In 2011, the Sustainable Energy for All Initiative was launched to ensure universal energy access, through global initiatives that would mobilize action by these diverse actors in support of SDG 7’s three core objectives: 1) ensuring universal access to modern energy services; 2) doubling the share of renewable energy in the global energy mix; and 3) doubling the global rate of improvement in energy efficiency.

Space applications can support work on SDG 7, affordable and clean energy, through adding value-products to energy mapping and identification. Space-derived data and GIS can support identification and mapping of renewable energy potential, such as hydropower and geothermal and solar energy. Geospatial services can also contribute to the tracking of biomass stocks, map energy infrastructure such as transmission lines, gas pipelines and untapped energy resources.

ESCAP’s Committee on Energy, at its first session, acknowledged the new Asia-Pacific Energy Portal, which offers access to comprehensive statistical data and visualization, using space applications. Using this geospatial data can contribute to more efficient and knowledge-based decision-making processes, potentially leading to more targeted intervention efforts.

In India, the potential of solar and wind power is being harnessed by using remote sensing technology and mapping renewable energy sources. Satellite data is being used to assess the
actual solar power potential of concentrated solar power and centralized photovoltaic (PV) solar systems in each district\textsuperscript{30}. GIS and remote sensing can help to identify key locations for solar power to calculate technical requirements and identify the economic viability. To increase renewable energy consumption in India, a comprehensive GIS-based energy map and a geospatial energy portal are being developed\textsuperscript{31}.

In Georgia, the energy sector is one of the main users of space applications and data resources. Space applications, such as digital maps, satellite imagery and data on the ownership of lands and registration, are used in the construction of hydropower plants to analyse potential sites for natural oil and gas reserves\textsuperscript{32}.


\textsuperscript{31} India, presentation to the Drafting Committee for the Asia-Pacific plan of action for space applications for sustainable development (2018–2030) at its first meeting, Bangkok, 31 May and 1 June 2018. Available at www.unescap.org/sites/default/files/Committee%20Member%20Presentation-India_0.pdf

\textsuperscript{32} Georgia, presentation to the Drafting Committee for the Asia-Pacific plan of action for space applications for sustainable development (2018–2030) at its first meeting, Bangkok, 31 May and 1 June 2018. Available at https://www.unescap.org/sites/default/files/Committee%20Member%20Presentation_Georgia_rev_0.pdf
Box 5: Papua New Guinea energy potential study

The vast majority of Papua New Guinea’s (PNG) population (85 per cent) live in isolated and dispersed villages in rural areas not connected to an electricity supply. Limited or restrained access to energy can constrict development and cause significant challenges to already vulnerable communities.

The University of Technology in Papua New Guinea has conducted spatial research on the potential of the country’s renewable energy resource capacities. The study outlines the regions which are most suited for wind, solar, geothermal and biomass power plants. Through such initiatives the scientific community is making its contribution to numerous ongoing sustainable energy projects, which are being implemented as part of the plan to increase the mix of renewables to 32 per cent by 2030 and make electricity available to isolated island communities.

Figure 9: Average potential renewable energy distribution Annually (Source: http://file.scirp.org/pdf/IJG_2015081015172515.pdf)
f. Climate Change

The Asia-Pacific region is set to play a key role in transitioning toward net zero emissions and increased climate resilience. Yet it faces substantial challenges, contributing to over half of the world’s total greenhouse gas emissions with six out of the ten top global country emitters. The region is already experiencing the negative effects of climate change, with higher temperatures, a rise in sea level and an increase in extreme weather events.

Space applications can contribute to achieving the goals set out in the United Nations Framework Convention on Climate Change, the Paris Agreement and the 2030 Agenda for Sustainable Development. In endorsing the New Delhi Declaration, adopted by the Asian Ministerial Conference on Disaster Risk Reduction in 2016, space agencies acknowledged the need to coordinate their methods and their data to monitor human-induced greenhouse gas emissions. In developing countries geospatial services, such as remote sensing, may offer important insight into urban and environmental conditions that are currently not available through traditional sources of governmental and private sector data. This data can support land-use monitoring, ecosystem changes, urban development, ocean cycles and air-quality developments.

A number of countries are already incorporating space applications into their climate response strategies. For example, in the Bangladesh Climate Change Strategy and Action Plan 2009, emphasis is placed on geospatial applications using satellite technology by developing an understandable early warning and forecasting system that helps minimize risk to lives and properties by improving the prediction and accuracy of cyclones tracking and flooding. Similarly, the Department of Meteorology of Sri Lanka is developing downscaled high-resolution climate change scenarios for specific regions by combining based on the “Hadley Centre Coupled Model” and the regional climate model from the “Providing Regional

33 Indian Space Research Organization, “World’s space agencies unite to face the climate challenge”, 3 June 2016.


Climates for Impacts Studies” system. To improve its weather forecasting capability, the Department of Meteorology is also using receiving stations to collect data from geostationary weather satellites, such as Meteosat, the Moderate-resolution Imaging Spectroradiometer, the Advanced Scatterometer and Oceansat to analyse various weather and climate impacts.

With the rapid development of innovative digital technologies, more advanced solutions are becoming available to monitor the Earth. In October 2018, the Japan Aerospace Exploration Agency (JAXA), developed jointly by the Ministry of the Environment (MOE) and the National Institute for Environmental Studies (NIES), successfully launched the GOSAT-2 satellite. The GOSAT-2 satellite, short for "greenhouse gases observing satellite-2", is intended to provide data that will help Japan create and publish "emission inventories" of the CO2 output of various countries, as outlined in the Paris climate accord.

Also, in October 2018, China, in partnership with France, launched their first ever satellite built in partnership with another county. The 650-kilogram China-France Oceanography Satellite (CFOSAT) will allow scientists to survey the world’s oceans, becoming the first satellite to simultaneously measure winds and waves as well as assist with a range of tasks including global marine monitoring, disaster management, and risk reduction as well as tracking the effects of climate change. It will also allow scientists to better understand interactions between oceans and the atmosphere. Fitted with two radars: the French-made SWIM spectrometer will measure the direction and the wavelength of waves, and China's SCAT, a scatterometer will analyse the force and direction of winds.

The Asia-Pacific region is experiencing higher air pollution emissions with negative impacts on health more often making the news. In the Republic of Korea for example, the National Aeronautics and Space Administration (NASA) and the Korean National Institute of Environmental Research (NIER) are jointly developing the Korea-United States Air Quality


Study (KORUS-AQ) to observe the air quality across the Korean peninsula and surrounding coastal waters.

This joint research seeks to use an innovative approach to data collection and monitoring of air quality. Over the years, scientists have used satellites to try to study air pollution but have found disadvantages due to shorter required acquisition periods of more than once a day. As changes in air quality can quickly change from hour-to-hour, new satellites are currently being built to collect hourly air quality measurements to allow for a better understanding of air pollutant emissions\textsuperscript{39}.

\textsuperscript{39} EPA, KORUS-AQ: An International Cooperative Air Quality Field Study in Korea. Available at: https://www.epa.gov/sites/production/files/2016-03/documents/korus-aq_fact_sheet_1.pdf
Regional Cooperation and initiatives within the Asia-Pacific Region

a. ESCAP initiatives

ESCAP as a regional cooperation mechanism with unsurpassed convening power in the Asia-Pacific region brings diverse country stakeholders together to share knowledge and good practices on a multitude of development issues. Over the years ESCAP has played a leading role in strengthening regional cooperation through multiple initiatives and programmes, especially within the space sector.

ESCAP operates as a regional hub for harnessing the latest advances in space technology and GIS applications to address key issues and support member countries. Through the Space Applications Programme for Sustainable Development (RESAP), ESCAP has brought together space agencies and relevant stakeholders to discuss and address challenges surrounding space technology applications in support of disaster risk reduction and sustainable development agenda.

Capacity building and training

RESAP aims to provide satellite-derived data and images to support evidence-based approaches for better-informed and timely decision-making for disaster risk reduction. As a unique regional mechanism, RESAP pulls together regional resources in the form of satellite-derived data, knowledge products, tailored tools, timely service and training. It brings together countries with an advanced experience in utilizing innovative space applications, and pairs them with countries lacking the knowledge or capacity to take advantage of such applications.

The mechanism has been providing cutting-edge technology in the form of tools and services to enhance drought risk management and build resilience to both disasters and climate change. It has also provided a range of capacity building activities through thematic trainings and the provision of geospatial information, thus strengthening evidence-based decisions on how and when to prepare for drought. For example, a drought monitoring system is now operating in Mongolia, Sri Lanka and Myanmar, with another being established in Cambodia.
ESCAP, under RESAP, has also created successful cooperation through the Regional Drought Mechanism established in 2017. This has helped member States utilize space-derived information, from spacefaring countries in the region and service nodes in China, India and Thailand, to create a comprehensive real-time drought monitoring and early warning system (EWS). This programme works to provide the most appropriate products and services on frontier space technology, building capacities and disseminating information, while also aiming to build strong regional cooperation through knowledge products and new initiatives and information. The mechanism provides a toolbox of data and expertise to build the capacity of drought-prone countries in applying EO-based risk information.

Through the technical service nodes operated by China, India and Thailand, the following countries have been assisted in establishing drought monitoring and early warning systems:

- Mongolia: The Drought Monitoring System in Mongolia has been supporting efforts to mitigate the impacts of dzud (summer drought followed by severe winter) on communities and livestock. Based on the drought watch system developed by China,
the system synthesizes various indices and provides baselines using space and ground-based data.

- Myanmar: A drought monitoring system in Myanmar has been operationalized recently at the Department of Meteorology and Hydrology with technical support from India. This has improved drought monitoring capability, focusing initially on the country’s central dry zone region. The system provides drought information of great value to the agricultural sector pertaining to prevalence, severity and persistence using moderate resolution data and multiple indices for drought assessment and augments the ground databases.

- Cambodia: The drought watch system is being installed and validated at the Ministry of Agriculture Forestry and Fisheries with support from China.

In tandem with long-range climate outlooks issued before the start of the planting season, in-season monitoring information provides a near real-time and finer assessment of drought risk throughout the crop growth cycle. While coarse resolution EO data from NASA are available in the public domain, 20 to 50-m multispectral data for regular drought monitoring are not available yet are needed for monitoring drought risk in small agricultural landholdings common in many countries in the Asia-Pacific region. The mechanism addresses this gap by enabling access to these datasets from the earth observation constellation owned by China, India, and Thailand.

The mechanism is contributing to strengthening country-level institutional and policy coordination for drought risk management while also building a strong support network for regional and South-South cooperation in the Asia-Pacific. It can facilitate the replication of best practices across the region through providing access to data, technical support, training, validation and installation of drought monitoring systems.
ii. Strengthening Multi-Hazard Early Warning Systems in Pacific Island Countries

From May 2016 to August 2018 ESCAP, with financial contributions from the Government of Japan, undertook the project “Strengthening Multi-Hazard Early Warning Systems in Pacific Islands Countries”. The project was requested by Member States in order to strengthen instructional capacity building on disaster risk management through the use of space applications and GIS.

Partner organizations in the project included the United Nations International Strategy for Disaster Reduction (UNISDR), the World Meteorological Organization (WMO), the Secretariat of the Pacific Community (SPC) and the Secretariat of the Pacific Regional Environment Programme (SPREP), the Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG), the Asian Institute of Technology (AIT), the Japan Aerospace Exploration Agency (JAXA) and universities in Japan and the Republic of Korea.

The key objective of the project was to enhance knowledge and capacity of Pacific Island Countries (PICs) on early warning systems (EWS), strengthen their capacity in utilizing space-referenced data for the operation of EWS, and build geo-referenced information systems (geo-portals) for disaster risk reduction (DRR) in selected pilot countries.
The project also aimed to support existing Pacific cooperation platforms in the region and promote South-South cooperation within and between sub-regions and other developing countries.

The project produced a number of key outputs, these included:

- Enhanced knowledge and capacity of participating Pacific countries in using geospatial data for disaster risk management (DRM).
- Build geo-portals and geo-databases in participating Pacific countries.
- Establishment of high-resolution Weather Research Forecasting (WRF) in Tonga.
- Establishment of high resolution WRF model and ocean wave model (Wavewatch3) in Solomon Islands, Figure 6.
- Development of mid-term work plans.
- Strengthened partnerships with regional organizations.

Throughout the project a number of workshops, meetings and trainings were also convened to enhance awareness, share key challenges, practices and knowledge and to bring together relevant stakeholders, NGOs, member States and United Nations entities.

Figure 12: Display of the SIMS' WRF model output of 10-m surface wind speed and direction (a) before and (b) after the implementation phase of the pilot project with resolution downscaled from 0.25 degree to 7-km (Source; ESCAP).
iii. Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness

The Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness (referred to as the Trust Fund), is another ESCAP mechanism that provides financial and technical support to address unmet needs and gaps in EWS in the Asia-Pacific region. It has promoted innovative pilot initiatives, scaled up successful early warning systems and facilitated multi-country cooperation across the region. The Trust Fund serves as an example of how South-South cooperation, has facilitated developing countries as donors and promoted complementary triangular cooperation.

b. Asia-Pacific Regional Initiatives

Regional efforts concerning the use of space applications and geospatial data have increased within the Asia-Pacific region as follows:

APRSAF

The Asia-Pacific Regional Space Agency Forum (APRSAF) was established to enhance space activities in the region. It provides four major working groups — Space Applications, Space Technology, Space Environment Utilization, and Space Education, which share information about geospatial activities and future plans, while supporting the establishment of international projects as solutions for common issues, such as disaster management and environmental protection40.

Through these regional agencies many space initiatives have been formed, including Sentinel Asia and Space Applications for the Environment (SAFE). Sentinel Asia is an international collaboration initiative among space agencies, disaster management agencies, and international agencies for applying remote sensing and Web-GIS technologies to support disaster management. It aims to improve safety in society through ICT and space technology, improve the speed and accuracy of disaster preparedness and early warning and minimise loss of life and property damage. The programme is supported and promoted by a number of regional collaborative partners within the space community, such as ESCAP, UNOOSA and ASEAN.

40 APRSAF. Available at: https://www.aprsaf.org/about/
SAFE is a voluntary initiative to encourage the use of satellite remote sensing for the use of long-term environmental monitoring, to understand key changes, which may in turn be helpful in risk reduction and adaption programmes associated with disasters and environmental risks.

**ARTSA**

In 2015, the Space Technology and Applications (SCOSA) committee endorsed the establishment of the ASEAN Regional Training Centre for Space Technology and Applications (ARTSA) by GISTDA, Thailand. ARTSA aims to provide educational services, knowledge enhancement, awareness raising, and research collaboration in space technology and its applications for SCOSA member countries worldwide. GISTDA can support the regional capacity development and training programme of ARTSA at the Srindhorn Center for Geo-Informatics in Thailand and help move forward promotion of applications of space technology for supporting disaster management and sustainable development in the ASEAN region\(^41\).

**ASEAN**

The Association of Southeast Asian Nations (ASEAN) has grown and strengthened over the years, creating basic steps for the coordination of space development and strategies for regional cooperation on space related issues, within member countries. In the early 2000s, the ASEAN sub-committee on Space Technology and Applications (SCOSA) was formed as the national body responsible for providing coordination, cooperation and information dissemination on activities, developments and issues of all space technology related fields in support of environmentally sound and sustainable national development\(^42\).

ASEAN SCOSA released the ASEAN Plan of Action on Space, Technology and innovation for 2016-2025 (APASTI), which highlights the objectives, priority areas, collaborations and


future initiatives for improving space applications within the region. Among this, three priority areas were highlighted which include: 43

1. Geoinformatics: Remote Sensing, Global Navigation Satellite System (GNSS), Geographic Information System (GIS);
2. Space technology applications, including space-based communication, disaster risk reduction (DRR), agriculture, environment and resource monitoring, surveying and mapping, and space astronomy and space exploration; and
3. Satellites, such as nano, micro and small satellites, payloads such as sensors, and ground facilities.

Through the ASEAN Plan of Action, ASEAN is also pushing for, not only region cooperation between ASEAN countries, but also international cooperation on relevant space applications matters.

**UN-GGIM-AP**

The Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific (UN-GGIM-AP) was established pursuant to resolution 16 at the 13th United Nations Regional Cartographic Conference for Asia and the Pacific (Beijing 1994). The aim of UN-GGIM-AP is to identify regional issues relevant to geospatial information management and take necessary actions on the discussions on the United Nations Regional Cartographic Conference for Asia and the Pacific (UNRCC-AP), and thus contribute to the discussions in the UNCE-GGIM 44.

Led by United Nations member States, UN-GGIM aims to address global challenges regarding the use of geospatial information, including in the development agendas, and to serve as a body for global policymaking in the field of geospatial information management. Since 23 November 2018, the secretariat of the UN-GGIM-AP has been permanently transferred to ESCAP, to strengthen the capacity of the member States in geospatial information management


44 UN-GGIM, Statutes of the UN-GGIM-AP. Available at: [http://ggim.un.org/knowledgebase/KnowledgebaseArticle50156.aspx](http://ggim.un.org/knowledgebase/KnowledgebaseArticle50156.aspx)
and to facilitate the dissemination of the outcomes and benefits of the activities of the Committee.

**SAARC**

The South Asian Association for Regional Cooperation (SAARC) is working towards regional cooperation in space technology and applications. In 2017, the Indian Space Research Organisation (ISRO) launched the South Asia Satellite (GSAT-9), a geostationary communications and meteorology satellite. GSAT-9 will play a large role in providing information on disaster management support, tele-medicine, tele-education, banking, television broadcasting opportunities and networking of academic, scientific and research institutions. The satellite is also equipped with state-of-the-art remote sensing technology which enables collection of real-time weather data, to help observation and forecasting over the South Asian region. These applications will help benefit member countries to address their specific needs and aid in the progression of space technologies, while also intending to strengthen regional cooperation among members.45

**Gaps and opportunities**

Despite advances in the availability and quality of space applications and geospatial information, several gaps and challenges in their effective use remain. A lack of capacity and resources, such as those related to finance, tailored tools and human resources, is a common problem. Processing geospatial information into a form that can be effectively used for accurate and evidence-based decision-making can be very time consuming and errors can easily be made. Many developing countries, including small island developing States, do not have a critical mass of people who can utilize, analyse and interpret space applications and geospatial information at the country level.

Additionally, within countries there is often a lack of communication, information-sharing and coordination which acts as a barrier between potential end users and data providers. Related to this is the lack of understanding by end users of the potential use of space applications products,

including how to interpret the products. There is a greater need for effective, user-friendly tools to bridge the gap between the space applications community – with its own language, priorities and means of working – and the potential end users who could benefit from EO information. In addition, many excellent pilot activities are being conducted in the region, but unless the benefits and potential of these activities are applied across other important sectors, including planning and financing, they will remain academic activities and will not be incorporated into country development plans.

Another challenge is often a weakness in policies, procedures, guidelines and standards for acquiring, sharing and utilizing space-based products and services. Existing procedures are often not harmonized between agencies and countries that need to cooperate, particularly during disasters. There may be security or privacy issues with the data or information, or a culture of not sharing.

Although a number of challenges to effectively use space applications exist at the national level, enhanced regional cooperation can help overcome many challenges in ways that can be innovative and cost effective.

**Conclusion**

Geospatial services have rapidly progressed and developed, over the years as one of the most valued services in the world. This rapid growth will continue to progress in the coming years with advanced services becoming widely available to a large range of sectors. Space technology, applications and geospatial data provide unprecedented opportunities for countries and regions to transform to sustainable digitally driven communities.

Space applications and geospatial information have significantly contributed, and will continue to contribute, to addressing sustainable development challenges in a multi-dimensional way. By utilizing the contributions of space technology, digital innovations and geospatial information applications and recognizing the potential for future development, these innovative technologies can be used as means of implementation that can leapfrog development efforts within the region. Combined with innovations in digitization, quantum computing and artificial intelligence (AI), vast new data streams and insights are emerging that will bode well for improving disaster risk reduction, natural resource management, connectivity, social development, sustainable and renewable energy and building resiliency to climate change.
Countries are now also armed with international tools such as the Sustainable Development Goals, the Sendai Framework for Disaster Risk Reduction, and the Paris Agreement that provide strong guidance to support national and local efforts to build resilience to climate change and disasters within the context of sustainable development.

The Asia-Pacific region has the potential to achieve a developmental transformation that will serve as a global model on the cooperative use of innovative technologies for the common good. ESCAP encourages members and associate members, United Nations agencies, international and regional organizations, the private sector and other relevant stakeholders to enhance collaboration in support of the implementation of the Plan of Action on Space Applications for Sustainable Development, 2018 - 2030 and to contribute to the globally agreed space agenda formulated by the Committee on the Peaceful Uses of Outer Space. Thus, all ESCAP countries, space-faring have the opportunity to build and progress geospatially through research and knowledge sharing, capacity building and technical support as well as intergovernmental discussions and regional practices.