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Space for agriculture development and food security

Special report of the Inter-Agency Meeting on Outer Space Activities on the use of space technology within the United Nations system for agriculture development and food security

I. Introduction

1. The General Assembly, in its resolution 67/113 of 18 December 2012, on international cooperation in the peaceful uses of outer space, urged entities of the United Nations system, particularly those participating in the Inter-Agency Meeting on Outer Space Activities, to continue to examine, in cooperation with the Committee on the Peaceful Uses of Outer Space, how space science and technology and their applications could contribute to implementing the United Nations Millennium Declaration on the development agenda, particularly in the areas relating to, inter alia, food security.

2. The Inter-Agency Meeting serves as the focal point for inter-agency coordination and cooperation in space-related activities within the United Nations system. At its thirty-second session, held in Rome from 7 to 9 March 2012, the Meeting agreed that a special report, to be issued in 2013, should address the use of space technology for agriculture and food security. The topic was also discussed at the open informal session held on 9 March 2012, providing an impetus to the preparation of the present report and contributing to increased awareness of the benefits of space technology and space-derived geospatial data in agricultural monitoring, agriculture development and food security.

3. In recent years, thematic reports produced by or in consultation with the Inter-Agency Meeting have included the special report entitled "Space benefits for Africa: contribution of the United Nations system" (A/AC.105/941), prepared by the Office for Outer Space Affairs of the Secretariat in cooperation with the Economic Commission for Africa and in consultation with members of the Meeting, and the special report of the Meeting on the use of space technology within the United Nations system to address climate change issues (A/AC.105/991), prepared under

the leadership of the World Meteorological Organization in cooperation with the Office for Outer Space Affairs and with contributions from the secretariat of the United Nations Framework Convention on Climate Change and other United Nations entities.

4. The present report was compiled under the leadership of the Office for Outer Space Affairs with contributions from the following United Nations entities: the secretariat of the United Nations Convention on Biological Diversity, the secretariat of the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, the Economic Commission for Africa (ECA), the Economic Commission for Latin America and the Caribbean (ECLAC), the Economic and Social Commission for Asia and the Pacific (ESCAP), the Economic and Social Commission for Western Asia (ESCWA), the Food and Agriculture Organization (FAO), the International Atomic Energy Agency (IAEA), the United Nations Environment Programme (UNEP), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Office for Disaster Risk Reduction (UNISDR), the Operational Satellite Applications Programme (UNOSAT) of the United Nations Institute for Training and Research (UNITAR), the World Food Programme (WFP) and the World Meteorological Organization (WMO).

5. The present report was endorsed by the Inter-Agency Meeting at its thirty-third session, held from 12 to 14 March 2013 in Geneva, for submission to the Committee at its fifty-sixth session, to be held from 12 to 21 June 2013.

Harnessing the use of space-derived geospatial data for sustainable development: the food security component

6. The Committee, in its contribution to the United Nations Conference on Sustainable Development (Rio+20), held in Rio de Janeiro, Brazil, from 20 to 22 June 2012, on the topic of harnessing the use of space-derived geospatial data for sustainable development, provided a set of recommendations on ways and means of fostering international cooperation with a view to building up national infrastructures to use geospatial data (A/AC.105/993). Among its recommendations, the Committee pointed to the need for establishing sustainable national spatial data infrastructure; enhancing autonomous national capabilities in the area of space-derived geospatial data, including the development of associated infrastructure and institutional arrangements; engaging in or expanding international cooperation in the area of space-derived geospatial data and increasing awareness of existing initiatives and data sources; and supporting the United Nations in its efforts to access and use geospatial information in its mandated programmes to assist all Member States. The recommendations, if implemented, would strengthen decision-making in many sectors, including in agriculture and food security.

7. To promote the use of space-derived geospatial data by United Nations entities, the Inter-Agency Meeting developed a set of recommendations, as contained in the report of the Secretary-General on the coordination of space-related activities within the United Nations system: directions and anticipated results for the period 2012-2013 — the use of space-derived geospatial data for sustainable development (A/AC.105/1014). The recommendations include addressing gaps and bottlenecks through raising United Nations system-wide awareness of the benefits of space-derived geospatial data; meeting the requirements of United Nations

entities in terms of data discovery, data access and technical capabilities for information processing; using existing coordination mechanisms and establishing, if necessary, informal coordination mechanisms for streamlining the use of space-derived geospatial data; and promoting partnerships with the private sector, academia and Government agencies.

8. In its outcome document entitled "The future we want",[1] the United Nations Conference on Sustainable Development acknowledged that food security and nutrition had become a pressing global challenge and reaffirmed its commitment to enhancing food security and access to adequate, safe and nutritious food for present and future generations.

9. The Conference also reaffirmed the necessity to promote, enhance and support more sustainable agriculture, including crops, livestock, forestry, fisheries and aquaculture, while conserving land, water, plant and animal genetic resources, biodiversity and ecosystems and enhancing resilience to climate change and natural disasters. In that connection, the Conference resolved to improve access to information, technical knowledge and know-how, including through new information and communications technology that empowered farmers, fisherfolk and foresters to choose among diverse methods of achieving sustainable agricultural production.

10. In paragraph 274 of its outcome document, the Conference specifically acknowledged the use of space-technology-based data and information for sustainable development, recognizing the importance of such data, in situ monitoring and reliable geospatial information for sustainable development policymaking, programming and project operations, and noting the relevance of global mapping in that regard.

The post-2015 development agenda perspective

11. The United Nations System Task Team on the Post-2015 United Nations Development Agenda was established by the Secretary-General in September 2011 to support United Nations system-wide preparations for the post-2015 development agenda, in consultation with all stakeholders. In its report to the Secretary-General entitled "Realizing the future we want for all", the Task Team provided key recommendations and suggestions on a new vision for development, as well as the possible contours of such an agenda and options for moving forward, and recognized, inter alia, that bold, comprehensive efforts to eradicate hunger and guarantee food and nutrition security for all, including access to sufficient nutritious food, were both feasible and essential.

12. The Task Team noted that such efforts would include adopting national strategies to support faster growth in food productivity, greater food security and less volatility in food prices; strengthening resilience through the implementation of inclusive social protection systems; and empowering people through land tenure security and the provision of information, technology and better access to credits and markets to better manage price shocks and climate risks. The Task Team recognized that, in areas such as climate monitoring, land-use planning, water management and food security, improving access to geographical information and

[1] General Assembly resolution 67/288, annex.

geospatial data and building capacities to use scientific information would allow for more accurate environmental and social impact assessments and more informed decision-making at all levels.

13. At its thirty-third session, the Inter-Agency Meeting agreed that the report of the Secretary-General on coordination of space-related activities within the United Nations system for the period 2014-2015 should address the post-2015 development agenda, with attention given to resilience and building upon his previous reports.

II. Selected areas in which United Nations entities use space technology for agriculture development and food security

14. United Nations entities employ space technology in their routine operations aimed at enhancing food security and sustainable food production. They also support Member States in advancing their capacities, promoting policy-science dialogue, developing institutional frameworks and bridging the gap between knowledge, governance and capacity to use such technology to enable early detection of threats to agriculture and food security and informed decision-making in preventing and mitigating the effects of such threats.

15. For example, satellite imagery obtained from Earth observation systems informs decision-making in agriculture, aquaculture and forestry, and provides inputs for yield forecasting and risk assessments of pest, disease and other threats in those sectors. In addition to space-derived geospatial data and information, space technology and its applications provide other solutions that could be effectively employed to address global supply uncertainty and improve the productivity and resilience of food production, in combination with other sources of data and information from terrestrial applications. The effective use of existing Earth observation information, in combination with data gathered in the field, provides tools that enhance the collection, storage, analysis and dissemination of food security information.

16. Furthermore, the availability of historical remote sensing data also allows the analysis of past trends that have led up to the current situation. In particular, it assists in the assessment of areas where agriculture can be recognized as unsustainable, as well as the factors leading up to that point, for example how agricultural development might have led to land degradation, desertification or salinization. Changes in agricultural practice that lead to improved sustainability can also be assessed. In addition, there are opportunities for real-time assessment of the broader impacts of agriculture on land and water, for example, by correlating current agriculture (including by location and agricultural practice) with associated ecosystem change.

Weather monitoring and forecasting

17. The monitoring and forecasting of weather by satellites is of crucial importance to farmers. Satellites are an important complement to ground-based weather stations for predicting storms, flooding and frost. Weather observations are performed by a constellation of geostationary meteorological satellites for permanent monitoring, as well as a constellation of low-Earth orbit satellites, generally near-polar sun-synchronous, for global coverage with a comprehensive

suite of active or passive instruments. Both types of observations are extensively assimilated in numerical weather prediction models to support short- to medium-range weather forecasts. Rainfall estimations derived from infrared and/or microwave satellite imagery help farmers plan the timing and amount of irrigation for their crops. Land-surface temperature and soil moisture products are starting to be operationally available. Of course, ground-based measurements of air and soil temperature and soil moisture continue to be needed for verification.

18. As an example, WFP works with Governments, local partners and key scientific institutions to use spatial information to identify key livelihood and food security vulnerabilities. As part of an initiative within the Research Programme on Climate Change, Agriculture and Food Security of the Consultative Group on International Agricultural Research, which analyses linkages between climate variables and food security indicators, climate data from weather stations and remote sensing imagery are being assessed for Nepal to seek recent changes in climate patterns and how they may impact food security in the country.

Monitoring agricultural production

19. Monitoring crop growth and producing early forecasts of planted crops are of immense importance for planners and policymakers at the national level in areas related to food security. Reliable, timely and credible information enables planners and decision makers to handle deficits or surpluses of food crops in a given year in an optimum manner. Timely and reliable national agricultural statistics can be obtained through the establishment of an adequate, periodic national agricultural survey based on probability-sampling methods, image classification and adherence to well-defined and reproducible techniques.

20. The use of a number of ancillary data, including the integral use of remotely sensed data, is a key component in effective monitoring of agricultural production. Earth observation data is now used regularly to monitor the crop season, and satellite imagery coverage integrated by field surveys allows the quantification of areas planted and to be harvested during crop seasons. United Nations entities continue to provide support to Member States in enhancing their national capacities for improved crop forecasts and production estimates.

21. In 2012, FAO, in collaboration with the International Institute for Applied Systems Analysis, launched the global agroecological zones data portal (www.fao.org/nr/gaez), which provides geospatial and tabular information and reporting for better understanding of the potential and actual production of the major production areas, including mapping the extent of cropland areas, making improved seasonal forecasts and improving area and yield estimates to be used at the regional, subregional, national and subnational levels. An example of crop estimation and forecasting at the national level is a process put in place by Pakistan through its national space agency, the Space and Upper Atmosphere Research Commission (SUPARCO), and in close collaboration with FAO. The process is aimed at quantifying planted areas through Earth Observation Satellite (SPOT) imagery, acquired twice a year and complemented by field surveys.

22. To support improved crop estimates, FAO is implementing and assisting with technical advice and the development of standards for land-cover mapping through ISO/TC 211 for the production of standardized and harmonized land-cover

baselines. These standardized databases, created using the interpretation of remote sensing imagery combined with in-situ data, serve as the bases for assessing per-cent cultivation and are used for the preparation of improved sample allocation for the area frame analysis. The high resolution land-cover databases improve the area frame statistical analysis, along with sample allocation through discontinuous stratification. The sampling strategy has proved very successful in improving both the efficiency of the approach and the accuracy of the image interpretation.

23. Recognizing the need for adequate resourcing of the agricultural monitoring activities of member countries to support sustainable agriculture development and address food security and climate variability, FAO fosters the use of medium- and high-resolution Earth observation agricultural monitoring and technology, combined with in-situ observation, to provide reliable information as decision support products.

24. Available high resolution satellite remote sensing data, combined with satellite navigation data, also contribute to the development of precision farming techniques for monitoring crops on individual farms. Those techniques help in the gathering of data such as soil condition, humidity, temperature, intensity of planting and other variables in order to precisely identify water, fertilizer and pesticide requirements. Accurate targeting of such areas contributes to an optimal distribution of water and fertilizers, which not only improves crop yields but also saves money and reduces the environmental impact of agricultural activities. Applications of global navigation satellite systems (GNSS) help in the positioning and operation of robotic equipment.

Biodiversity

25. Biodiversity for food and agriculture includes the crops, farm animals, aquatic organisms, forest trees, microorganisms and invertebrates that are directly or indirectly responsible for the production of food for the human population. It is represented by the many thousands of species and their genetic variability that are at the heart of healthy ecosystems, and is among the Earth's most important resources. Space technologies, especially in terms of systems for Earth observation and characterization of agroecological zones and ecosystems, could prove an important asset for assessing the state of conservation of biodiversity for food and agriculture, estimating the health status of ecosystems and predicting threats from climate change and invasive alien species, among other things. Space technologies can also provide additional value, through the integration of images and mapping abilities into existing information systems on genetic resources for food and agriculture.

26. FAO and its Commission on Genetic Resources for Food and Agriculture are undertaking a number of major initiatives to assess the state of the world's biodiversity for food and agriculture. FAO has produced two reports on the state of the world's plant genetic resources for food and agriculture and one report on animal genetic resources for food and agriculture; it is presently finalizing a report on forest genetic resources. A report on aquatic genetic resources for food and agriculture is presently under preparation, and the Commission is also initiating the process for the preparation of the *State of the World's Biodiversity for Food and Agriculture* report. On the basis of those reports, States members of the Commission have adopted specific global plans of action for the conservation and sustainable use of their genetic resources for food and agriculture.

Water and irrigation

27. Space technology provides spatial information regarding water and food production, which is used for assessing water productivity and evapotranspiration and identifying irrigated areas. Assessing the water productivity of irrigated and rain-fed agriculture, in terms of yield per cubic metre of water transpired, allows the benchmarking of the performance of different agricultural systems and the identification of possibilities for improving such performance. Data on evapotranspiration is useful in water accounting frameworks and in the assessment, under irrigated circumstances, of the amount of water used beneficially for crop growth in comparison with the amount of water withdrawn for irrigation.

28. Information and statistics related to the mapping of irrigated areas is used for the global map of irrigated areas that is distributed by FAO and the University of Bonn (Germany). That map is one of the major input layers for global water balance studies carried out by FAO (in the framework of its "World agriculture: towards 2030/2050" studies) to assess the amount of water that is used for food production under current circumstances and the amount that will be used in the future.

29. In collaboration with the Governments of Chad and Switzerland, UNITAR/UNOSAT is working to improve water management in Chad through the use of remote sensing, geographic information system analysis and geological surveys. The initiative includes remote assessments, field surveys, technical training, capacity development and the production of maps and a geographic information system database for informed decision-making with regard to water management.

Oceans and mariculture

30. Marine fisheries around the world continue to be seriously threatened as a result of fishing overcapacity and a range of environmental problems. As a result, the rising demand for fish products is largely being supported from increased aquaculture output. Changes in the sourcing of fish will continue to cause significant spatially variable effects on the marine and other aquatic environments, effects that are best managed through the application of geographic information systems and remote sensing methods. Furthermore, changes need to take into account wider approaches to addressing aquatic problems, e.g. via marine spatial planning and/or ecosystem approaches to both fisheries and aquaculture.

31. FAO has been active in promoting the use of geographical information systems (GIS) and remote sensing in fisheries (both inland and marine) and aquaculture since 1985, aiming to demonstrate the capabilities of GIS and remote sensing to address aquaculture and fisheries issues, mainly for strategic planning. The FAO publication on advances in GIS and remote sensing for fisheries and aquaculture serves as a guide to understanding the role of spatial analysis in the sustainable development and management of fisheries and aquaculture. It outlines current issues, the status of GIS and remote sensing and their applications to aquaculture, inland fisheries and marine fisheries to illustrate the capabilities of these technologies with regard to management, assessment of potential, and zoning and site selection in mariculture.

32. In recognition of a growing need to transfer land-based/coastal aquaculture production systems further offshore as a result of expected increases in human

population, and in competition for access to the land and clean water needed to increase the availability of fish and fishery products for human consumption, FAO has produced and published a global assessment of the potential for offshore mariculture development from a spatial perspective, providing for the first time measures of the status and potential of such development.

33. As part of its activities, FAO has also developed two information systems: the GISFish website,[2] and the National Aquaculture Sector Overview[3] (NASO) map collection. GISFish, a “one stop” site to provide information on the global experience with regard to GIS, remote sensing and mapping as applied to fisheries and aquaculture, sets out the issues related to fisheries and aquaculture, and demonstrates the benefits of using GIS, remote sensing and mapping to resolve them. The NASO map collection consists of Google maps showing the location of aquaculture sites and their characteristics at the subnational level (state, province or district) and in some cases even at the individual farm level, depending on the degree of aquaculture development, the resources available to complete the data collection form and the level of clearance provided by the country experts.

Land-use mapping

34. Land-use and land-cover maps are essential tools for decision makers in formulating policies for sustainable rural development. Remote sensing data are a source of information used to map the risk of desertification, soil erosion, oversalinization and acidification. There are over 50 Earth observation satellites, including those of the Landsat and the Sentinel-2 series, that are used for monitoring land cover. Some of these are high resolution (submetre) imagery platforms that assist in enhancing sustainable land use and land resource management across a range of agroecological zones and production systems, such as rain-fed and irrigated cropping, intensive and extensive livestock production, agroforestry and sustainable forest management. The resulting data and maps of status and trends, combined with best practices and lessons learned, are intended to allow decision makers to identify areas at risk and to better plan, and later monitor and assess, the effectiveness of their implementation and investment strategies and supporting policies in regard to improving sustainable land management.

35. Promoting a participatory process with land users and service providers at the subnational level improves their inputs and access to information, technical knowledge and know-how and thereby facilitates the empowerment of farmers, livestock keepers and foresters to implement sustainable production systems. The combined use of geospatial information and participatory assessments provides an effective decision-making process for enhanced spatial planning (land use/territorial) and sustainable land resource management among the various sectors and actors.

36. Through the recently established Global Soil Partnership, FAO is helping countries to improve the quality and availability of soil data and information at the national and subnational levels, which will improve technical capacities for enhancing soil protection and productivity across a range of production systems and will also strengthen modelling tools and capacities for land resources, climate

[2] www.fao.org/fishery/gisfish/index.jsp.

[3] www.fao.org/fishery/naso-maps.

mitigation and adaptation, food security and disaster risk reduction at the national, regional and global levels.

Desertification

37. Sustainable land use is a prerequisite for lifting billions of people out of poverty, enabling food and nutrition security and safeguarding water supplies. Building on the recognition by the United Nations Conference on Sustainable Development, in its outcome document, of the need for urgent action to reverse land degradation, the 2012 observance of the World Day to Combat Desertification and Drought culminated in commitments to achieve a land-degradation-neutral world in the context of sustainable development.

38. Further to the adoption of its strategic plan for the period 2008-2018, the secretariat of the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, has been implementing a new approach to planning, monitoring and reporting, moving from a qualitative to a quantitative measurement system of its outputs, outcomes and impact. Quantitative data on the conditions of dryland ecosystems and of the livelihood of their populations are required to support policymaking and environmental management on all scales.

39. In the current 2012-2013 biennium, the concentrated effort is on the measurement of land productivity and the rural poverty rate, the two impact indicators identified as mandatory for reporting by affected States parties. Nevertheless, since desertification is a complex, cross-sector environmental problem promoted by multiple drivers, its monitoring requires the integration of human- and environment-based variables, and should include the collection of information relating to climate change and biodiversity. As reported by countries participating in the recently concluded pilot tracking exercise on impact indicators, availability of and access to data and information remain critical issues.

40. In support of the Convention, FAO has developed, built capacity with regard to and validated with several countries and partners a set of tools and methods for assessing, mapping and monitoring the status of and trends related to land use and land resources (e.g. degradation, conservation and restoration of soil, water and biological resources), their drivers (e.g. demographics, poverty and governance) and their impacts on a range of ecosystem services and on livelihoods. The resulting toolbox and process of the Land Degradation Assessment in Drylands-World Overview of Conservation Approaches and Technologies project use available geospatial information at the global, national and subnational levels, along with participatory, multisector expert assessments to assess the type, extent and severity of degradation, as well as the extent and effectiveness of existing and new land management practices.

41. Together, the Joint Research Centre of the European Commission (JRC) and UNEP are coordinating the compilation of a third edition of the *World Atlas of Desertification*, which will be an update of the second edition, published by UNEP in 1997. The atlas is being prepared in response to the interest expressed by the Committee on Science and Technology of the Conference of the Parties to the United Nations Convention to Combat Desertification and its stakeholder communities. The overarching objectives of the atlas are to: (a) establish a global

baseline for the status of and indicative trends relating to human-induced desertification and land degradation, as well as for biophysical and socioeconomic contributing factors, (b) map the spatial distribution of human-induced desertification, land degradation and drought, along with the various contributing factors, on global and more detailed spatial scales and (c) document and illustrate state-of-the-art scientific assessment methodologies, integrating biophysical and socioeconomic dimensions. The atlas will be available as both a published reference atlas and an online digital information portal towards the end of 2013.

Drought: groundwater monitoring

42. Drought is one of the main causes of food insecurity in the world. In 2011, the Horn of Africa faced its worst drought in 60 years. An estimated 12.4 million people suffered from a massive food shortage. In the region, water scarcity is exacerbated by a lack of information on groundwater. Most data are incomplete, fragmented or outdated, and scientists in the area lack the tools to assess groundwater and rapidly improve water supplies. Furthermore, effective management of groundwater needs to be complemented by relevant policies to enable actors in the region to build long-term preparedness for drought.

43. Working closely with Governments and key partners, WFP is introducing new approaches to risk transfer by using space-based and other climate information to inform food security interventions. One such example is the Livelihood Early Assessment and Protection (LEAP) software platform, a service which uses ground and satellite rainfall data to monitor the water requirement satisfaction index and quantify the risk of drought and excessive rainfall in different administrative units of Ethiopia. The software is used to guide disbursements to scale up the Government's safety net programme and protect the livelihoods of food-insecure populations in the event of a climate-related shock.

44. Established in 2012 by UNESCO, the Groundwater Resources Investigation for Drought Mitigation in Africa Programme (GRIDMAP) is aimed at combating climate change in water-scarce areas of Africa by identifying emergency and sustainable water supplies and delivering measures to mitigate long-term drought and famine. The Programme assesses the availability of groundwater resources in target areas through the use of remote sensing data, in combination with ground-penetrating radar and information from geological, hydrogeological, geographical, hydrological and climate data and, when dealing with deep aquifers, seismological data, and determines which resources can be utilized safely for emergency and long-term development situations.

45. The Programme also strengthens the drought preparedness of local, national and regional actors by building the capacity to sustainably manage groundwater resources, and is aimed at building the resilience of populations vulnerable to drought and famine. The project is expected to increase access to water for thousands of vulnerable populations, enhance understanding of where safe groundwater resources exist and how much can be used for emergency and long-term development needs, and build sustainable skills in groundwater assessment and management. In its first phase (2012-2013), the Programme is focusing on the Horn of Africa region.

46. As a way to contribute to response efforts in the Horn of Africa, the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) and the National Disaster Reduction Centre of China collaborated on the generation of maps depicting the extent of droughts and their impact on crops. The maps were used by national and international organizations providing humanitarian assistance in the region.

Drought: vegetation monitoring

47. Drought forecasting and early detection relies, inter alia, on satellite imaging systems and enables decisions to be taken to prevent and mitigate the effects of drought. Monitoring that is built on knowledge acquired from past events and that uses archived imagery can help profile current trends and events so that the effects of droughts can be mitigated and famine avoided. FAO has developed applications to monitor the status of vegetation in cultivated and rangeland areas, to identify those areas which are likely to suffer from either drought or excessive rainfall. FAO continues to monitor food supply and demand, as well as food security, at the global, regional, subregional, national and subnational levels, using the Global Information and Early Warning System on Food and Agriculture. The main objective of the System is to provide early warning of imminent food crises to ensure timely interventions in countries or regions affected by natural or man-made disasters.

48. To mitigate the impact of agricultural drought, it is of high importance to have at one’s disposal timely and reliable information on the condition of food crops in all regions and countries. The Global Information and Early Warning System on Food and Agriculture and the Climate, Energy and Tenure Division of FAO have as their aim the development of an agricultural stress index system, based on meteorological operational satellite-advanced very high resolution radiometer (METOP-AVHRR) composite imagery over 10 days and with a resolution of 1 km, for detecting, on a global scale, agricultural areas with a high likelihood of water stress (drought). This system is being implemented on behalf of FAO by the Flemish Institute for Technological Research, with the technical support of the Monitoring Agricultural Resources unit of JRC.

49. The agricultural stress index system is based on the vegetation health index (VHI), which was derived from the normalized difference vegetation index (NDVI) and developed by the Center for Satellite Applications and Research of the National Environmental Satellite, Data and Information Service. VHI has been successfully applied under many different environmental conditions around the globe, including in Asia, Africa, Europe, and North and South America. It can detect drought conditions at any time of the year. For agriculture, however, only the period that is most sensitive for crop growth (temporal integration) is of interest, so the analysis is performed only between the start and end of the crop season.

50. The agricultural stress index system is aimed at assessing the severity (intensity, duration and spatial extent) of an agricultural drought and express the final results at the subnational level, offering the possibility of comparing them with the agricultural statistics of the country concerned. From the global version of the system that was designed for detecting agricultural hotspots around the globe, it is possible to develop a stand-alone version for monitoring agricultural drought at the country or regional level. The stand-alone version would be calibrated with local

agricultural statistics and would use specific parameters, coefficients and masks of the main crops of the country or region. This version could be used for risk management by establishing remote-sensing-based crop insurance.

51. A global drought detection and monitoring system being developed by WFP and the Information Technology for Humanitarian Assistance, Cooperation and Action (ITHACA) association, a joint venture between WFP and the Politecnico di Torino in Turin, Italy, to define thresholds and triggers suitable for early warnings is also based on the analysis of a series of drought-related variables and indices, including NDVI, which is a satellite-based vegetation index, and the standardized precipitation index (SPI), which is a meteorological drought index obtained from satellite data. Land cover, land use, soil moisture, soil type and other relevant information may be integrated into the system to improve its effectiveness.

52. Integration of NDVI allows the monitoring of vegetation water stress. Monthly historical time series of data from the National Oceanic and Atmospheric Administration (NOAA) of the United States, the advanced very high resolution radiometer and NDVI for the period 1982-2007 have identified long-term vegetation dynamics and helped to produce maps about the areas that were subject to an increase or decrease in vegetation greenness. The use of SPI provides a numerical value which offers quantitative information related to the deviation from normal conditions, and which can be interpreted as the intensity of a drought spell in the case of a negative value. It also allows the study of different time scales related to different drought conditions.

53. The impacts of the two consecutive seasonal droughts in the Horn of Africa (October 2010-February 2011 and April-June 2011) were evaluated based on multi-year NDVI data from SPOT-VGT. The magnitude of the drought impacts were assessed through statistical indicators (standardized anomalies and ranks), both for each season and jointly, allowing clear identification of areas suffering dual, single or no impacts, as well as a ranking of the episodes within the historical record.

54. For the 2012 emergency response in the Sahel, WFP, together with the ITHACA association, performed NDVI analysis (studying vegetation vitality) to identify areas of potential vulnerability. That analysis enabled WFP to use historical remote sensing data to support programme design in an affordable and effective fashion. Also, WFP used remote sensing data and related analysis to forecast optimal pre-positioning of commodities. Additionally, WFP collaborated with the World Bank, among other partners, to develop an open-source solution to share geospatial information pertaining to the Sahel. That website (http://sahelresponse.org) is still in use by humanitarian agencies and the general public.

55. WMO and George Mason University (United States) are involved in the Agromet and Soil Moisture Applications pilot projects in Africa, which are aimed at building an integrated soil moisture-vegetation moisture observation system, utilizing remote sensing and in situ soil moisture network measurements and crop models to quantify crop vigour, crop health and vegetation indices in a comprehensive agrometeorological monitoring programme. The projects will also develop a methodology for integrating these analyses into a decision-support system for assessing the impacts of extreme events on crop productivity

and the agroecosystem, utilizing a user-friendly, knowledge-based interactive resource-sharing system.

Vegetation fires

56. Globally, vegetation fires affect an estimated 350 million ha of land each year. The control of such fires has become an issue of high importance, not only because of the increasing number of casualties and the huge areas burned but also because of the linkages with issues of global interest, like climate change and food security. The Global Fire Information Management System[4] (GFIMS) addresses these issues by delivering global near-real-time fire information to users to support fire managers around the world.

57. GFIMS is a web-based integrated tool which uses remote sensing and GIS technologies to deliver global Moderate Resolution Imaging Spectroradiometer (MODIS) hotspot/fire locations (from MOD14/MYD14 standard products) and burned areas (from the MCD45 standard product) to natural-resource managers and other stakeholders around the world. National and regional historical fire statistics and frequency by major land-cover types (i.e. when, where and what) are produced in support of projects and programmes. GFIMS was implemented operationally by the Natural Resources Department of FAO in 2010, based on the Fire Information for Resource Management System (FIRMS) research project financed by the National Aeronautics and Space Administration (NASA) of the United States and conducted by the University of Maryland. It is intended to be one of the components of an operational monitoring system of FAO that delivers near-real-time information to ongoing monitoring and emergency projects.

Floods

58. Among disasters caused by natural hazards, floods continue to play a significant role in terms of human and economic impacts. There is a serious need to bridge the gap between the scientific flood forecasting and modelling community and the humanitarian and local support systems in risk-prone areas. In this context, end users are not limited to humanitarian agencies, but instead also include ground-level end users such as smallholder farmers. WFP has outlined a plan of action to engage with academia and scientific research institutions such as JRC, the Dartmouth Flood Observatory, NASA and NOAA in an effort to conceptualize how critical flood information can be translated into useful operational data. Critical forecasts will not only allow timely humanitarian planning (pre-positioning), but also enable the most vulnerable members in communities to prepare for and ultimately build resilience to repeated shocks.

59. In 2012, floods were the most frequent disaster to occur in Asia, and had the highest human and economic impact. Pakistan suffered large-scale loss of life from floods for the third successive year, while floods in China affected over 17 million people and caused huge economic losses. The significant impacts of floods and storms in the region could also be seen in the Philippines, where Typhoon Bopha resulted in more than 1,000 deaths. Earth observation products were used extensively to monitor these disasters and the overall impact on the economy. As an

[4] www.fao.org/nr/gfims.

example, floods accounted for 20 per cent of all UNITAR/UNOSAT rapid-mapping activations in 2012.

60. In 2011, floods had an impact on food supply chains in Cambodia, Myanmar, Pakistan, Thailand and Viet Nam, which were monitored using Earth observations. The analysis of Earth observations for food supply chains was reported in the *Asia-Pacific Disaster Report 2012*, a joint publication of ESCAP and UNISDR.

61. The mapping of floodplains and areas at risk of landslides with high resolution imagery and detailed elevation models generated from satellite imagery and precise GNSS services can reduce the vulnerability or exposure of urban and rural populations. Evidence and experience from the disasters suggest that having substantive capacity enables policymakers to use Earth observation inputs more effectively, as was the case in countries such as China, India, Pakistan, the Philippines and Thailand.

62. Nevertheless, space applications continue to be underutilized, owing to the lack of capacity in developing countries of the region in terms of human, scientific, technological, organizational and institutional resources and expertise for operational applications of these tools. This is evidenced by the fact that floods in Cambodia and Myanmar in 2011 were captured by Earth observations only through international cooperation such as the International Charter on Space and Major Disasters, Sentinel Asia and the UNITAR/UNOSAT programme. To address these gaps, ESCAP will continue its efforts to build technical and institutional capacities in the use of space applications for inclusive and sustainable development.

63. UN-SPIDER, through its advisory services, organized a training activity in 2012 on the use of light detection and ranging (LIDAR) data for flood monitoring in Sri Lanka. The materials developed will be reused in other countries that face similar threats.

64. The UNEP Global Resource Information Database network's Geneva centre (GRID-Geneva) developed the first global flood model for the 2009 UNISDR Global Assessment Report on Disaster Risk Reduction. GRID-Geneva is now collaborating with the International Centre on Environmental Monitoring (CIMA Research Foundation) to improve the data set and provide for six different flood intensities, with global coverage. This data set can be overlaid with an agricultural land data set to assess the exposure and potential threat to food security. The current data sets can be viewed and downloaded from the PREVIEW global risk data platform, available from http://preview.grid.unep.ch.

Disasters and crisis preparedness and response

65. In the case of disasters caused by natural hazards and complex humanitarian emergencies, space technology is crucial to the effectiveness of response and relief operations when it comes to ensuring food security for the affected population. It has facilitated data collection and transmission, as well as the recent progress made in using crowdsource communities and social networks, through which relevant and validated data can more easily be shared. As communications capabilities are often limited by emergency-related destruction, satellite communications facilitate the smooth and expedient coordination that is critical for prompt understanding of the extent of damage and complex planning with respect to food, water and other necessities, without the need for costly ground-based infrastructure. Satellite

navigation and positioning technology is indispensable for tracking and tracing food security efforts during such devastating events, and for fleet management related to food delivery.

66. WFP has been using analysis from remote sensing provided by the ITHACA association to target its food aid and logistical support operation in several major humanitarian crises: the Horn of Africa, Haiti, Mozambique, Myanmar, Pakistan, the Philippines and the Sahel. These operations have provided direct support to several million people affected by disasters caused by natural hazards, and have taken significant advantage of information on affected areas derived from remote sensing. The main aim is to rapidly produce georeferenced information on the impact of disasters, especially data on affected areas and populations. The rapid mapping activities aimed at supporting the first stage of disaster management are generally based on satellite remote sensing data.

67. In conjunction with the Global Facility for Disaster Reduction and Recovery of the World Bank and the ITHACA association, WFP has developed a platform for the exchange of geodata, including data derived from remote sensing. The aim of the project is to develop, implement and optimize web infrastructures dedicated to geographical data-sharing and data management, based on open-source components. The architecture is involved mainly in data sharing, both for early impact and early warning activities, with outputs through WebGIS applications accessible through a common web browser from anywhere.

68. WFP and UNITAR/UNOSAT have been proactive in defining the type of products and services that best support humanitarian operations. As part of its mandate, WFP has requested the activation of the European Commission emergency services to provide support in emergencies in Libya, Mozambique, Myanmar, Pakistan, the Philippines, Yemen and the Horn of Africa. The products have been widely disseminated to partners and the humanitarian community.

69. The years 2011 and 2012 were marked by adverse winter conditions in many parts of the world. WFP, for the purposes of defining the type, scale and zoning of its interventions, worked to identify areas subject to a recent exceptional shock and areas subject to recurrent seasonal shocks. This was achieved by analysis of multi-year data sets of rainfall estimates and NDVI, identifying seasons when shocks occurred and summarizing information on the frequency and magnitude of such shocks in easy-to-interpret maps for stakeholder discussions. Using a multi-year data set of MODIS NDVI with a resolution of 250 m, the temporal development of the winter wheat crop in Afghanistan was followed and a seasonal assessment was made, identifying the provinces that had undergone the most severe impact as well as providing assessments on a comparative basis with previous years.

70. UN-SPIDER is taking a leading role in harnessing the potential of crowdsource mapping for the benefit of countries in need. Following a series of workshops aimed at promoting innovative approaches to social networking and crowdsource mapping with data provider and disaster management communities, efforts are being taken to prepare a survey and disseminate its results with regard to the respective requirements and expectations of each of those communities, so that more opportunities for collaboration may be explored.

71. Since 2012, the UN-SPIDER regional support offices and other partners have been conducting efforts to improve drought early warning through the use of

archived and up-to-date satellite imagery. The step-by-step methodology will be used by ministries of agriculture, environment and natural resources, as well as by disaster management agencies, to track the effects of droughts on crops, thereby leading such institutions to generate geospatial information that, when combined with ground-based information, will allow decision makers and local communities to implement measures aimed at mitigating famine and food insecurity, with a particular emphasis on rural communities.

72. Endemic food insecurity and lack of access to water are major challenges faced by displaced populations. This is often made worse where forced displacements result in camps with a very high population density. The mapping of camps of refugees or sites of internally displaced populations will remain a priority for the Office of the United Nations High Commissioner for Refugees (UNHCR), and access to affordable, adapted and timely remote sensing products will be further utilized. Remote sensing analysis through technical partnerships facilitates site planning and camp management. UNITAR/UNOSAT and UNHCR collaborate through a joint memorandum of understanding to ensure that satellite imagery and mapping is available to United Nations field staff and implementing partners.

73. UNITAR/UNOSAT continues to develop its HumaNav service. This vehicle fleet management system is a public-private partnership with Novacom Services. The system has been used by UNHCR, WFP and the World Health Organization, and continues to expand, to the benefit of more cost-efficient fleet management, improved driver security and a reduced environmental impact of several hundred vehicles operated by humanitarian and development actors. The UNITAR/UNOSAT humanitarian rapid-mapping service was activated by United Nations entities, international non-governmental organizations and Member States 35 times in 2012. Satellite imagery provided by commercial actors, public websites and the International Charter on Space and Major Disasters was used by UNOSAT to derive information on, for example, flood extent and the duration of time that agricultural areas spent underwater, thus contributing to assessments of food production capacity following floods.

III. Regional outlook: examples of initiatives of United Nations regional commissions

Economic Commission for Africa

74. The Comprehensive Africa Agriculture Development Programme (CAADP) and the Sirte Declaration on the Challenges of Implementing Integrated and Sustainable Development on Agriculture and Water in Africa, adopted at the second extraordinary session of the Assembly of the African Union on 27 February 2004, are at the heart of efforts by African Governments under the joint initiative of the African Union and the New Partnership for Africa’s Development to accelerate growth and eliminate poverty and hunger on the continent. To achieve the main goal of CAADP of eliminating hunger and reducing poverty and food insecurity through agriculture, African leaders have set a target of increasing agricultural output by 6 per cent a year for the next 20 years. Without adopting and/or upgrading technology, even large-scale investment would not be sufficient for Africa to achieve this target.

75. The Economic Commission for Africa, working with the African Union Commission to support the CAADP programme, has built the agricultural commodity value-chain database, a primary database on ecological and crop production zones, optimum processing locations, markets and infrastructure, with a related tool developed for accessing and querying the data. This spatially enabled database will assist the Food Security, Agriculture and Land section (formerly the Agricultural Marketing and Support Services section) of ECA to perform analyses on regional trends related to agriculture production and marketing in Africa. The database will also enable decision makers to analyse and model relationships between suitable agroecological zones for the priority crops identified by CAADP. The use of space-based information is indispensable in supplementing and sustaining policy research in the agriculture sector.

76. WMO, ECA, UNEP and FAO provide support to the African Monitoring of the Environment for Sustainable Development project of the African Union Commission, which is being implemented from 2007 to 2013. The project is designed to provide decision makers with full access to the environmental data and products needed to improve policy and decision-making processes, focusing on crop and rangeland management in Western Africa; water resource management in Central Africa; agricultural and environmental resource management in Southern Africa; land degradation, desertification mitigation and natural habitat conservation in Eastern Africa; and marine and coastal management in the Indian Ocean subregion. The project has paved the way for the Monitoring of Environment and Security in Africa programme, which is being implemented to address the environment, climate and food security in enhancing access to and exploitation of relevant Earth observation applications in Africa.

Economic Commission for Latin America and the Caribbean

77. In the course of the last several years, the Agricultural Development Unit of ECLAC has been engaged in two work areas linked in some sense to the use of space technology for agriculture and food security: information and communications technology for agriculture; and the impacts of climate change on agriculture. The main activities carried out in these areas have been the identification of best practices, in Latin America and other regions, in the use of satellite remote sensing data to enhance agricultural productivity and sustainability and to mitigate the effects of climate change, and the regional dissemination of such experiences through publications, seminars, workshops and technical assistance activities.

78. An international conference on the effects of climate change on agriculture and the use of new technologies to mitigate these effects and to help farmers adapt to forecasted scenarios has been organized every year since 2009 by the Agricultural Development Unit. Some contributions to these seminars have analysed feasible uses of satellite data with regard to predicting changes in farming conditions and advising farmers how to make better use of agricultural inputs. The main results of each conference have been compiled in a series of publications available on the ECLAC website.

79. The Agriculture Development Unit has also been engaged in several activities to analyse the use of information and communications technology in agriculture, in the framework of a broader European Union-ECLAC

project: ECLAC@lis2 (Alliance for the Information Society, phase 2). These activities have included the preparation of a book, to be released in the first trimester of 2013, which will also be available on the ECLAC website. Three international seminars on this issue were conducted in different Latin American countries (Bolivia (Plurinational State of), Chile and Ecuador) in the course of 2012. The idea was to present best practices in the use of information and communications technology in agriculture and the possibilities for adapting these technologies to local agricultural needs and conditions. Several experiences discussed in these seminars were related to the use of spatial imagery, satellite data and satellite Internet access for agricultural purposes, including in areas such as precision agriculture and precision irrigation. In any case, the main objective was to discuss how to make agriculture a more productive and sustainable activity, for instance, by reducing its transaction costs and making more efficient use of agrochemicals and water in agricultural tasks.

Economic and Social Commission for Asia and the Pacific

80. A historic five-year regional plan of action for the application of space technology and GIS for disaster risk reduction and sustainable development[5] was adopted by ESCAP member States at an intergovernmental meeting held in December 2012 in Bangkok. The plan of action provides the roadmap for implementation of ESCAP resolution 68/5,[6] which is aimed at broadening and deepening the contribution of space and GIS applications to addressing issues related to both disaster risk reduction/management and sustainable development. The ESCAP secretariat, in collaboration with all partners and stakeholders, will take the lead in implementing the plan of action through harmonizing and enhancing the effectiveness of the efforts of existing regional initiatives, as well as pooling expertise and resources in the region.

81. Countries of the region declared that they were united in their resolve to implement the plan of action by increasing relevant activities at the national, subregional and regional levels in order to narrow capacity gaps in developing countries with regard to the use of space and GIS products. It was proposed that a ministerial conference on space applications for disaster risk reduction and management and sustainable development in the Asia and Pacific region be held in 2015. The conference would evaluate progress made, provide further guidance and build stronger political support and ownership among all stakeholders for the successful implementation of the plan of action.

82. Under the framework of the ESCAP Regional Space Applications Programme for Sustainable Development in Asia and the Pacific, the Regional Cooperative Mechanism on Disaster Monitoring and Early Warning, Particularly Drought, was launched in September 2010 with the aim of providing substantive technical support, including satellite information products and services, as well as an information portal and capacity-building activities, to the region for the development of national (agricultural) drought disaster monitoring and early warning capacities and services. Stakeholders of the Mechanism in countries of the Asia-Pacific region committed their existing satellite and technical resources and

[5] See www.unescap.org/idd/events/2012-IGM-Asia-Pacific-Years-of-Action/index.asp.

[6] See E/2012/39-E/ESCAP/68/24.

relevant services to support the operationalization of the Mechanism. Discussion and consideration of institutional, financial and technical service modalities are ongoing.

83. As the logistical arrangements for the request and fulfilment of space-based products and services are an important part of the Mechanism, with significant implications for other aspects of providing satellite imagery for other major disasters, the ESCAP secretariat proposed at the sixteenth session of the Intergovernmental Consultative Committee on the Regional Space Applications Programme for Sustainable Development that service nodes be established in different regions, serving their respective subregions, to perform those duties in lieu of a functional secretariat. The service node modality is better suited to the Mechanism, as the nodes could provide modelling, localized by region and subregion, through the use of space-based products to achieve more effective drought monitoring and early warning, making it possible for the Mechanism to become operational within the year. The first service node is expected to be hosted in China, with subsequent ones to be established based on the success and modalities of the first one and with the support of all stakeholders of the Mechanism.

Economic and Social Commission for Western Asia

84. Under the framework of the Regular Programme for Technical Cooperation, ESCWA has advocated for the use of space-based technology in water resource management. Recent examples of this include assistance rendered to the Sudan, in which the use of satellite observations for water resource management was recommended. After that intervention, the Sudan embarked on an initiative to integrate the use of this data into its approach to water harvesting and resource planning. ESCWA also addressed the issue of remote sensing in environmental hazard mitigation at a regional conference in Oman.

85. Through a joint technical cooperation project, ESCWA is cooperating with the Federal Institute for Geosciences and Natural Resources of Germany to complete the Inventory of Shared Water Resources in Western Asia, to be launched in 2013. The inventory compiles and explores information on shared groundwater systems and surface water basins in Western Asia, with an emphasis on hydrology, hydrogeology, water resource development and use, and the status of cooperation. The targeted beneficiaries are decision makers, Government representatives from the water sector and other sectors, donors and international organizations. As part of the research process, open-access satellite imagery was used to supplement available mapping data and to enhance available analysis. This research will provide policymakers and researchers with greatly improved data in the management of water resources.

IV. Capacity-building, research and outreach in space technology

Capacity-building

86. Some recent activities organized by the Office for Outer Space Affairs in cooperation with Member States, specialized agencies and intergovernmental

organizations in the area of agriculture and food security include workshops focusing on the use of space technology for sustainable development towards food security (2007, India), integrated space technology applications for monitoring the impact of climate change on agricultural development and food security (2008, Kenya) and integrated use of space technology for food and water security (2013, Pakistan). The latter, hosted by SUPARCO on behalf of the Government of Pakistan and co-sponsored by the Inter-Islamic Network on Space Sciences and Technology, explored how present-day space technologies help to identify and monitor the relationships between the mountain environment (as a source of water) and sustainable water resources, and how both affect food security on an international and regional scale.

87. At that workshop, participants discussed how space technology applications, information and services could contribute to sustainable economic and social development programmes supporting agricultural and water security, primarily in developing countries. The workshop had the following objectives: enhancing the capabilities of countries with regard to the use of space-related technologies, applications, services and information for identifying and managing water resources and addressing food security concerns; examining low-cost space-related technologies and information resources available for addressing water and food security needs in developing countries; strengthening international and regional cooperation in that area; increasing awareness among decision makers and the research and academic community of space technology applications for addressing water- and food-related issues, primarily in developing countries; and promoting educational and public awareness initiatives in the area of water and food security, as well as contributing to capacity-building efforts in those areas.

88. UNITAR/UNOSAT has initiated a capacity development project to strengthen the capacity of the Intergovernmental Authority on Development, including its Climate Prediction and Application Centre and its Conflict Early Warning and Response Mechanism, in the area of disaster risk reduction. The initiative focuses on technical training on the use of satellite imagery and GIS for addressing at the regional level issues such as drought, food security and prevention of conflict related to resource scarcity. UNITAR/UNOSAT has established a presence in Nairobi to foster collaboration with other East African regional actors, including the Regional Centre for Mapping of Resources for Development.

89. With the goal of enhancing capacities in using space-derived information for informed decision-making, WMO, the European Organization for the Exploitation of Meteorological Satellites and the Regional Training Centre for Agrometeorology and Operational Hydrology organized a Land Surface Analysis Satellite Application Facility satellite products training course on applications in agrometeorology in November 2012 in Niamey. A similar workshop will be held for English-speaking participants in Ghana in June 2013.

Agricultural research and development

90. The space industry has an essential role to play in agricultural research, as a microgravity environment has a great impact on plant growth and development and affects plant yield. In order to assist Member States in harnessing the benefits of human space technology and its applications, in 2012 the Office for Outer Space Affairs launched the Zero-Gravity Instrument Project in the framework of the

Human Space Technology Initiative of the United Nations Programme on Space Applications.

91. As part of the project, the Office promotes space education and research in microgravity, particularly for the enhancement of relevant capacity-building activities in developing countries. The project will provide opportunities for students and researchers to study gravitational effects on samples, such as plant seeds and small organisms, in a simulated microgravity condition, with hands-on learning in the classroom or research activities conducted by each institution. It is also expected that a data set of experimental results in gravity responses will be developed and will contribute to the design of future space experiments and to the advancement of microgravity research.

92. The use of the space environment to uncover hidden potential in crops, commonly described as space breeding, was a focus of a project undertaken by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture. Approximately 10 kg of rice of the Pokkali variety were sent into space in 2006 for the Division by a Chinese spacecraft to observe heritable alterations in the genetic blueprint of these seeds and planting materials induced by the effects of cosmic rays, microgravity and magnetic fields in space. Upon return to Earth, the seeds were planted in the greenhouse at the FAO/IAEA Agriculture and Biotechnology Laboratory in Seibersdorf, Austria, with the objective of evaluating progeny for desirable traits such as resistance to stress and improved quality.

93. Induced mutation in general is a tool for the plant breeder to access sought-after heritable variations for developing new crop varieties. So far, there has been no proof that mutations induced in space would differ from those induced using physical mutagens in controlled settings. While the plants did not grow well at Seibersdorf and there were no results to report from this one experiment, the Division supported two research contracts as a follow-up. The overall conclusion from those experiments was that "space environment mutagenesis has widespread use potential in crop mutation breeding". FAO encourages the application of the best scientific and technological tools in addressing the scourge of food insecurity, and expresses its hope that work relating to space-induced mutation will contribute to the advancement of the science of plant breeding and genetics.

Open informal sessions of the Inter-Agency Meeting on Outer Space Activities

94. To increase awareness of the applications of space technology for agricultural development and food security and to promote dialogue among United Nations entities, Member States and other stakeholders, the ninth open informal session of the Inter-Agency Meeting was held on 9 March 2012 in Rome on the theme "Space for agriculture and food security" under the auspices of WFP.

95. The session featured presentations on various topics, such as the applications of remote sensing to food security analysis, crop monitoring, agriculture change assessment for agricultural monitoring, and enhanced risk management and resilience, delivered by representatives of WFP, FAO, the European Commission, the European Space Agency, national authorities and the private sector. Discussions were held on future developments in remote sensing, as well as their implications for food security and agricultural monitoring; the potential, limitations and

sustainability of remote sensing technology; and access and wider use of space-derived data and information.

96. The dialogue on the use of satellite data in addressing landslides, droughts, floods and other threats to food security and agriculture continued in the framework of the tenth open informal session, held on 12 March 2013 in Geneva under the auspices of UNISDR, with speakers representing the United Nations Human Settlements Programme (UN-Habitat), UNITAR/UNOSAT, UN-SPIDER, UNISDR, the World Bank, the European Commission and national and international institutions.

97. The tenth open informal session, in targeting the fourth session of the Global Platform for Disaster Risk Reduction, to be held in Geneva from 19 to 23 May 2013, and the post-2015 disaster risk reduction framework, focused on “Space and disaster risk reduction: planning for resilient human settlements” and covered, inter alia, urban planning, land-use planning and rural development processes for effective disaster risk reduction, in applying cross sector strategies for the use of space-derived and terrestrial geospatial data and information in reducing vulnerability to natural hazards.