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XII Халықаралық ғылыми конференциясының
БАЯНДАМАЛАР ЖИНАҒЫ

СБОРНИК МАТЕРИАЛОВ
XII Международной научной конференции
студентов и молодых ученых
«НАУКА И ОБРАЗОВАНИЕ – 2017»

PROCEEDINGS
of the XII International Scientific Conference
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«SCIENCE AND EDUCATION - 2017»

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SPACE FOR AGRICULTURE DEVELOPMENT AND FOOD SECURITY: INTERNATIONAL LEGAL ASPECTS

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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.

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.

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 2 V.13-82409 A/AC.105/1042 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.

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. 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. 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. [1]

Weather monitoring and forecasting. 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 V.13-82409 5 A/AC.105/1042 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.

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. 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.

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. 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. [2]

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 6 V.13-82409 A/AC.105/1042 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.

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.

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.

Land-use mapping. 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.

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.

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

Economic and Social Commission for Asia and the Pacific. A historic five-year regional plan of action for the application of space technology and GIS for disaster risk reduction and sustainable development5 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. [3]

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

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.

Biodiversity. 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.

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.

Agricultural research and development. 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. 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.

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. [2]

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.

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LIABILITY FOR DAMAGE CAUSED BY SPACE OBJECTS

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Due to exploration of space environment, which do consists of outer space, moon, celestial bodies the risk of damage can be resulted to cause some harm to people and property of them. International law has focused on the norms which permit payment of some amount of money for damage caused by space objects and their parts. Payload is the money compensation for harm which was caused by punching country space objects as liability for activity they do.

The Liability Convention of 1972 expands upon the principles of liability for damage caused by space objects introduced in Article VII of the Outer Space Treaty of 1967. There are two scenarios where damage could be caused by a space object. The first scenario envisions a space object that causes damage to the surface of the Earth or an aircraft in flight, and the second scenario