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**Committee on the Peaceful  
Uses of Outer Space****Coordination of space-related activities within the United Nations system: direction and anticipated results for the period 2004-2005****Report of the Secretary-General\****Summary*

The present report contains updated information provided by the entities of the United Nations system on their plans for space-related activities to be carried out in 2004 and 2005. The report focuses on major new initiatives or activities that are being carried out through inter-agency coordination and cooperation and aims to serve as a strategic tool for United Nations entities to further enhance inter-agency cooperation.

The report indicates that a number of activities are being carried out through inter-agency cooperation with the use of space science and technology and their applications, in particular in the areas of environmental research, monitoring and assessment, management of natural resources, weather and climate forecasting, disaster management, refugee operations and public health, as well as enhancement of information and communication infrastructure. Capacity-building continues to be the focus of many space-related activities within the United Nations system. Many entities collaborate in their activities to strengthen the capacity of developing countries to use and benefit from space-related technologies. There have also been increased efforts among United Nations entities to share the available data sets and information derived from satellites.

\* The present report was reviewed and revised by the Inter-Agency Meeting on Outer Space Activities, held from 21 to 23 January 2004, and finalized following the Meeting.



Recognizing the importance of the societal benefits of space science and technology and their applications for their mandated activities, some entities of the United Nations system also launched new programmes or established new units to strengthen their space-related activities or space components in the existing programmes, which support the goals identified in the United Nations Millennium Declaration (General Assembly resolution 55/2).

## Contents

	<i>Paragraphs</i>	<i>Page</i>
I. Introduction .....	1	3
II. Policies and strategies pertaining to the coordination of space-related activities .	2-7	3
III. Current and forthcoming space-related activities .....	8-86	7
A. Protecting the Earth's environment and managing resources .....	8-35	7
B. Using space applications for human security, humanitarian assistance, development and welfare .....	36-60	12
C. Development of law, guidelines and codes of ethics relating to space activities .....	61-67	17
D. Utilizing and enhancing information and communication technology for development .....	68-74	18
E. Using and improving satellite positioning and location capabilities .....	75-77	19
F. Capacity-building and education in space applications for sustainable development .....	78-82	20
G. Advancing scientific knowledge of space and protecting the space environment .....	83-85	21
H. Other activities .....	86	22

## **I. Introduction**

1. The Inter-Agency Meeting on Outer Space Activities, which was first established as a subcommittee of the Administrative Committee on Coordination (now the United Nations System Chief Executives Board for Coordination) in 1975, serves as a focal point for inter-agency coordination and cooperation in space-related activities. Since the Committee on the Peaceful Uses of Outer Space requested the Secretary-General in 1975 to prepare an annual, integrated report on the plans and programmes of United Nations entities related to outer space activities for consideration by the Committee's Scientific and Technical Subcommittee, the Inter-Agency Meeting has been assisting in the preparation of the report. The present report, which is the twenty-eighth annual report of the Secretary-General on the coordination of space-related activities within the United Nations system, was compiled by the Office for Outer Space Affairs on the basis of submissions from the following United Nations entities: the Office for Outer Space Affairs, the United Nations Office for Project Services (UNOPS), the secretariat of the International Strategy for Disaster Reduction, the Economic Commission for Africa (ECA), the Economic Commission for Europe (ECE), the Economic and Social Commission for Asia and the Pacific (ESCAP), the United Nations Environment Programme (UNEP), the Office of the United Nations High Commissioner for Refugees (UNHCR), the secretariat of the United Nations Convention to Combat Desertification, the Food and Agriculture Organization of the United Nations (FAO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Civil Aviation Organization (ICAO), the World Health Organization (WHO), the International Telecommunication Union (ITU), the World Meteorological Organization (WMO) and the International Maritime Organization (IMO). The participation in outer space activities of these and other entities of the United Nations system is summarized in the table below. The report was reviewed and finalized by the Inter-Agency Meeting at its twenty-fourth session, held in Geneva from 21 to 23 January 2004.

## **II. Policies and strategies pertaining to the coordination of space-related activities**

2. In its resolution 54/68 of December 1999, the General Assembly endorsed the resolution of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) entitled "The Space Millennium: Vienna Declaration on Space and Human Development",<sup>1</sup> and urged organizations of the United Nations system to take the necessary action for the effective implementation of the Vienna Declaration. In response to that call, the Committee on the Peaceful Uses of Outer Space established action teams under the voluntary chairmanship of member States to implement recommendations of UNISPACE III. In addition to the 11 action teams established in 2001 (see A/AC.105/792, para. 6), in 2003 the Committee established an action team to implement the recommendation to improve knowledge-sharing through the promotion of universal access to space-based communication services. As at 1 January 2004, 15 entities of the United Nations system were participating in one or more of the action teams, which aim to build upon work accomplished within the United Nations system.

## Participants in outer space activities and matrix of outer space programmes<sup>a, b</sup>

<i>United Nations entity</i>	<i>Protecting the Earth's environment</i>	<i>Human security, development and welfare</i>	<i>Development of law and guidelines</i>	<i>Information and communication technology</i>	<i>Satellite positioning and location capabilities</i>	<i>Capacity-building and education</i>	<i>Advancing scientific knowledge</i>	<i>Other activities</i>
Department of Peacekeeping Operations		36						
United Nations Office for Project Services		36, 40, 46						
Secretariat for the International Strategy for Disaster Reduction		41, 47						
Office for Outer Space Affairs	8	39-42	62	74		78	83	
United Nations Office on Drugs and Crime		56						
Economic Commission for Africa	16, 19	38				80		
Economic Commission for Europe		37						
Economic and Social Commission for Asia and the Pacific	8, 18, 20, 21	42, 43	63	68, 69		79		
United Nations Development Programme	15, 16	36, 38, 47-49				79, 81		
United Nations Environment Programme	8-13, 15-18, 21-29	36, 38, 44, 47-49, 56				79		
Office of the United Nations High Commissioner for Refugees		36, 44-46		73				
United Nations Children's Fund		56						
World Food Programme	30							
Secretariat of the United Nations Framework Convention on Climate Change	10, 15							
Secretariat of the United Nations Convention to Combat Desertification	15-18	38						

<i>United Nations entity</i>	<i>Protecting the Earth's environment</i>	<i>Human security, development and welfare</i>	<i>Development of law and guidelines</i>	<i>Information and communication technology</i>	<i>Satellite positioning and location capabilities</i>	<i>Capacity-building and education</i>	<i>Advancing scientific knowledge</i>	<i>Other activities</i>
Secretariat of the United Nations Convention on Biological Diversity	15							
United Nations Institute for Training and Research	16	36, 38						
Food and Agriculture Organization of the United Nations	8, 9, 12, 13, 15-17, 21, 30, 31	38, 50-52, 56	64					86
United Nations Educational, Scientific and Cultural Organization	8, 9, 13-16, 27	38, 53	62	70, 72, 73				
International Civil Aviation Organization		54			76, 77			
World Health Organization	15	56-59	65	74		82		86
World Bank		47						
International Telecommunication Union	26	55		70-74	76			
World Meteorological Organization	8-13, 16, 32-35	38, 47, 54, 60				81		
International Maritime Organization			66, 67		76			
International Fund for Agricultural Development	17	38						
International Atomic Energy Agency							84	

<sup>a</sup> The numbers in each column indicate the relevant paragraphs in the present report.

<sup>b</sup> For continuously updated information on the coordination of outer space activities within the United Nations system, see [www.uncosa.unvienna.org](http://www.uncosa.unvienna.org)

٧. At its fifty-ninth session, the General Assembly will conduct a review of progress made in the implementation of the recommendations of UNISPACE III and consider further actions and initiatives. On the basis of recommendations made by the action teams and taking into account input provided by entities of the United Nations system, the Committee is currently preparing a report to be submitted to the Assembly in the context of its review.

4. In its resolution 58/89 of 9 December 2003, the General Assembly noted with satisfaction the increased efforts of the Committee, its Scientific and Technical Subcommittee, the Office for Outer Space Affairs and the Inter-Agency Meeting on Outer Space Activities to promote the use of space science and technology and their applications in carrying out actions recommended in the Plan of Implementation of the World Summit on Sustainable Development,<sup>2</sup> and urged entities of the United Nations system, particularly those participating in the Inter-Agency Meeting, to examine, in cooperation with the Committee, how space science and technology and their applications could contribute to implementing the United Nations Millennium Declaration (General Assembly resolution 55/2), particularly in the areas relating to, inter alia, food security and increasing opportunities for education.

5. Under its newly established subprogramme on information, communication and space technology, ESCAP is implementing the second phase of the Regional Space Applications Programme for Sustainable Development (RESAP II), as recommended by the Second Ministerial Conference on Space Applications for Sustainable Development (see A/AC.105/792, para. 10). At its fifty-ninth session, the Commission recommended initiating preparations for the Third Ministerial Conference, which is planned for 2007, and requested the secretariat to consider specific steps towards an institutional framework for regional space applications and development. ESCAP will continue to promote institutionalization of regional cooperation among space agencies in Asia and the Pacific, including the provision of technical support to the initiative towards an Asia-Pacific space cooperation organization and similar cooperative mechanisms.

6. ECA will organize an ad hoc expert group meeting on the African Information Society Initiative and the second phase of the World Summit on the Information Society, which will consider the impact on African development of the World Summit. Another ad hoc expert group meeting, on geographical data as a national asset, will develop guidelines for African countries to adopt street addressing in the delivery of urban services and general geo-referencing. ECA will also hold the fourth meeting of the Committee on Development Information, the Subcommittee on Information and Communication Technologies and the Subcommittee on Geo-Information.

7. Recognizing the critical importance of data, products and services provided by the World Weather Watch's (WWW) expanded space-based component of the Global Observing System (GOS) to WMO programmes and programmes supported by it, the fourteenth WMO Congress initiated a cross-cutting space programme to increase the effectiveness of satellite systems and their contribution to the development of GOS, as well as to other WMO-supported programmes. The decision by the Executive Council to expand the space-based component of GOS to include appropriate research and development environmental satellite missions was a landmark decision in the history of WWW.

### III. Current and forthcoming space-related activities

#### A. Protecting the Earth's environment and managing resources

8. The Office for Outer Space Affairs, ESCAP, UNEP, FAO, UNESCO, the Intergovernmental Oceanographic Commission (IOC) of UNESCO and WMO will continue to contribute to the work of the Committee on Earth Observation Satellites (CEOS) as associate members. Members of the CEOS Working Group on Education and Training, which is chaired by the Office for Outer Space Affairs, include ESCAP, UNEP, FAO, UNESCO, IOC and WMO. FAO, UNESCO and WMO participate in the implementation of the Integrated Global Observing Strategy (IGOS).

9. FAO, the International Council for Science (ICSU), UNEP, UNESCO and WMO will continue to participate in the Global Terrestrial Observing System (GTOS), with the GTOS secretariat hosted by the FAO Environment and Natural Resources Service (see A/AC.105/792, paras. 16 and 58, and the GTOS web site, [www.fao.org/gtos](http://www.fao.org/gtos)). Key activities of GTOS include the Terrestrial Ecosystem Monitoring Sites (TEMS) database (see [www.fao.org/gtos/tems](http://www.fao.org/gtos/tems)) and the Terrestrial Carbon Observations network (see [www.fao.org/gtos/tco.html](http://www.fao.org/gtos/tco.html)).

10. ICSU, UNEP, IOC and WMO continue to support the implementation of the Global Climate Observing System (GCOS), an integrated system for obtaining observations needed to monitor, understand and predict climate and climate variability (see A/AC.105/792, para. 17). In 2004, GCOS will develop an implementation plan in response to the recommendations of its recently completed second report on the adequacy of the global observing systems for climate in support of the United Nations Framework Convention on Climate Change,<sup>3</sup> which emphasizes the crucial importance of satellite observations to ensuring global coverage and the need to combine long-term continuous observations from both satellites and in situ networks into an integrated global system for monitoring climate and climate change.

11. ICSU, UNEP, IOC and WMO continue to cooperate closely in the development, planning and implementation of the Global Ocean Observing System (GOOS). Implementation of a coastal theme in the coming years will ensure that a global view of the ocean's role in the carbon cycle is developed to underpin predictions of climate change caused by the increase in the greenhouse gas carbon dioxide (A/AC.105/792, para. 18).

12. UNEP, FAO, IOC, WMO and ICSU will continue to cooperate in the Sponsors' Group for the Global Observing Systems (A/AC.105/792, para. 21).

13. A number of partners, including CEOS, UNEP, FAO, UNESCO, IOC, WMO, ICSU and the International Group of Funding Agencies for Global Change Research, will continue to work on the development of IGOS and various related themes. Those organizations cooperate in sponsoring environmental monitoring systems. The emergence of IGOS provides a suitable framework in which to forward appropriate advice and recommendations to the governing bodies of the organizations with respect to monitoring systems designed to address climate-related issues (A/AC.105/792, para. 22).

14. The new IOC Regional Ocean Observing and Forecasting System for Africa (ROOFS-AFRICA) project will be implemented in 2004. The UNESCO cross-cutting project on the application of remote sensing for integrated management of ecosystems and water resources in Africa has been extended for two further years (2004-2005).

15. Many entities of the United Nations system, including UNEP, the United Nations Development Programme (UNDP), FAO, UNESCO, WHO, the secretariats of the United Nations Framework Convention on Climate Change, the United Nations Convention to Combat Desertification in those Countries Experiencing Drought and/or Desertification, particularly in Africa,<sup>4</sup> and the Convention on Biological Diversity,<sup>5</sup> are involved in the Millennium Ecosystem Assessment, a project that will help meet ecosystem assessment needs by, among other things, providing tools for planning management and assisting in building individual and institutional capacity to undertake integrated ecosystem assessments and to act on their findings. Development of new integrated indicators will require new data sets and participants in the Millennium Ecosystem Assessment are committed to filling data gaps with additional remote sensing information.

16. ECA, UNEP, the UNDP Office to Combat Desertification and Drought, the United Nations Institute for Training and Research (UNITAR), FAO, UNESCO, WMO and the secretariat of the United Nations Convention to Combat Desertification support the Sahara and Sahel Observatory, which will continue to carry out a programme of the Society for International Development/Information System to Monitor the Environment through the Internet to implement a system for circulating information on desertification and an environmental information and monitoring system on the Internet and which aims to develop an institutional framework and a technological tool for assessment, exchange and circulation of environmental information. The Observatory also runs the Network of Observatories for Long-term Ecological Monitoring (ROSELT) to promote and support long-term programmes for environmental monitoring in arid zones affected by land degradation with the use of remote sensing data.

17. FAO, the International Fund for Agricultural Development (IFAD), UNEP, the secretariat of the United Nations Convention to Combat Desertification and the International Soil Reference and Information Centre will continue to implement the Land Degradation Assessment in Drylands project in order to develop a framework for land degradation assessment at the global and national levels through a process of consensus-building. The long-term purpose of the project is to identify socio-economic benefits accruing from addressing land degradation in drylands with a view to conserving biodiversity and international waters and sequestering carbon.

18. Jointly with the secretariat of the United Nations Convention to Combat Desertification and UNEP, ESCAP will continue the implementation of a technical assistance project on prevention and control of dust and sand storms in North-East Asia of the Asian Development Bank and the Global Environment Facility. ESCAP is also involved, in cooperation with relevant organizations, in the development of a Global Environment Facility project on a drought monitoring and assessment network.

19. In cooperation with the Regional Centre for Mapping of Resources and Development, ECA will provide advisory services to member countries on mapping



equipment specifications, space technology applications for mapping of resources and the environment and development of spatial data infrastructures.

20. ESCAP will develop and implement regional cooperative projects on space technology applications for environmental monitoring through a phased approach, within the framework of RESAP II. In future years, when resources become available, ESCAP will implement projects that address environmental concerns of member countries, including projects on capacity-building in disaggregated poverty mapping and its integration with environmental information; promote regional cooperation for integrated coastal zone management; and enhance capacity in urban and rural development planning.

21. Within the framework of RESAP II, ESCAP will develop and implement regional cooperative projects on space technology applications for natural resource management. In cooperation with FAO and several participating countries, the first phase of the project on development and applications of a multi-purpose environmental and natural resource information base for food security and sustainable development in the ESCAP region (ASIACOVER) has been initiated. ASIACOVER is also related to the Global Land Cover Network (GLCN), a new initiative of FAO and UNEP (see A/AC.105/792, para. 69).

22. Through its Division of Early Warning and Assessment and the Global Resource Information Database (GRID) network, UNEP maintains linkages with providers and users of remote sensing and information technology applications in many countries to support an assessment framework for reviewing the state of the global environment and environmental issues of international significance. The GRID network currently consists of 15 centres and UNEP is establishing a regional resource centre for assessment and early warning in Western Asia. The UNEP regional resource centre and other GRID centres continue to produce, enhance and disseminate data sets useful for environmental assessment (see A/AC.105/792, paras. 42, 43 and 49).

23. GRID-Geneva will continue providing the Division of Early Warning and Assessment and collaborating centres with access to a common and consistent set of major global and regional core data sets from a wide variety of recognized sources. Institutional arrangements with many United Nations entities and other key data partners are made to allow for compilation of and access to a core database of data and indicators of the global and regional environment. Through the online Global Environmental Outlook (GEO) data portal, hundreds of environmental and socio-economic data sets are available for analysis in support of the GEO assessment process and preparation of the flagship GEO report series.

24. The UNEP Regional Office for West Asia signed an agreement with the Environmental Research and Wildlife Development Agency of the United Arab Emirates to implement specific components of the Abu Dhabi Global Environmental Data Initiative. The main objective of the joint work is to establish a sound overall design, strategy and plan of implementation for the Data Initiative based on UNEP and other relevant experience in the development of global environmental data systems. Remote sensing and geographic information systems (GIS) are among the tools for implementation of the Initiative.

25. In direct response to the request made by the African Ministerial Conference on the Environment, the Africa regional office of the Division of Early Warning and

Assessment is coordinating the technical implementation of the Africa Environmental Information Network, with focus on developing an infrastructure and support mechanism for collating and storing relevant geo-spatial and bibliographic data, harnessing professional skills and expertise to analyse and generate policy-oriented information and using information and communication technologies to communicate that information to decision makers at various levels. The Division is also helping the African Ministerial Conference on the Environment to prepare the second Africa Environment Outlook report, which will highlight the potential of the region's natural resource base to support the development agenda of the New Partnership for Africa's Development.

26. During the ITU World Radiocommunication Conference held in 1997, many countries agreed to the principle that ITU should take action in response to the need identified by the United Nations Conference on Environment and Development<sup>6</sup> for assessment and systematic observations of forest cover and rates of forest degradation in tropical and temperate regions. The Radiocommunication Sector of ITU (ITU-R) studied emission criteria, specific sharing criteria and operational characteristics for active space-borne sensors in the frequency band 420-470 megahertz (MHz) as a matter of urgency and developed a relevant recommendation. The World Radiocommunication Conference held in 2003 decided that the 432-438 MHz band would be used by sensors in the Earth exploration-satellite service (active) in accordance with recommendation ITU-R SA.1260-1. It also decided to include in the agenda of its next conference the consideration of allocations and regulatory issues related to the Earth exploration-satellite (passive) service, space research (passive) service and the meteorological satellite service.

27. UNEP and UNESCO will continue to work with the ICSU Scientific Committee on Problems of the Environment.

28. The UNEP Regional Office for West Asia is entering into a joint project with the Arab League Educational, Cultural and Scientific Organization on the use of remote sensing in coastal zone management in the Arab region. A meeting held in Damascus in July 2003 recognized the following coastal and marine areas as a geographical framework for pilot sites for the applications of remote sensing in coastal zone management in the Arab region: the Mediterranean Sea, the Red Sea and Gulf of Aden, the Arabian Sea and the Persian Gulf. Based on the criteria agreed upon and the balance among those areas, six sites were selected for pilot applications. In 2004, two projects will be implemented: one led by the General Organization of Remote Sensing of the Syrian Arab Republic in the coastal zone shared with Lebanon and the other led by the Environmental Protection Council of Yemen at a site in Yemen.

29. The Regional Office for West Asia and the secretariat of the Millennium Ecosystem Assessment (see para. 15 above), with funding from Saudi Arabia, are undertaking a joint partnership for an Arab Region Millennium Ecosystem Assessment: Supporting Decision-Making for the Sustainable Use of Ecosystems. The project will be implemented in the Assir National Park in Saudi Arabia, the Sinai Peninsula in Egypt and the Tafilalt Oasis in Morocco, in collaboration with national partners led by the Presidency of Meteorology and Protection of the Environment in Saudi Arabia, the Suez Canal University in Egypt and the National Observatory for the Environment in Morocco, respectively.

30. The GeoNetwork initiative is the cornerstone of spatial data infrastructure development by FAO (see A/AC.105/792, para. 57). This Internet-based spatial information catalogue with web map serving capacity is fully compliant with International Organization for Standardization (ISO) metadata standard ISO 19115 and the specifications of the Open GIS Consortium. The operational GeoNetwork search interface can be found at [www.fao.org/geonetwork](http://www.fao.org/geonetwork). FAO, in cooperation with the World Food Programme (WFP) Vulnerability, Analysis and Mapping Unit, successfully established the first GeoNetwork national-level capacity in Mozambique in September 2003 and thereby established substantial cooperation on food security-related spatial database information among 13 government and international agencies active in the country. Additional GeoNetwork spatial information environment deployments were made by WFP in Senegal, South Africa and Uganda.

31. FAO is making progress in the development of the African Water Resources Database, which is being set up under the guidance of the FAO Inland Water Resources and Aquaculture Service in collaboration with the Land and Water Development Division and the Environment and Natural Resources Service. The database is a GIS-based analytical platform that allows users to visualize and analyse the complex hydrological and ecological relationships within specific river reaches, larger-scale river basins or entire mega-basins.

32. The Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology has an interest in observations of the ocean and marine atmosphere from oceanographic satellites and the use of satellites for both marine data collection and the dissemination of information to marine users. In 2004, the satellite rapporteur of the Joint Commission, who is responsible for direct interactions with the operators of oceanographic satellites primarily through the Coordination Group for Meteorological Satellites, CEOS and the IGOS Partnership, is expected to complete a statement of guidance on how well the requirements for marine meteorological and oceanographic data to support marine services are met by existing ocean observing systems, including ocean satellites.

33. In the last two years, the World Climate Research Programme of WMO has undertaken a reflection on the requirements of the space research community with respect to Earth observation space missions and the use of corresponding data. That reflection led to the definition of a number of guidelines, which have been reported to the space community at large. They are complementary to the GCOS recommendations to the extent that they are specific to research aspects. The World Climate Research Programme also formulated priorities on space matters relating to the continuity of existing operational space systems, the development of new research or precursor sensors, the transfer of appropriate research or precursor sensors to operational platforms and the integration of satellite data into global, high-quality climate products.

34. WMO is leading an effort to develop a strategy for an integrated global atmospheric chemistry observations system. The draft strategy, which was reviewed by 10 international atmospheric chemistry experts and the IGOS Partnership committee and is expected to be available in February 2004, will contain recommendations on specific steps to be taken in integrating satellite and non-satellite measurements of atmospheric compositions.

35. Under the Technical Cooperation Programme of WMO (see A/AC.105/792, para. 27), in 2004, a number of data collection platforms will be replaced or installed for the collection of meteorological and hydrological data via the geostationary meteorological satellites (Meteosat satellites) in Africa and the Geostationary Operational Environmental Satellite (GOES) in the Americas. Under a project funded by the European Union, satellite receiving ground equipment in 47 African countries will be replaced to enable them to receive data and products from the Meteosat second-generation (MSG) satellites.

## **B. Using space applications for human security, humanitarian assistance, development and welfare**

36. UNEP, UNDP, UNITAR, FAO, UNESCO and WMO are supporting the Regional Training Centre for Agrometeorology and Operational Hydrology (AGHRYMET). AGHRYMET is an institution of the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS), which consists of nine member countries in Africa and in which ECA, FAO, IFAD, WMO and the secretariat of the United Nations Convention to Combat Desertification are partners. AGHRYMET aims to increase agricultural production in the member countries of CILSS and to help improve management of natural resources in the Sahel region by, among other things, producing and disseminating information and providing training in the field of agro-ecology.

37. In 2003, the Office for Outer Space Affairs became a cooperating body of the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters (the "International Charter 'Space and Major Disasters'"), a mechanism through which United Nations entities can request and receive satellite images to support their disaster response activities. In accordance with the arrangements negotiated with the Charter, the Office has compiled a list of focal points of United Nations entities that have capability to process information requested under the Charter.

38. UNOPS is a focal point for access by the United Nations system, coordinated by the Office for Outer Space Affairs, to the International Charter "Space and Major Disasters". The UNOSAT service of UNOPS has delivered value-added products from the Charter for disasters in the Dominican Republic and Nepal and will expand the application of the Charter to increase the distribution of satellite image-derived information to relief personnel on the ground.

39. The secretariat of the International Strategy for Disaster Reduction will continue to work closely with the Office for Outer Space Affairs on topics relevant to disaster reduction and space, including the United Nations Programme on Space Applications and the implementation of the Vienna Declaration. The secretariat of the International Strategy for Disaster Reduction has maintained collaboration with the GEO initiative and its secretariat, the European Space Agency (ESA) and other global as well as specific undertakings. In doing so, the International Strategy for Disaster Reduction seeks to develop specific grounds for space-based applications aimed at longer-term risk and vulnerability reduction with a particular focus on user needs and local communities. The preliminary results of this work appear to indicate that there could be distinctive value-added in using satellite techniques in the

prevention phase of natural and other disasters rather than solely during the response phase (see A/58/277).

40. ECE will continue its activities applying GIS, remote sensing and related mapping information technologies in the fields of transport, environment, human settlements, and economic analysis. These include the GIS application of the Census of Road Traffic on Main International Traffic Arteries in Europe (E-Road) as well as the River Information Service (RIS). GIS data sets on road and inland waterway transport are useful in the development of transport infrastructure and in support of legal instruments on transport covering the ECE region. The ECE Working Group on Environmental Monitoring and Assessment, through its Task Force on Remote Sensing in Central Asia, organized a Workshop on Remote Sensing Applications for Environmental Monitoring in Baku in November 2003. GIS and remote sensing tools were also used in the areas of land management, population and air pollution monitoring and modelling. At the request of the United Nations Geographic Information Working Group, ECE organized two meetings of Geneva-based users of GIS and initiated training in GIS software and spatial data infrastructure.

41. ESCAP is promoting the institutionalization of regional cooperative mechanisms for operational access and utilization of disaster management-oriented space information services and products. ESCAP and the Government of France have developed a cooperative three-year-long project entitled "Capacity-building for disaster management in Asia and the Pacific", designed to strengthen the capacity of ESCAP members and associate members in disaster management through improved operational use of space technologies and the development of regional cooperative mechanisms. In response to that initiative and following the results of the two regional workshops organized by ESCAP on the use of space technologies in disaster management, one of which was co-organized with the Office for Outer Space Affairs, ESCAP is planning follow-up meetings in 2004 and 2005 in order to promote improved regional cooperation in disaster management. The follow-up meetings will include two workshops for South-East Asia and the Pacific Islands planned for 2004 in cooperation with ESA and the Office for Outer Space Affairs.

42. Within the framework of RESAP II, ESCAP will develop and implement, when resources become available, regional cooperative projects on space technology applications for social development, including projects on telemedicine for rural populations and for family-planning workers at the grass-roots level and on environmental monitoring and analysis for health care and hygiene.

43. In anticipation of and during the Iraq war, the UNEP Regional Office for West Asia compiled an environmental database and satellite images of Iraq and the region around the Persian Gulf. The satellite images were analysed to identify areas that were potentially most vulnerable to the impact of war activities and to establish a knowledge base that could facilitate the provision of advice on priority areas for detailed environmental assessment and intervention. In collaboration with GRID-Sioux Falls and using Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) images, UNHCR developed space maps for contingency planning purposes for the Iraq emergency.

44. In 2003, UNHCR and its Geographic Information and Mapping Unit developed a partnership with Metria, a component of the Swedish National Land

Survey of the Ministry of the Environment of Sweden. This partnership is intended to enhance the role that very high-resolution satellite imagery (VHRS) can play in refugee situations in particular by developing: (a) space maps during emergencies for areas where little or no information is available; (b) mapping products for camp planning and staff security using high-resolution images; and (c) algorithms, in particular, for shelter counting, which is an essential component in improving the knowledge and the quality of the information UNHCR collects on populations of concern. Combined with GIS capabilities, VHRS images help to improve camp design and integrate data on refugee populations collected in the field into an information management system using GIS capabilities.

45. UNHCR is collaborating with UNOPS on a project directly linked to the above-mentioned project that is intended to strengthen refugee population information management (including standards and indicators for assessment and monitoring) using GIS, remote sensing and the Global Positioning System (GPS) in refugee camps. The main objective is to support major UNHCR operations and to develop GIS capacity at the field level. The role of UNOPS is to assist UNHCR in identifying, hiring and managing GIS experts. The project is expected to result in the development of a pool of GIS experts, which could be drawn upon again in new refugee situations that require such assistance.

46. UNOPS, on behalf of UNITAR, through the UNOSAT service, is cooperating with other entities such as the Department of Peacekeeping Operations, the Office for the Coordination of Humanitarian Affairs, UNDP, UNEP, UNHCR, UNITAR and the United Nations Geographical Information Working Group on a wide range of projects related to environmental assessment, development, humanitarian security, development of local GIS expertise, provision of satellite imagery and GIS staff and database hosting.

47. Through the Project for Risk Evaluation, Vulnerability, Information and Early Warning, GRID-Geneva has collected and created data sets on floods, cyclones, earthquakes, fires and drought for risk and vulnerability initiatives. GRID-Geneva will continue to collaborate with the International Strategy for Disaster Reduction, UNDP and WMO on this project. A tool for near real-time impact evaluation following tropical cyclones will be developed together with the European Union's Joint Research Centre. Research on vulnerability to landslides, conducted in cooperation with the Norwegian Geotechnical Institute and the International Strategy for Disaster Reduction, and multiple-risk integration for the Hotspot Project, implemented with ProVention, Columbia University in New York and the World Bank, will be completed.

48. GRID-Geneva will continue to provide technical support for a project carried out by the UNDP Bureau for Crisis Prevention and Recovery on development of a disaster index for use in the UNDP report *Reducing Disaster Risk: A Challenge for Development*, which will be launched officially in February 2004 (see A/AC.105/792, para. 92).

49. The UNEP Regional Office for Europe, the Division of Early Warning and Assessment/GRID-Geneva and GRID-Arendal in Norway will continue their collaboration on environment and security. The general purpose of the project, being carried out in collaboration with UNDP and the Organization for Security and Cooperation in Europe, is to identify linkages between major environmental

concerns or issues in European subregions and countries and existing or potential security problems that have an impact on people and States. The project and its activities are initially focused on subregions in Eastern Europe, the Caucasus and Central Asia (see A/AC.105/792, para. 108).

50. FAO has upgraded the analytical capacity of its Global Information and Early Warning System (GIEWS) (see [www.fao.org/giews/](http://www.fao.org/giews/)). The new version of the GIEWS workstation aims to enhance its interoperability with other FAO information systems and to ensure continued, seamless use of data provided by systems such as the Advanced Real-Time Environmental Monitoring Information System (ARTEMIS), through which FAO provides satellite-derived operational environmental information services to its food security early warning and locust control programmes at the global, regional and national levels (see A/AC.105/792, paras. 93 and 94).

51. The Food Security and Agricultural Projects Analysis Service of FAO is developing its capacity to respond to complex emergency situations. In order to support that effort, FAO will develop an Emergency Information System (EIS) to provide access to applicable data, both spatial and non-spatial, and will use models to produce information to assist the analysts.

52. The FAO Environment and Natural Resources Service has proposed a methodology known as the Rapid Agricultural Disaster Assessment Routine (RADAR) to contribute to the rapid assessment of disasters caused by geophysical factors. RADAR makes use of various input data such as near real-time remote sensing and ground-based observation in combination with knowledge-based analysis and physical modelling derived from a detailed geo-referenced database of similar historical events.

53. As part of the UNESCO/ESA Earth Observation for Integrated Water Resources Management in Africa Space Hydrology International Partnership (TIGER/SHIP) project, a second regional workshop will be held in 2004, hosted by Côte d'Ivoire and countries of the Southern African Development Community. In 2004, UNESCO, ESA and relevant IGOS partners will prepare a study on the geohazards theme focusing on earthquakes, volcanoes and landslides, in the framework of the Geological Applications of Remote Sensing (GARS) programme. In the framework of the UNESCO open initiative on the use of space technology for monitoring World Heritage sites, a first pilot project is being carried out in Central and Eastern Africa in cooperation with ESA.

54. ICAO and WMO are involved in the implementation of the World Area Forecast System (WAFS), which uses satellite communication systems to distribute aeronautical meteorological forecasts in support of commercial aviation (see A/AC.105/780, para. 167). Those satellite systems are also used to distribute basic meteorological data as part of the WMO Global Telecommunication System (GTS). Distribution of WAFS products via satellite systems constitutes a part of the meteorological component of the ICAO communication, navigation and surveillance/air traffic management (CNS/ATM) systems, which involve the use of satellite technology to support international air navigation and, hence, contribute to increased aviation safety.

55. In 2003, the World Radiocommunication Conference discussed the regulatory framework of public protection and disaster relief and agreed that the term "disaster

relief radiocommunication” referred to radiocommunications used by agencies and organizations dealing with a serious disruption of the functioning of society, posing a significant widespread threat to human life, health, property or the environment, whether caused by accident, natural phenomena or human activity and whether developing suddenly or as a result of complex long-term processes (resolution 646 (WRC-03)). In the same resolution, ITU member States (administrations) also resolved to encourage public protection and disaster relief agencies and organizations to utilize relevant ITU-R recommendations in planning spectrum use and implementing technology and systems supporting public protection and disaster relief.

56. WHO has established various levels of collaboration with entities of the United Nations system as well as other bodies, including national entities involved in public health, regarding the use of space-related technologies in health. WHO collaborates with, for example, the United Nations Geographical Information Working Group, the Committee on Health of the United Nations Information and Communication Technologies Task Force, the Joint United Nations Programme on HIV/AIDS, UNEP, FAO, the United Nations Children’s Fund and the United Nations Office on Drugs and Crime.

57. Recently, the WHO Regional Office for the Americas supported the establishment of the Inter-American Network on the Use of GIS/RS to Control Infectious Diseases. This is a multilateral and multi-agency effort that includes the Oswaldo Cruz Foundation, the Inter-American Institute for Global Change Research and government agencies and institutes of Brazil and the United States of America involved in public health, meteorology, geological survey and Earth sciences. The objective of the network is to support and promote the participation of the academic and research sectors jointly with operational public health services to use remote sensing and GIS in research into and control of infectious diseases. The participation of other United Nations entities dealing with spatial and geo-codified information as well as those working with digital imagery is considered essential to accomplish that objective.

58. WHO uses raster layers derived from satellite images, such as land cover, digital elevation models (DEM), population and road and river networks, to measure accessibility to health care, which is an important factor affecting population health. The objective of the application is to identify problems of regional coverage and accessibility to primary health-care services. Future activities in the area will aim at improving the quality of some layers of reference (roads and delimitation of urban areas) through collaboration with academic institutions. Efforts will also be made to improve existing methods of designing catchment areas and measurement of travel time. The activity further underscores the importance of urban areas in the domain of public health (see A/AC.105/792, para. 121) and the need for WHO to use satellite images in order to delimit those areas and to provide, through the use of GIS, an analysis platform for this particular context.

59. As poverty influences the distribution of a large number of diseases, WHO is working on the improvement of an approach that uses night-time light images, other raster grids and survey data to extrapolate per capita income figures at the subnational level (poverty mapping). Such a method is currently applied to the data collected in the context of the WHO World Health Survey.



60. Recognizing the potential of remote sensing applications in agricultural meteorology, the WMO Commission for Agricultural Meteorology actively promotes the use of remote sensing and GIS in national meteorological and hydrological services to enhance improved agrometeorological applications. To that end, the Commission reinforces the importance of capacity-building in those new fields through the organization of training workshops and seminars. The promotion of new specialized software should make the application of various devices easier, bearing in mind the possible combination of several types of input, such as data coming from standard networks, radar and satellites, meteorological and climatological models, digital cartography and crop models based on the scientific knowledge acquired in the past 20 years.

### **C. Development of law, guidelines and codes of ethics relating to space activities**

61. The Legal Subcommittee of the Committee on the Peaceful Uses of Outer Space will begin in 2004 to consider the practice of States and international organizations in registering space objects, under its four-year work plan, in order to enhance adherence to the Convention on Registration of Objects Launched into Outer Space (General Assembly resolution 3235 (XXIX), annex).

62. At its forty-second session, in 2003, the Legal Subcommittee had before it a report of a group of experts on the ethics of outer space, which had been established in 2001 to identify which aspects of the report of the World Commission on the Ethics of Scientific Knowledge and Technology of UNESCO needed to be studied by the Committee. With the agreement of the Legal Subcommittee, the Office for Outer Space Affairs transmitted the report to UNESCO with the request to keep the Committee informed of developments in the area in UNESCO (see A/AC.105/792, para. 14).

63. Recognizing the importance of policy and institutional issues in the operationalization of available technology in developing countries, in particular in least developed countries, ESCAP has been conducting studies to develop policy frameworks and guidelines for adaptation by its members and associate members for the integration of space-based information and communication technology with their national development planning process. ESCAP has been conducting policy studies to provide its members and associate members with policy frameworks on operational applications of space technology to support informed decision-making in poverty alleviation, sustainable development and bridging the digital divide.

64. In April 2003, metadata standard ISO 19115 was confirmed as a full international standard. That confirmation, at the same time validated an earlier decision by FAO to implement the standard as the basis for its GeoNetwork metadata catalogue, an online database of interactive maps, GIS data sets, satellite imagery and related applications.

65. The WHO Regional Office for the Eastern Mediterranean has adopted and developed a code of ethics for health information that is available on the Internet ([www.emro.who.int/his/ethicscode.pdf](http://www.emro.who.int/his/ethicscode.pdf)).

66. At the Conference of Contracting Governments to the International Convention for the Safety of Life at Sea, in 2002, IMO adopted a new chapter XI-2 on special measures to enhance marine security, supplemented by the new International Ship and Port Facility Security Code, which is expected to enter into force on 1 July 2004 for all passenger ships and cargo ships of 500 gross tonnage and above, mobile offshore drilling units and port facilities serving such ships engaged in international voyages. As part of the regulatory and mandatory regime, ships are required to carry ship security alert systems, the information exchange of which is based largely on satellite communications and/or data exchange systems.

67. IMO is currently developing functional and carriage requirements for long-range tracking and identification systems for ships for consideration by the Marine Safety Committee at its seventy-eighth session, to be held in May 2004. IMO is also developing a major pilot project on a marine electronic high-way information system, providing real-time information on, for example, maritime traffic, weather, currents, tidal conditions, navigation aids and incidents of piracy and armed robbery, as well as maritime threats. Once operational, the systems will rely largely on satellite communications and/or data exchange systems.

#### **D. Utilizing and enhancing information and communication technology for development**

68. ESCAP will develop projects and mechanisms to prepare countries of Asia and the Pacific to introduce satellite broadband services and applications by establishing partnerships with private satellite operators and service providers and by conducting studies on relevant policy issues and possible regional cooperative institutional arrangements.

69. In cooperation with other international organizations, ESCAP has developed the Road Map towards the Information Society in the Asia-Pacific Region and has prepared regional contributions to the World Summit on the Information Society. ESCAP will play a leading role in follow-up activities to the World Summit in the region. In that regard, contributions related to the use of space technologies will be a component of ESCAP efforts to bridge the digital divide in the region.

70. UNESCO and ITU will continue to initiate pilot projects on educational applications of interactive television (see A/AC.105/780, para. 182).

71. As part of its E-Strategy Programme, the ITU Telecommunication Development Bureau is undertaking a number of projects on a global scale in order to bring the benefits of information and communication technology to the population of developing countries. Projects in education, health, business, government and other areas have been implemented to foster development and reduce the social divide through information and communication technology. Activities aimed at addressing policies and strategies in that area have been undertaken at the national and regional levels. Development-oriented projects (electronic (e-) agriculture, e-health, e-learning and e-government) using information and communication technology were highlighted at the ITU e-strategy stand during the World Summit on the Information Society in December 2003 (see [www.itu.int/ITU-D/e-strategy](http://www.itu.int/ITU-D/e-strategy)).

72. Interactive television distance learning via very small aperture terminal (VSAT) pilot projects for primary teachers will be continued in India and Morocco by UNESCO and the ITU Telecommunication Development Bureau.

73. In a project being initiated for refugees in the Lukole refugee camps in the United Republic of Tanzania, ITU, UNHCR and UNESCO are supporting the development of multi-purpose community telecentres making use of WorldSpace content and the low-Earth orbit electronic mail system of Volunteers in Technical Assistance and VSAT facilities.

74. WHO is finalizing a draft tele-health strategy that includes the use of space technology in the provision of health services. Similarly, the WHO Collaborating Centre for Telemedicine in Tromsø, Norway, has recently produced an authoritative report on the use of satellite technology to provide the communications link in tele-health services. WHO is collaborating closely with ITU in the area of tele-health in developing countries, including assessment of tele-health projects undertaken by ITU. Collaboration with other agencies is also planned, such as with the Office for Outer Space Affairs in the area of tele-health using VSATs in rebuilding health services after crises. Telemedicine activities are carried out in all of the WHO regions. For example, the Regional Office for the Eastern Mediterranean provides support to countries in selecting and installing telemedicine infrastructure, conducting assessment of needs and project planning, developing human resources and training personnel, consulting and providing advisory services, developing e-health portals, and networking and collaborating at the regional and international levels.

#### **E. Using and improving satellite positioning and location capabilities**

75. In 2003, the World Radiocommunication Conference agreed on the frequency allocation and sharing criteria for satellite systems in the Radio Navigation Satellite Service (RNSS) and established a RES-609 RNSS consultation meeting for administrations operating or planning to operate RNSS systems. Administrations will need to agree cooperatively through consultation meetings to achieve the level of protection for aeronautical radio-navigation service (ARNS) systems and should establish mechanisms to ensure that all potential RNSS system operators are given a full picture of the process but that only real systems are taken into account.

76. The ICAO Eleventh Air Navigation Conference, held in 2003, reconfirmed the ultimate goal of transition to satellite-based navigation for all phases of flight and developed guidance for the gradual introduction of satellite-based navigation systems. In addition to the Global Navigation Satellite System (GNSS) and its associated aircraft-, satellite- and ground-based augmentation systems, which have already been standardized, work is under way to develop standards for ground-based regional augmentation systems by 2005. Subsequent work will include the development of standards for new GNSS elements such as the modernized GPS of the United States, the Global Navigation Satellite System (GLONASS) of the Russian Federation and the European system GALILEO. On matters related to navigation policy and the radio frequency spectrum, ICAO coordinates its work with IMO and ITU, respectively.

77. ICAO continues to coordinate closely with the International Satellite System for Search and Rescue (COSPAS-SARSAT) programme in matters relating to aircraft carriage of emergency locator transmitters (ELTs). Present ICAO provisions require that all ELTs installed after 1 January 2002 and all those carried on aircraft after 1 January 2005 operate on 406 MHz and 121.5 MHz simultaneously to take full advantage of the current COSPAS-SARSAT system, which provides more reliable, accurate and timely accident alert and location data through digitized transmissions from 406 MHz ELTs. At the same time, research is continuing into how a low-cost 406 MHz solution can be found to the planned phase-out in 2009 of satellite processing of 121.5 MHz signals. Assistance is also provided to the COSPAS-SARSAT programme and States in urging 406 MHz ELT users to register on States' ELT databases. Without recourse to registration details, rescue coordination centres will be unable to take advantage of the digitized data embedded in ELT signals that assist considerably in the rapid location and rescue of accident survivors.

## **F. Capacity-building and education in space applications for sustainable development**

78. In 2004, the Office for Outer Space Affairs plans to streamline the activities being carried out under the United Nations Programme on Space Applications into the following four main areas: (a) training for capacity-building in developing countries, including the work carried out by the four regional centres affiliated with the United Nations; (b) promoting the use of and access to space-based technologies and information, including application areas such as disaster management, natural resource management and environmental monitoring, and also enabling space technologies such as communication satellites and GNSS; (c) promoting the dissemination and increasing the awareness of knowledge-based themes, building upon work carried out in basic space science and in space law; and (d) providing technical advisory services and promoting regional cooperation, including activities that promote the participation of youth in space activities and organization of events to celebrate World Space Week and support the implementation of the recommendations of the World Summit on Sustainable Development.<sup>7</sup>

79. In collaboration with other organizations, ECA is planning to support a web-based distance learning programme to enable former students of the Regional Centre for Training in Aerospace Surveys and the geo-information community in Africa to keep abreast of new developments in information and communication technology and space technology. In 2004 and 2005, ECA will also organize a seminar on cooperative mechanisms for the management of information resources and services and three subregional training workshops on spatial data standards, clearing houses and metadata.

80. UNEP will continue to develop data access agreements in Asia and the Pacific with cooperating institutions of the Association of South-East Asian Nations, the Mekong River Commission, the International Centre for Integrated Mountain Development, the South Asia Cooperative Environment Programme in Colombo and the South Pacific Regional Environment Programme, as well as with other small intergovernmental organizations. Cooperation in that area will continue with the ESCAP Statistics and Natural Resources Division, the UNDP Regional Office for

Asia and the Pacific, the Asian Disaster Preparedness Centre, the International Centre for Integrated Mountain Development, the International Crop Research Institute for the Semi-Arid Tropics and the International Rice Research Institute. For the countries with economies in transition in Eastern Europe, the Caucasus and Central Asia, UNEP carries out its capacity-building programme in integrated environmental assessment and related methodologies and tools. UNEP places strong emphasis on inter-agency cooperation at all levels in the region (see A/AC.105/792, paras. 150, 153 and 154).

81. WMO will continue to grant fellowships under its Voluntary Cooperation Programme and its regular budget, as well as through UNDP and trust funds, for studies or training in meteorology, climatology and operational hydrology, including satellite meteorology. In particular, such support will be provided to trainers in WMO regional meteorological training centres and to members' representatives participating in training courses jointly organized or co-sponsored by other agencies and organizations.

82. WHO provides technical training to strengthen the analytical and epidemiological capacity of health professionals, managers and decision makers with the aim of assisting countries in using public health data in combination with GIS for operational decision-making and further developing material to support disease-specific analysis. For example, the regional technical cooperation project on GIS applied to public health and health situation analysis, developed and supported by the WHO Regional Office for the Americas for countries in the Americas, includes the use and development of GIS applications, the development of training courses and materials, the provision of direct technical assistance to countries and the promotion of multi-disciplinary collaborating groups of excellence and networks in GIS.

## **G. Advancing scientific knowledge of space and protecting the space environment**

83. In 2003, the Office for Outer Space Affairs, ESA and the European Southern Observatory finalized the 10-year assessment report on the development of basic space science worldwide, focusing on the achievements of the series of United Nations workshops on basic space science that the Office organized during the period 1991-2002. This was the first attempt of its kind since the workshops on basic science started in 1991. The next, twelfth, workshop will be organized in China in May 2004, taking into account the results of the 10-year assessment.

84. In 2003, the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space adopted a further multi-year work plan, covering the period 2003-2006, to consider the use of nuclear power sources in outer space, with the aim of developing an international technically based framework of goals and recommendations for the safety of nuclear power source applications in outer space. In accordance with the plan, the Office and the International Atomic Energy Agency prepared possible organizational plans providing for potential co-sponsorship of an effort to develop an international technical safety standard relating to nuclear power sources in space and potential advice from the Agency to the Subcommittee in the preparation of such a standard.

85. The Scientific and Technical Subcommittee is also reviewing proposals submitted by the Inter-Agency Space Debris Coordination Committee on space debris mitigation measures and considering means of endorsing the utilization of the proposed measures.

## H. Other activities

86. The Second Administrative Level Boundaries data set project is taking advantage of existing administrative boundary data sets, thereby meeting the general need for a consistent global coverage down to the second administrative level within the context of the United Nations Geographic Database project and the United Nations Geographic Information Working Group. Coordinated by WHO, the project has the active support of more than 20 entities of the United Nations system and other bodies. More information on the subject as well as the available data can be obtained from WHO ([www3.who.int/whosis/gis/salb/salb\\_home.html](http://www3.who.int/whosis/gis/salb/salb_home.html)). The project is using the FAO GeoNetwork ISO standard for its metadata and is making approved maps available through the network.

### Notes

<sup>1</sup> See *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3), chap. I, resolution 1.

<sup>2</sup> *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 1, annex.

<sup>3</sup> United Nations, *Treaty Series*, vol. 1771, No. 30822.

<sup>4</sup> United Nations, *Treaty Series*, vol. 1954, No. 33480.

<sup>5</sup> See United Nations Environment Programme, *Convention on Biological Diversity* (Environmental Law and Institution Programme Activity Centre), June 1992.

<sup>6</sup> See *Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992* (United Nations publication, Sales No. E.93.I.8 and corrigenda).

<sup>7</sup> See *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum).

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