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Report on the United Nations/Kenya Conference on Space Technology Applications for Wildlife Management and Protecting Biodiversity

(Nairobi, 27-30 June 2016)

I. Introduction

1. The United Nations Programme on Space Applications, implemented by the Office for Outer Space Affairs, was established in 1971 to assist Member States with capacity-building in the use of space science, space technology and space applications in support of sustainable development, and to promote international space cooperation. Since its inception, the Programme has organized several hundred training courses, conferences, seminars and meetings for the benefit of Member States.

2. The Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), through its resolution entitled "The Space Millennium: Vienna Declaration on Space and Human Development", recommended that activities of the United Nations Programme on Space Applications should promote collaborative participation among Member States at the regional and international levels in a variety of space science and technology activities by emphasizing the development and transfer of knowledge and skills to developing countries and countries with economies in transition.[1]

3. The Conference was organized by the United Nations in cooperation with the Government of Kenya through the Ministry of Environment and Natural Resources, with support from the European Space Agency (ESA), and hosted by the United Nations Environment Programme (UNEP) at the United Nations Office at Nairobi. Local coordination and other valuable support was provided by the United Nations Office on Drugs and Crime (UNODC). The Conference was also supported by DigitalGlobe, the Lusaka Agreement Task Force, the National Commission for Science, Technology and Innovation and several other ministries of Kenya.

[1] *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, sect. I, para. 1 (e)(ii), and chap. II, para. 409 (d)(i).

A. Background and objectives

4. Pressures resulting from climate change, ecosystems loss and wildlife crime today are threatening biodiversity and wildlife around the globe. In particular the loss of wildlife due to poaching and illegal trade is threatening the survival of certain key species such as the African elephant and the rhinoceros. According to the Great Elephant Census, a recently completed continent-wide survey, populations of African savanna elephants declined by about 30 per cent between 2007 and 2014. At present there are about 350,000 savanna elephants remaining. Their current decline is 8 per cent per year, primarily due to illegal poaching.[2] The African forest elephant population is declining at a similar rate.[3]

5. Elephants are just one of the many species being decimated as a result of excessive human activity. In 2015, 1,175 rhinoceroses were poached in South Africa, up from just 13 in 2007. The number of black rhinoceroses has shrunk by 96 per cent as a result of poaching.[4] Increasingly, poachers are targeting new plant and animal species, thus causing alarm about the status of global biodiversity.

6. In its resolution 69/314 of 30 July 2015 titled "Tackling illicit trafficking in wildlife", the General Assembly called upon UNODC, within its mandate and resources, in line with Economic and Social Council resolution 2013/40 and in close cooperation and collaboration with Member States, to continue to collect information on patterns and flows of illicit trafficking in wildlife and to report thereon.

7. In the resolution the General Assembly also requested the Secretary-General to further improve the coordination of activities undertaken by United Nations specialized agencies, funds and programmes relating to the scope of that resolution, within their respective mandates and in line with Economic and Social Council resolution 2013/40.

8. In March 2005, after four years of research, the Millennium Ecosystem Assessment found that the rate of irreversible biodiversity loss was 10 to 30 per cent of mammal, bird and amphibian species, and that they were threatened with extinction owing to human activity.[5]

9. The loss of biodiversity was also recognized in the 2030 Agenda for Sustainable Development (see General Assembly resolution 70/1). The protection and conservation of biodiversity and ecosystems, cornerstones of environmental development, is addressed under Sustainable Development Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

10. One of the major problems faced by policymakers within Governments and entities of the United Nations system — stakeholders that have a direct role in addressing the problems — is that available data sets related to biodiversity are incomplete. Although several indicators have been developed, considerable gaps remain in the geographic, taxonomic and temporal information about various

[2] Michael J. Chase and others, "Continent-wide survey reveals massive decline in African savannah elephants", *PeerJ*, 31 August 2016. Available from doi.org/10.7717/peerj.2354.

[3] Wildlife Conservation Society, "African elephants". Available from www.wcs.org/our-work/species/african-elephants. (Accessed 7 September 2016).

[4] Eliza Strickland, "Do you have any tigers to declare?", *Foreign Policy*, vol. 220 (7 September 2016).

[5] Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Synthesis* (Washington, D.C., Island Press, 2005).

species.[6,7] Indicators are as good as the data that underlie them. To obtain a clear picture regarding the loss of biodiversity and the pace at which it occurs, monitoring mechanisms should be in place that can provide both temporal and spatial data in near-real time.

11. Another problem is the inadequate mix of technology and policy instruments used. Advances in technology have made geospatial monitoring solutions cheaper and more effective. However, their application requires adequate infrastructural and policy frameworks, which are lacking in many developing countries, especially in countries that deal separately with technology adoption and policy development. In those circumstances, even if a country has adequate technology, policy constrains may limit its usage. Therefore, in developing and deploying geospatial environmental monitoring tools, consideration should be given to the context of the policy framework for which the tool is designed.[8]

12. Finally, in most parts of the world, species habitats cut across national boundaries. As rules and policies for monitoring and reporting mechanisms vary according to country, missing and inaccurate data, double counting and insufficient access to data remain a constraint. Inter-agency cooperation at both the national and international levels remains a key factor in making information readily accessible. Hence there is a need for enhanced transboundary cooperation in the implementation of monitoring and compliance mechanisms, and for the use of advanced technology in support of such cooperation.[9]

13. Space technology will be essential for successfully implementing the 2030 Agenda for Sustainable Development. It provides data, information and services that directly or indirectly contribute to achieving particular sustainable development goals or to assessing and monitoring the progress of their implementation. Specific access to reliable, frequent and open geospatial data, in particular Earth observation data, will be crucial to that work.

14. In order to raise awareness of space technology and its applications in the areas of biodiversity and ecosystems and make use of its benefits, the Office for Outer Space Affairs has introduced monitoring and protecting biodiversity and ecosystems as a new area of work under the United Nations Programme on Space Applications.[10] This has also made it possible to hold the Conference, which was the first related to this topic.

15. The objectives of the Conference were to:

(a) Present experiences with existing and planned state-of-the-art space technology and its applications for use in the management of wildlife, both flora and fauna; the protection of biodiversity, including biodiversity assessments, ecosystem and wildlife habitat management, and wildlife monitoring and tracking; and the fight against wildlife crime by documenting and preventing poaching;

(b) Bring together and connect the stakeholders involved in relevant initiatives, including stakeholders with official mandates;

[6] Stuart H. M. Butchart and others, “Global biodiversity: indicators of recent declines”, *Science* (Washington, D.C.), vol. 328, issue 5982 (28 May 2010), available from science.sciencemag.org/content/328/5982/1164.

[7] Remi Chandran, *If Wildlife Enforcement Monitoring System (WEMS) Is the Solution, What Is the Problem?* (Enschede, the Netherlands, University of Twente, 2016).

[8] Ibid.

[9] Ibid.

[10] See A/AC.105/C.1/2015/CRP.10.

(c) Present opportunities to build capacity in the implementation of space-based solutions;

(d) Discuss opportunities for cooperation;

(e) Consider legal and regulatory aspects;

(f) Formulate observations and recommendations for the best way to use space-based solutions for wildlife management and protecting biodiversity.

16. The Conference was closely linked to the 2030 Agenda for Sustainable Development, in particular the relevant targets under its goal 15. In addition, the outcomes of the Conference will inform the preparations for the United Nations Conference on the Exploration and Peaceful Uses of Outer Space to be held in 2018 (UNISPACE+50). The United Nations/Kenya Conference specifically addressed two thematic priorities of UNISPACE+50, namely international cooperation towards low-emission and resilient societies (thematic priority 6), considering that conservation of biodiversity and environmental protection are important for resilient societies, and capacity-building for the twenty-first century (thematic priority 7).[11]

B. Attendance

17. The aim of the Conference was to bring together stakeholders involved in biodiversity and wildlife management so that they could share their experience and requirements as users of space technology and hear presentations about existing and planned space technology and space applications. Those stakeholders included space industry representatives, representatives of governmental and non-governmental organizations, experts in space and geospatial applications, and users such as park rangers and wildlife managers.

18. The Conference was attended by 228 participants, including 63 participants from outside the host country and 25 United Nations staff based in Nairobi. They came from the following 30 countries: Antigua and Barbuda, Australia, Austria, Cameroon, Canada, Congo, Ethiopia, France, Germany, Hungary, India, Italy, Japan, Jordan, Kenya, Liberia, Mexico, Nepal, Netherlands, Nigeria, Romania, Russian Federation, South Africa, Thailand, Uganda, United Republic of Tanzania, United States of America, Uruguay, Viet Nam and Zambia. Among the participants were major stakeholders dealing with wildlife management, biodiversity and ecosystems protection. The biographies of the speakers can be consulted on the web page of the Conference.[12]

C. Programme

19. The programme of the Conference was developed by the Office for Outer Space Affairs in cooperation with the programme committee of the Conference. The programme committee included biodiversity and ecosystem experts as well as representatives of national space agencies, international organizations and academic institutions. An honorary committee and a local organizing committee also contributed to the successful organization of the Conference.

[11] See A/71/20, para. 296.

[12] www.unoosa.org/oosa/ourwork/psa/schedule/2016/conference_kenya_biodiversity.html.

20. The Conference programme was structured around the following thematic sessions:

(a) Managing wildlife and protecting biodiversity: issues and space technology solutions;

(b) Biodiversity assessment;

(c) Ecosystem and wildlife habitat management;

(d) Wildlife monitoring and tracking for law enforcement;

(e) Addressing wildlife crime;

(f) Legal, governance and policy challenges in sharing information related to wildlife management;

(g) Capacity-building, awareness-raising and outreach;

(h) International experiences and cooperation opportunities;

(i) Observations, recommendations and the way forward.

21. The Conference programme was complemented by two panel discussions, a poster session at which 24 posters presented, and numerous side-meetings, training sessions and demonstrations of software products and data sets.

22. Participating institutions and selected speakers were asked to present their work in specific thematic areas and to highlight its relevance to the conference objectives. The panels then discussed core issues, laying the groundwork for the Conference's recommendations.

23. The Conference clearly demonstrated that space technology and its applications are already making essential contributions to biodiversity and ecosystem management and the fight against wildlife crime. One of the key observations emphasized repeatedly during the Conference was that space technology has advanced considerably and has become more accessible and affordable over the last few years, leading to various government-owned or commercial Earth observation satellites able to provide remotely sensed imagery whose resolution and quality could compete with aerial photography. Please see chapter III for detailed conclusions and recommendations.

24. The final programme, presentations and poster presentations are available online on the Conference web page.[12]

25. The Conference was advertised and promoted on various websites and on social media tools such as Twitter, and was covered by UNEP and the Office for Outer Space Affairs in live Twitter feeds. Online and printed media, both in Kenya and beyond, published articles about the Conference highlighting its importance and the interest shown in the topics addressed.

II. Summary of the Conference programme

A. Opening

26. The Conference was opened with welcome speeches by the Deputy Executive Director of UNEP, the cabinet secretary of the Ministry of the Environment and Natural Resources and representatives of the Office for Outer Space Affairs and of ESA.

27. Keynote addresses were given by representatives of the Kenya Wildlife Service and UNEP. The Office for Outer Space Affairs then gave an introductory presentation, pointing out the linkages with the 2030 Agenda for Sustainable Development and reviewing the objectives of the Conference and its intended outcome.

B. Thematic session 1. Wildlife management and protecting biodiversity: issues and space technology solutions

28. In the first thematic session, which was dedicated to issues in wildlife management and protecting biodiversity and the solutions space technology could offer, presentations focused on recent developments in space technology and on various examples of current utilization in the domain addressed by the Conference.

29. Speakers highlighted that, in addition to Earth observation applications, satellite telecommunication and global navigation and positioning were playing an important role in the monitoring of natural processes worldwide. Presentations were given about dedicated systems and projects making use of positioning, timing and navigation, and of sensor-based technology for the worldwide tracking of wildlife and environmental monitoring by satellite. Those systems included the Argos data collection and location system, which had provided reliable global marine and terrestrial wildlife monitoring services for more than 30 years, the International Cooperation for Animal Research Using Space initiative, whose space-based infrastructure was to be deployed in 2017, and Chipsafer, a platform for the geolocalization of cattle brought to market by a young entrepreneur from Uruguay.

30. Copernicus, a joint initiative of the European Union and ESA, was presented as an example of how some of the world's space agencies were developing infrastructure that made environmental data and information available for global operational use based on an open data policy.

31. Commercial imaging companies also contributed to the session. They highlighted the latest developments in services for the collection and online distribution of very-high-resolution satellite imagery that enabled much faster and easier access and let customers consider cost savings, multi-user licensing and subscription services.

C. Thematic session 2. Biodiversity assessment

32. The second thematic session, dedicated to biodiversity assessment, included presentations about and demonstrations of the UNEP Live platform, the essential biodiversity variables proposed by the Group on Earth Observations, various other biodiversity mapping and monitoring initiatives, the monitoring of changes in land use and ecosystems services research.

33. In the Group on Earth Observations Biodiversity Observation Network, biodiversity and remote sensing experts were currently developing a set of essential biodiversity variables to support operational monitoring and to facilitate data standardization to aid policymaking and to assist with the monitoring of targets and indicators related to the Sustainable Development Goals.

34. A case study on the use of space technology for studying the effects of the nuclear accident at the Fukushima Daiichi power plant that resulted from the devastating earthquake that affected Japan in 2011 was presented as an example of ecosystems monitoring. The study highlighted how the accident had affected ecosystems around the power plant.

35. Speakers and members of the audience highlighted the various longer-term Earth observation efforts that used more open data policies, such as the Landsat programme of the United States, the China-Brazil Earth Resources Satellite programme, the earlier generation of France's Satellite pour l'observation de la Terre, and Japan's Advanced Spaceborne Thermal Emission and Reflection Radiometer. The participants acknowledged that open-data policies had a considerable impact on a wide range of monitoring applications aiding policy and decision-making processes relating to assessment and conservation efforts globally.

D. Thematic session 3. Ecosystem and wildlife habitat management

36. The presentations in the third thematic session focused on systems that had been put in place for assessing and monitoring wildlife habitats and ecosystems. The systems had been applied in other sectors of development as well, and involved geospatial technology, spatial analysis techniques and specialized geospatial and satellite imagery databases.

37. Speakers highlighted the need for more very-high-resolution imagery sensors and radar sensors and for systematic collection of data. Remote sensing was also shown to make a key contribution to the grassland conservation efforts of the Wildlife Conservation Society and the broader Conservation Remote Sensing Network. Speakers noted that while there was general awareness of geographic information systems in a broad sense, greater numbers of remote-sensing experts needed to be trained in the use of Earth observation data, and capacity-building should focus on that aspect more.

38. Various speakers stressed the importance of global navigation satellite systems in aerial surveys to track the movements of elephants and other animals and to identify with precision the effects of poaching. The importance of technical solutions for wildlife monitoring and tracking was also noted in resolution 11.25 of the Conference of the Parties to the Convention on the Conservation of Migratory Species of Wild Animals on advancing ecological networks to address the needs of migratory species.

39. Another area of work addressed at the session was marine and coastal spatial planning as it relates to the management and protection of coastal ecosystems.

E. Thematic session 4. Wildlife monitoring and tracking for law enforcement

40. The Tokyo Conference on Combating Wildlife Crime, held at the United Nations University on 3 and 4 March 2014, called for evidence-based policymaking in combating wildlife crime. It stressed the need for a more active role on the part of scientists, non-governmental organizations (NGOs), national policymakers and United Nations agencies in facilitating research and supporting an information-based decision-making process.

41. Seven presentations were given during the fourth thematic session, which was dedicated to wildlife monitoring and tracking for law enforcement. The related panel discussion was moderated by the National Institute for Environmental Studies of Japan. Participants stressed that poaching remains a worldwide problem, despite huge efforts being made by park rangers and various law enforcement organizations. Helpful technology and a number of tools that could be used to address the issue were discussed.

42. In coordination with the Office of the Geographer and Global Issues and with the National Geospatial-Intelligence Agency, both of the United States, a live video link

was established during the session with a symposium of the Presidential Task Force on Wildlife Trafficking being held at that Agency in Springfield, Virginia.

43. Speakers showed that the fight against wildlife crime faced challenges in the form of conflicting institutional mandates, beliefs about conservation policy and mistrust among entities. These affected how crucial information was shared.

44. Mechanisms mandated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora had been introduced, such as Monitoring the Illegal Killing of Elephants and the Elephant Trade Information System, and case studies had been conducted on the use of drones for the collection of data over protected areas where space technology is less affordable. A presentation was given about the information platforms European Union Trade in Wildlife Information Exchange and Africa Trade in Wildlife Information Exchange, both of which were tools to monitor both the legal and illegal trade in wildlife.

F. Thematic session 5. Addressing wildlife crime

45. At the fifth thematic session, which was dedicated to the fight against wildlife crime, participants highlighted the capacity-building efforts of UNODC regarding technical services for wildlife monitoring and law enforcement organizations and for the judiciary in developing countries. Those efforts also helped to reduce corruption, which was a major challenge in the fight against wildlife crime in Africa. Various other projects were presented that came under the environmental security programme of the International Criminal Police Organization (INTERPOL). One of those was Project Wisdom.

46. Several geographical mapping platforms had been developed for sharing information on matters related to wildlife crime. However, a major concern was that their funding remained low, jeopardizing their sustainability. One example was the Wildlife Enforcement Monitoring System, managed by the Lusaka Agreement Task Force,[13] which was concerned with wildlife crime and formed a bridge between scientists, policymakers and administrators in the public sector at large. In combination with satellite imagery and space-based data, information obtained from geographical mapping platforms such as the Wildlife Enforcement Monitoring System could be used to determine key variables needed to understand the state of biodiversity and the changes it was undergoing.

47. Instant intrusion detection systems using camera traps and metal sensors capable of alerting security personnel in near-real time were being deployed at multiple sites with assistance from the Zoological Society of London. Space technology was also being used in Spatial Monitoring and Reporting Tool ranger patrol systems deployed in Thailand in combination with a wildlife forensic laboratory, as highlighted in various presentations.

G. Thematic session 6. Legal, governance and policy challenges in information-sharing for wildlife management

48. The sixth thematic session was dedicated to legal, governance and policy challenges in information-sharing for wildlife management. Presenters addressed issues related to the confidence NGOs needed to have in regional and national wildlife

[13] Remi Chandran, Padmanabhan Krishnan and Khoi Nguyen, “Wildlife Enforcement Monitoring System (WEMS): a solution to support compliance of multilateral environmental agreements”, *Government Information Quarterly*, vol. 28, No. 2 (2011), pp. 231-238.

law enforcement agencies in order to support their work, gaps in the information needed to fight wildlife crime, infrastructure and capacity-development needs, space technology and space governance. The Great Apes Survival Partnership was presented as a case study showing that space technology could assist in various planning processes and in environmental decision-making.

49. Among the challenges speakers identified were the lack of national and regional integrated databases that could improve information-sharing, and the lack of transparency and accountability in past donor-supported projects, although improvements were under way. More collaboration was also deemed necessary in various contexts to avoid insular information management (also known as "information silos").

50. Speakers noted that institutions for capacity-building in Africa such as the Regional Centre for Mapping of Resources for Development, the Regional Centre for Training in Aerospace Survey, the regional centres for space science and technology education, affiliated to the United Nations and various universities provided a wide range of educational opportunities that could help to address capacity-building challenges. However, curriculums and facilities were often outdated, the number of trained lecturers inadequate, the bandwidth of Internet connections low and financial resources for training limited, all of which restricted the possibilities to deliver training. In that context there was a particular need for further refined training opportunities in space technology and its applications, including in meteorology, satellite data applications, surveying and mapping, and monitoring systems.

H. Thematic session 7. Capacity-building, awareness-raising and outreach

51. The seventh thematic session was dedicated to capacity-building, awareness-raising and outreach. It included six presentations on the following topics: space technology programmes at universities in Kenya; capacity-building measures aimed at strengthening regional enforcement networks, such as the Lusaka Agreement Task Force; building capacity for the use of operational Earth observation data; building capacity for the development of experimental nanosatellites for wildlife monitoring; the activities of the United Nations Programme on Space Applications; and the regional centres for space science and technology education, affiliated to the United Nations.

52. A case study was presented on enhancing the capacity of park rangers for using space technology for their patrols in the Mount Kenya ecosystem. Support provided by commercial partners such as the Environmental Systems Research Institute was also highlighted.

53. During the discussions the limitations that have been identified in capacity-building were emphasized. Those included the lack of dedicated training programmes, the weak linkages between academia and industry, the inadequate facilities and resources available to universities, and the fact that many countries lacked a national space agency or other relevant mechanism that could provide advice for and coordinate space-related activities. Recommendations in regard of those limitations are given in chapter III. The use of open-source software was identified as a possible way to avoid the expense of proprietary software.

I. Thematic session 8. International experiences and cooperation opportunities

54. The eighth and last thematic session was dedicated to international experiences and cooperation opportunities. A number of significant international initiatives were presented. ESA highlighted its Copernicus programme, which provided global environmental data at no cost. In Africa, low Internet bandwidth continued to hamper the downloading of data from the Copernicus Sentinel satellites. Data dissemination mechanisms such as GEONetcast might provide a solution.

55. A representative of the World Bank discussed its Listening to Africa initiative, under which welfare and development were monitored using data collected with mobile telephones. A representative of the United States Agency for International Development spoke about leveraging the results obtained from interagency cooperation and partnerships. A representative of the Kenya Wildlife Service presented initiatives aimed at mobilizing resources for wildlife conservation, and a representative of the Wildlife Conservation Society presented a case study on challenges in conserving biodiversity in Murchison Falls National Park in Uganda.

56. Speakers highlighted the importance of space technology in the collection of data relating to the atmosphere, security, disaster management and climate change. They also discussed the need for adequate infrastructure and open data policies that would make those data more accessible. They emphasized that wildlife was an important economic asset for many countries both in Africa and elsewhere, and that every effort should therefore be made to improve wildlife protection and monitoring and to secure sustainable funding.

J. Panel discussions

57. In addition to the thematic sessions, two related panel discussions were held at which participants considered in more detail how the challenges could be met and helped to formulate observations and recommendations. The point was reiterated that the proposed technological solutions had to take policy considerations into account. Certain countries were often cautious about applications that involved monitoring from aircraft, drones or space-based platforms, and views on conservation and trade policy varied widely among countries. Therefore, policy factors relevant to the implementation of technology-based solutions were included in the discussions.

1. Panel discussion on space technology solutions for wildlife management and biodiversity

58. The first panel discussion was dedicated to space technology solutions for wildlife management and biodiversity. The panel was moderated by the Office for Outer Space Affairs and included speakers from the first thematic session who represented research institutions, NGOs and commercial providers. The key questions addressed were the cost of data and the possible reduction of that cost; interaction and coordination among users and providers, including support that commercial entities could provide in capacity-building and data analysis where needed; and the security of tracking systems to prevent wildlife criminals from gaining access to critical data. Participants noted that in most African countries that did not have a national space entity, satellite imagery providers and donor agencies had difficulties identifying the best counterparts with which to explore funding modalities.

59. Speakers and other participants agreed that mechanisms were needed to facilitate data access and increase the availability of open data, and that commercial data licensing should become more flexible so as to address specific user requirements.

2. Panel discussion on integrated solutions for wildlife and biodiversity management: opportunities and challenges in using space technology solutions

60. The second panel discussion had as its topic integrated solutions for wildlife and biodiversity management: opportunities and challenges in using space technology solutions. It focused on the use of technology, policy development and implementation, and the need to identify champions on the ground. Key issues addressed included the use of emerging technology, such as drones, information-sharing and the cost of accessing space-based data and information.

61. Participants agreed that drone technology could assist with the collection of real-time information, but that appropriate policies and guidelines were needed and that more capacity had to be built for operating drones.

62. Information access and data-sharing were seen as paramount to the success of operations aimed at managing wildlife and protecting biodiversity. Participants noted that there was a need to guide the process of information-sharing by creating information categories and establishing levels of confidentiality. It was vital to build more confidence among non-State actors and State agencies to facilitate easier and more timely information-sharing between them.

63. Participants recognized that space companies were investing heavily in space technology and were not only expecting to recover their investments but also to make a profit. For that reason, access to certain data, usually very-high-resolution data, could not be expected to be free of charge in all cases. As major users and beneficiaries, Governments should therefore consider allocating adequate funds to space technology initiatives and access to space data, so that the desired projects could be implemented. It could be expected that the economic benefits from the use of the data would usually far outweigh the cost of purchasing those data. Developing strong partnerships between the private sector and Governments was also essential to enhancing awareness of the capabilities of space technology and promoting a better understanding of user requirements.

K. Poster session

64. An afternoon was set aside for a poster session. Participants viewed and discussed 24 posters displayed throughout the duration of the Conference. The poster session was opened by a representative of the NGO Save the Elephants, who introduced a number of technical tools and applications for the analysis of satellite imagery that were available at no cost from Google. This was followed by a series brief talks to the plenum about the posters by the organizations displaying them. Commercial satellite imagery providers gave hands-on presentations of their online data delivery services, and the Wildlife Enforcement Monitoring System offered a training class.

L. Side meetings

65. A number of side meetings were held at which representatives of the Lusaka Agreement Task Force and the Wildlife Enforcement Monitoring System, as well as other experts, met in breakout groups to discuss current issues. The UNEP Live team gave hands-on demonstrations of its tools and applications to interested participants.

III. Observations and recommendations

66. Participants were made aware that the Secretariat would compile a report on the Conference that was to be presented to the Committee on the Peaceful Uses of Outer Space and the General Assembly at their respective sessions in 2017.

67. Throughout the Conference the Secretariat, the chairs of the thematic sessions and panel discussions and the rapporteurs took note of the observations and recommendations made by participants. A roundup meeting was held at which they briefly presented the conclusions the participants had reached and further discussions were held.

68. Participants noted the following relevant frameworks:

(a) The 2030 Agenda for Sustainable Development;

(b) The Aichi Biodiversity Targets, adopted by the Conference of the Parties to the Convention on Biological Diversity at its tenth meeting, held in Nagoya, Aichi Prefecture, Japan, from 18 to 29 October 2010;[14]

(c) General Assembly resolution 69/314 on tackling illicit trafficking in wildlife.

69. Participants identified a number of opportunities and challenges:

(a) Advances in technology in general, including miniaturization and robotics, and advances in space technology in particular, including the launch of Earth observation constellations, the development of advanced sensors, operational improvements in data delivery, the wider availability of free and open data and the reduction in the cost of using space systems could contribute to space applications for wildlife management and protecting biodiversity;

(b) Space technology, including geospatial technology and applications, already played an important role in managing biodiversity and ecosystems, in tackling wildlife crime and in supporting policymaking and decision-making. While space technology was becoming more generally available and accessible, its potential often remained unexplored and underutilized, in particular in developing countries;

(c) Access to applications often remained restricted because of the complex nature of data policies;

(d) The affordability and accessibility of certain data sets remained an issue and should be addressed more thoroughly under development or bilateral aid initiatives.

70. The discussions showed that the challenges identified by the key stakeholders often exceeded the capacity of any single country or organization. Broader intergovernmental cooperation was required, both bilateral and multilateral.

71. The main findings of the Conference, as agreed by all participants, related to three categories: the role of space technology, governance and capacity-building.

A. The role of space technology

72. Participants found that space technology, including Earth observation satellites, telecommunications satellites and global navigation satellite systems, could play a more important role in managing biodiversity and ecosystems, tackling wildlife crime

[14] United Nations Environment Programme, document UNEP/CBD/COP/10/27, annex, decision X/2, annex.

and supporting policymaking and decision-making. In particular, space technology could support planning processes and environmental decision-making, compliance monitoring in line with best-practice guidelines, increased transparency and early warning of suspicious activity.

73. To confront global biodiversity challenges it was essential to step up efforts against wildlife crime and support the sustainable management of biodiversity and ecosystems by equipping biodiversity and ecosystem experts as well as wildlife rangers and park rangers with the best available tools, including tools that made use of space technology.

74. Geospatial technology offered key tools for meeting the Sustainable Development Goals and, within the context of biodiversity, could support activities to achieve the targets of goal 15 and other relevant goals.

75. Thanks to ongoing technological advances, sensors were becoming smaller, more energy-efficient and more affordable, making them suitable for tracking even smaller animals. Current technology already made it possible to envision a concrete scenario for the monitoring and studying of global biodiversity. However, governance, legal, policy and regulatory challenges would have to be overcome before the technology could effectively be used (see paras. 77-82).

76. In view of the significant role space technology played in wildlife management and biodiversity protection, and given the often limited budgets (if any) allocated for the utilization of space technology, stakeholders were encouraged to take steps to prioritize mainstreaming the use of space technology by allocating sufficient budgets. Such steps would enhance investment in and application of space technology, in particular the acquisition of infrastructure for data and information access and management and the sharing of information. They would also enhance investment in the development of human resources in both technical and non-technical fields, including administrators, economists, and finance officers, and investment in programmes that applied space technology in wildlife management, biodiversity protection and other fields.

B. Governance

77. Participants recognized the many existing organizations and institutional frameworks relating to biodiversity and ecosystem management, such as the International Consortium on Combating Wildlife Crime and its members, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, INTERPOL, UNODC, the World Bank and the World Customs Organization.

78. Existing regional networks in Africa, such as the Lusaka Agreement Task Force, the Southern Africa Regional Environmental Programme, the Central African Forests Commission and others could strengthen transboundary collaboration among African countries. While the discussion focused on the African region, participants recognized that comparable frameworks with comparable roles also existed in other regions.

79. Participants noted that there was a need to strengthen policy, legal and institutional frameworks on the use of space and geospatial technology in natural resource management to meet the needs of policymaking and decision-making for sustainable development.

80. Participants drew attention to the need for better coordination among stakeholders and for making more efficient use of existing infrastructure. There was also a need to share information at the national, regional and international levels,

especially among enforcement agencies, for example by sharing operational information regarding the illegal exploitation of biodiversity.

81. Participants agreed that the use of space technology should be better integrated into national biodiversity action plans, as only very few countries were reporting such activities to UNEP. The mainstreaming of space technology into national biodiversity action plans should involve collaboration between UNEP and the Office for Outer Space Affairs.

82. The host country saw a clear need for the Kenya Wildlife Service to enhance its capacity for collecting information to better curb elephant poaching by adopting systems for tracking animal movements that alert the Service when animals stop moving for longer periods. Another approach could be the involvement of local communities and farmers, who could alert the Service to any poaching activities they noticed.

C. Capacity-building

83. Participants noted that under existing and future national and international reporting obligations, countries had to enhance their capacity-building efforts. Countries were required to develop relevant human expertise, infrastructure, data management capacities and strategic networks, including by designing and implementing appropriate, up-to-date academic and professional curriculums at the tertiary level of education and continuous awareness-raising programmes targeting policymakers and decision makers.

84. Most of the technology related to geospatial information science originated from the industrialized countries, and hence access and use in Africa is often limited to donor-funded projects. Geospatial companies should help to ensure that the cost of ownership or utilization of the technology was better subsidized to make the technology more accessible to developing countries in Africa and elsewhere. When designing capacity-building strategies, more attention should be given to open-source software, which was becoming easier to use and more competitive compared to established commercial solutions, as well as to cloud services, online services and rapid and simplified data delivery mechanisms in general.

85. While there was an urgent need to train more experts in Africa in the use of geoinformation tools to monitor biodiversity, it was also essential for countries to establish the conditions needed to retain skilled experts. Creating self-sufficiency and efficiency was a key consideration for the development of African institutions. For that purpose targeted training programmes should be established and the curriculums of relevant educational institutions should be updated.

86. In Africa and elsewhere, many organizations and institutions were already building capacity in the use of space science, space technology and space applications. Among them were the Lusaka Agreement Task Force, the University of Nairobi and the Kenya Wildlife Service. Strengthening those organizations and institutions would ensure that those being trained achieve their full potential in using spatial and non-spatial information for purposes of wildlife tracking, monitoring biodiversity and ecosystems, detecting illegal activities, and identifying causes and potential solutions.

87. Integrated solutions should be developed to address issues identified at all levels. Use could increasingly be made of space technology and space applications to end the demand for wildlife products, combat poaching and trafficking and prevent illegal activities in general. There was an urgent need to consider guidelines and policies to facilitate the use of space technology and other relevant technology such as drones. Especially in Africa, the Office for Outer Space Affairs should aim to play a key role

by cooperating with agencies such as the Lusaka Agreement Task Force and the Central African Forests Commission in promoting space technology and space applications as key components in wildlife management and protecting biodiversity, and by assisting Member States in developing the policies and guidelines needed for their optimum use and integration.

88. The role of the private sector in promoting the use of space technology in wildlife management, biodiversity protection and other areas that benefited society was well noted. To ensure sustainability, innovation, employment and wealth creation in the emerging and fast-growing field of space science and technology in Africa, there was a need to enhance the engagement of private actors in the development of space infrastructure, space applications, and the building of capacity in the use of space technology. Innovative public-private partnerships should also be encouraged, promoted and fostered.

D. Other matters

89. The participants recommended that the Office for Outer Space Affairs should continue to work with relevant stakeholders to promote the use of space science, space technology and space applications for wildlife management and protecting ecosystems and biodiversity under the new thematic priority on biodiversity and ecosystems of the United Nations Programme on Space Applications.

90. The Conference participants thanked the Government of Kenya for hosting the Conference. They also thanked UNEP, for making its facilities available, and the cosponsors for their contributions to the Conference. They also expressed their appreciation for the work done by the members of the Conference committees in preparing the programme.

IV. Conclusions

91. The Conference brought together multiple stakeholders working on the development, use of geoinformation technology for monitoring wildlife, biodiversity and ecosystems. It attracted considerable attention throughout the region thanks to, in part, its outreach and press activities. A range of possible follow-up activities have been identified and are currently under discussion.

92. The Conference was a good example of successful inter-agency cooperation, in which the Office for Outer Space Affairs worked together with UNODC and UNEP, two United Nations entities whose mandates were relevant to the topic of the Conference. This demonstrates that synergy was possible between offices of the Secretariat implementing relevant programmes, such as the Office for Outer Space Affairs, responsible for the United Nations Programme on Space Applications, and UNODC, responsible for the Global Programme for Combating Wildlife and Forest Crime.

93. The present report will be brought to the attention of relevant policymaking and decision-making bodies, including the Committee on the Peaceful Uses of Outer Space and the General Assembly. Through the delegation of Kenya the report should also be brought to the attention of the thirteenth meeting of the Conference of the Parties to the Convention on Biological Diversity, to be held in Cancún, Mexico, from 4 to 17 December 2016.

94. Following the successful conclusion of the Conference, which was the first in its kind to address the use of space technology in biodiversity protection, several

participants representing institutions and ministries from outside Kenya expressed an interest in hosting follow-up conferences in the future.

95. Making full use of the framework provided by UNISPACE+50 and the opportunities it offers, the Office for Outer Space Affairs stands ready to assist Member States with the development and implementation of the capacity-building initiatives necessary to address the global challenges that characterize our rapidly changing world in the twenty-first century.