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Report on the Ninth United Nations/Sweden International Training Course on Remote Sensing Education for Educators

(Stockholm and Kiruna, Sweden, 3 May-11 June 1999)

I. Introduction

A. Background and objective

1. The Ninth United Nations/Sweden International Training Course on Remote Sensing Education for Educators, held in Stockholm and Kiruna, Sweden, from 3 May to 11 June 1999, was organized by the United Nations Programme on Space Applications of the Office for Outer Space Affairs in cooperation with the Government of Sweden. The course was conducted specifically for the benefit of educators from developing countries with the objective of enabling them to introduce remote sensing courses in their respective academic institutions. It was co-sponsored by the Swedish International Development Cooperation Agency (Sida) on behalf of the Government of Sweden and was hosted by the Department of Physical Geography of the University of Stockholm in Stockholm and by the Swedish Space Corporation (SSC) Satellitbild in Kiruna.

2. The present report, prepared for the Committee on the Peaceful Uses of Outer Space and its Scientific and Technical Subcommittee, describes the organization of the training course, its technical contents and the results of the course evaluation. Participants have reported on the knowledge acquired and the work conducted during the course to the appropriate authorities of the Government, universities and research institutions in their respective countries.

B. Organization and programme

3. Application forms for and information brochures on the training course were sent out in November 1998 by the Office for Outer Space Affairs to offices of the United Nations Development Programme in developing countries for transmission to the relevant national authorities. The same materials were also distributed simultaneously to relevant Swedish embassies and to previous course participants for circulation in their academic institutions. One hundred and forty-two completed applications were subsequently received and processed jointly by the United Nations Office for Outer Space Affairs and the University of Stockholm. The selection of participants was completed by the end of February 1999.

4. Twenty-seven candidates, 10 of them women, were selected as participants, from the following 22 countries/entities: Bangladesh, Cambodia, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Eritrea, Haiti, Kenya, Mozambique, Nepal, Nigeria, Pakistan, Palestine, Peru, Sri Lanka, Swaziland, United Republic of

Tanzania, Uganda, Viet Nam and Zambia. Funds for the international travel of 13 participants were provided from the fellowship budget of the United Nations Programme on Space Applications. All other support, including the international travel of the remaining 14 participants and room and board, course materials and inland transport for all 27 participants, was provided by the Government of Sweden.

5. Course instructors and speakers came from several institutions, including the Office for Outer Space Affairs, the European Space Agency (ESA), Sida, the University of Stockholm, the Swedish Royal College of Technology, the University of Uppsala, the Swedish National Space Board, the National Land Survey of Sweden, the Environmental Satellite Data Centre, L & L Monitor AB and SSC Satellitbild.

II. Summary of the contents of the course

6. The technical contents of the course were determined by the Department of Physical Geography of the University of Stockholm, with input from the Office for Outer Space Affairs. The course was modular in format and consisted of a series of lectures and office and field exercises. A more detailed summary of the contents of the course can be found in the report on the fifth course in the series (A/AC.105/617).

7. The first technical module of the course lasted four days and dealt with the fundamental principles of remote sensing. The principal topics covered were the following: electromagnetic radiation, the reflective properties of various types of materials on the surface of the Earth and elementary optics; electronic imaging; georeferencing of objects in the field, on maps and on satellite imagery; remote sensing for land use planning and environmental monitoring; and Earth resources and environmental satellites.

8. Four days were subsequently devoted to image interpretation and presentations on the following subjects: introduction to visual interpretation and in-service training in remote sensing in developing countries and applications of remote sensing in applied environmental impact assessment.

9. To reinforce their understanding of the principles of image interpretation, participants were divided into groups on a regional basis; each group studied a case where visual interpretation of satellite images played a key role. The case studies included forestry and land development in Ethiopia; application in hydropower development in the United Republic of Tanzania; disaster prevention in the Cotopaxi region of Ecuador; application in hydropower development in Rio Viejo, Nicaragua; and river dynamics in central Bangladesh. The results of a case study on land use and land degradation in the Lesotho lowlands were also presented to all the participants.

10. A further series of lectures dealt with digital image analysis and geographic information systems (GIS). That aspect of the programme lasted six days and covered the following subjects: digital analysis (theory); computer image enhancement (theory); GIS theory; and digital image processing techniques, including computer-aided analysis, GIS applications, CD-ROM data capture, compass techniques and global positioning systems.

11. The participants were also introduced, over a period of four days, to the principles of radar image formation and the use of such images in various development and research applications. In addition, they were introduced to the use of appropriate procedures for the field verification of interpretations of remotely sensed data using satellite images of the Skinnskatteberg area in southern Sweden.

12. The next part of the course was held in Kiruna, at the facilities of SSC Satellitbild. Four days were reserved for visual interpretation in project planning exercises and presentation of results. Wherever possible, the exercises were carried out on images selected by the participants of areas of their countries with which they were familiar. Lectures were also presented on the following subjects: archiving, catalogue updating and standard production of images; image processing, value-added production, radiometric and geometric corrections, digital elevation model production and ortho image production; computerized cartography; standard and higher-level processed imagery; and future Earth resource satellites.

13. While in Kiruna, participants made technical visits to a number of sites of interest, including the ESA/Salmijärvi and Esrange satellite receiving stations and the Kirunavaara underground mine. Lectures were supplemented by tours of the production facilities of SSC Satellitbild.

14. The final section of the course concerned the development of remote sensing curricula and was held over a period of two days in Stockholm at the Department of Physical Geography. This was followed by a half-day session reserved for formal evaluation of the course.

III. Course evaluation

15. Participants made a formal presentation of their evaluation of the course to representatives of the Office for Outer Space Affairs, SIDA, the Department of Physical Geography, the Ministry of Foreign Affairs and several course lecturers. Discussions following the formal presentation made by a representative of the participants allowed additional inputs to be made by all participants.

16. During the discussions, the participants made suggestions they believed would improve the programme of the course in the future. The main suggestions and recommendations made were as follows: (a) the digital image processing and GIS parts of the programme should be expanded; (b) additional training in advanced technologies and microwave remote sensing would be useful in order to enable participants to improve educational curricula in their respective institutions; and (c) access to satellite images and teaching materials should be improved.

17. A summary of the opinions of the participants extracted from 26 completed questionnaires is as follows: (a) 77 per cent thought the course was right in length; (b) 12 per cent found the schedule too heavy; (c) 65 per cent found that both the theoretical training and the practical training corresponded to their professional needs to a large or very large extent; (d) 88 per cent found the overall level of the programme to be adequate from their personal professional point of view; (e) 58 per cent found that there were subjects not adequately covered in the programme, with most of them indicating digital techniques and GIS as being such subjects; (f) 60 per cent found the methods of instruction to be very good; and (g) 69 per cent thought that they would have an opportunity to apply the newly acquired knowledge and experience in their present employment to a great or very great extent.

18. The results of the Workshop on the Evaluation of the United Nations/Sweden International Training Course Series on Remote Sensing Education for Educators, organized jointly by the United Nations Programme on Space Applications and the Government of Sweden in Gaborone from 18 to 21 October 1998, were also addressed during the discussions. The Workshop had been organized with the primary aim of evaluating the impact of the series of training courses, held annually in Sweden since 1990 (except in 1991), and of determining the future direction for the courses. Thirty-two academic-level teachers from African countries who had attended the training courses held between 1990 and 1996 participated in the workshop and their experience in either introducing or enhancing remote sensing education in their own institutions was a major input to the final outcome of the evaluation exercise. Information on the programme and recommendations of the Workshop as well as proposed follow-up actions can be found in the report of the Workshop (A/AC.105/709).

19. At the conclusion of the discussions the participants in the course expressed their appreciation to the Government of Sweden, Sida, the University of Stockholm and the United Nations for making possible their participation in the training programme.