❖ CSSTE-AP Newsletter ❖

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Socio-economic development in developing countries: contributions from remote sensing

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Population and development

It is a grim reminder for all time to come what Rev. T. Malthus said 200 years ago! He said "population grows at a geometric rate while food supplies grow only linearly". However, contrary to the Malthusian theory and towards the beginning of this century, an optimistic view arose that the prosperity of western economics could continue unabated. Natural resources were no longer regarded as posing severe restriction on economic growth as new resources and technologies for making better use of resources were discovered. The population did not pose difficulties. It was thought that the Malthusian concept of enormous vision has not yet had its worst consequence. But the fact is that it asked for constant preparedness. Even as 'development' became known as a global parameter especially with its hinge in developing countries, the neo-Malthusians began to have doubts about unlimited growth, stressing once again the importance of natural resources in setting limits to economic growth. By the last decade, it was also discovered to everybody's dismay that the population grows especially where natural resources are scarce and the stresses on local carrying capacity are thus the greatest. It is now known that dramatic increases in population in developing countries at the rate about 3 percent per year is expected to increase their population to an abominable level of 9 billion by the end of the coming century. Even with rapid urbanisation due to frequent migrations, the rural population in the developing countries is estimated to increase from the present 3 billion to 4.5 billion by 2100. Doubts on economic security of the expanding agrarian population is thus half of all the socio-cultural insecurities that face us today. It is also unfortunate that although food production has been increasing at a rate of about 3 percent a year, the agricultural productivity in our countries has been very low. This has resulted in a gap of over 140 million tons between the annual demand and production of food grains and it is expected that this gap would double in the next 20 years.

Besides, the developing countries also face a peculiar situation of urban migration of rural communities to the extent that nearly half the world population now lives in cities. This shift from rural agrarian economy to urban industrial economies in the developing countries have generated unique problems that are difficult to solve and even complicated to fully appreciate. On the one hand, it has increased the urban woes and has put enormous pressure on the provisions of power, water, food and safety. On the other hand, there is less interest in agrarian productivity amongst the youth and the foundations of food security and sustainability are shaken.

Moreover, the distance of prosperity and security between developed and developing countries is clearly indicated in the disparity of GDP. While 75 percent of global population resides in the developing countries accounting for only 16 percent of global GDP, the remaining 84 percent of global wealth is concentrated at the hands of 25 percent of the population. This difference is attributable to a variety of reasons, but can only be rectified if we enable the developing nations to have full access to the multiplying opportunities created by technological revolution. Proper and judicious use of technology is the only known pathway to prosperity and sustainability of the developing world today.

Inside this issue...

Issues of socio economic security in the remote sensing context

It is generally agreed that food, property, health and environment are the four elements of security of human life in the developing countries. Food security emerges from the enormous concern of keeping intact the agrarian culture in view of feeding the multiplying millions. Development of agricultural technology, forecasting the yield, identification of crop diseases, optimising water supply, monitoring the growth pattern, progressive restructuring of landuse pattern, managing soil fertility, harmonising environmental cycles with agricultural activities are an integral part of the food security of developing countries. Likewise, forest management, coastal development, landuse optimisation, meteorological modelling, urban sprawl and land reappropriation monitoring, environmental impact assessment, earth resource modelling, and nature watch are parts of

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environmental security. One of the most important concerns in the recent days is our preparedness to face the natural disasters and thus our interests in the security of human and social property. Prediction of natural disasters, development of hazards vis a vis human activities, disaster mitigation planning, defining environmental abuse and protection, disaster monitoring, relief planning and assessment of environmental vulnerability and resilience are necessary components of this act. A combined and comprehensive understanding of these factors allow us develop a system of human and environmental health security in our region. It is of immense importance to observe that these parameters are within the ambit of possibilities of remote sensing experimentation and operationalisation.

Doctrine of sustainability vis a vis remote sensing

Recognising that the world is changing faster than what we realise and can manage, we ought to recognise in the developing countries that we only threaten our security in the region. Why then is this callousness? It reminds us of Oscar Wilde said "we know the price of everything and value of nothing". Arthur C. Clarke went a step ahead in saying "our models of economic growth fail to account for reduction in natural capital". Quoting from V.M. Canuto, we realise that " we are yet to recognise that there is no natural waste since nature is cyclical while our linear economies never reabsorb their own waste". In other words, nature on its own without human intervention is sustainable on the principles of long term recycling. Environmental changes and resource cyclicity are a part of natural sustainability of the biosphere-geosphere interaction. However, it only becomes unsustainable when we embark upon economic activities like resource harvest and environmental degeneration in a linear manner without much contribution to environmental regeneration and resilience. Most of the grandiose projects of developed countries have been of this nature. In this context, it is worthwhile to remember that Dr. Vikram Sarabhai laid the foundation for use of technology towards sustainable development by saying " There are some who question the relevance of space activities in a developing nation. To us, there is no ambiguity of purpose ... We are convinced that if we are to play a meaningful role nationally or in the community of nations, we must be second to none in the application of advanced technologies to the real problems of man and society, which we find in our country. And we should note that the application of sophisticated technologies and methods of analysis to our problems is not to be confused with embarking on grandiose schemes whose primary impact is for show than for progress measured in hard economic and social terms." This in essence is the underling principle of remote sensing applications in the developing countries.

Moreover, the challenge of providing adequate food, environmental and economic security to the large population in the developing countries can only be faced by achieving substantially higher environmental resources through initiation of sustainable integrated development strategies, which are largely dependent on remotely sensed information sources. For example, as against the cost of 2 mill. US$ towards the implementation of remote sensing based Integrated Mission for Sustainable Development (IMSD) in India, even conservative estimate of the annual economic gain resulting from the enhanced food grain production works out to 2.5 mill. US$ each year (U.R. Rao, Member, Indian Space Commission, at the seminar on Space Futures and Human Security, 1997).

Hence, sustainable development is the key for progress in developing countries and involves, undoubtedly, use of remote sensing, application to hardcore human problems and an aspiration of inter-generation equity.

Aspects of application of remote sensing to development

These issues make it explicit that the developing countries are to use remote sensing technology for the sustainable development of their environment, human resources and natural products. In the social context, the following is a check list of applications or in other words, a road map to wise use of space technology.

- Development of human resources
- Natural resource management
- Management of common property resources
- Preventive rural environmental management
- Agricultural economics
- Valuation of biodiversity

- Sustainable socio economic development programme
- Socio economic development of indigenous population that depend on natural resources
- Rural infrastructure development
- Sociological and anthropological development
- Integrated approach to land, vegetation and aquatic environments
- Judicious understanding of meteorological conditions and their application to resource production
- Mitigation and management of natural hazards and disasters.

Information and satellite communication technology in social development

It is not only that we need to explore the nature in its entirety using modern technologies like remote sensing, it is also necessary that we archive, analyse and communicate the knowledge to where and when it is actually required. This need makes it important to recognise the applicability of GIS techniques and satellite communication facilities. While GIS helps in organising the remotely sensed data with respect to other data forms, satellite communication facilities render a possibility to deliver the information to the field units at real time. This capability of communicating even with the remotest places has resulted in calling our world a 'global village'. We may recall that villages in the ancient past were epitomes of sustainability where resources were shared, distributed and regenerated with a sense of harmony with environment. It is only that the sustainability remained disconnected from human exploitation of nature under the pressures of population and greed. Now since earth exploration and communication are aided by space based technologies and since we are able to visualise the world as a village through technological means, sustainability should return to our actions. This feeling should also be a part of the objectives of earth observation.

The CSSTE-AP cherishes this perspective of using high technology towards environmental exploration and judicious exploitation in a sustainable manner. Our efforts at the Centre, mainly for developing human resources are directed towards this perspective.

4th Remote Sensing and GIS (RS & GIS) Course at IIRS, Dehradun

S. K. Saha, *Course Co-ordinator, RS/GIS Course*

The fourth Post Graduate Course in RS & GIS, was conducted at Indian Institute of Remote Sensing (IIRS), during October 1, 1999 to June 30, 2000. 17 participants from 11 countries of the Asia-Pacific region attended the course. The participants were from Bangladesh (2), Bhutan (1), India (3). Kyrghystan (1), Lao PDR (2), Mongolia (1), Myanmar (1), Nepal (1), Philippines (1), Sri Lanka (2) and Vietnam (2).

The core faculty of the course consisted of experienced faculty of IIRS. Some specialized faculty from several Indian Institutes/organizations viz. Centres of Department of Space; Indian Institute of Science, Bangalore; Indian Institute of Information Technology, Hyderabad, Andhra University, Visakhapatnam, KDM Institute of Petroleum Exploration, Dehra Dun; Indian Institute of Technology, Kharagpur; Forest Survey of India and Wildlife Institute of India, Dehra Dun etc. Several international distinguished Scientists/Professors from various organizations/Universities viz. Prof. Shunji Murai, Tokyo University (Japan); Dr. Karsten Jacobson, University of Hannover (Germany); Dr. Didier Giacobbo, GDTA (France); Dr Christine Pohl and Dr. Gerrit Huurneman, ITC (The Netherlands) and Dr. Kiyoshi Honda, Asian Institute of Technology (Thailand), also delivered number of lectures.

In addition to class room theory lectures and practical and tutorial sessions, a numbers of field visits/excursions were arranged to demonstrate the practical aspect of field data collection for analysis of Remote Sensing data. Computer facilities with state-of-the art hardware and software of IIRS were extensively used for hands on experience of working with various Digital Image Processing (DIP) and GIS sortwares during practical sessions in Modules-I & II and pilot project work in Module-III.

Lectures notes and reading materials were distributed to the participants to help in future reading. Soft copy (in the CD-ROM form) of the lectures is also generated for distribution. Video lectures, computer based multimedia self learning training packages were also used as part of teaching materials, in addition to class room lectures. Library and internet facilities of IIRS were available to the participants.

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Dr. K. Jacobson, Univ. of Hannover, delivering lecture

Examinations in the form of written theory, practical tests, assignments and viva-voce, at periodic intervals were conducted to evaluate the academic performance of course participants. One course director, one course co-ordinator and seven thematic disciplines focal points were responsible for organising the course. Director CSSTE-AP and Dean, IIRS, periodically conducted feed back sessions to understand the problems faced by the participants of the course. Suggestions from the participants were implemented, wherever possible.

A number of educational tours to different parts of the country were organized as part of the course curriculum, to give the participants a chance of visiting different RS & GIS establishments. Places visited by the participants included ISRO Satellite Centre (ISAC) and Regional Remote Sensing Service Centre (RRSSC) at Bangalore; National Remote Sensing Agency (NRSA) and RS Satellite data receiving Earth Station at Hyderabad; Andhra University at Visakhapatnam; Survey of India (SOI) and Forest Survey of India and Wild Life Institute of India at Dehra Dun etc. The course participants also attended UN/ESCAP & ISRO, Science Symposium on "Space Technology for improving quality of life in developing countries :A perspective for the next millennium" at Delhi, November 14-17, 1999. The symposium was organized on the occasion of second Ministerial Conference on "Space Applications for Sustainable Development In Asia and the Pacific". Eight nos. of course participants also participated international conference "Map India-2000" at Delhi during April 10-11, 2000. The participants also had a glimpse of India's diverse rich culture and heritage during visits to different Indian cities such as Agra, Delhi, Hyderabad, Bangalore, Mysore and Visakhapatnam etc.

The course participants carried out pilot projects in Module III covering RS & GIS applications in several thematic areas such as Forest cover and density mapping; Assessment and monitoring of forest disease; Urban sprawl, Urban land use/ land cover analysis; Drought monitoring; Hydrological modeling; Ground water pollution assessment & zonation; Soil erosion modeling; Lithological mapping and mineral targeting; Urban environment, Watershed management; Wireless communication system design and Site suitability analysis for solid waste disposal. The topics for one year project of phase II of the course were identified after discussions with the participants. The field of interest of the participants, the needs of the sponsoring agencies and the RS & GIS facilities available in the countries of the participants for supporting the project work, were taken into consideration while deciding about one year project.

2nd Space Science Course of CSSTE-AP at PRL, Ahmedabad

Prof. H. S. S. Sinha
Course Director, Space Science Course

The second post-graduate course of the CSSTE-AP in the area of space science will be held at the Physical Research Laboratory (PRL), Ahmedabad, India during August 1, 2000 to April 30, 2001. Like other courses of CSSTE-AP, this course will also be conducted in two phases. After having the experience of the 1st space science course in which both the phases had a duration of six months, the duration of the 2nd space science course has been increased. The first phase of the course will now be of nine months duration and will be conducted at PRL, Ahmedabad. The second phase will be of twelve months duration and will be conducted in the home country of the participants. After successful completion of the first phase, the participants will be awarded a Post-Graduate Diploma in Space Science by CSSTE-AP. At the end of the second phase, all the eligible candidates will be considered for the award of a M.Tech. degree in Space Science by the Andhra University, Visakhapatnam, India.

In the first phase of the course, all the participants will be required to undergo an orientation course of two weeks to acclimatize with local conditions, English language, facilities at PRL, etc. If required, some tuition in English language will also be given to participants. After the acclimatization, participants will undergo four core modules and a pilot project of two month's duration. The details of these core modules have been finalized based on the curriculum developed under the auspices of the UN Office for Outer Space Affairs (UN-OOSA) and the guidelines emerging from the meeting held for Education Curriculum Development for the Centre at Granada, Spain in February/March, 1995. The contents of all the modules are revised from time to time by an International Advisory Council of CSSTE-AP.

Two of the core modules will be devoted to theory and two to experiments. The emphasis in these core modules will be on the development and enhancement of the knowledge and skills of the participants through lectures, colloquia, seminars, tutorials, group discussions, laboratory work, field visits, etc.

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The teaching methods include classroom lectures, tutorials, laboratory experiments, group discussions, demonstrations, seminar presentations, field work/case studies, etc. Modern methods of teaching and instruction will be used for imparting training during the course. Lecture notes will be supplied to all participants in advance. Computer-based interactive packages will also be used to facilitate self-learning.

Two core modules aim to provide the theoretical knowledge on the following major disciplines of space science viz., structure and composition of earth's neutral atmosphere, plasma aspects of earth's environment, astronomy and astrophysics, ionospheric physics, optical and laboratory studies of space processes and modeling of atmospheric processes. The other two core modules aim to expose the participants to various ground based, balloon-, rocket- and satellite-borne experiments which are used the world over to explore the outer space. Participants have to perform these experiments under the guidance of PRL scientists and engineers, who have conducted a number of rocket and satellite- borne as well as ground based experiments.

The module on the Pilot Project will be of two months duration. The aim of this module is to ensure that a) the one year project work, which has to be done in the home country of the participant, is finalized in consultation with the supervisors in India as well as in the home country of the participant, b) that some ground work is done for the one year project work, in terms of identifying and procuring the necessary data, software, literature, etc. and c) that the participant has developed reasonable depth of understanding of the field under the guidance of the Indian supervisor. This also ensures that on return home, the participant can start the research project right away. The topic for the Pilot Project will be decided by the Course Director after consulting the supervisor in the home country and one Indian supervisor to be appointed by the Director, CSSTE-AP/Course Director. After the successful completion of the one year research project, participants will have to write a thesis, which, after approvals from both supervisors, Course Director and Director, CSSTE-AP, will be submitted to the Andhra University, Visakhapatnam, India for the award of M.Tech. degree in Space Science.

The faculty for the course consists of experts in different fields drawn from the Physical Research Laboratory, Ahmedabad, a number of ISRO Centers and various research institutes and universities in India and abroad. The core faculty has a strong scientific background with a number of publications, experience of participating in international scientific programs, organizing a number of courses / workshops / symposia, etc. to their credit. A few visiting international experts will also be invited to deliver lectures on recent developments in space science.

The performance of the participants will be assessed through oral and written examinations, class tests, seminars, laboratory work, etc. at periodic intervals during each module of the course.

Prof. MGK Menon visits CSSTE-AP

Prof. MGK Menon, FRS, Vikram Sarabhai Distinguished Professor visited CSSTE-AP and delivered a special lecture on Science and Technology Policies for Developing Countries in the newly emerging scenario at IIRS auditorium on June 9, 2000.

The participants will be taken on a few field trips to expose them to some of the modern space research facilities developed by the Indian Space Research Organization (ISRO) and other research institutes in India.

About the Venue (PRL, Ahmedabad)

Physical Research Laboratory, Ahmedabad, which celebrated its golden jubilee in 1997, is the premier centre of space research in India. A number of sophisticated experiments like a digital ionosonde, high power lidar, optical instruments for photometry, spectrophotometry and imaging of day/night airglow emissions, instruments for surface/in-situ measurements of ozone, aerosols, trace gases, conductivity, electric fields in the middle atmosphere and of electron density, ion-neutral composition and electric fields in the ionosphere, etc., form the backbone of current space research activity of PRL. Computer facilities include a number of high power work stations with a large number of PCs connected through network with connectivity to internet. PRL hosts an excellent fully computerized library with a large collection of books, journals and periodicals in various fields including space science. A modern workshop equipped with CNC machines supports the experimental activities of various research groups.

Post Graduate Course on Satellite Meteorology

P.C. Joshi, *Course Director, SATMET Course*

SATMET - 98 : The first 9-months Post Graduate Course on Satellite Meteorology & Global Climate was conducted during March 1 to November 30, 1998 at Space Application Centre (SAC), Ahmedabad. 17 Participants from 10 countries of the Asia-Pacific region, viz. Bangladesh, India, Indonesia, Iran, Kazakastan, Mongolia, Nepal, Philippines, Sri Lanka and Uzbekistan attended the course. An International Workshop on "emerging trends in Satellite Meteorology : Technology and Applications" : was organized during March 9-12, 1998, as a trendsetter for the course. About 100 scientists from various Organisations in India, 17 Course participants, besides the Governing Board Members of CSSTE-AP and 5 foreign scientists participated in the Workshop.

The detailed syllabus for the 9-month course was prepared as per Granada Meeting (1995) recommendations. Faculty members for this course were drawn mostly from SAC. A few experts from other national organizations and two from abroad - (Japan and Malaysia) also served on the faculty. These experts provided a flavor of the various SATMET activities being conducted in the AP region.

A special computer facility was established for this course with 10 workstations and a server. All the 17 participants were divided into group of two and each was provided with workstation. This provided and excellent opportunity to them to learn about various aspects of satellite data (mainly INSAT and NOAA) processing, analysis and interpretation.

The participants also undertook 3 months pilot project on topics relevant to their country and to their organization. These pilot projects are being elaborated further during the 1-year project in their respective countries. 3 participants have submitted their 1-year project thesis based on the work carried out by them in their home country. These have been sent for evaluation by examiners to assess the suitability of the work for the award of M. Tech degree by Andhra University. Considerable progress has been made by at least 5 more candidates and they are expected to submit thesis in near future.

A CD-ROM containing all the lecture notes, practical reports etc. was prepared and distributed to the participants at the end of the course.

SATMET-2K : Second Post Graduate Course on Satellite Meteorology and Global Climate (SATMET-2K) is starting on 1st July, 2000 at Space Application Centre, Ahmedabad. Twenty two participants from fourteen countries in the Asia - Pacific region have been selected for the Course. Majority of the participants selected are senior forecasters working in the National Weather Service of their respective Countries.

New features added in this Course in comparison to SATMET - 98 are :

- More lectures on extra - tropical weather Systems
- Concept of Elective papers has been introduced. Candidates have option of selecting anyone of the following :
  a) Satellite Data Assimilation and NWP b) Parameter Retrievals c) Climate Change
- Practicals on new satellite data applications have been added viz.
  a) Aerosols from INSAT-2E CCD b) Meteorological parameters from MSMR onboard IRS P4.
- Pilot projects involving more recently launched Satellite data like NOAA-AMSU, IRS P4-MSMR, TRMM, SSM/I etc. being planned.
- The participants will have the opportunity to work with INSAT & NOAA satellite data received in real time.

FORTHCOMING COURSES OF CSSTE-AP

PG Courses :

- 2nd PG Diploma Course in Satellite Meteorology and Global Climate commencing on July 1, 2000 at SAC, Ahmedabad.
- 2nd PG Diploma Course in Space Science commencing on August 1, 2000 at PRL, Ahmedabad.
- 5th PG Diploma Course in Remote Sensing and GIS commencing on October 1, 2000 at IIRS (NRSA), Dehra Dun.

Short Courses

- Satellite Communications Applications for Development- July 17-21, 2000 Sponsored by Centre for Science and Technology of the Non Aligned and other Developing Countries at Ahmedabad.
- International Training Course on Remote Sensing and Geographic Information System - Technology and Applications in Natural Resources and environmental Management. August 28 - September 22, 2000 at IIRS, Dehra Dun.

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CSSTE-AP welcomes the views and opinions of the readers of the newsletter. Short communications on space science and technology education which may be relevant to Asia Pacific region are also welcome. Views expressed in the articles of the newsletter are those of the authors and do not necessarily reflect the official views of the Centre