



❖ CSSTEAP Newsletter ❖

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BIODIVERSITY CONSERVATION PLANNING IN ASIA PACIFIC REGION - ROLE OF GEOINFOMATICS

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Biodiversity is the variability among the living organisms from all sources including inter alias terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are the part. It is the totality of inherited variation of all forms of the life across all levels of organization ranging from landscape to ecosystem to species to genes. Today the value of biodiversity is being realized in economic, social, aesthetic and moral terms. Thus the biodiversity is and will remain an issue of global concern. Some of the species have direct benefit to the mankind while the others are important for the existence of such species. About 10 to 20% plant species provide 80-90% of the food requirement of the world. More than 8000 plant species have been used in making over 10,000 drugs. The global plant based drug trade accounts for approximately 124 millions U.S. dollars. In this context conserving biodiversity becomes a priority to ensure environmental, food and health security for the future.

The Asia Pacific region contains highest biodiversity, not only due to its size but also due to its climatic and topographic complexity and its complex geological and evolutionary history. This region inhabits diverse ecosystems, habitats and ecological niches. It

extends from Mediterranean Sea in the west to the Japanese archipelago in the east, from polar landscapes in the northern Siberia to hot deserts in the southwest and tropical regions south of the Himalayas and China. The tropical Asia includes equatorial rainforest climates as well as seasonally wet and dry tropical savannas, raingreen woodlands, and monsoon forest. Dry regions of Asia include an eastward extension of the subtropical Sahara dessert into southern west Asia, large expanses of higher latitude interior desert with cold winters and also a small Mediterranean region and east west strip of temperate grasslands. The main area of the temperate forest is in east Asia, with deciduous and mixed forest, rich evergreen laurel forest, and extensive areas of mostly secondary pine forest. Mountain areas of Asia have many endemic species, especially relict conifers. Northern Asia contains enormous expanses of relatively diverse Siberian conifer forest, polar and up-land tundra. Wetlands in Asia include mangrove, coastal strand forests, salt marshes and bogs, most of which are highly productive and represent critical habitat for terrestrial and aquatic animals.

Biodiversity of this region is under immense pressure. Habitats and ecosystems are facing the



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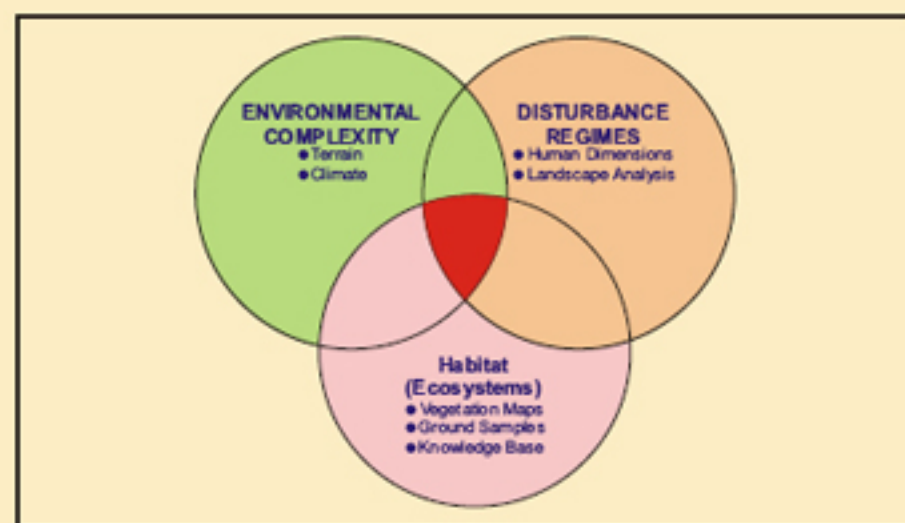
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threats due to fragmentation and alteration caused due to human impacts. There has been a substantial decrease in the tropical forests cover in the Asian region. Deforestation amounted to 2.9 million ha per year during the period 1990-1995 in continental and insular Southeast Asia. This represents the highest annual rate of deforestation among the tropical regions of the world. Direct major causes of forest loss have been due to clearing of land for agriculture, shifting cultivation, forest conversion to monoculture plantations and excessive legal and illegal cutting for timber.

It is now widely recognized that biodiversity is a multidimensional and multiscale phenomenon encompassing different levels of organization and a wide range of spatial scales. Inventorying biodiversity and monitoring know-how of measures for its conservation have emerged as a major scientific challenges of the recent years. Identifying the patterns of biodiversity and its causal factors requires mapping and monitoring of biological patterns across the different spatial and temporal scales and analysis of such pattern with respect to the diverse aspects of physical and human environment. Remote sensing is probably the best tool available today to address this challenge. It provides multidimensional real time information at all levels of biological organization viz. species, community, ecosystem and above all the landscape. Landscape analysis represents one of the most reliable surrogates for the biodiversity characterization. It may be taken as an abstract of the large and much varied biodiversity actually existing in a region. By monitoring the landscapes and land-cover systems it is possible to evaluate the biodiversity. In fact landscape is a mosaic where the local ecosystem or land use is repeated in similar form throughout. Thus, whereas different sections of a region (patch) are quite dissimilar, ecological unity with similar ecological conditions is found in all sections. The communities, which may differ in species composition, phenology and physiognomy, form a mosaic of patches of various sizes and shapes. The

structural approach to landscape ecology elucidates how the building blocks (patches) of the landscape are distributed in relation to the sizes, shapes, numbers, kinds and configuration of the ecosystems or landscape elements present. Thus the very significant know how of the tropical structure and composition may be interpreted. Landscape pattern can be quantified from patches mapped using remotely sensed data. Quantification of spatial relationships and patterns allows comparisons between different areas and over time, and provides input to models that can be used to test underlying processes predicted by ecological theory. The Geographical Information System (GIS) is another complementary tool that stores, enhance, analyze display and interpret layers of geographical data and link it to the non-geographical data to arrive at scientifically sound conclusions. Thus with an integration of space remote sensing data with comprehensive databases on social, economic, political, and legal factors one can have a better understanding of actual relationships between the biophysical environment and the landscape pattern.

India is one of the twelve, mega biodiversity center and twelve centres of origin of cultivated plants and domesticated animals. It exhibits wide array of natural complexes at one hand and on the other hand supports the huge population of over 10 million. Furthermore still it is under the developing countries of the world. Therefore one can imagine the pressure on its rich biodiversity. This urges the need to



Hypothesis for Biodiversity Characterization

generate base line data for the protection, conservation and judicious utilization of its biodiversity potential. Recently a pioneering effort has been made in this direction jointly by the Department of Space and the Department of Biotechnology and satisfactory achievements have been made. A programme entitled “ Biodiversity Characterization at Landscape Level using Satellite Remote Sensing and Geographical Information System (GIS)” was launched in 1998, in the floristically rich regions viz. North Eastern Region, Western Himalayas, Western Ghats and Andaman and Nicobar Islands based on preliminary pilot studies in the test areas. With the aid of satellite remote sensing data detailed vegetation type maps have been prepared using digital or on-screen visual classification techniques subject to feasibility in the region. Other thematic maps representing human impact zone and terrain complexity were also generated. Sufficient field inventories were also conducted for the purpose of ground truth and sample data (phytosociological) collection. All these information were finally integrated and modeled in the GIS platform to derive information on landscape pattern viz. fragmentation status, disturbance regimes and biologically rich zones.

The final outputs have been compiled in the form of comprehensive reports and atlases providing information at regional as well as state level. A web enabled programme based on the concept of Open GIS, has also been launched and made available on the internet for the dissemination of the knowledge gained and result obtained to the various user

departments mainly government agencies and universities. Such information base can be of immense value for bioprospecting. It is expected that the maps will be used for planning detailed ground level inventories of flora and fauna by premier institutions like Botanical Survey of India, Zoological Survey of India, State forest departments and Wildlife Institute of India. This information can also be used for re-defining ecological zones required for biodiversity conservation over the period of time.

Conservation of biological diversity has become a central environmental policy concern for the Asia and Pacific region. For the foreseeable future the resources devoted to conservation will remain limited. Therefore, it is necessary to set conservation priorities to allocate resources where they will do the most good. Also it is essential to understand what gives species a conservation value. The major conservation priorities have been on conserving the species subject to rarity, vulnerability, endemism and above all having a direct or indirect benefit to the mankind. Perhaps the greatest challenge to defining reasonable conservation policy is to understand the link between particular conservation strategy and the likely biological and economic effects. The ultimate goal of the conservation policy is to ensure the survival of the various elements of biodiversity and not merely representing them. This needs some understanding of population dynamics, which comes from the collection and analyses of sample data e.g. phytosociological data collected during field inventories.

SEVENTH RS & GIS COURSE

The seventh post graduate course on Remote Sensing and Geographic Information System (RS & GIS) which started on October 1, 2002, is in progress at Indian Institute of Remote Sensing (IIRS), Dehradun. 23 participants from 13 countries (including four from India) of the Asia-Pacific region are attending the course. The course is now running

in Module-II which has started on January 07, 2003 and is ending on March 31, 2003. This module deals with both optional elective and compulsory streams. The optional elective stream covers several thematic disciplines of RS & GIS applications such as Agriculture and Soils, Forestry and Ecology, Geosciences, Water Resources, Human Settlement

and Urban Analysis and Marine Science. Six numbers of course participants had chosen Agriculture & Soils discipline, five numbers each in Geosciences and Water Resources, three numbers of course participants opted for Urban Analysis discipline and rest two participants had chosen Marine Science discipline. The compulsory stream in Module-II covers several subjects dealing with advances in RS & GIS; Satellite Meteorology, Earth Processes, Natural Disaster monitoring and management, Sustainable development and integrated natural resource management; Environmental analysis, monitoring and management. The course curriculum was covered by the faculty of IIRS and additional/guest lectures on specialised topics were also arranged for the benefit of course participants. The guest lecturers were from various Indian organisations/Institutes/Universities such as SAC and PRL, Ahmedabad; NRSA & ADRIN, Hyderabad; ISRO Hq., Bangalore, Andhra University, Visakhapatnam; FSI, WII, SOI & WIHG, Dehradun; NIH & IIT, Roorkee, NSP, Delhi, UPRSAC, Lucknow etc. Two International guest faculty Dr. Jean Claude Souyris, CNES France and Dr. Norman Kerle, ITC, The Netherlands were also invited to deliver lectures on Advanced aspects of satellite microwave data processings and applications and role of earth observation in natural disaster management, respectively. The academic performance of the course participants was evaluated

through periodically conducted theory and practical examinations, home assignment and seminar presentation during this module. The topic and supervisor for the pilot project which will be carried out by the course participants in module-III was also



Participants in a field excursion

finalised for each participant during this period. An educational visit of two weeks duration to ISRO Satellite Centre (ISAC), Bangalore and Andhra University, Visakhapatnam was also organised during this module. The course participants also got opportunity to exposure to Indian rich historic, cultural and social heritage during the visit to various Indian cities such as Bangalore, Mysore and Visakhapatnam. The course participants also actively participated 'Holi'- the Festival of Colours of India.

THIRD MEETING OF BOARD OF STUDIES OF RS & GIS COURSE

Third meeting of Board of Studies (BOS) of RS & GIS Course was held on February 25, 2003 at Indian Institute of Remote Sensing (IIRS), Dehradun. The BOS members consisting of Dean, IIRS and Course Director RS & GIS (Chairman), Director, CSSTEAP, Prof. I.V. Muralikrishna (JNTU, Hyderabad), Prof. B.S. Prakasa Rao (Focal Point of RS & GIS Course,

Andhra University, Visakhapatnam) and Dr. S.K. Saha, Course Co-ordinator (Member-Secretary) participated in the meeting. Focal Points of RS & GIS course representing eight RS & GIS Technology and Applications Divisions of IIRS also attended the meeting as special invitees. The existing course curriculum, teaching methods, examinations and

course evaluation procedures, sequencing of lectures, english language problem of student, self-learning methods etc. were discussed and suggestions were made by the BOS members. The

suggestions of BOS for course curriculum improvement and organisation of course will be implemented in the forthcoming eighth RS & GIS course starting from October 01, 2003.

THIRD SATMET COURSE

The Post Graduate CSSTEAP Third Course in Satellite Meteorology and Global Climate (SATMET) is underway at Space Applications Centre, Ahmedabad since August 1, 2002. Twenty participants from 13 countries in Asia and the Pacific region are attending the course.

The participants successfully completed the second module of three months duration on January 31, 2003. This module dealt with Advanced Concepts in Radiative Transfer and meteorological parameter retrievals using space based data in different wavelength bands of Electromagnetic spectrum. A number of applications involving the use of these digital data in monsoon monitoring, tropical cyclone analysis and mid latitude analysis were demonstrated. Various climate topics including Global Warming, Greenhouse Effect, Sea Level Variability have been covered. The role of space observations in supplementing the long-term trends is emphasized. The participants have been exposed to numerical weather prediction at various scales involving the 1-D, 2-D and 3-D models with parameterization schemes, Data Assimilation techniques, Satellite data impacts etc. Profiles of temperature and moisture using NOAA-TOVS data, CMV's using Geostationary satellite data, precipitation estimations using IR and Microwave data, Model output interpretation etc. are some of the practicals undertaken by the participants.

Presently the participants are carrying out a 3 months Pilot Project under the guidance of SAC Scientists. These topics have been evolved considering the interests of the participants, their organizations and its relevance to the region.

The faculty of the second module consisted of scientists from SAC, India Meteorological

Department (IMD), Indian Institute of Science (IISc), Indian Institute of Tropical Meteorology (IITM) and National Institute of Oceanography (NIO). Besides the following scientists from abroad



At NCAOR, Goa

also visited SAC and delivered lectures :

- ❖ Dr. G. Liu, Florida State University, USA
- ❖ Dr. A. Kitoh, Japan Meteorological Agency, Japan
- ❖ Dr. M. Tokuno, Japan Meteorological Agency, Japan
- ❖ Dr. Jose Prieto, EUMETSAT, Germany
- ❖ Dr. John Le Marshal, Bureau of Meteorology, Australia

In addition to these academic activities, technical tour to Bangalore and Goa was arranged. The satellite integration facilities, the space exhibition at ISRO Satellite Centre (ISAC), the satellite tracking station (ISTRAC) and the mission control activities, Aerosol and radiation laboratory in the Indian Institute of Science provided a glimpse of the complex high technology activities being carried out at these National laboratories. They were briefed about the various National Oceanic Science Programmes

along with the demonstration of marine observations carried out by sensors onboard research vessels at the premiere National Institute of Oceanography.

Participants were privileged to visit the National Centre for Antarctic and Oceanic Research

(NCAOR) in Goa and learnt a great deal about the research programs pursued in the harsh continent of Antarctica. The participants thoroughly enjoyed the lovely beaches and the sunshine in the picturesque Goa.

REGIONAL WORKSHOP FOR ASIA PACIFIC ASTRONOMERS

- Prof. H. S. S. Sinha
PRL, Co-Organizer

An international Workshop on "Data Processing from the Chandra and XMM-Newton Space Missions" was conducted at Laxmi Vilas Palace Hotel, Udaipur, India during January 13-24, 2003. This workshop was organized jointly by the Committee on Space Research (COSPAR), Physical Research Laboratory (PRL), Ahmedabad, Indian Space Research Organization (ISRO), Bangalore and the Center for Space Science and Technology Education in Asia and the Pacific (CSSTEAP),

Prof. D. Lal, FRS from the University of California, San Diego, USA.

There were in all 31 participants from PR China, Korea, South Africa, Taiwan and India and 14 Faculty Members from England, Spain, The Netherlands, USA and India. The entire duration of the workshop was divided in two sessions of lectures and downloading and computations. A very high-speed satellite data link was specially established for the entire duration of the workshop.

In the forenoon session there were three lectures by international experts. The afternoon was devoted to a specially designed project for each participant, which had to be performed under the direct supervision of a faculty member. This project work was so designed that each participant was able to identify a specific scientific problem, was able to download all the necessary data and software files from Chandra and/or XMM-Newton archives and analyze the data to achieve the desired objectives of the project. In view of the fact that a very high-speed satellite data link was provided by PRL, it was possible for all participants to download large data files at the same time. In addition to the registered participants, the workshop attracted a large number of young scientists from the MLS University, Udaipur and the Udaipur Solar Observatory, Udaipur. The feedback from the participants indicated that the Workshop was very useful, especially to the young scientists who wanted to launch themselves in to the field of X-ray astronomy.



Prof. D. Lal, FRS inaugurate the COSPAR Workshop

Dehradun. The objective of the workshop was to expose the young scientists of the Asia Pacific region to the potential of the X-ray astronomy and the extremely high quality of X-ray data and the necessary software from the two state of the art space missions namely the "Chandra" and "XMM-Newton". This workshop was inaugurated by

THIRD SPACE SCIENCE COURSE

The 3rd Space and Atmospheric Science Course of the CSSTEAP, which started at the Physical Research Laboratory (PRL), Ahmedabad, India on August 1, 2002 is nearing completion on April 30, 2003. This course is made up of four modules (two dealing with the theory and two dealing with experiments) and a pilot project. The topics covered in theory included "Structure, Composition and Dynamics of Planetary Atmospheres", "Ionospheric Physics", "Solar Wind, Magnetosphere and Space Weather", "Astronomy and Astrophysics" and "Basics of Spacecraft Design, Construction and Launch". In addition, all participants have performed 12 experiments in the areas of atmospheric sciences, aeronomy and astronomy. Out of these eight experiments, four experiments were performed at prestigious international observatories, viz., PRL's IR Observatory at Gurushikhar, Mt. Abu, Udaipur Solar Observatory, Udaipur and Ooty Radio Telescope, Ooty.

During their nine-month's stay at PRL, all the participants were taken for a number field tours to show them the state of the art space research facilities in India. Some of the laboratories, which were shown to the participants included ISRO Satellite Centre (ISAC), Bangalore, ISRO Telemetry, Tracking and Telecommand Network (ISTRAC), Bangalore, Vikram Space Science Centre (VSSC), Trivandrum, Centre for Earth Science Studies (CESS), Trivandrum, National Remote Sensing Agency (NRSA) Hyderabad, National Balloon facility, Hyderabad, Ooty Radio Telescope, Ooty, PRL's IR Observatory at Gurushikhar and Udaipur Solar Observatory, Udaipur.

In view of the recommendations made by the International Syllabi Review Committee for

CSSTEAP Courses, the 3rd Space and Atmospheric Science Course was different from the earlier courses in two aspects. Firstly, an entirely new discipline of "Basics of Spacecraft Design, Construction and Launch" was introduced, wherein the participants were introduced to the basics of Orbital Dynamics, Control and Guidance, Power Generation and Storage, Telemetry and Telecommand, Mechanical, Thermal and Payload Design Aspects and Space System Materials. This basic knowledge coupled with witnessing the actual functioning of these systems at ISRO centers gave the participants a real feel of space systems and technologies involved. The other factor was performing the experiment with international standard telescopes in optical, IR and radio region. This gave them additional confidence in performing experiments using very big telescopes and equipped them with all the information, which one needs to know for writing a proposal for getting the telescope time for any astronomical study.

The progress of participants was monitored through call tests, written examinations, seminars, maintenance of experiment journals, etc. A very distinct improvement in written and oral English was observed near the end of the course, which is a result of English lessons for a period of two months and a very strong interaction with other members of PRL and other international institutes.

Participants are currently engaged in their Pilot Projects under supervision of PRL faculty members. Some of the participants, who are keen in getting an M. Tech. degree in Space and Atmospheric Sciences and who are eligible, have to complete a one-year project in their home country and submit a thesis, which after proper evaluation by the Andhra University could yield an M. Tech. degree.

MEETING OF THE BOARD OF STUDIES OF SPACE AND ATMOSPHERIC SCIENCES COURSE

A meeting of the Board of Studies for the Space and Atmospheric Sciences Course of CSSTEAP was held at the Brach Secretariat of the Department of Space, New Delhi on March 13, 2003. Prof. Karl Harmsen, Director, CSSTEAP chaired the meeting, which was attended by the Members of the Board of Studies, viz., Prof. H. S. S.

Sinha, Prof. D. Madhusudan Rao, Prof. Rajesh Pandey and Dr. K. P. Subramanian. The Board deliberated on matters pertaining to the syllabus of the 3rd Space and Atmospheric Sciences Course, the necessity of having a core faculty of CSSTEAP, number of faculty members appropriate for giving the course on a particular topic, the

possibility of one year project work (after the 9-month's course) and the eligibility for the M. Tech. degree in Space and Atmospheric Science from the Andhra University, Visakhapatnam. Prof. Sinha informed that the idea of performing the experiments at international facilities like Ooty Radio Telescope, PRL's IR Observatory and Udaipur Solar Observatory was very good and gave the real insight to the participants. It was felt that the syllabus, which was revised only in 2002, was very good and should continue as it is for a few more years at least. There was general feeling that faculty from the Asia-Pacific countries should also be tapped for giving course work and for this the alumni of CSSTEAP should be contacted.

BACKGROUND OF CSSTEAP

In response to the UN General Assembly Resolution (45/72 of 11th December, 1990) endorsing the recommendations of UNISPACE-82 the United Nations Office for Outer Space Affairs (UN-OOSA) prepared a project document (A/AC.105/534) envisaging the establishment of Centres for Space Science & Technology Education in the developing countries. The objective of the Centres is to enhance the capabilities of the member states in different areas of space science & technology that could advance their social and economic development. The first of such centres, named as Centre for Space Science & Technology Education in Asia & the Pacific (CSSTEAP) was established in India in November 1995. Government of India has made available appropriate facility and expertise to the Centre through the Indian Institute of Remote Sensing (IIRS) Dehradun, Space Application Centre (SAC) & Physical Research Laboratory (PRL) Ahmedabad. The Centre is an education and training institution that is capable of high attainments in the development and transfer of knowledge in the fields of space science & technology. The emphasis of the Centre is on in-depth education, training and applications programmes, linkages to global programmes/databases; execution of pilot projects, continuing education and awareness and appraisal programmes. The Centre offers Post Graduate level & Short courses in the fields of (a) Remote Sensing and Geographic Information Systems, (b) Satellite Communications and GPS, (c) Satellite Meteorology and Global Climate, (d) Space and Atmospheric Sciences. A set of standard curricula developed by the United Nations is adapted for the educational programmes. The Centre is affiliated to the United Nations and its education programmes are recognised by Andhra University, Visakhapatnam, India.

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Courses in Progress

- ❖ Third 9-month Post Graduate Course in Satellite Meteorology and Global Climate at SAC, Ahmedabad from August 1, 2002.
- ❖ Third 9-month Post Graduate Course in Space and Atmospheric Science at PRL, Ahmedabad from August 1, 2002.
- ❖ Seventh 9-month Post Graduate Course in Remote Sensing and GIS (RS & GIS) at IIRS, Dehradun from October 1, 2002.

Forthcoming Courses

- ❖ Fourth 9-months Post Graduate Course in Satellite Communication (SATCOM) at SAC, Ahmedabad from August 1, 2003.
- ❖ International Training Course on Geoinformatics for Biodiversity Assessment, August 18, 2003 to September 12, 2003 at IIRS, Dehra Dun
- ❖ Eighth 9-month Post Graduate Course in Remote Sensing and GIS (RS & GIS) at IIRS, Dehradun from October 1, 2003.

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CSSTEAP welcomes the views and opinions of the readers of the Newsletter. Short communications on space science and technology education which may be relevant to the Asia Pacific Region are also welcome. Views expressed in the articles of the Newsletter are those of the authors.