

# Remote Sensing and Geographic Information System (RS&GIS)

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## INTRODUCTION

The developing countries have 55% of geographical area of the world, support more than 75% of the world population, are constrained by serious shortage of natural resources and capital, large scale illiteracy, low agricultural and industrial productivity, and serious environmental degradation. A fundamental requirement of Agenda 21 of UNFED is to support sustainable development while safeguarding the earth's environment. This will require optimal management of natural resources which depends on the availability of reliable and timely information at national and regional levels.

Large areas in developing countries including Asia-Pacific region are disaster prone and huge losses of life and property caused by natural calamities are not uncommon. Rapid population growth, poverty, urban development, deforestation and land degradation etc. in this region cause depletion degradation of natural resources and deterioration of environmental quality. Sustainable development is key to provide long-term benefits required to achieve overall development and poverty alleviation in the Asia-Pacific region.



IIRS, Dehradun- RS & GIS host institute

Remotely sensed data play an increasingly important role as source of a reliable and timely information needed for sustainable management of natural resources and for environmental protection. Through Geographic Information System (GIS), remote sensing data can be integrated with ancillary data to facilitate the efforts of resource managers, planners and decision makers in obtaining the relevant information they need. In Asia-Pacific region, there is an urgent need for more and better trained scientific personnel in the field of Remote Sensing and GIS for sustainable natural resources and environmental management. In view of this CSSTEAP conducts post graduate long term and them specific short terms course in Remote Sensing and GIS.

## OBJECTIVES

This is expected at the end of RS&GIS educational program, participating scholars will be able to:

- Serve as catalysts for furthering the skills and knowledge of other professionals in their countries,
- Contribute to policy making, planning, development and management of Remote Sensing & GIS technology and its application in their countries,
- Enhance the self reliance in their countries,

## TARGET PARTICIPANTS

The course is directed towards- university educators, researchers, natural resources and environmental management professional and specialists. Prospective participants should be from Asia-Pacific region and should be post graduate in science or graduate in engineering or equivalent qualification relevant in the field of natural resources or environmental science disciplines. They must have sufficient knowledge in written and spoken English.

## COURSE STRUCTURE

The post graduate course of RS & GIS is organized in two phases-

### Phase I ( In India)

#### Core modules:

where the emphasis is on the development and enhancement of the knowledge on the subject.

#### Pilot project:

oriented towards planning and executive project to be carried out in the home country as part of Phase-II



Students during their field work

### Phase II (In home country)

Research project for scholars to conduct and execute projects in their respective countries with a view to transfer the technology in his/her organization. It will also be a test of the methodology assimilated during phase I at the centre.

Few meritorious students are awarded with 1 year fellowship to complete their one year phase-II project work at CSSTEAP, Dehradun, at Indian Institute of Remote Sensing.

On successful completion of the phase-I of the nine months course, the centre will award Post Graduate Diploma. If the participant is able to complete Phase-II project work satisfactorily, Andhra University (India) would award M. Tech Degree to the participants who satisfy the M. Tech eligibility requirements of Andhra University.

## COURSE CONTENT

Phase I of the RS&GIS PG course consists of three modules each of 3 months duration

Subjects Covered in

First Module (Lectures, tutorials & Practical)	Second Module (Lectures, tutorials & Practical)	Third Module (Pilot Project)
* Fundamentals of Remote Sensing	* Advance concepts in Remote Sensing and GIS	* Pilot project in the domain of Remote Sensing and GIS Technology & applications in Natural Resources & Environment
* Remote Sensing Platforms & Sensors	* Satellite Meteorolgy	* Planning and design of the project
* Mathematical concepts applied to Digital Image processing & GIS	* Earth Processes & modeling	* Review of Literature
* Principles & analysis of Remote Sensing data (Visual & digital)	* Natural Disaster	* RS data products Identification and acquisition
* Photogrammetry	* Sustainable Development and Integrated resource Management	* Ground data collection and field verification
* Principles of Geoinformatics	* Environmental Analysis, Monitoring & Management	* RS data interpretation
* Global Positioning System (GPS) Technology and applications	* Remote Sensing & GIS technology & applications in thematic areas (elective subject) (one elective to be chosen) viz.	* Analysis and results
* Seminar presentation	- Advances in RS&GIS Technology - Agriculture & Soils - Forestry & Ecology - Geosciences - Water Resources - Urban Analysis - Marine Science	* Documentation and generation of report
	* Seminar Presentation	* Project seminar
		* Recommendation of Research area selected in Home country for one year project

## COURSE ORGANIZATION

CSSTEAP has arrangement with Indian Institute of Remote Sensing (IIRS) Dehra Dun, India as host institution for conducting educational and research programs related to RS&GIS (both long term



Students attending ISRS 2004 Symposium at Jaipur

PG course and Theme specific short term course every year). IIRS is the premier training and education institute dealing with RS, GIS and GPS technology in the region that has trained more than 5500 persons from India and abroad in the last three decades.

The academic program of the course is organized through class room lectures, tutorials, practical, multi-media self learning packages, field excursion, Seminar etc. State of the art software and hardware on Digital Image Processing (DIP) and GIS analysis are used for computer based practical exercises and for pilot project work. Lecture notes in the form of printed books and supplementary reading materials are distributed well in advance to the course participants to help easy assimilation of the subject in the class and for future reading. Soft-copy (in CD-ROM) of the lectures is also distributed. Academic performance of the course participants is evaluated through periodic class test, tutorials, seminar, written and practical examinations. English language class beyond office hours in the evening are also conducted during Module-I of the course for improving English communication and writing skill of the course participants.

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The faculty of the course constitutes scientists in different fields mainly drawn from IIRS and also from other centers of ISRO/DOS and Universities/various agencies from India. The core faculty and these experts have long and varied experience in the field of RS&GIS. International visiting faculty from several countries viz. Europe, USA, Australia, Canada, Japan etc. also conduct lectures, tutorials etc. on specialized topics in the course.

As part of the technical tour, the participants visit different centers of ISRO/DOS, Govt. of India, Andhra University, India and organizations of India concerned with RS&GIS Technology. The course participants get opportunity to attend National/International seminar/symposium on theme of RS & GIS technology and applications, held in India, during the course period. The course participants also get opportunity to experience Indian rich historic, cultural and social heritage during the educational visits to various cities of India. Students are accommodated in fully furnished with good living facilities international hostel located in IIRS campus.

## ACHIEVEMENTS IN PAST 10 YEARS

- Since last 10 years CSSTEAP through the host institute IIRS, Dehradun, had conducted 9 post graduate course on RS&GIS. This educational program had benefitted total 189 scientist/ engineers/researchers from 23 countries of Asia Pacific regions. The course

participants had carried out pilot project works on various aspects of natural resources inventory, monitoring and management & environmental protection etc, using RS and GIS technology during module-III of Phase I of the course. A summary of broad themes of pilot project work carried out by the students from various countries of Asia-Pacific region is presented in Table-I.

- 32 students representing 12 countries of Asia-Pacific region completed Phase-II home country research project work and had been awarded M.Tech degree by the Andhra University. Thesis works cover various research problems of natural resources inventory and management and use of RS&GIS and a summary is given in Table-II.

**Table- I: RS & GIS (CSSTEAP) P. G. course student's pilot project work themes**

S.No.	Trainees Country (No. of student)	Application Theme
1.	Azerbaijan (2)	Land use/Land cover change, Slope stability analysis
2.	Bangladesh (15)	Crop Inventory, EIA, Flood hazard, Geomorphology, Ground water targetting, Optimal land use planning, Urban facility mapping, Village amenities, Forest Growing stack assessment.
3.	Bhutan (4)	Landslide hazard zonation, SDSS, tourist Information system
4.	Cambodia (1)	Forest Cover Mapping
5.	China (5)	Alpine pasture analysis, LULC change, Resource utilization pattern analysis, Watershed management, Geomorphological studies.
6.	DPR Korea (10)	Geomorphology, Land use analysis, Watershed management, Water quality assessment, Snowmelt runoff, Site suitability analysis.
7.	Fiji (2)	Coastal landform and land use study, soil resource inventory
8.	India (22)	Biodiversity, Crop inventory, EIA, Earthquake, LULC, Water resource management, Watershed hydrology, Wildlife habitat, Urban sprawl, Hydrogeology
9.	Indonesia (9)	Agro ecological zonation, Crop water requirement, Coral reef, LULC analysis, Public utilities, Salt water intrusion, Water supply system, Soil erosion risk.
10.	Iran (1)	Flood Zonation.
11.	Kazakhstan (2)	Forest ecological assessment & Crop inventory
12.	Kyrgyzstan (7)	Crop inventory, route planning, soil erosion modeling, snowmelt runoff, Urban greenspace mapping, Wetland dynamics.
13.	Lao PDR (7)	Forest change detection, Land use planning, Urban sprawl and land use change
14.	Maldives (1)	Coastal Zone management.
15.	Mangolia (15)	Crop inventory, drought monitoring, forest fire & Desertification risk zonation, Geomorphology, soil spatial variability, Traffic network, wildlife habitat, Urban sprawl.

16.	Myanmar	(11)	Crop inventory, forest resource management, LULC change, Ocean colour remote sensing, Urban growth analysis.
17.	Nepal	(17)	Forest resource mapping, Landslide, LU Planning, site suitability analysis, soil erosion modeling, Urban Planning, Urban sprawl studies, Water balance, Irrigation water management
18.	Pakistan	(1)	Pasture development.
19.	Philippines	(7)	Climate change, Crop inventory, Flood hazard, forest cover mapping, Ocean SST, Wildlife habitat, Urban analysis.
20.	Srilanka	(17)	EIA, Forest Fire risk zonation, Ground water targeting, Landslide hazard, Site suitability analysis, Urban planning, Watershed hydrology, Soil & Water conservation, Irrigation water management
21.	Thailand	(8)	Climate change, Landslide hazard, Urban green space analysis, Flood hazard, Urban Planning
22.	Uzbekistan	(10)	Agrometeorology, Crop water requirement, LULC change, Land degradation, Saline soils, Snow-melt runoff, LU, Wildlife habitat, Coastal Zone management.
23.	Vietnam	(15)	Coastal zone management, Crop Inventory, EIA, flood hazard, Groundwater, Landslide, Land use mapping, site suitability analysis, Urban planning Land subsidence

(Total 189 students from 23 countries of Asia-Pacific Region)

Table II RS&GIS course Phase-II completed M. Tech. Project themes.

SI No	Country	No. of student Completed	Major themes
1.	Bangladesh	3	Characterization of Mountain Agro-ecosystem, Cropping system & yield modeling SDSS for planning village amenities
2.	Bhutan	1	Landslide hazard zonation
3.	India	8	Hydrological modeling, Watershed prioritization & soil conservation planning paleo environment of Godavari delta Ground Water re-charge zonation, MCE for agro-based industrial site suitability analysis, City Solid waste management Forest biodiversity prioritization Wetland environmental analysis.
4.	Indonesia	1	Coastal Ground water quality assessment
5.	Iran	1	Drought assessment & monitoring in Iran
6.	Kyrgyzstan	1	Soil erosion modeling
7.	Mongolia	2	Forest fire risk modeling & LU/LC change modeling
8.	Myanmar	4	Sustainable development planning in rainfed agriculture zone Rice & Sugarcane crop inventory Forest cover assessment Urban expansion & environment
9.	Nepal	5	Hydro-geology and environment, Urban environment quantification of forest growing stock watershed hydrological modeling LU/LC change & its impact on surface run-off.
10.	Sri Lanka	1	Optimal agricultural land use planning

11.	Thailand	1	Selection of potential sites for sanitary landfill
12.	Vietnam	4	Estimation of ground water recharge Urban expansion & environmental impact analysis Ground water targeting Forest cover mapping & monitoring

➤ To boost the research activity of the Centre, CSSTEAP supported four meritorious students of 8<sup>th</sup> RS&GIS course (2003-2004) to carry out Phase-II M. Tech research project work at CSSTEAP/IIRS at Dehradun, under the supervision of IIRS faculty. Fellowship in the form of living and project allowances is provided to the student. The research themes are-



Students with Mr. G. Madhavan Nair, Chairman GB, CSSTEAP at ISRO Hqrs., Bangalore

- Flood hazard zonation & optimal pattern planning for a flood prone area using satellite RS & GIS aided Multi-Criteria Evaluation (MCE) approach (by student from Bangladesh)
- RS & GIS approach for facility planning of Osh City, Kyrgyzstan (by student from Kyrgyzstan)
- To study the effect of interpretation keys on Digital land use/land cover mapping (by student from Azerbaijan)
- Study of irrigation water management and seasonal water balance in Parbati Reservoir area: a RS & GIS approach (by student from Nepal)

➤ In addition to long terms PG course on RS & GIS last 10 years CSSTEAP organized 7 theme specific short term courses and 1 Workshop on RS & GIS. These courses/workshop had benefitted 126 scientific/technical personnel from 24 countries of Asia-Pacific region and also benefitted 16 participants from 10 countries outside Asia-Pacific region.

The various themes covered are mentioned below:-

- Digital image processing (DIP) for environmental management: a remote sensing perspective (year -1999)
- RS & GIS Technology and applications in natural resources and environmental management (year-2000 & 2001)
- Geoinformatics for disaster management (year -2002 & 2004)
- Geoinformatics in biodiversity assessment ( year-2003)
- Geoinformatics for sustainable agriculture (year -2005)
- Satellite RS & GIS applications in agricultural meteorology (WMO sponsors International Workshop (year-2003)

➤ During this 10 year period, the centre had published 8 volumes of lecture notes in book form covering syllabus of PG course on RS&GIS. 6 Nos. of books are also published by the centre covering the themes of short term courses and workshop.