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...on a mission for transferring technology through education, research and capacity building

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Technological Trends in Geospatial Modelling

Geospatial technologies since its advent has grown from a mapping platform to modelling with the emphasis turned from descriptive query to prescriptive analysis of datasets. Over the decades, the geospatial data and applications have been 'democratized' and available through portals e.g., Bhuvan, India-WRIS, MOSDAC, etc. Hitherto, open source tools were obscure and difficult to use. The Free and Open Source software (FOSS) and web resources have opened vistas to execute geospatial modelling tasks at individual's desktop. The geospatial modelling caters to various aspects of real world phenomena which can be modelled either through deterministic, stochastic, empirical or semi-empirical, process or event based models depending upon the behaviour. The execution of these models at the conceptual and implementation level needs appropriate data design, unified modelling language, spatial operators, multi-scale databases, geo-computation models, spatial data mining, GIS implementing architectures, etc. Very recently, a string of new evolutionary terms e.g., enterprise GIS, interoperability, distributed computing, web-services, mobile GIS, grid computing and mash-ups have captured geospatial technology's imagination, as well as attention. 'Cloud computing' is the latest in this trajectory of terminology and computing advances that appears to be coalescing these seemingly disparate evolutionary perspectives. The proliferation of Location Based Services (LBS) has been one of the major trends since last decade. The Online Analytical Processing (OLAP) and Online Transaction Processing (OLTP) are few of the advanced developments in the field of advanced spatial databases. Agent-based Modelling and Simulation (ABMS) is a new approach to modelling systems comprising of interactive autonomous agents. ABMS promises to have far-reaching effects on the way that businesses use computers to support decision-making and researchers use electronic laboratories to do research. The content based image retrieval and geo-data implementing architectures are upcoming geospatial technological tools. In the years to come, the demand for near real-time information and real-time modelling using wireless sensor network or sensor web enablement (SWE) seems to increase and poses major challenges on interoperability. The distributed systems for loosely coupled information systems will emerge, and will become widely accepted and relied upon in the management and interpretation of geospatial information. Semantic technologies using ontologies will play an important role when it comes to publishing and making sense of geospatial data on to web, offering the opportunity to create rich machine-processable descriptions of data. The technological trends from two dimensional (2D) mapping to three dimensional (3D) and on to four dimensional (4D) visualisations is both user and technology-driven and will accelerate in the near future. Users are likely to increasingly expect more complex and realistic 3D City models, to enable effective planning and management and to optimise resources. This issue of CONTACT newsletter addresses some of the geospatial modelling applications carried out in diverse fields of resources management. It has always been the endeavour of geospatial scientists and students community at IIRS to propagate the technology for better management of resources, addressing climate-change to predictive modelling using geospatial datasets with far-reaching societal benefits. The IIRS User Interaction Meet (IUM) has given the platform to deliberate on geospatial technology trends, including the future directions of data creation, maintenance and management, legal and policy developments, skills requirements and training mechanisms, the role of the government institutions in geospatial data provision and management, and the role of industry and academia for their end-utilization by user communities.

- Dr. Y.V.N. Krishna Murthy

RESEARCH COMMUNICATIONS

Modelling Potential Distribution of Medicinal Plant, *Justicia adhatoda* L. in Lesser Himalayan foothills

Predicting potential geographic distribution of the species is important from ecological and conservation point of view. This paper reports the results of a study carried out in the Lesser Himalayan foothills in India-Doon Valley on potential distribution modelling for Malabar nut (*Justicia adhatoda* L.), a medicinal plant using *Maxent* model. *Maxent* is basically a species distribution model, which estimates target probability distribution by assessing the probability distribution of maximum entropy. The *Worldclim* bioclimatic variables, SRTM DEM derived slope, aspect, elevation, and the land use/land cover got through on-screen visual interpretation of IRS LISS-3 data were used in the *Maxent* model to work out the potential distribution of *J. adhatoda* in the 1950 km² study area. A total of 46 randomly selected species occurrence points from field (34 for model training and 12 for testing) were used in the process. Two statistical measures, *Area under ROC* (AUC) and *Jackknife* were used to assess the model success. The model had 91.20% success rate, which was statistically significant. The approach appeared to be promising in predicting the potential distribution of species and thus, can be a useful tool in species conservation planning and species distribution-climate change studies.

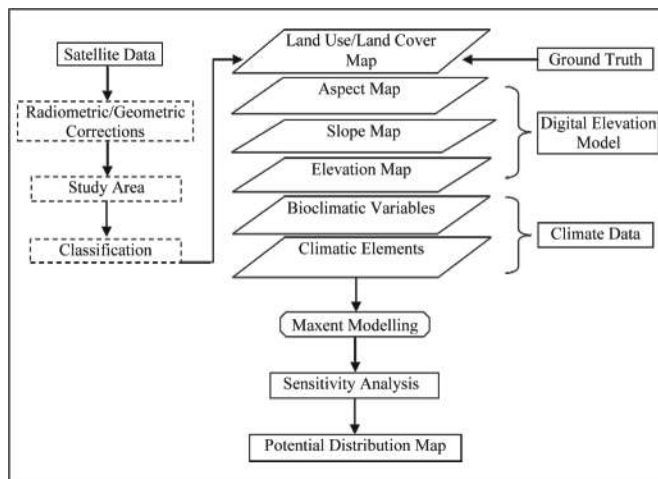


Fig. 2. Methodology.

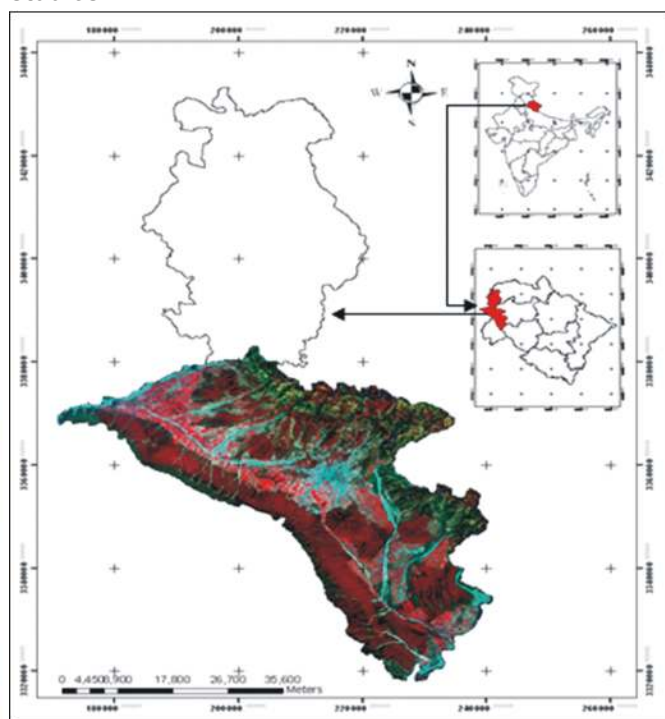


Fig. 1. The study area.

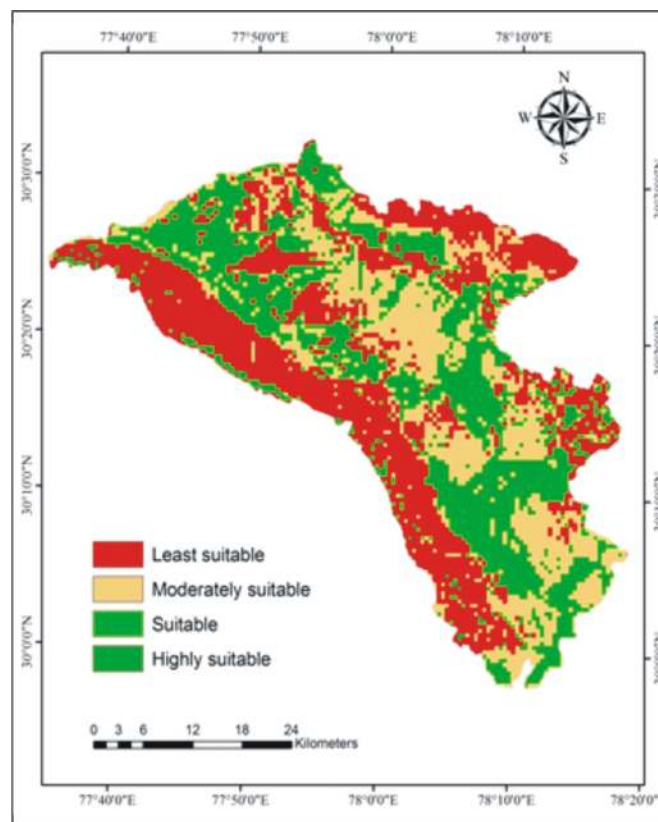


Fig. 3. Potential distribution of *J. Adhatoda*.

-Xue-Qing Yang, S.P.S. Kushwaha & Sameer Saran
(*Ecological Engineering*, 51, 83-87, 2013)

Geospatial Assessment of Climate Change Impact on Maize Productivity in Doon Valley, Uttarakhand

Climate change is posing a serious threat to food security in many parts of the world. Impact of climate change on productivity of major food crops (rice and wheat) is well understood at district level but studies on climate change impact on crop's productivity over high resolution grids are limited. There are many approaches to investigate possible regional impact of climate change on crop productivity, however, biophysical models processing in GIS environment has received wider acceptance during recent decades. The present study deals with climate change impact on crop productivity in Doon valley, Uttarakhand with the help of GIS based Environmental Policy Integrated climate model (GEPIC). The study area covers complex landscapes of the Himalayan region and the GEPIC model is capable of taking into account the variability in topography, soil and climatic conditions by incorporating high resolution datasets. The model can simulate crop yield as a combined effect of soil, weather and management practices. The study was conducted in a spatial domain (1 km*1 km grid) to simulate and evaluate the potential productivity of maize crops under baseline and three future climate change scenarios (2020, 2050 and 2080). The climatic data for the baseline period and future scenarios (HadCM3, A2a and B2a) were obtained from the *Worldclim* high resolution (1 km*1km) gridded dataset. Agricultural land use and other land cover data were derived through the classification of Resourcesat-2 LISS-III data. Model parameterization were done as per the local conditions. Calibration and validation of the model were done in selected sites with respect to ground measured yield data and daily weather data as input.

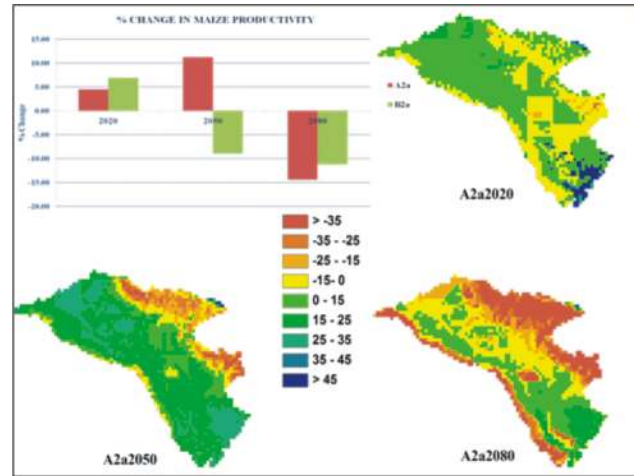


Fig. 1. Climate change impact on maize productivity under A2a scenario

The changes in maize productivity under A2a and B2a scenarios with respect to baseline period were analysed for maize crop. The results indicated that there would be an increase in maize productivity (5% and 7%, respectively, under A2a and B2a scenarios) during 2020 period. During 2050 period, there will be an increase (11%) in productivity under A2a scenario whereas reduction in productivity under B2a Scenario. Even though, there is a hike in temperature during both scenarios, the enrichment due to high atmospheric CO₂ concentration in A2a scenario will help to increase productivity. There is a decreasing trend in productivity during 2080 in both scenarios (-14% and -11%, respectively under A2a and B2a scenarios) due to increase in temperature that will lead to temperature stresses.

- N. R. Patel, Suresh Kumar & Akarsh

Landslide Assessment, Susceptibility Mapping and Debris Flow Modelling at Ukhimath, Uttarakhand

Landslide damage assessment using very high resolution satellite images provides valuable inputs that can be utilized at various stages of disaster management. Landslide modelling using numerical simulation methods at probable locations can further

facilitate proper forecasting and selection of protective measures to minimize the loss of life and property. In order to evaluate this, preparation of landslide inventory, damage assessment, hazard mapping and subsequently risk analysis were

attempted in and around Ukhimath area of Rudraprayag District, Uttarakhand, India. Numerical simulation using RAMMS (Rapid Mass Movement) was found to be extremely useful to model debris flow run-out with reference to a known catastrophic event that caused at least 47 deaths during 13-14 September 2012. Landslide inventory (present and past) were prepared by comparing pre and post event using Cartosat-1 PAN and GeoEye-1 multispectral imagery. Damage assessment was carried out with respect to settlement, road and agricultural land. Moreover, for susceptibility mapping, thematic layers viz., geology, geomorphology, slope, aspect, relative height, distance from lineament, faults and streams, soil erosion, soil depth, vegetation and land use/ land

cover were prepared mostly by visual interpretation of satellite images, aided by published maps, literature and field survey. Validation of susceptibility map using ROC statistics showed that 89% of the observed landslide falls in 10% of the predicted high susceptibility zone indicating good accuracy (Fig. 1). In order to model the targeted debris flow run-out zone; frictional characteristics viz., dry friction coefficient (μ), viscous turbulent coefficient (ξ), density of materials and terrain parameters such as height of the release area were provided from reference data and high resolution DEM. Simulated results included spatial variation of depositional height, velocity, pressure and momentum of debris flow in 3-dimension (Fig. 2). Modelled event can be further utilized to make simulations for other potential landslides of the area with similar geotechnical attributes.

- Ashrafur Islam, Rajeev Ranjan, Shovan Lal Chatterraj & P.K. Champati ray

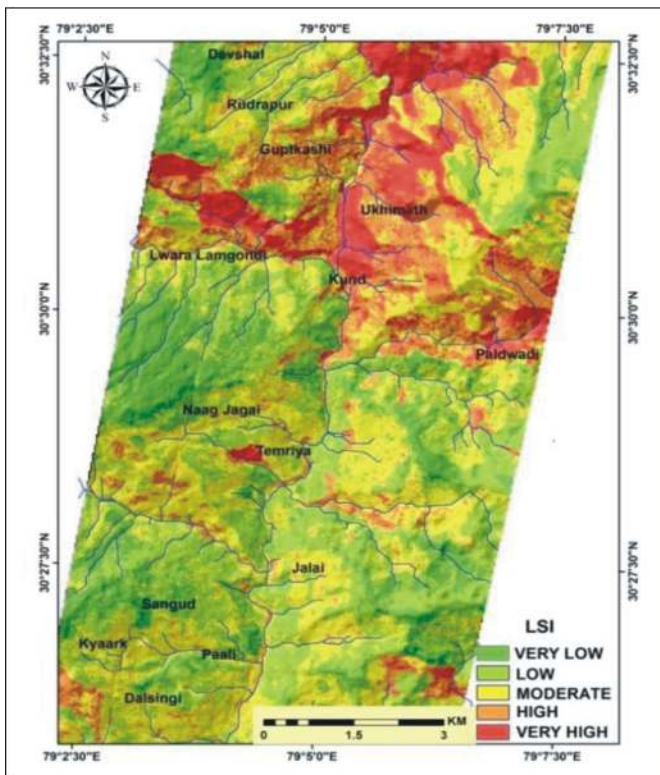


Fig. 1. Landslide susceptibility zones

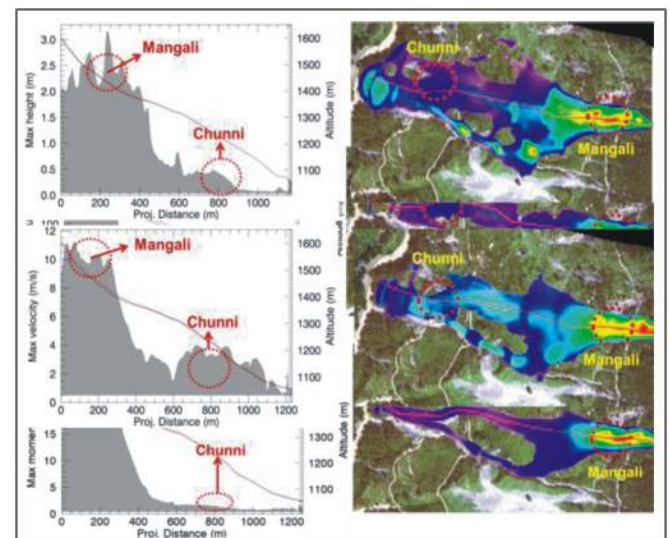


Fig. 2. Longitudinal profile of pressure, momentum, height, velocity (left) and their respective simulations (right)

Forest Fire Likelihood Modelling based on Causative and Anti-causative Factors

An attempt to develop a geospatial modelling approach for management of forest fire in Madumulai Wildlife sanctuary, Tamil Nadu, India was demonstrated by preparing a forest fire likelihood model. The model has been developed by integrating thematic input and knowledge-based approach for

predicting fire-sensitive initiation areas considering major causative and anti-causative factors (Fig. 1). The input parameters of the model i.e., causative factors (antler collection and poaching) and anti-causative factors (stationing of anti-poaching/fire camps) were evaluated using multi-criteria decision analysis which

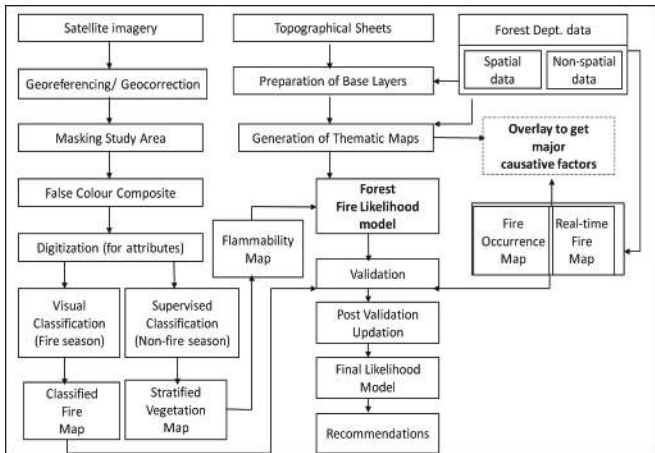


Fig. 1. Methodology

helped to generate different scenarios by using pairwise comparison matrix on an ordinal scale. The robustness of the fire likelihood model was proven by evaluating sensitivity analysis of all input parameters. Thus, the model outputs helped to predict and prevent a forest fire in an effective and scientific manner (Fig. 2) by proposing new fire towers (Fig. 3) and other preventive measures.

- Sanjay K. Srivastav & Sameer Saran

(Srivastava et al., *IJGIS*, 28(3), 427-454, 2013)

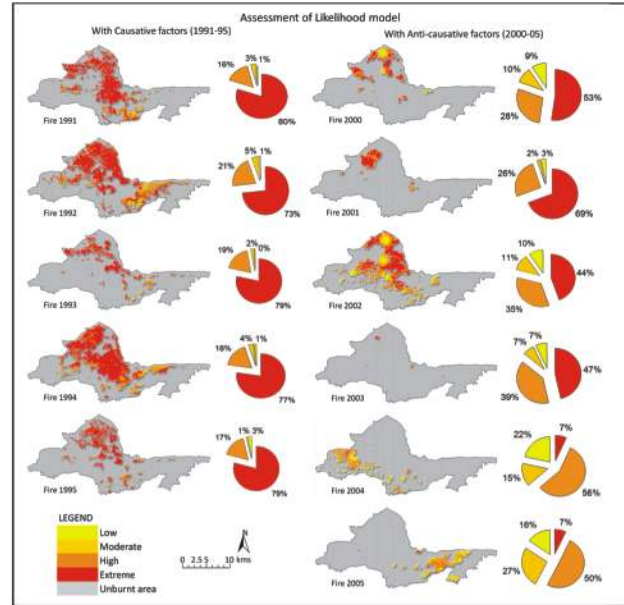


Fig. 2. Assessment of fire likelihood model using RS data

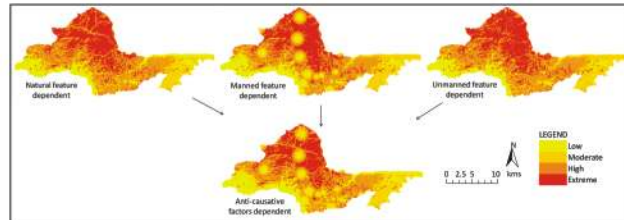


Fig. 3. Proposed fire towers

Retrieval of Ozone Profile from Simulated INSAT-3D Sounder Data

Principal Component Analysis (PCA) of ozone profiles over tropical region (45°S to 45°N) has been carried out with the aim of retrieving ozone profile from satellite data. The SeeBor dataset has been used and it was observed that first two Principal Components (PCs) explain 76% of the total

variance in the ozone profiles. Principal component of order 1 (PC1) is highly correlated with ozone at 10 hPa ($r = -0.95$) while principal component of order 2 (PC2) is highly correlated with ozone at 30 hPa ($r = -0.85$). First two PCs have been used for profile construction as they have been found to be

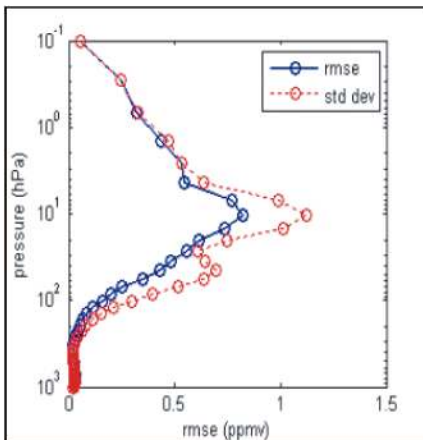


Fig. 1 RMSE of retrieved ozone profile along with standard deviation of testing dataset

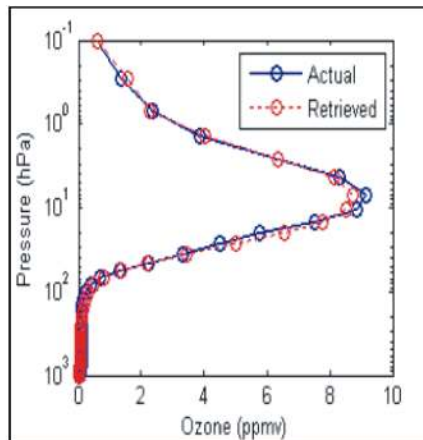


Fig. 2 An example of actual and retrieved ozone profile using testing dataset

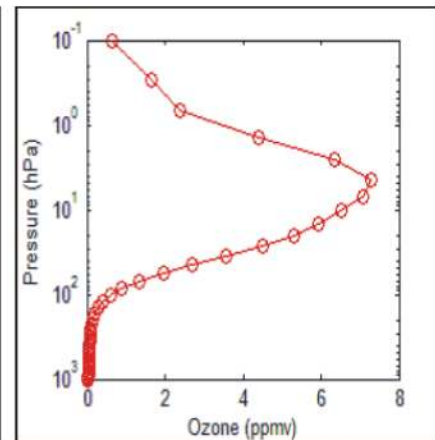


Fig. 3 Ozone Profile retrieved using INSAT 3D sounder data at 0823 UTC on 15th Oct 2013 at (4.98°N , 80.81°E)

statistically significant and stable. An algorithm has been proposed for retrieval of first two PCs and these two components were used to find the ozone profile. RMSE of ozone profile constructed using retrieved PCs varies from about 0.05 ppmv to 0.8 ppmv at various vertical levels. Fig. 1 gives RMSE of retrieval of ozone

profile along with standard deviation of data set. Fig. 2 shows an example of actual and retrieved ozone profile and fig. 3 shows an ozone profile retrieved using INSAT 3D data.

- Pooja Jindal

Low Cost Virtual 3D Mapping Using Mobile Phone Camera

Three-dimensional, photo-realistic experience of cities and towns, streets and sidewalks, and building exteriors and interiors would be a useful tool for planners and administrators. The methodology allows a low cost virtual first-person experience of the real world. The revolution in digital technology has geared up production of mobile phones with built-in digital cameras. As mobile phones are constantly carried, camera phones allow for capturing moments at any time. Cell phone manufacturers have recognized the need for optimization and are developing models with higher-resolution sensors

and more powerful lens systems. Mobile phone cameras which have 10 mega-pixels have appeared in the market. Such products give us the opportunity to take photographs of any object, at anytime instantaneously. Under these circumstances, one has to analytically study whether mobile phone cameras are capable to produce quality images of standards similar to consumer grade digital cameras in close-range photogrammetric applications. The full potential of the technique can be explored once its accuracy has been evaluated.

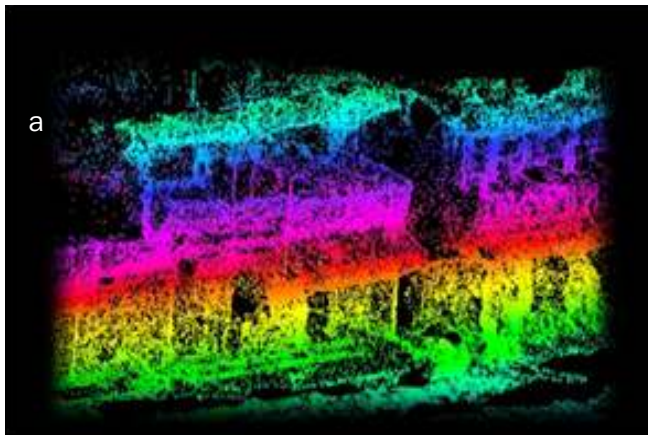


Fig.1. 3D Street view of road sections at New Cantontment Road Dehradun a) Point cloud b) Textured Model

The study demonstrates the use of a close-range digital photogrammetric methodology accessible to non-photogrammetrists and yet capable of yielding good quality 3D information at minimal cost and also provides comprehensive review of the principles and concepts relevant to data quality. To explore the possibility of generating the roadside view using point and shoot camera and mobile phone camera, several sections of street were photographed. Photography was carried out using Nokia N70, Nokia E72, Samsung Galaxy Note II and Nikon Coolpix N10 cameras. The photographs were collected with minimum shadow and proper light condition. Since, a large number of photographs need to be stitched together, thus sufficient overlap was maintained. The photographs were oriented in close-range photogrammetric software to generate a 3D view of the road section. The generated model exhibited holes and spikes due to problems in image matching. The errors are attributed to occlusions such as shadows, trees, moving vehicles and other textureless surfaces. These holes and spikes have to be manually edited to get a seamless model.

-Hina Pande, Poonam S. Tiwari & Shefali Agrawal

Performance Evaluation of an Irrigation Project using Geospatial Technology

In India, the irrigation potential has increased from 22.6 M ha in year 1951 to 102.77 M ha by year 2007 with a gross investment of more than 71,21,300 Million Rupees by the end of 10th five year plan. In spite of such a large investment and phenomenal growth of irrigation potential, the performance of several irrigation projects in India has not been encouraging. Major emphasis has been given recently on improving performance of irrigation projects which are currently running at 35 - 40% efficiency levels. Government of India has proposed activity of benchmarking of irrigation projects based on performance improvement in 11th five year plan and has given top priority to improving water use efficiency of all the projects in 12th five year plan. This makes the performance evaluation of all the irrigation projects a pre-requisite task. Whereas traditional analyses of irrigation performance, especially the concept of irrigation efficiency if considered alone, can mislead planners and policy makers. The traditional techniques of performance evaluation lacks in the spatial scale on which the performance is evaluated. Due to non-availability of detailed data and complexity in estimation at sub-project (branch/distributary/minor) level, the performance evaluation is traditionally being done at project level only. However, few attempts have been done to use remote sensing and GIS to measure performance at different hierarchical levels. An attempt is done in the present study to evaluate overall performance of Upper Wardha Irrigation project at sub-project level (Division level) using remote sensing data. The Upper Wardha project is a multipurpose

project developed on Wardha river, Maharashtra, which provides water for irrigation, drinking and for industrial use. To evaluate performance of this project, first detailed mapping and database preparation was done using multispectral-temporal LISS-III data (Resourcesat-1) and high resolution Cartosat-1 data as shown in Fig. 1.

Overall accuracy of 94.5% with KHAT statistics of 0.9266 was achieved through multi-level LULC classification techniques (supervised +knowledge based). The crop water requirement of the area irrigated by each canal (Fig. 2) has been estimated by method proposed by Ray and Dadhwal (2001) as shown in Fig. 3. Since the detailed field data (irrigation discharge) was not available for all the divisions (sub-project levels), hence the performance of six representative divisions was evaluated under five categories; 1) Water Use Performance, 2) Agricultural Performance, 3) Physical Performance, 4) Economic Performance and 5) Environmental Performance.

Performance indicators viz., Relative Water Supply (RWS), Relative Irrigation Supply (RIS), Depleted Fraction (DF), Irrigation Efficiency (IE), Irrigation Ratio (IR), Reliability, Crop Productivity, Yield per unit water supplied, Waterlogging, Soil Salinity and Trends of Groundwater table were

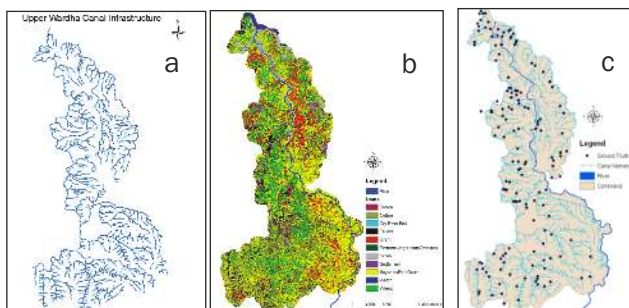


Fig.1.a) Canal infrastructure mapped using Cartosat-1 data, b) Land use mapping done using LISS-III data & c) location of ground truths

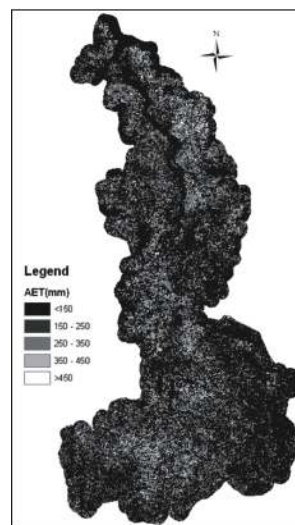


Fig. 2. Seasonal ETa map of Upper Wardha command

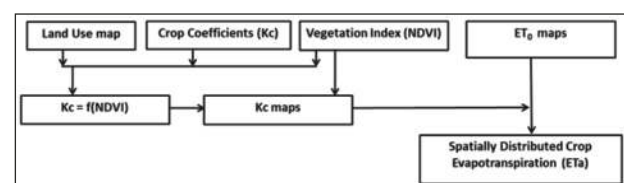


Fig. 3. Methodology to estimate spatially distributed crop water Requirement

used to analyse overall performance of the irrigation project. The results indicated that Divisions 1, 2 and 3 are under-performing divisions of the project with 27%, 41% and 45 % irrigation efficiency, respectively and high value of RIS. Low Irrigation Ratio values (i.e., 0.35, 0.33 and 0.40) in these divisions indicate that only small portion of designed irrigable area is getting the irrigation supply which is main reason for poor physical performance of these divisions. Low RIS value of Division 4 hints towards insufficient water supply in this division, which is also evident from low Delta values in this division. Even with insufficient supply, Division 4 has achieved 65% Irrigation Ratio, with almost same level of productivity of all crops. These results help us conclude that Division 4 is the best performing division of the project whereas Division 1 and Division 2 are the underperforming divisions

of the project. The waterlogging, soil salinity and trends in groundwater table are studied using RS, GIS and ground based observations, no environmental degradation problem exists in the command area of the Upper Wardha Project. The overall positive impact of this project on agriculture system of the area is evident in terms of 60 to 70% additional productivity in command area compared to non-command area. The performance of Upper Wardha Project can further be increased/improved if the water losses in Divisions 1, 2 and 3 are stopped and Irrigation Ratio of these divisions are increased. The major advantage of this study is that it can point out exact component/division/canal, where performance needs to be improved.

- **Bhaskar R. Nikam & S.P. Aggarwal**

Airborne LiDAR for Modelling Urban Areas

LiDAR data in combination with aerial images has many applications in remote sensing and surveying. Most widely publicised application is 3D modelling of earth features i.e. buildings, trees, digital terrain model etc. In this work, automated extraction of manmade features especially, buildings were carried out from Airborne LiDAR data. In most of the studies dealing with urban object extraction, extraction of single object class with one building or a small group of buildings is carried out but in the present study, entire dataset has been analysed. The datasets of two regions i.e., Vaihingen near Stuttgart, Germany and Toronto, Canada (Table 1) were analysed and 3D models of the buildings were reconstructed. A three-step process was applied to filter LiDAR data into three broad feature classes mainly ground, vegetation and building points (Fig. 1) using Terra

Table 1: Specifications of the Air Borne LiDAR data used

Study area	Airborne LiDAR Data		Aerial Images	
	Point density	No. of Strips	Ground Resolution	No. of images
Vaihingen	4 pts/sq.m	10	8 cm	20
Toronto	6 pts/sq.m	3	15 cm	13

Source: Downtown Toronto data set by Optech inc. First Base Solutions Inc., GeolCT Lab at York University, and ISPRS WG III/4. Vaihingen data set : German Society for Photogrammetry, Remote Sensing and Geoinformation (DGPF)[Cramer, 2010]. and ISPRS WG III/4 "

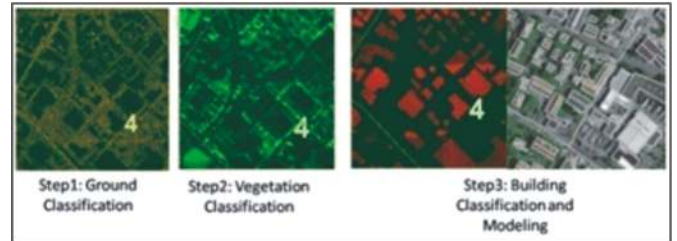


Fig 1: Classification results at different steps

Solid software for LiDAR data processing. It has been observed that a nominal manual editing is required at every step to remove the errors and improve the results of building extraction. The completeness of classification was ensured at each step. The 3D models of the buildings were rendered with the help of the natural color mosaic of the aerial photographs of the study area.

The LiDAR data set of Toronto Canada was also classified and 3D model of the study area was reconstructed as per the procedure described above. The skyline and 3D model of Toronto (Fig. 2 & 3) clearly showed that the major building type are the high-rise buildings with large size of structures. At the time of ground classification, this characteristic was considered by increasing maximum building size accordingly. Complexity and variety of structures



Fig. 2. Rendered 3D model, Toronto, Canada

were comparatively more in this data set as compared to Vaihengen data set. Hence, it was found that classification and rendering of 3D model was a bit tedious and required comparatively more manual editing.

Heights of selected buildings representing the variation in building heights were measured over the



Fig. 3. The Skyline of Toronto, Canada

full data sets using photogrammetric 3D measurements and extracted building heights from LiDAR. The accuracy were calculated using various statistical parameters (Table 2) including cumulative relative error (CRE). It has been found that accuracy of LiDAR derived building points are at sub-meter level and CRE is within 1% for both the data sets. Airborne LiDAR takes approximately 12 hours for data acquisition and 24 hours for data processing to generate DEM of 1000 sq. km area.

Table 2: Accuracy Assessment of LiDAR derived model against Photogrammetric methods

	Vaihengen	Toronto
Average dz	-0.089	-0.117
Minimum dz	-0.773	-1.778
Maximum dz	1.301	1.04
Average magnitude	0.327	0.856
Root mean square	0.483	0.969
Std deviation	0.495	1.028
CRE	0.11%	1%

- Kshama Gupta & Ashutosh Bhardwaj

आपदा प्रबंधन में सुदूर संवेदन और भू-सूचना प्रणाली का महत्व

तेजी से बढ़ती हुई आबादी और जनसंख्या घनत्व ने प्राकृतिक आपदाओं की आवृत्ति और गंभीरता दोनों में वृद्धि की है। भूकम्प, भूस्खलन, बाढ़, दावानल, सुनामी, ज्वालामुखीय विस्फोट, चक्रवात आदि प्राकृतिक आपदाओं से हर वर्ष मानवसमाज को जान-माल की बहुत हानि होती है। जहां यह एक स्थापित तथ्य है कि प्रकृति पर मनुष्य का कोई वश नहीं है, वहीं इस बात से भी इनकार नहीं किया जा सकता कि इस परिप्रेक्ष्य में समुचित तैयारी एवं प्रबंधन के माध्यम से इन आपदाओं से बचा जा सकता है अथवा इनका प्रभाव कुछ कम अवश्य किया जा सकता है। इस प्रबंधन व्यवस्था को हम आपदा प्रबंधन के नाम से जानते हैं। यद्यपि आपदा प्रबंधन से इन विपदाओं को न तो टाला जा सकता है और न ही इनके खतरों को कम ही किया जा सकता है तथापि अध्ययन एवं पूर्वानुमान आपदा प्रबंधन के अभिन्न अंग है। कुछ समय पहले तक आपदा प्रबंधन प्रतिक्रियात्मक और राहत केन्द्रित था किन्तु अब इसकी जगह एकीकृत एवं समग्र दृष्टिकोण ने ले

ली है, जिसमें सम्पूर्ण ध्यान रोकथाम, शमन और तैयारियों सम्बन्धी व्यवस्था पर दिया जा रहा है ताकि जीवन, आजीविका एवं सम्पत्ति को कम से कम नुकसान हो।

आपदा प्रबंधन में सुदूर संवेदन और भू सूचना प्रणाली विशेषकर आपदा मानचित्रण का योगदान अविश्वसनीय रूप से उपयोगी एवं प्रभावकारी सिद्ध हुआ है। अंतरिक्ष अनुप्रयोगों से जुड़ी इन प्रौद्योगिकियों में सभी देशों की काफी रुचि रही है और इसी कारण इस क्षेत्र में शोध को बढ़ावा मिलने से इसमें निरंतर प्रगति हो रही है। सुदूर संवेदन वस्तुतः ऐसी उन्नत विधा है जिसके माध्यम से मानव निर्मित उपग्रहों द्वारा आकाश से बिना किसी भौतिक सम्पर्क के पृथ्वी के संसाधनों एवं स्थिति का अध्ययन वैज्ञानिक विधि से किया जाता है। सुदूर संवेदन के माध्यम से जुटाए गए आंकड़े/उपग्रह से ली गई तस्वीरें प्राकृतिक आपदाओं से हुए नुकसान की गंभीरता का आकलन करने एवं तदनुसार

राहत एवं बचाव कार्यों के नियोजन में बहुत उपयोगी सिद्ध होते हैं। इस सक्षम प्रौद्योगिकी से हमें प्रबंधन सम्बन्धी निर्णय लेने हेतु महत्वपूर्ण जानकारी तुरंत मिलती है। पूर्णतः उजड़ चुके क्षेत्रों में चलाए जाने वाले राहत कार्यों में भू सूचना प्रणाली एवं सार्वत्रिक स्थान निर्धारण प्रणाली (ग्लोबल पोजीशनिंग सिस्टम) का संयोजन बहुत उपयोगी और लाभकारी सिद्ध हुआ है।

आपदा विशेषज्ञों का प्रमुख उद्देश्य होता है आपदा प्रबंधन में स्थिति पर नजर रखना, घटित आपदा के यथासम्भव सटीक अनुरूपण की जटिल प्रक्रिया को पूरा करते हुए पूर्वानुमान के बेहतर मॉडल तैयार करना, यथोचित आकस्मिकता योजना से सम्बन्धित सुझाव देना तथा स्थानिक डेटाबेस तैयार करना। भू-सूचना प्रणाली विभिन्न प्रकार के स्थानिक आंकड़ों को गैर स्थानिक एवं विशेष आंकड़ों से जोड़कर आपदा प्रबंधन के विभिन्न चरणों में उनका आवश्यक जानकारी के रूप में उपयोग करने के सुविधा एवं क्षमता प्रदान करती है। आपदा निवारण के चरण में भू-सूचना प्रणाली का प्रयोग विशाल आंकड़ों के प्रबंधन में किया जाता है। जो खतरों के मूल्यांकन में काम आता है। आपदा से निपटने की तैयारियों के चरण में भू-सूचना प्रणाली की, निकासी मार्गों

को चिन्हित करने में, आपातकालीन कार्यों के संचालन हेतु बनाए जाने वाले केन्द्रों का खाका तैयार करने में तथा आपदा चेतावनी प्रणाली निर्माण हेतु उपग्रह से प्राप्त डेटा को अन्य प्रासंगिक/सम्बन्ध डेटा के साथ एकीकरण में महत्वपूर्ण भूमिका होती है। आपदा पुनर्वास के चरण में भू सूचना प्रणाली तथा सार्वत्रिक स्थान निर्धारण प्रणाली (ग्लोबल पोजीशनिंग सिस्टम) का प्रयोग तबाही व आपदा के बाद जनगणना सम्बन्धी जानकारी प्राप्त एवं व्यवस्थित करने में और पुनर्निर्माण के लिए स्थानों के मूल्यांकन सम्बन्धों कार्यों के लिए किया जाता है।

इस तरह सुदूर संवेदन और भू-सूचना प्रणाली जैसी प्रौद्योगिकियों ने हमें प्राकृतिक आपदाओं से मुकाबला करने का पर्याप्त सामर्थ्य दिया है। इसमें कोई दोराय नहीं है कि मनुष्य वैज्ञानिक उन्नति के पथ पर निरंतर गतिमान है और उसके पास अपने बचाव हेतु तमाम वैज्ञानिक साधन भी हैं, किन्तु प्रकृति से उसका सरोकार भी उसी अनुपात में कम होता जा रहा है जो कुछ हद तक हमारे प्रति प्रकृति की नाराजगी का कारण भी है। भले ही प्राकृतिक आपदाओं से मनुष्य मुक्ति नहीं पा सकता है किन्तु प्रकृति के साथ समन्वय निश्चित तौर पर एक हद तक अभय दान दे सकता है।

— राजीव त्रिपाठी

COURSE REPORTS

Postgraduate Diploma in Geo-Information Science and Earth Observation (Specialization: Geoinformatics)

The 11th Postgraduate (PG) Diploma course (2012-2013) in Geo-Information Science and Earth Observation (Specialisation in Geoinformatics) offered within the framework of IIRS-ITC Joint Education Programme was completed on 19th July 2013. The course objectives were to develop a critical understanding of appropriate tools, exposure to new methods and techniques, gaining competence in developing tools for the acquisition, processing, transformation, analysis, modelling, storage and presentation of spatial data; using geo-information in identifying and responding to development problems and in drafting development policies. The course was divided in 14 modules (each module of three-weeks duration), 10 modules of teaching and 4 modules of independent pilot project by each participant.

Among the 15 participant, who (obtained their diploma on the graduation day) 9 were from India, 1 from Algeria, 1 from Ethiopia and 4 from Venezuela. The participants worked on different topics related to Geoinformatics, such as geospatial data infrastructure, map generalisation, Geo-web services using open source tools and technologies, GIS based studies for urban titling, real estate valuation, vehicle routing, health care, modelling urban growth, hydrology and urban land use analysis, image



processing for illicit crop mapping and deforestation due to mineral mining, and aerosol radiative forcing under their pilot projects. The pilot projects were evaluated by an examination committee consisting of members from IIRS and ITC, the Netherlands. Dr. Nicholas Hamm, Assistant Professor, ITC, visited IIRS as a member of the examination committee and attended the valedictory function of the course. Apart from IIRS faculties, invited faculties from different organisations have contributed in this course and shared their knowledge and experience with the students. These organizations were DST, New Delhi; SOI, Dehradun; IIT, Roorkee; GSDL, Delhi; BIT, Ranchi and ADRIN, Hyderabad. Thanks to all invited faculties, and their Heads of organisations and colleagues of IIRS and ITC for their full cooperation and support in conducting the course successfully.

- S.K. Srivastav

Postgraduate Diploma in Geo-Information Science & Earth Observation (Specialization: Natural Hazards and Disaster Risk Management)

The 12th PG Diploma course in Earth Observation and Geo-Information Science with specialization in Natural Hazards and Disaster Risk Management (NHDRM) has commenced on 24th September 2012 and concluded on 19th July 2013. The PG Diploma course is modular in structure with 10 course work modules and 4 project modules (each module is of three weeks duration) spread over 10 months. The initial three modules are the core modules on Principles of Remote Sensing, Principles of GIS and Principles of Databases and Mathematics, and Programming in Geoinformatics for Disaster management. After the completion of core module, two application modules namely, (i) Natural Hazards and Disaster Management: Concepts and overview and Module, and (ii) Image Interpretation and Analysis for Natural Hazards Assessment were conducted. Thereafter, the students pursued the module under three specializations: Environmental, Hydro-Meteorological, and Geological Hazards. The project module has followed after the core module, where the students chose challenging topics namely, Hydrological Modelling for Flood Generation in Brahmaputra Basin; Flood Damage Assessment and Vulnerability Analysis in Parts of Mahanadi Basin,



India; Landslide Risk Mapping using Analytic Hierarchy Process (AHP), Landslide Risk Assessment Including Rainfall Threshold Analysis and Debris Flow Simulation of Ukhimath Area, Forest Vulnerability Modelling in Sirmaur District of Himachal Pradesh, and Identification and Mapping Spread of Invasive Species. The project work was evaluated by a board of examiners consisting of Dr. S.K. Saha, Dean (Academics), Dr. Nicholas Hamm, faculty from ITC, project supervisors from IIRS, and Dr. P.K. Champati ray, Course Director. The course was concluded on 19th July 2013 with a valedictory function wherein all successful candidates were presented Diploma certificate by ITC/UoT faculty, Dr. Nicholas Hamm and Dr. Y.V. N. Krishna Murthy, Director, IIRS.

-P.K. Champati ray

Map the Neighbourhood in Uttarakhand (MANU): Capacity Building for Disaster Damage Assessment through Crowd-sourcing

The Uttarakhand State witnessed a large-scale devastation in June 2013 due to flash floods accompanied with glacial lake outburst flood and landslides. The Department of Science and Technology (DST), Govt. of India took an initiative towards damage assessment mapping through crowd-sourcing useful to plan the restoration activities in Uttarakhand. It envisages field data collection in 'Char-Dham' and 'Pindar Valley' area by the students / teachers community using state-of-art tools and technologies and integration of field data with ISRO's Bhuvan geoportal. The capacity building and development of appropriate tools under this initiative has been carried out jointly by Indian Institute of Remote Sensing (IIRS), National Remote Sensing

Centre (NRSC) and Survey of India (SOI). A total of 130 students and 19 teachers / scientists from HNB Garhwal University (HNBGU), Kumaun University (KU) and Wadia Institute of Himalayan Geology (WIHG) were trained in two batches (27th-29th September 2013 and 3rd-5th October 2013) at IIRS, Dehradun, to use Android-based mobile application with customized field inventory forms, GAGAN SBAS receiver, ISRO's Bhuvan geoportal and other field instruments for field data collection in the disaster-affected areas. The students with the support of their teachers / mentors started the process of field data collection within a week after the training courses were over. The mobile application uses in-built GPS and mobile camera to capture the ground



Participants and faculty of 1st batch (27-29 September 2013) and 2nd batch (3-5 October 2013) of MANU training programme.

coordinates and field photographs which along with filled-in field inventory forms are transmitted in near-real-time to Bhuvan geoportal using GPRS. The online mapping application on Bhuvan is also developed and is made available to the community in the region. The field data are being collected on five major categories: (1) Damage to buildings and infrastructure, (2) Landslides, (3) River Bank erosion, (4) Damage to land cover and natural resources, and (5) Other points of interest. So far, about 15,000 points on above aspects have been uploaded to the Bhuvan geoportal by field observation parties from HNBGU, KU and WIHG. The process of field data

collection is likely to be completed by February, 2014. The field data collected by the local people of this region when collated with other existing / ancillary data and information will be vital in understanding the patterns of damage and planning restoration activities in Uttarakhand. Further, such an approach of collaborative mapping towards acquiring actual field information in near-real-time supported with well-planned and customised capacity building programmes has high application potential.

**- S. K. Srivastav & Team IIRS,
Team NRSC & Team SOI**

NNRMS-ISRO Sponsored Certificate Course

Fifty three university faculties/ teachers from seventeen states joined the 20th National Natural Resource Management System (NNRMS) training programme of 8 weeks duration from 6th May to 28th June 2013. The training program was conducted in eight thematic disciplines namely (i) GIS Technology and Advances (ii) RS and GIS in Water Resources (iii) Forestry and Ecology (iv) Urban and Regional Planning (v) Cartography and Mapping (vi) Geosciences (vii) Soils and Land use Planning and (viii) Meteorology and Atmospheric Sciences. The course has been structured into four modules with each module of two weeks duration. First two modules were devoted on geospatial technology dealing with Photogrammetry & Remote Sensing and Basics of GIS and last two modules focussed on thematic disciplines conducted by eight departments. Total 60 lectures, 66 hours practical



and 3 field days visit were conducted during the first three modules in six-weeks. The last module was focussed on to conceptualize pilot project by the participants and to execute and built their confidence in using geospatial technologies in their thematic area. Course participants also had a unique opportunity to hear Dr. K. Kasturirangan, Former Chairman, ISRO and Member, Planning Commission (Science), Govt. of India.

- Suresh Kumar

Remote Sensing-An Overview for Decision Makers

The special course on 'Remote Sensing-An Overview for Decision Makers' is a very prestigious course of IIRS and was organised during 18th-21th June 2013. This course is exclusively designed for senior decision makers from government and private sectors. The main objective of the course was to provide broad overview of the recent trends of geospatial technology (satellite remote sensing, GIS, GPS) and its application in various developmental projects related to natural resources management, disaster management support, infrastructural projects and environmental monitoring. This year the course received overwhelming response where 27 participants from various organisations: Central water commission, Uttarakhand University of Horticulture & Forestry, Indian Air Force, Survey of India, Dr. Y.S. Parmar University of Horticulture & Forestry, Botanical Survey of India, Soil & Water Conservation, Nagaland, Coal India Ltd., Water Resources Development Organisation, Bangalore, ISTRAC, ISRO, Fishery Survey of India, Mumbai, IRS & SSS PMO, Bangalore, DIPAC, New Delhi, Indian Army, Dehradun, Kolkata Port Trust, FRI, and PWD, Uttarakhand attended the course. The course was designed keeping in view the background and interest of candidates. Lectures were delivered on Overview of Remote Sensing, GIS, Operational Remote Sensing application in Natural Resources Management, Geological applications including



disaster management support, RS applications in Agriculture, High resolution RS data applications in urban and regional planning, RS applications in Forestry and Ecology, Water resources applications including hydro-meteorological hazards, Overview of Bhuvan and open data/software sources, 3-D features extraction and visualization, and Space based information support and Decentralized Planning for Rural Development. In addition to lecture, there were several interactive sessions on wide-ranging topics namely, RS & GIS Applications in Agriculture & Soil, Forestry & Ecology, Mining & Environment, Marine & Atmosphere Sciences, Large Scale mapping: NUIS, and Water Resources/Flood. A field visit to Mussoorie was also organised to demonstrate features as observed on satellite image and as they exist in the field.

- P.K. Champati ray

Summer School on Usefulness of Remote Sensing & GIS for Environmental Studies

With an aim to create awareness about remote sensing technology and its use for the study of planet earth and its environment among the school students, IIRS organized a summer school on 'Usefulness of Remote Sensing and GIS for Environmental Studies' during 24th-28th June 2013. The focus of the course was on Principles of Remote Sensing and Geographic Information System (GIS) and its applications for environmental studies. 14 students of 9th to 12th standard from seven different



schools of Dehradun participated in the course. Broad subject covered in the lectures were on

basics of remote sensing, basics of GIS, visual interpretation, olive ridely turtle migration, climate change, cyclone and coastal processes. Practical demonstrations were also arranged to familiarize them with satellite images and GPS technique. A guest speaker from Wildlife Institute of India, Dehradun also delivered a lecture in the course. Students have also

visited various departments of IIRS to get an exposure on the use of remote sensing in various fields. Videos on Indian Space Programme were also shown to the students. In the feedback, students appreciated this unique initiative of IIRS/ISRO for school students.

- D. Mitra

Special Course on Applications of Remote Sensing and GIS in Water Resources Management

A two weeks special course on 'Application of Remote Sensing and GIS in Water Resources Management' was organized from 8th-19th July 2013 for officials from Govind Ballabh Pant University of Agriculture & Technology (GBPUA&T), Pantnagar, Uttarakhand. Total 9 officers joined this course. The training programme was designed such that participants should acquire working knowledge of remote sensing and GIS technologies and their application in fields of water resources assessment, agricultural crop mapping, hydrological modelling of watershed, etc. The detailed topics covered were Fundamentals of Remote Sensing; Visual and Digital Image Processing; Overview of GIS; Introduction to GPS/GNSS; GPS/GNSS Survey and Accuracy Issues; Database Creation; Web-GIS, Online Resources and Open Source GIS Tools, Quantification of Hydrological Elements Using Remote Sensing Data; DEM Generation and its Application in Water Resources; Application of Remote Sensing in Hydrological Modelling of Watershed; Irrigation Water Management and Flood Mapping using Remote Sensing. Hands-on exercise on each of the above mentioned topics were



conducted in supervised practical mode. One day field-excursion to Asan Watershed was carried out to demonstrate the use of DGPS in ground truth collection and field Survey.

A feedback was collected from all the course participants regarding all the aspects of course organization, the course participants have ranked this course as 'Excellent'.

- Bhaskar R. Nikam, Vaibhav Garg & S. P. Aggarwal

Special Course on Geospatial Technologies (RS & GIS) for Watershed Management

A special course on 'Geospatial Technologies for Watershed Management' of 2 weeks duration for the scientists of various regional centers of Central Soil & Water Conservation Research & Training Institute (CSWCRTI), Dehradun was conducted in Agriculture & Soils Department from 16th to 27th December 2013. Total 16 participants joined the course. During the course, 22 no. of lectures and 10 sessions of practical were conducted while focusing



on natural resource inventory, watershed characterization, soil erosion modelling and land use planning using high resolution remote sensing data and GIS. At the end of first week, one-day field work was organized in a sub-watershed near Bhatta Village on Dehradun-Mussorie road to familiarize participants with high-resolution satellite remote sensing data, to

identify and map land surface features. Participants were exposed Arc-GIS, ERDAS and Open Source ILWIS RS/GIS software and use of Bhuvan web services for obtaining spatial information available on ISRO Bhuvan portal.

- Suresh Kumar

Special Course on Principles & Applications of Radar Remote Sensing with Emphasis on RISAT-1 Data Utilization

A special course on 'Principles and Applications of Radar Remote Sensing with Emphasis on RISAT-1 Data Utilization under RISAT-UP Programme was conducted during 2nd to 13th September 2013 at IIRS, Dehradun. Previously, IIRS has conducted five courses under JEP-Microwave Programme; one course under CSSTEAP (UN) Programme; and two courses under RISAT-UP Programme (including the present course). Under these courses, the IIRS has trained more than 200 professionals from ISRO, State Remote Sensing Centres, other Govt. of India Organizations and Academic Institutions. The course was designed for two-week duration. During the 1st week, the topics e.g., fundamentals of Radar remote sensing, SAR data processing & analysis, and advanced techniques like Interferometric & Polarimetric SAR (InSAR & PoISAR) were covered. During the second week, the applications of Radar remote sensing in different thematic areas like Geosciences & Geohazards, Soil & Agriculture, Water Resources, Forestry & Coastal applications were covered. The course began with the inaugural lecture on 'Indian EO Programmes & Applications' by Dr. Y.V.N. Krishna Murthy, Director, IIRS & Director, CSSTEAP (UN), Dehradun followed by a special invited lecture on RISAT-1 Mission, its Potential & Future Microwave Programmes of ISRO by Dr. Tapan Mishra, Dy. Director, Microwave Remote Sensor Area, Space Applications Centre (SAC), Ahmedabad. Other special lectures included Relevance of Radar Remote Sensing for EO applications by Dr. S.K.Saha, Dean (Academics), IIRS, Dehradun, RISAT-1 and Chandrayaan-1 MiniSAR data processing techniques, Operational use of SAR data towards food security and



potential of RISAT-1 data, and Applications of microwave remote sensing in earth observation: NRSC experience by the senior scientists and microwave remote sensing experts from SAC, Ahmedabad and NRSC, Hyderabad. The topics like lunar science & planetary studies using SAR data and differential interferometric SAR for land displacement monitoring were also covered in the course. Demonstrations on (i) Principles and usage of corner reflectors for geocoding of SAR images, (ii) DGPS survey for ground control point collection, (iii) Functionalities and resources in Bhuvan, and (iv) Some multimedia on RADAR imaging modes, operations and applications were also arranged. One-day field excursion was also arranged for the demonstration of field-based surface roughness and soil moisture measurements. In this course, 36 scientists and academicians from different parts of the country including 12 from ISRO/DOS and State Remote Sensing Centres, 15 from other Central & State Govt. Organizations, and 7 from the academic institutions were trained.

- R. S. Chatterjee & Mamta Kumari

Special Course on Geoinformatics for Meteorology and Climatology Applications

In view of the TROPMET-2012 recommendation for the capacity building of meteorologists for Geoinformatics applications, Indian Institute of Remote Sensing has taken up the initiative to organize a two week special training course on 'Geoinformatics for Meteorology and Climatology Applications' during 18th-29th November 2013 under the aegis of Indian Meteorological Society Dehradun Chapter (IMS-DC). The major objectives of the course was to impart training on geo-informatics as a technology for integrating meteorology/climatology research and applications for geo-scientific community. Around 140 applications from different organizations e.g., IITs, IITM, ISRO, IMD, NESAC, C-DAC, BIT, ARIES, Indian Navy, Indian Air Force and various universities and colleges of India were received. Among these applications, 40 candidates were selected and finally, 38 participants from diverse background like meteorology, GIS, Agrometeorology, Atmospheric Science, CSE, Electronic, Environmental Science etc. joined the course. The course had focus on the basics of GIS, meteorology, GIS for weather and climate modeling, retrieval of meteorological and agro-meteorological parameters, GIS applications in cyclone and tsunami hazard assessment, decision support system for flood early warning, numerical modelling, ocean-atmosphere interaction, etc. There were a total of 22 lectures and 7 practical demonstrations. Five guest lecturers from SAC, IMD, IITM and NCMR-WF also delivered lectures in the course. Course participants had been provided a hard copy of lecture notes and a CD containing lecture PPTs & few open source GIS software. One day field visit to Mussoorie was also organized for the participants to expose them to GPS technique. For a small project work, participants were divided into eight groups and each



group had four or five members. Each group made a presentation depending on their background, research area and the content of the present course.

As part of the training, a panel discussion on 'Integration and use of Geoinformatics: challenges and future plans' in the discipline of meteorology was also arranged on the last day of the course i.e., 29th November 2013. The discussion panellists were Dr. Ajit Tyagi, Koteswaram Professor, MoES; Dr. Y.V.N. Krishna Murthy, Outstanding Scientist & Director, IIRS & CSSTEAP; Dr. P.K. Pal, Outstanding Scientist & GD, AOSG/SAC; and Dr. S.C. Kar, Scientist-G, NCMRWF. The panel was chaired by Dr. Ajit Tyagi, who appreciated and thanked IIRS for conducting such a unique programme. The panel suggested the participants to continue their project work with the help of IIRS faculty. The participants were also informed about various funding sources and data sources. A formal feedback was taken at the end of the course wherein the participants appreciated the overall structure of the course and suggested to give more time for practical demonstration.

- Pooja Jindal, D. Mitra & P.L.N. Raju

Special Course on RS & GIS Applications for Hydrological and Hydrodynamic Studies for CWC Officials

A special course was organised during 16th-27th September 2013 for the officers of Central Water Commission (CWC) New Delhi on 'Remote Sensing and GIS Applications for Hydrological and Hydrodynamics Studies'. The lectures and practical

material were provided in both soft and hard copy book volumes. The first week of course was devoted to fundamentals of remote sensing, image interpretation, digital image processing and image enhancements, image classification, image fusion, basics of

photogrammetry, DEM and ortho-image, remote sensing applications in water resources, map projections and coordinate systems, fundamentals of GPS and GNSS, basics of GIS, data formats and structures, spatial data analysis, Web-GIS, online resources and open source GIS tools. During second week (23rd-27th September 2013), the topics related to water resources and hydrological modelling such as spectral characteristics of water and quantification of hydrological cycle elements using remote sensing and GIS, overview of hydrological modelling, types and scale issues, DEM analysis and watershed delineation and geomorphic parameters, rainfall-runoff modelling, catchment Geo-database creation using Geo-HMS and flood hydrograph estimation using HEC-HMS and river data creation & hydrodynamic modelling with HEC-RAS/Mike 11 were delivered. Each lecture was followed by hands-on practical exercises in the afternoon. One-day field work was also done in Asan river watershed for image interpretation and hydrological analysis on 21st September 2013. Officers showed very keen interest and enthusiasm to learn new tools and techniques especially related to their work on DEM analysis and hydrological modelling. Overall feedback given by officers was excellent to very good



and they emphasized that more time to be given to practical demonstrations. Refresher and follow-up course was also suggested by officers. Valedictory function of this special course was held on 27th September 2013 and certificates were distributed by Director, IIRS to CWC officers on successful completion of course. Overall, this course would help CWC officers to streamline the use of geospatial techniques in the field of hydrological and hydrodynamic modelling of various river basins and watersheds of country.

- Praveen K. Thakur & S.P. Aggarwal

Special Course on Monitoring of IWMP Watershed using Geospatial Data and Bhuvan Web Services

A special Course on 'Monitoring of IWMP Watershed using Geospatial Data and Bhuvan Web Services' sponsored by Department of Land Resources (DoLR), Ministry of Rural Development, Govt. of India, New Delhi was organized at IIRS, Dehradun from 30th December 2013 to 4th January 2014. A total of 27 participants from four states namely Uttarakhand (6 Nos.), Himachal Pradesh (04 Nos.), Jammu & Kashmir (5 Nos.) and Uttar Pradesh (10 Nos.) and DoLR, New Delhi (02 Nos.) attended the training. During the training, 12 lectures and 7 no. of practical sessions were conducted and one-day field visit was organized in Sitlarao watershed, 50 km away from Dehradun to familiarize the participants on satellite data and land features such as land use/ land cover and erosion features. Participants were exposed to open source Quantum GIS software and its use with the satellite



data and other thematic maps available on ISRO Portal Bhuvan. Mrs. Neena Grewal, Additional CEO, S.L.N.A., Uttarakhand was invited as Chief Guest to address course participants during the valedictory function held on 3rd January 2013.

- Suresh Kumar

Special Course on Oak Forest Mapping of Sikkim using Remote Sensing & GIS

A six-week GIZ sponsored Special Course on Oak Forest Mapping in Sikkim was organized for two personnel of Sikkim Forest Department from 19th August to 27th September, 2013. The course started with a reconnaissance survey of oak bearing forest areas of Sikkim. During the survey, team of scientists from FED, IIRS (Drs. Hitendra Padalia and Stutee Gupta) trained the participants in the techniques for identification of oaks and groundtruth collection using satellite image and the GPS. After field survey, the participants were given hands-on exercises on preprocessing, image enhancement and classification (both unsupervised and supervised) of satellite imagery of the area. The participants were also exposed to the procedures used to minimize the effect of shadow on the vegetation classification in mountainous terrain and integration of topographic and field data to improve the classification accuracy. Prof. Dr. Claus-Peter Gross, Chair Professor, Department of Remote Sensing and LIS, University of Freiburg and Consultant to GIZ for Climate Change Adaptation



Programme for North-Eastern Region visited IIRS and expressed his satisfaction on the course contents. He also lectured on Remote sensing applications in forestry with special emphasis on LiDAR for the benefit of the IIRS students of various courses. The FED faculty apprised him on the ongoing and future research plans. He expressed that the University of Freiburg, Freiburg is interested in signing a Memorandum of Understanding with IIRS for cooperation in capacity building and research in the environment and natural resource areas.

- Stutee Gupta

Special Course on Geoinformatics Applications in Disaster Management

A one week training programme on 'Geoinformatics Applications in Disaster Management Course', was conducted for the faculty members of Govt. College of Engineering, Karad, Maharashtra at IIRS from 16th to 21st September 2013 for capacity building in Remote Sensing and GIS for Disaster Management Support. The training was attended by nine faculty members of Civil Engineering and Information Technology department. The course was designed keeping in view of the background of the course participants and utilization of space technology viz., remote sensing and communication tools for effective Disaster Management Support. The one-week course was composed of theory, applications and case study demonstration. Seventeen lectures and five practical demonstrations were conducted by twenty-two faculty members from seven departments of IIRS during the course. One day field visit was also conducted to Mussourie, Bata Village, Kolhu Gaon and adjoining areas to demonstrate utility of satellite images for the interpretation of geological features, structures and ground verification. During the field visit, different landforms, landslides and geological features (faults) were described and identification of the same on satellite images was explained. As a part of feedback and response survey to understand how the



participants would use the knowledge and experience gained through this training course, each participant was asked to furnish information on how they plan to utilize the expertise gained during this course. The participants were highly satisfied with the course content, conduction of lectures, practicals, field visit, logistic facility and support provided by IIRS. As a follow-up action, MoU has been initiated by Govt. College of Engineering, Karad, Maharashtra for sharing of students and knowledge between the two institutes.

- Ajanta Goswami & P.K. Champati Ray

Special Course on Remote Sensing and GIS for Census Officials

On the request from Census Department, to train their recently joined officials on geospatial technology and its applications, a two-week

special course was organized from 16th-27th September 2013. Ten officials from the Census Department joined the course from various directorates of

Registrar General namely, UP, Delhi, Sikkim, Nagaland, Jharkhand, Assam, Chhattisgarh, Tamil Nadu and Bihar. The course curriculum was designed keeping in consideration the requirements of the user department. The course included lectures and hands-on practical exercise on overview of remote sensing technology and mapping, satellite image interpretation of urban features, image processing, overview of GIS and database creations, concept of Web-GIS and visualization, fundamentals of photogrammetry, terrestrial photogrammetry, cartography, map projections and GPS/GNSS survey methods and data processing. Lectures on remote sensing and GIS for census enumeration planning, population estimation using RS, Health GIS, application of RS and GIS for urban studies, data interoperability issues, GIS customization and geo-processing was also organized. A technical discussion related to census database issues, linkages to National Population Register, etc. with the faculty was also organized. At the end, a small exercise related to database creation and high resolution RS data fusion



techniques was carried out by the participants. A formal feedback was taken at the end of the course; in general the participants appreciated the course, and suggested to have practical oriented advanced training program in future.

- Ashutosh Bhardwaj & Shefali Agrawal

Special Course on Data Assimilation

As part of ISRO-UK Space Agency collaborative link, Indian Institute of Remote Sensing (ISRO), Dehradun conducted a one week summer school on Data Assimilation during 16th- 20th December, 2013. Data Assimilation is a major subject for ingesting the various sources of data, complexity of scale and in time, and needs to be understood for advanced predictive modeling. This will be useful for the remote sensing application scientists of ISRO working on complex models for predicting future scenario. Data assimilation methods are used to prepare the grid data as the best possible estimate of the true initial state of a system by merging various measurements irregularly distributed in space and time e.g., satellite data, ground measurements etc. with a prior knowledge of the state given by a numerical model. It improves the quality of the forecast and the model, and increases the physical understanding of the considered systems. Data assimilation now plays a very important role in studies of atmospheric and oceanic problems. The course was started with the introduction of data assimilation and further insight was given on various methods of data assimilation like: variational methods (3DVar and 4DVar), Kalman Filters, particle filters, etc. Its implementation for various case studies was also discussed. The technical limitations of different data assimilation techniques were also discussed in detail. Hands on exercises includes the



exposure to the Python (freely available programming language), and application of the 3DVar, 4DVar, Kalman and Particle filters. Thirteen participants from various organizations like VSSC, SPL, SAC, NARL, NRSC, IMD, IAF & IIRS participated in the programme. Dr. Jan Van Leeuwen of University of Reading, UK and Director, NCEO was the chief instructor for the training programme and his team members Dr. Tristan Quife, Dr. Anthony Brown, Dr. Melanie Ades and Dr. David Livings of Data Assimilation Research Centre, University of Reading, UK delivered the lectures. The course was funded by UK Space Agency and delivered by National Centre of Earth Observation (NCEO) staff, UK free of charge to ISRO scientists.

- D Mitra

WORKSHOPS/SYMPOSIA/MEETS

World Space Week (WSW) Celebration

The World Space Week (WSW) celebration is held every year during 4th-10th October, in more than 65 countries across the world, to commemorate two milestones in space exploration: 4th October marking the launch of first manmade satellite Sputnik-1, in 1957 and 10th October marking the day on which the first International Space Treaty for peaceful uses of Outer Space came into force in 1967. The celebrations are intended to foster interest in Space Science, Technology, and Exploration for the benefit of mankind. The theme of WSW-2013 was 'Exploring Mars, Discovering Earth'. The WSW was celebrated at IIRS on 10th October 2013 with the participation of school students, IIRS trainees and faculty. Participants from 12 schools of Dehradun attended and participated in Quiz Programme, which was followed by documentaries on Mars Mission and Indian Space Programme. Two popular lecturers on Indian Space Programme and the satellite Launch Vehicles were delivered by Dr. S.K. Saha, Dean (Academics), IIRS and Shri Anil Painuily, Scientist, Vikram Sarabhai Space Centre (VSSC),



Thiruvananthapuram, respectively. The school students were also provided an opportunity to interact with a panel of senior Scientists/Engineers of IIRS/ISRO led by Dr. Y.V.N. Krishna Murthy, Director, IIRS. The prizes were distributed by Director, IIRS to winning team for quiz competition. First, second and third trophies were won by Rashtriya Indian Military College, Kendriya Vidyalaya, ONGC, and Jaswant Modern Sr. Sec. School, respectively.

- Kshama Gupta & Pooja Jindal

CAMPUS NEWS

Distinguished Visitors



Dr. K. Kasturirangan, Former Chairman, ISRO and Member (Science), Planning Commission visited IIRS, Dehradun on 07th June 2013. He addressed the IIRS fraternity and was apprised about the training education and research activities of IIRS.



Dr. A.S. Kiran Kumar, Director and Distinguished Scientist, Space Applications Centre, Ahmedabad visited IIRS, Dehradun on 9th September 2013 and chaired the IIRS Management Council meeting.



Shri S. Srinivasan (IAS), Member (Finance), Atomic Energy/ Space/ Earth Commissions visited IIRS campus on 18th November 2013. He was apprised of IIRS activities by the Director, IIRS.

Appointments



Shri Rajeev Kumar Tripathi joined IIRS on 16th September, 2013 as Junior Hindi Translator. He is M.A., L.L.B. from CSJM University, Kanpur. Prior to joining IIRS, he has served in the Indian Air Force for 18½ years.



Shri Bhanu Bhushan Bijalwan joined IIRS on 3rd December, 2013 as Technician-B in Construction and Maintenance Division.

CONTACT



Shri Vivek Ashish has joined IIRS on 11th March 2013 as an Assistant in Purchase & Stores Department. Prior to it, he was working at VSSC (ISRO Inertial Systems Unit), Trivandrum since 26th October 2010 as an Assistant in Purchase & Stores area.



Shri Prabhakar Alok Verma joined IIRS on 28th October 2013 as Scientist/Engineer-SC in Geoinformatics Department.



Shri Vijay Kumar Singh joined IIRS on 3rd June 2013 as an Assistant in Construction and Maintenance Division.

CONTACT extends a warm welcome to the new faculty and staff to IIRS family

Superannuations

We wish them a happy & healthy life after superannuation



Dr. K.P. Sharma
Scientist/Engineer-SG on
30th June 2013



Shri Om Prakash
Sr. Office Attendant on
30th June 2013



Shri Gopal Krishna
Sr. Project Attendant on
30th September 2013



Shri Madhu Mohan
Jr. Engineer on
31st October 2013



Shri B.S. Sokhi
Scientist/Engineer-SF on
30th November 2013

Awards

Best Chapter Award-2013 conferred to ISRS- Dehradun Chapter

The ISRS - Dehradun Chapter has significantly contributed for promoting remote sensing activities under ISRS umbrella. As per the aims and objectives of the society, the chapter has put up special efforts towards advancement, dissemination and application of knowledge related to remote sensing technology and its applications. It organized various activities like National Remote Sensing Day Celebration, Science Day Celebration, Interactive meet with Distinguished Scientists, Earth Day Celebration, World Environment Day Celebration, etc. involving student community by conducting quiz/ essay/ elocution/ exhibition/ lectures/ film shows/ green run, etc. The Chapter extended support to FICCI in organizing a Seminar on 'Geo-enabling Uttarakhand: Opportunities and the Way Forward'. The Chapter has also invited a good number of eminent subject experts to deliver a series of popular technical talks. In recognition of pioneering and outstanding contributions towards popularisation of remote sensing activities by way of conducting large



number of activities, its efforts in creating and sustaining enthusiasm among members and its contributions to the national body, the Indian Society of Remote Sensing conferred "Best Chapter Award for Contribution to the Society for the year 2013" on ISRS Dehradun Chapter. The award was conferred on 4th December 2013 during the inaugural function of 'ISG-ISRS National Symposium on Remote Sensing and GIS for Environment with Special Emphasis on Marine and Coastal Dynamics', at Visakhapatnam.

Recreation Club Kathak Performance by Pt. Rajendra Gangani

Pt. Rajendra Gangani, a brilliant exponent of Kathak and 'Sangeet Natak Academy Award' winner 2003 performed in IIRS campus on 16th August 2013. A disciple of Pt. Kundanlal Gangani, Rajendra Gangani started training in the art of Kathak dance at the early age of four. An accomplished musician, composer of tunes, he also has a rare mastery over the *tabla*, *harmonium*, *pakhawaj*, etc. Among the numerous awards and accolades he has won, are the 'Sangeet Raj', 'Shastriya Natya Shiromani', and the prestigious 'Sangeet Natya Akademy Award' which was bestowed upon him in 2003 by The President of India, Hon'ble Shri A.P.J. Abdul Kalam. Pt. Rajendra stands out for his style; making use of his excellent blend of manly grace and delicacy, he depicts the devotional aspects that characterises the Jaipur Gharana. The renowned 'Jaipur Gharana' saw the emergence of an outstanding

performer and crusader of the art in the talented scion of a family of hereditary dancers serving the art of Kathak for centuries together. The programme was hosted under the aegis of SPIC MACAY, a pioneering society in promoting Indian classical music & art. For the past 34 yrs, SPIC MACAY has exposed students to various forms of Indian classical music, dance, folk art, craft and folk theatre, in schools, colleges and professional institutions through concerts, lecture demonstrations, baithaks and workshops and scholarship programs. SPIC MACAY organizes almost 4000 such events each year and reaches out to students in virtually all the states of India.



- Recreation Club

स्वतंत्रता दिवस समारोह

15 अगस्त, 2013 को स्वतंत्रता दिवस के अवसर पर निदेशक डॉ. वाई. वी.एन. कृष्ण मूर्थि ने ध्वजारोहण किया। सभा को संबोधित करते हुए उन्होंने सभी को स्वतंत्रता दिवस की बधाइयों दी और आई.आई.आर.एस. व इसरो की गतिविधियों से अवगत कराया। ध्वजारोहण तथा निदेशक महोदय के भाषण के पश्चात् समस्त उपस्थित कर्मचारियों, उनके परिजनों तथा छात्र-छात्राओं को मिष्ठान वितरण किया गया। इस समारोह को आगे बढ़ाते हुए मनोरंजन क्लब द्वारा विभिन्न आयु वर्ग के लोगों के लिए खेल-कूद प्रतियोगिताएं आयोजित की गईं और सभी विजेताओं को निदेशक महोदय द्वारा पुरस्कृत किया गया। समारोह के दौरान 'लाइफ ऑफ पाई' फिल्म समस्त आई.आई.आर.एस परिवार को दिखाई गई, समारोह के बाद

आई.आई.आर.एस में विभिन्न जगह पर वृक्षारोपण किया गया है सभी कर्मचारी जिन्होंने सेवा के 25 साल पूरे कर लिए हैं, उन्हें निदेशक आई.आई.आर.एस द्वारा सम्मानित किया गया है। स्वतंत्रता दिवस के अवसर पर कॉलोनी में बने बैडमिंटन कोर्ट का उद्घाटन निदेशक महोदय द्वारा किया गया। आई.आई.आर.एस कर्मचारियों उनके परिवार के सदस्यों और सभी छात्र-छात्राओं ने पूर्ण उत्साह के साथ समारोह में भाग लिया।



—मनोरंजन क्लब

Visit of 'Children with Special Needs'

The students of Saplings, a school for children with special needs run by Hopes foundation, a non-profit organization at Dehradun, visited IIRS Campus on 16th November 2013. These children are generally socially deprived and have less opportunity for nature outings. The children had the opportunity to visit and enjoy the serene environment of IIRS campus. The members of IIRS ladies club, faculty and staff of IIRS and students of IIRS took care of the children along with their staff. The students of Saplings had a

small get-together in the campus and played around with IIRS students. The children enjoyed the campus and the beautiful flowers.



Dr. Shivika Mittal, Founder Director of Hopes expressed her joy and mentioned that these outings are important for these children so as to make them feel as part of the society.

Dear Readers,

This issue of CONTACT newsletter focuses on research activities under a wider theme of features extraction and geospatial modelling. Kindly send your suggestions and feedback at newsletter@iirs.gov.in.

Editorial Team

Editor: Pramod Kumar

Members: Suresh Kumar, Anil Kumar, Vandita Srivastava, Hitendra Padalia, Puneet Swaroop, Bhaskar R. Nikam, S.L. Chatteraj, Shuchita Srivastava and Kamlesh Karki

CALENDAR OF TRAINING COURSES AT INDIAN INSTITUTE OF REMOTE SENSING, ISRO, DEHRADUN FOR THE YEAR 2014

Sl. No.	Course Code	Course Name	Entrance Requirements	Seats	Starting Date ddmmyy	Passing Out Date ddmmyy	Course Fee for Individual Candidate			Apply by Date
							Govt.-Spons. (₹)	Open (₹)	Foreign (US\$)	
POST-GRADUATE DIPLOMA COURSES IN REMOTE SENSING AND GIS WITH SPECIALIZATION IN										
1.	D-AS	Sustainable Agriculture	M.Sc. in Agri. / Agron. / Soil Sci. / Agril. Physics / Agromet. / Plant Physiol. / Env. Sci. / Agril. Bot. / Master in Geog. (with B.Sc. at Grad. level) / B.Sc. Agri. (4 years) / B.E. / B.Tech. in Agril. Engg. / Agril. Officers with 2 years experience.	6	19.08.2014	19.06.2015	Nil	60,000	6,000	30.05.2014
2.	D-FE	Forest Resources & Ecosystem Analysis	M.Sc. Forestry / Ecology / Botany / Wildlife Sci. / Biosci. / Zoology / Env. Sci. / Life Sci. / Master in Geog. (with B.Sc. at Grad. level) / B.Sc. Forestry (4 Years) / Forest Officers (B.Sc.+ 2 years experience).	6	19.08.2014	19.06.2015	Nil	60,000	6,000	30.05.2014
3.	D-GG	Geosciences & Geohazards	M.Sc./M.Sc.(Tech.) / M.Tech. in Geol. / Appl. Geol. / Geophy. / Earth Sci. / Geoexplor. / Petrol. Engg. or equivalent / Geo-Engg. / Mining Engg. / Env. Sci. / Master in Geog. (with special. in Geomorph.) / B.Tech. / B.E. in Civil Engg., Geosci., Petrol. Engg., Mining Engg., Mineral Process.	6	19.08.2014	19.06.2015	Nil	60,000	6,000	30.05.2014
4.	D-MS	Marine & Atmospheric Sciences	M.Sc. in Marine Sci. / Earth Sci. / Physics / Oceanog. / Atm. Sci. / Env. Sci. / Master in Geog. (with B.Sc. at Grad. level).	6	19.08.2014	19.06.2015	Nil	60,000	6,000	30.05.2014
5.	D-UR	Human Settlement Analysis	Master in Plann. / Geog. (with B.Sc. deg. at Grad. level) / B.E. (Civil) / B. Arch. / B. Plan.. / M. Arch.	6	19.08.2014	19.06.2015	Nil	60,000	6,000	30.05.2014
6.	D-WR	Water Resources	B.E. / B.Tech. / M.E. / M.Tech. (Civil Engg.) / Agril. Engg. / M.Sc. in Geol. / Env. Sci.	6	19.08.2014	19.06.2015	Nil	60,000	6,000	30.05.2014
7.	D-PR	Photogrammetry & Remote Sensing	B.E. / B.Tech. in Civil / Electronics / Electrical / ECE / Comp. Sci. / Comp. Engg. / IT / Geomatics / Geoinform. / Remote Sensing or equivalent or M.Sc. / M.Tech. in Physics / Appl. Physics / Math. / Stat. / Appl. Math. / Geog. / Geoinform. / Geomatics / Remote Sensing or equivalent with B.Sc. in Sci. Candidates should have Math as one subject up to 10+2 level.	6	19.08.2014	19.06.2015	Nil	60,000	6,000	30.05.2014
M.TECH. COURSE IN RS & GIS										
8.	+M-RG	M.Tech. in RS&GIS with specialization in: (i) Sustainable Agriculture, (ii) Forest Resources & Ecosystem Analysis, (iii) Geosciences, (iv) Marine & Atmospheric Sciences, (v) Human Settlement Analysis, (vi) Water Resources, (vii) Satellite Image Analysis & Photogrammetry & (viii) Geoinformatics	Corresponding entrance requirements as mentioned under Sl. Nos. 1 to 7 and 9 for respective courses is applicable.	30	19.08.2014	12.08.2016	Nil	1,44,000+ 20,000 (Andhra Univ. Regn. Fee)	14,400+ 250 (Andhra Univ. Regn. Fee)	24.05.2014
Note :										
(i) Preference will be given to candidates with Mathematics at 10+ 2 level.										
(ii) Candidates should have secured a minimum of 55% marks in the qualifying examination.										
(iii) M. Tech. is accredited by Andhra University, Visakhapatnam. From 2nd module onwards the students will have to select one of the these disciplines: (i) Sustainable Agriculture, (ii) Forest Resources & Ecosystem Analysis, (iii) Geosciences & Geohazards, (iv) Marine and Atmospheric Sciences, (v) Human Settlement Analysis, (vi) Water Resources, (vii) Satellite Image Analysis & Photogrammetry, and (viii) Geoinformatics.										
(iv) The admission for M. Tech. Course is based on entrance test held annually at Dehradun, Nagpur, Bengaluru, Jodhpur, and Kolkata and interview.										
(v) The age limit for admission to above courses (Sl. Nos. 1-8) is 50 years.										
IIRS-ITC JOINT EDUCATION PROGRAMME ON GEOINFORMATICS: TECHNOLOGY AND APPLICATIONS										
9.	D-GI	Post-Graduate Diploma in Geoinformation Science & Earth Observation with specialization in Geoinformatics	M.Sc. / M.Tech. In Physics / Appl. Physics / Electron. / Math. / Appl. Math. / Stat. / IT / Comp. Sci. / Geo-Engg. / Urban and Reg. Plann. / Remote Sensing / Geoinform. or its equivalent or Master in Geog. (with B.Sc. at Grad. level) / B.E. / B.Tech. / B.Sc.(Engg.) / Graduate (with four year deg. course) in Civil Engg. / Electron. & Comm. / Comp. Sci. / Comp. Engg. / IT / Agril. Engg. / Remote Sensing / Geoinform. / Geosci. Engg. / Petrol. Engg. / Mining Engg. / Agri. Inform. / Forest Inform. or its equivalent or B.Arch. / B.Plann. M.Arch. / M.Plann., MCA (with B.Sc. in Sci.).	10	22.09.2014	17.07.2015	Euro 375	65,000 + Euro 375	3000 + Euro 375	20.06.2014
10.	D-NHDM	PG Diploma in Geoinformation Science & Earth Observation with specialization in Natural Hazards & Disaster Risk Management	M.Sc. in Math. / Chemistry / Botany / Zoology / Geol. / Earth Sci. / Env. Sci. / Marine Sci. / Atm. Sci. / Agri. / Master in Geog. (with B.Sc. at Grad. level) or B. Arch. / B. Plann. / M. Plann. / Master in Geog. (with B.Sc. at Grad. level) or B.E. / B.Tech. in Civil Engg. / Agril. Engg. / Env. Engg. / Geosci. / Geoexplor. / Geo-Engg. / Earthquake Engg. / IT / CS / ECE or B.Sc. (4-year Forestry / Agri., course) or Master in Disaster Mgmt. / Forest / Agri. Officers (with B.Sc. deg.) / MCA (with B.Sc. in Sci.).	10	22.09.2014	17.07.2015	Euro 375	65,000 + Euro 375	3000 + Euro 375	20.06.2014

Sl. No.	Course Code	Course Name	Entrance Requirements	Seats	Starting Date ddmmy	Passing Out Date ddmmy	Course Fee for Individual Candidate			Apply by Date
							Govt.- Spons. (₹)	Open (₹)	Foreign (US\$)	
11.	M-GI	M.Sc. in Geoinformation Science & Earth Observation with specialization in Geoinformatics	Entrance requirements as mentioned under Sl. No. 9.	10	22.09.2014	18.03.2016	Euro 2500* payable to ITC + 2,00,000 approx. for own ITC visit expenses	1,20,000* payable to IIRS+Euro 2500 payable to ITC + 2,00,000 approx. for own ITC visit expenses	7000*	23.05.2014
12.	M-NHDRM	M. Sc. in Geoinformation Science & Earth Observation with specialization in Natural Hazards & Disaster Risk Management	Entrance requirements as mentioned under Sl. No. 10 and Master in Disaster Mgmt./Master in Geog. (with B.Sc. at Grad. level)	10	22.09.2014	18.03.2016	Euro 2500* payable to ITC + 2,00,000 own ITC visit expenses	1,20,000* payable to IIRS + Euro 2500 payable to ITC + 2,00,000 approx. for own ITC visit expenses	7000*	23.05.2014
<p>Note (for M-GI and M-NHDRM):</p> <p>(i) The candidate should have secured a minimum of 60% marks in the qualifying examination.</p> <p>(ii) The M.Sc. degree is awarded under Joint Education Programme of IIRS-ITC by the University of Twente, The Netherlands.</p> <p>* The ITC component of course fee is likely to be revised (Euro 4400 towards tuition fee & other charges + Euro 3735 towards living expenditure in the Netherlands)</p>										
REMOTE SENSING APPLICATIONS: THEME-SPECIFIC ORIENTATION COURSE										
13.	O-DM	Remote Sensing An Overview for Decision Makers	Decision makers in organizations (with 10 years experience in service).	10	17.06.2014	20.06.2014	10,000 (includes boarding+ lodging-charges)	10,000 (includes boarding+ lodging-charges)	-	16.05.2014
INTERNATIONAL PROGRAMMES (Only for Foreign Nationals from ITEC/SCAAP Partner Countries)										
14.	S-RS	Short Course on Remote Sensing with special emphasis on Digital Image Processing (ITEC Sponsored)	P.G. Deg. / Graduate in Physics, Chem., Math., Bot., Forestry, Zool, Wildlife Sci., Env. Sci., Life Sci., Agri. Sci. subjects, Geog. (with B.Sc. at Grad. level) or any other Sci. / any discipline of Engg. with sufficient knowledge of Math. / Stat. at high school level / middle level resource managers and professionals from Govt., NGOs, Universities with 2-year work experience. Age limit: up to 45 years.	20	06.01.2014	28.02.2014	20,000	20,000 (12,000-Fee+8,000 -Regn.)	\$2000	29.11.2013
15.	S-GI	Short Course on Geoinformatics (ITEC Sponsored)	P.G. Deg. / Graduate in Physics, Chem., Math., Bot., Forestry, Zoology, Wildlife Sci., Env. Sci., Agri. Sci. subjects, Geog. (with B.Sc. at Grad. level) or in any other Sci. / Engg. discipline with sufficient knowledge of Math. / Stat. at high school level / middle level resource managers and professionals from Govt., NGOs, Universities with 2-year work experience. Age limit: up to 45 years.	20	22.09.2014	14.11.2014	20,000	20,000 (12,000-Fee+8,000 -Regn.)	\$2000	22.08.2014
CERTIFICATE COURSE										
16.	C-RS	Short Course on Remote Sensing and Image Interpretation	Engg. Graduate. / P.G. in Sci. and Geog. (with B.Sc. in Sci.)	5	06.01.2014	28.02.2014	Nil	20,000-12,000-Fee+8,000 -Regn.)	--	29.11.2013
NNRMS-ISRO SPONSORED CERTIFICATE COURSES: FOR UNIVERSITY FACULTY ONLY (With Two Years Teaching Experience at P.G. Level)										
17.	N-GI	GIS Technology and Advances	P.G. Deg. in Sci. / Engg.	8	05.05.2014	27.06.2014	Nil	12000	1200	14.02.2014
18.	N-WR	RS & GIS in Water Resources	P.G. Deg. in Civil / Agril. Engg.	8	05.05.2014	27.06.2014	Nil	12000	1200	14.02.2014
19.	N-FE	RS & GIS in Forestry/ Ecology / Wildlife / Environmental Sciences	P.G. Deg. in Botany / Ecology / Forestry / Env. Sci. / Zoology / Wildlife Sci. / Life Sci. / Biosci.	8	05.05.2014	27.06.2014	Nil	12000	1200	14.02.2014
20.	N-UR	RS & GIS in Urban & Regional Planning	P.G. Deg. in Plann. / Civil Engg. / Arch. / Geog.	8	05.05.2014	27.06.2014	Nil	12000	1200	14.02.2014
21.	N-CM	RS & GIS in Cartography and Mapping	P.G. Deg. in Sci./Geog.	8	05.05.2014	27.06.2014	Nil	12000	1200	14.02.2014
22.	N-GG	RS & GIS in Geosciences	P.G. Deg. in Geol./Appl. Geol./ Geophy./ Geog.	8	05.05.2014	27.06.2014	Nil	12000	1200	14.02.2014
23.	N-GA	RS & GIS in Soils & Land Use Planning	P.G. Deg. in Agri./Geog./Env. Sci./Agril. Engg.	8	05.05.2014	27.06.2014	Nil	12000	1200	14.02.2014
24.	N-CO	RS & GIS in Coastal & Ocean Sciences	P.G. Deg. in Marine Sci./Geol./Oceanog./Appl. Geol./Env. Sci.	8	05.05.2014	27.06.2014	Nil	12000	1200	14.02.2014
Important information:										
<ul style="list-style-type: none"> If the date of course commencement falls on holiday, course will start from next working day. Sponsoring organizations are required to meet all expenses viz., traveling allowance, daily allowance, contingent expenses, medical expenses etc., for their candidates except course fee. However, Courses at Sl. Nos. 13, 14 & 15 are paid courses for all including Govt. organizations also. In case of NNRMS sponsored course, the candidates admitted are paid TA/DA by IIRS as per ISRO/DOS rules applicable for this course. The Govt. organizations (Central/State Government bodies/Autonomous Institutions and State and Central Govt. funded Universities) can sponsor only permanent employee. Private universities & self-sponsored candidates have to pay full course fee in advance. -Security deposit: Self-financed candidates have to deposit/remittance security deposit one month prior to the commencement of the course @ ₹ 4000/- in respect of Certificate Courses @ ₹ 6000/- in respect of P.G. Diploma Courses, and @ ₹ 10000/- in respect of M.Sc./M.Tech. courses failing which seats would be offered to the wait-listed candidates. Boarding and lodging charge at IIRS Hostel comes to ₹ 2500 p.m. (approx.). Local candidates will be considered for hostel accommodation, only if available. Number of seats are subject to change in all courses. 										
For further details, contact: Director, IIRS/Group Director, Programme Planning & Evaluation Group, Indian Institute of Remote Sensing, ISRO, Dept. of Space, Govt. of India, 4, Kalidas Road, Dehradun-248001, U.K., India. Tel: +91-135-2744583, 2524105, 2524107, 2524109, Fax: +91-135-2741987, 2748041; E-mail: admissions@iirs.gov.in; please visit our website- www.iirs.gov.in for details about IIRS and application form download.										