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Volume 23, Issue 1 March 2017

Inside this issue:

Editor's Desk

Dear Members,

It is a great pleasure to put this issue of newsletter in your hands after somewhat long gap. This issue is brought out on the occasion of Regional conference of ISG being organised at HARSAC Hisar to celebrate golden jubilee year of state on the topic of sustainable development. The topic of sustainability is an old one for our community but probably it will never become old enough to be ignored given the rise of human population on this earth which is unfortunately solid enough to resist any stretching. We, the community of geospatial scientists have proven through studies and demonstrations that we have best set of tools to ensure sustainability of developments on earth - both on physical as well as biological dimensions of human intervention. Yet the effect is not visible uniformly throughout the country because of various reasons, calling for more brain-storming and deliberations from scientific community.

We begin our main articles with the one on VEDAS, acronym for Visualisation of Earth Observation Data and Archival System, by Shri Shashikant A. Sharma. The article features specific case studies on vegetation monitoring, air quality monitoring and renewable energy resource potential in India, all hosted on VEDAS web portal. The region where this seminar is being organised is the bread basket of India and so sustainability of agriculture is a major issue here. Dr. B J Pateria presents a comprehensive set of achievements related to different aspects of agriculture sustainability like cropping systems, nutrient and groundwater management etc.. Work done in ISRO on glaciers and desertification is brought out by Dr. A S Rajawat in form of respective publications which are featured here. Shri Hiren Bhatt and Dr. S P Vyas elaborate about the TREES training and research programme at SAC. This issue also features the Annual Report of ISG for the year 2016 from the Secretary, Shri N. S. Mehta.

I hope you are going to enjoy reading through these interesting articles and news. I request you to keep giving your feedback and contributions to us.

R. P. Dubey
Editor
(rpdubey@hotmail.com)

Also in this issue:

ISG Executive Council

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Visualisation of Earth Observation Data and Archival System (VEDAS)

Shashikant A. Sharma
Space Applications Centre (SAC), ISRO, Ahmedabad.

Space Applications Centre (ISRO) is responsible for carrying out research and applications of optical and microwave remote sensing data in a large number of disciplines including agriculture, land use, forestry and environment, coastal and marine ecosystem, hydrological studies, climate change studies, urban planning and infrastructure development, snow and glaciers, spatial data infrastructure, atmospheric and oceanic sciences, early warning and disaster management support, planetary sciences etc. These applications are also aimed at meeting the requirements of various user ministries of the country. Large volume of data has thus been created at SAC which has both societal value as well as scientific research and development potential.

The advancements in EO systems and development of new and improved data products in recent years has strengthened natural resources inventory and management. The end-product from the EO applications will help towards establishment and operationalization of spatial infrastructure and information dissemination system. Visualisation of Earth Observation Data and Archival System (VEDAS) has been made operation for this purpose.

Salient features of VEDAS:

- Satellite based geo-spatial

Figure1: Home page of VEDAS (vedas.sac.gov.in)

data archival and dissemination

- Data visualization in 2-D and 3-D and graphical analysis on web
- Spatial and Non-spatial search engine
- Publish Web map services and metadata of all data
- Geo-processing tools for analysis
- Mentoring development of Indigenous software (IGIS Server)
- Integrate Web Map Service from various sources
- Providing platform for Research & training to Academia by providing data, domain knowledge and infrastructure
- Website available at www.vedas.sac.gov.in

Some of the applications VEDAS are described below:

Vegetation Monitoring

Monitoring vegetation status of a place during a crop-season and compare its progress vis-vis previous seasons' is a highly sought after information for ensuring food security and / or taking decision regarding management intervention to minimize hardship to the people. To assist planners in informed decision making, an application has been developed to support vegetation monitoring over India using Open Source WebGIS technology. It maintains database of spectral and weather variables. For example, spectral NDVI from various sources such as INSAT CCD, OCM, PROBA-V and MODIS sensors and weather variables such as daily temperature, soil moisture and wetness data, Rainfall are available. Maps are available as an OGC compliant Web Map Service. This application supports time series visualisation using dynamic profile generation for particular administrative unit such as district or taluk and defined grid level.

To support this application, a process is built for automatic conversion of daily data into cumulative weekly data as well as certain derived indicators. This is deployed on Internet. The layers are generated and published as WMS service without any manual intervention.

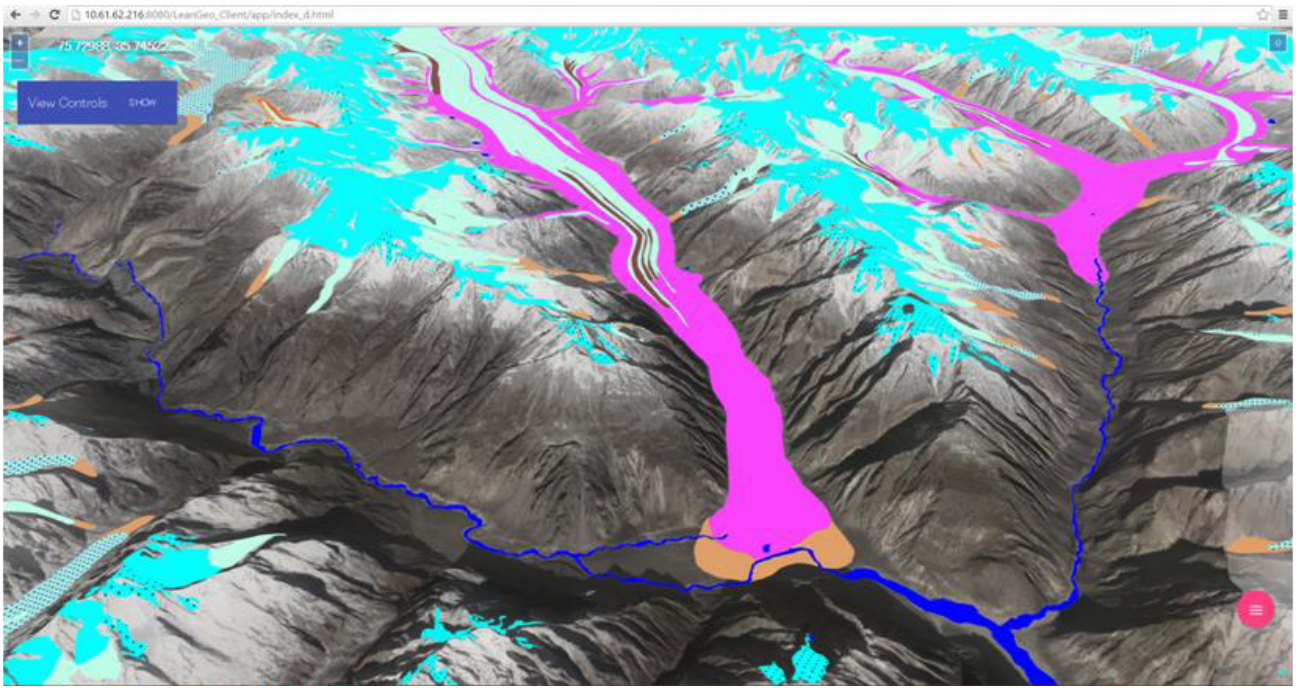


Figure 2 : Glaciers in 3-D on VEDAS (vedas.sac.gov.in)

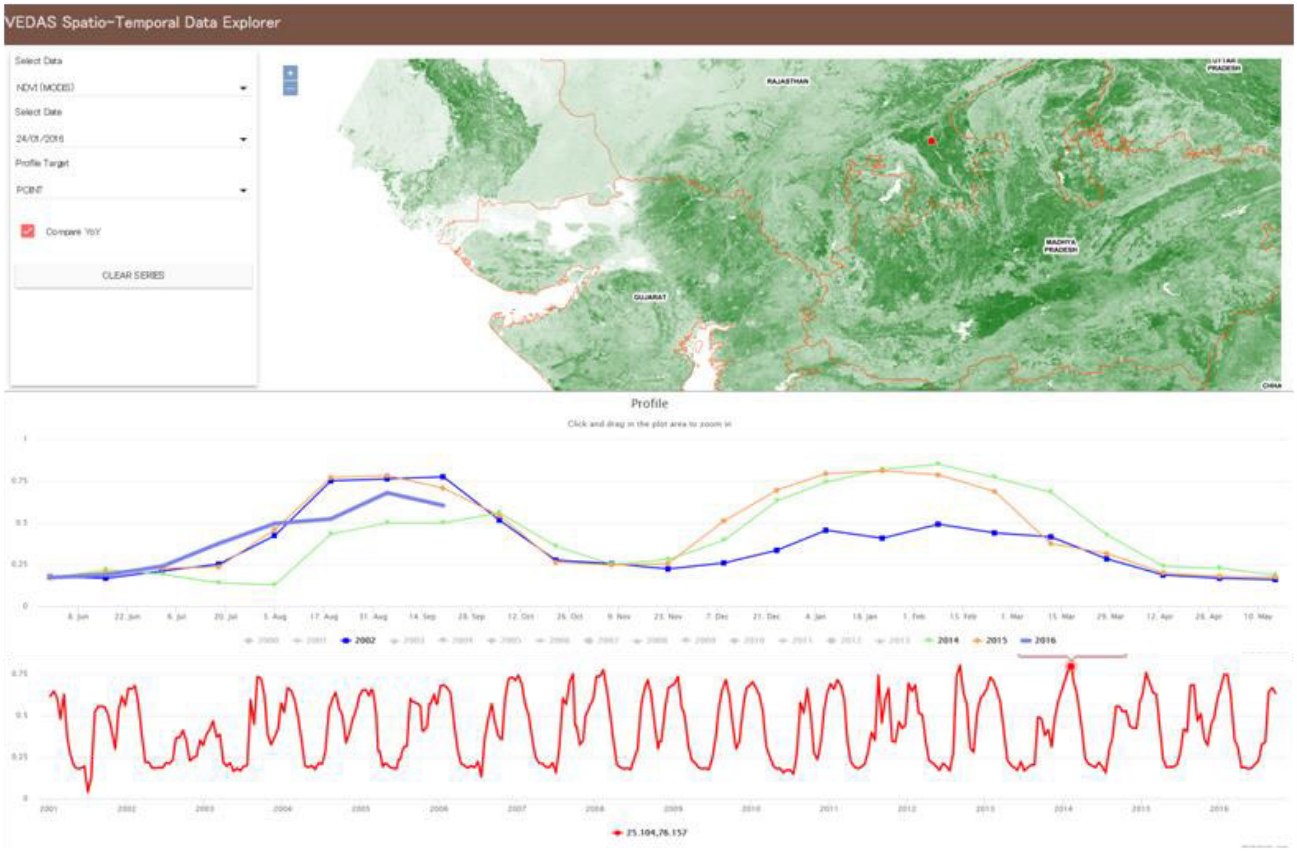


Figure 3 : Vegetation growth (NDVI) profile on VEDAS (vedas.sac.gov.in)

Air Quality Monitoring

State of environment is an important information sought after by masses. Air quality is an important component of environment. It was planned to build a template web-based information portal for monitoring air quality of Delhi for Central Pollution Control Board (CPCB). This system aggregates and displays space borne and ground based data relevant for monitoring air-quality.

The system provides up-to-date satellite and sensor information at one place. The data included in this system are Aerosol Optical Depth derived from INSAT Imager, Fire Products derived from AQUA-MODIS, Wind Forecast and Reflectance from ground from OCM and MODIS sensors. The system also provides temporal profiles of AOD at any point on map as well as data collected by the field sensors installed by CPCB at various locations in Delhi. The system also provides maps of reference information such as LISS3-Imagery, locations of cities/towns, national highways and administrative boundaries.

Renewable Energy Resources

An application has been developed which provides information on monthly and yearly potential solar, wind and wave energy at a location. Such information is required for locating potential sites for extracting / tapping New and Renewable Energy resources. One such example is roof top solar power availability at various locations of India. The website provides the technical solar energy potential, peak power generation potential, built-up area, temperature profile and optimum tilt-angle of solar panels for 98 proposed Smart cities and 68 Solar cities in India. It shows the monthly average solar inso-

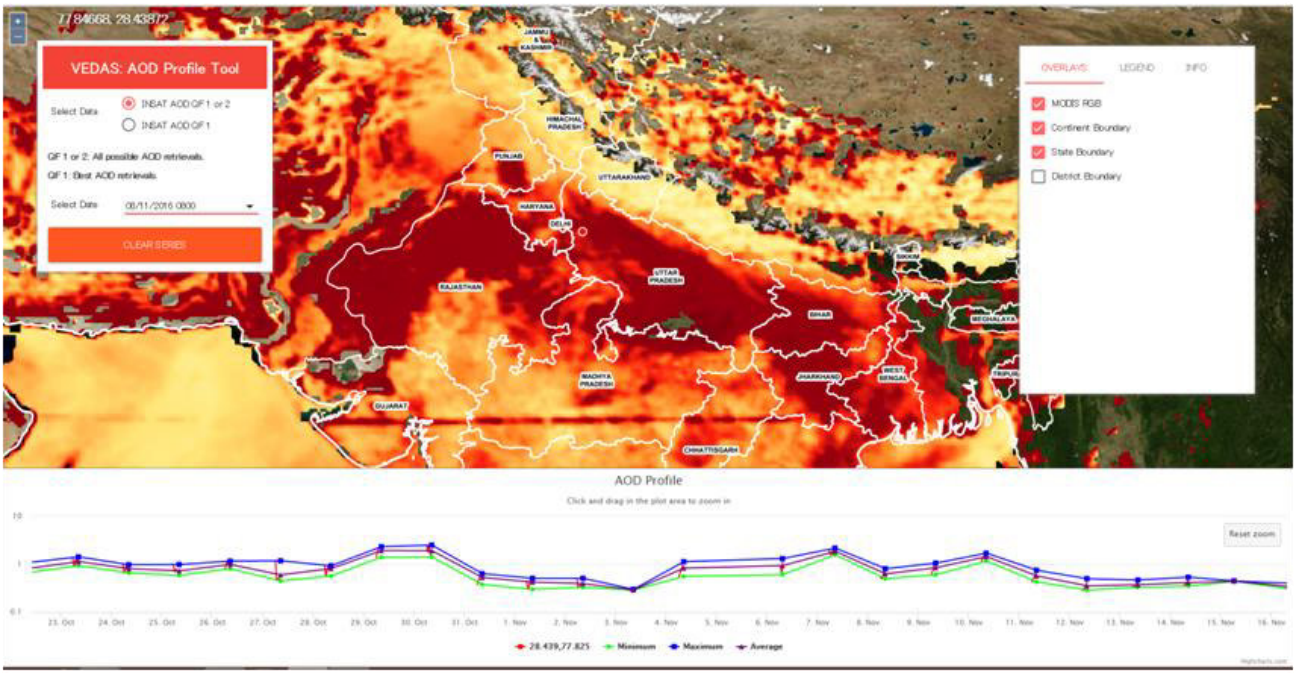


Figure 4 : AOD profile for monitoring air pollution (vedas.sac.gov.in)

lation and air temperature, annual sun path and daily solar hours for each of these cities as well as at any given location in India. The results are further available through an Android App, where location can be obtained from the mobile device GPS. The complete report for each city containing all relevant information on solar energy can be downloaded in PDF file format. The information is useful for assessment of solar energy potential in each city,

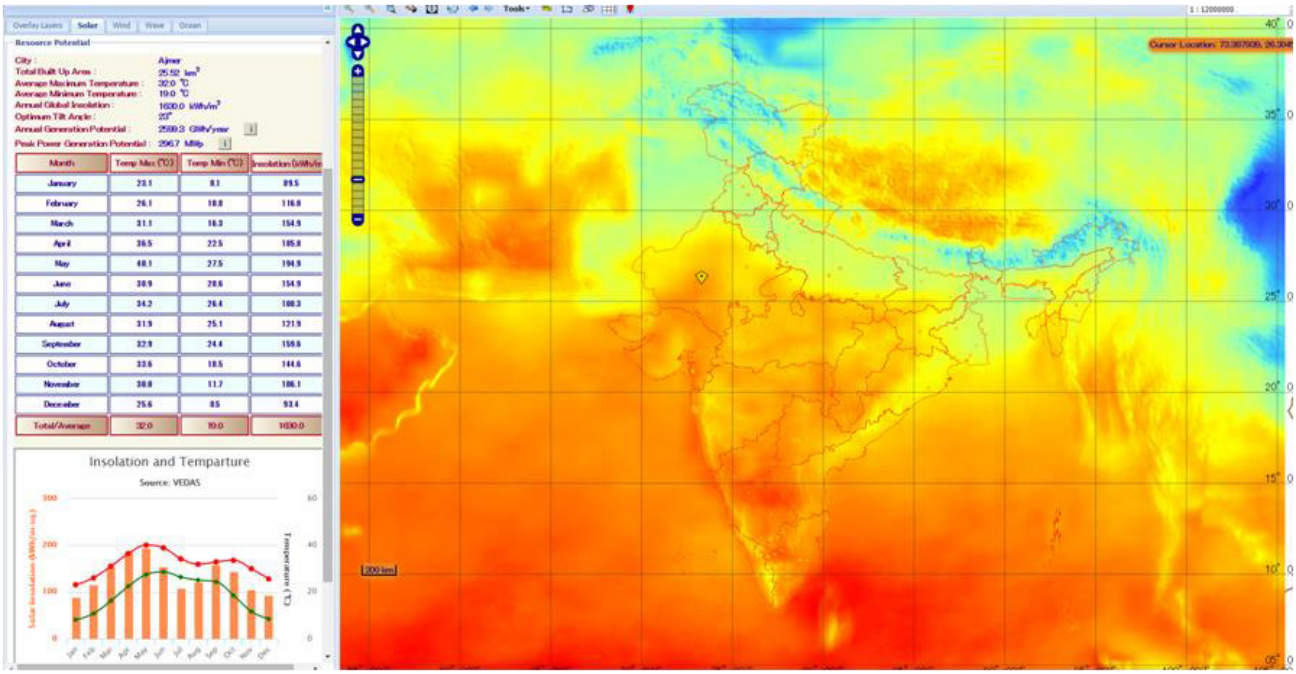


Figure 5 : Solar insolation and energy potential on VEDAS (vedas.sac.gov.in)

which in turn will benefit citizens, policy makers and solar energy industry professionals in maximum utilization of solar energy in respective cities. The solar insolation determines the total available incoming solar energy that can be tapped, while technical energy potential indicates the energy that can be generated from roof-top solar PV systems.

Conclusion

The primary intent of VEDAS remains encouraging wider dissemination of the research efforts undertaken at ISRO with the scientific community, academic institutions, user ministries and civil society, as shown in the cases studies presented in this article. VEDAS, not only provides an interface for sharing scientific data content generated at SAC with the user community, but also provides a platform to other Government agencies for sharing their data. The beginning made by VEDAS will hopefully inspire creation of a larger network of institutions and professionals engaged in realizing the vision of Dr. Vikram A. Sarabhai, i.e. to be second to none in harnessing space technology towards societal benefits.

Remote Sensing and GIS News

C. P. Singh
Space Applications Centre (SAC), ISRO, Ahmedabad.

India sets record with launch of 104 satellites on a single rocket

An ISRO Polar Satellite Launch Vehicle (PSLV) lifts off on Feb. 14, 2017 carrying 104 satellites on a single rocket creating euphoria all across the globe. This eye-popping launch of 104 satellites, including three Cubesats, set a record by successfully putting them in sun-synchronous orbit. The rocket's primary payload was an Indian remote sensing satellite, Cartosat-2D, which has started giving its services.

Planet to acquire Terra Bella from Google

Commercial remote sensing company Planet announced that it was acquiring rival Terra Bella from Google, bringing together what the companies believe are complementary capabilities to image the Earth from space. Planet will acquire Terra Bella's business, including its constellation of seven SkySat satellites. The Planet's existing medium resolution 60 satellite fleet has recently been enhanced with 88 Dove satellites launched by ISRO in one go. Now with these additional

7 high resolution satellites it can take care of many more geospatial services. Google is also going to sign a multiyear contract to purchase imaging data from Planet. Please recall that Google earlier acquired Terra Bella, then known as Skybox Imaging, in 2014 for $500 million. Planet, founded in 2010, has focused on providing medium resolution images from cubesat class spacecraft, with plans to develop a constellation capable of imaging the entire planet every day.

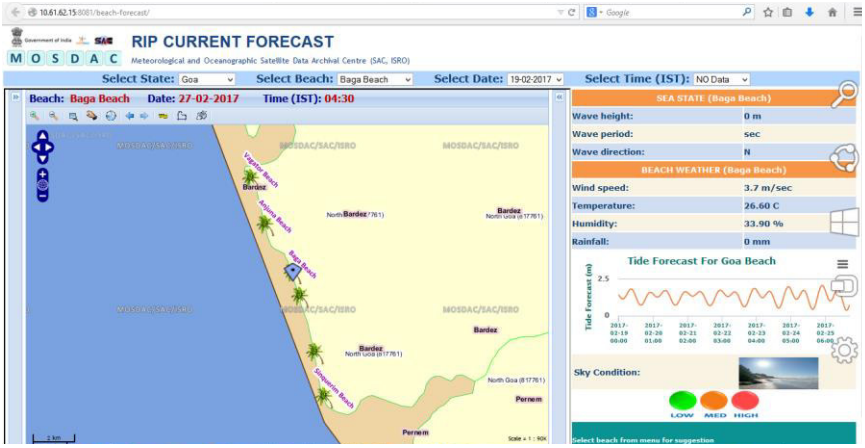
Beach sports safer through space inputs

The meteorological & oceanographic satellite data archival centre (MOSDAC) of Space Applications Centre has added a new geospatial service known as Rip Current Forecast (www.mosdac. gov.in/ rip_current_forecast.html) which is expected to save lives from deadly Rip currents. The three level of warnings (low, medium and high) can be used for making decisions and giving advisories on beach activities. Currently this is operational for beaches in Goa.

UAVRS Applications Rising in India

UAV based Remote Sensing (UAVRS) is the new addition to the North Eastern Space Applications Centre (NE-SAC) for large-scale mapping and real time assessment and monitoring activities of various applications. A Hex Copter has been designed and assembled by NE-SAC, which can carry maximum payload up to 2.5 Kg of different sensors such as thermal, multispectral, optical, hyperspectral or LIDAR. Mapping of Landslide Affected Area, Crop Assessment, 3-Dimensioinal Terrain Model Construction are demonstrated.

There are many private agencies also giving services on mapping through UAV. Space Applications Centre, ISRO, Ahmedabad and MNCFC, New Delhi is actively using UAVs for crop assessments.



Remote Sensing Applications for Sustainable Agriculture in Punjab

Brijendra Pateriya and Anil Sood
Punjab Remote Sensing Centre, Ludhiana

Prelude

Indeed it is matter of great pride that India has achieved top notched position in world as far as space technology is concern. Punjab is fortunate state to have its natural resources and for over decade's maintained high position as agrarian state and premier state for "Green Revolution" in India when our population is facing hunger in tender years of independence. To meet the food grain need of the nation and state, over period of time its natural resources specially water are under great threat due to over usage and over exploitation of ground water. Therefore sustainability is posing an alarming challenge for its future generation and to some extent to the nation. It is next to none that technological viable solutions must encapsulate in all walks of life for better, optimal and judicious usage of its resources. Remote Sensing technology coupled with GIS is a long time well tested, dependable and easy tools that must be taken on base of pyramid for almost all policy and decision making process for sustainable development.

Realizing the challenges of future and judicious utilization of its resources Government of Punjab designated Punjab Remote Sensing Centre (PRSC) as nodal agency to work in-tandem with all government line departments to chalk out the strategy and use of remote sensing to the best possible extent. PRSC is closely working with almost all the departments in the state and providing its services and solution to the user department along with capacity development in the state. Recently Punjab has launched "Bhuvan Punjab" Portal in association with ISRO, GOI, where all citizens can access various GIS layers for their day to day usage in spatial domain. In addition to provide common data to all stakeholders, PRSC is providing customized solutions to various user department and agencies. Research and upkeep of advancement is vital for all science and technological solutions. To coupe up with technological advances, innovations and to reach masses PRSC collaborated with leading academic institutions. Having said so, it is not enough to meet the challenges, it needs a revolutionary change and all stakeholders have to play dedicated and active role to achieve the common goal of sustainable development of state or country.

This article covers Agricultural aspects in general with special reference to Punjab State.

Agricultural Sustainability: A Brief Perspective

The growing concern of agricultural sustainability expressed during the last two decades of the twentieth century is being carried into the twenty first century because of the shrinking arable land resources, rapidly increasing population, transfer of arable land to other uses and degradation of land and water resources. The concept of sustainable agriculture becomes pertinent and takes on a new dimension when viewed in the context of limits to resource availability and use (Dumanski et al, 1992). Since the 21st century is a knowledge century, we may not lag behind in triggering the next phase of the Green Revolution by adopting knowledge-intensive precision farming based technologies, which are applicable under our conditions, so that agricultural sustainability and profitability can be assured while at the same time the natural resources are conserved.

The adoption of major technological developments in agriculture by the farmers generally takes much time and efforts in our country where a majority of the farmers are small and marginal, less educated or illiterate and resource poor. This will be particularly so in the case of adoption of knowledge-intensive precision farming based technologies. Remote Sensing and GIS technology are gaining importance as useful tools in sustainable agricultural management and development.

Cropping System Analysis

A cropping system can be defined as the cropping pattern and its management, to derive maximum benefits from a given resource base under specific environmental conditions. The cropping system analysis includes describing the current cropping system, monitoring its long term changes, evaluating the efficiency of cropping system, studying its long-term sustainability and suggesting alternate cropping system. This wok was carried out under National Jai Vigyan Science & Technology mission for two states (Punjab and West Bengal), which has now been extended to the whole of Indo-Gangetic Plains (IGP).

Cropping System Mapping

Understanding the current cropping system is essential for any development plan to be undertaken. The components of cropping system database include seasonal cropping patterns, crop rotations, crop sowing/planting pattern and crop calendar. Multi-temporal RS data available from IRS (Indian Remote Sensing) WiFS (Wide Field Sensor) and AWiFS (Advanced WiFS) have been utilized to generate state and district level Kharif, Rabi and Summer season cropping patterns (Panigrahy et al., 2003 and Panigrahy et al., 2004b). Since cloud-free optical data availability is limited in Kharif season, three-date Radarsat ScanSAR (microwave) data were also utilized along with available optical data. The three cropping pattern maps (kharif, rabi and summer) were integrated to generate crop rotation map. The multi-date data also helps in discriminating the areas with different sowing/planting pattern, as the spectral emergence depends upon the sowing time. This also helps in identifying allow period. Figure 1 shows a typical NDVI (Normalized Difference Vegetation Index) profile of different crop rotations in Punjab. NDVI is derived from spectral reflectance values. It is a general biophysical parameter that correlates with photosynthetic activity of vegetation and provides indication of 'greenness' of the vegetation (Sellers, 1985). The Figure shows the crop-growing period, sowing and harvesting time and crop condition. The two peaks of each curve are indicative of crops grown in two seasons.

Crop Phenology Study

Crop phenological stages are important indicators in agricultural production, management, planning and decision-making. Multi-temporal RS data provides opportunity to characterize the crop phenology at regional level. The ten-day NDVI composite products (from May 1, 2001 to November 21, 2001), available from the Vegetation sensor onboard SPOT4 satellite, were used to compute the minimum and maximum greenness, seasonality of vegetation, onset of sowing and harvesting, crop duration, total integrated greenness and skewness in the growing season (Das et al., 2005). The phenological maps could identify the differences not only between different crops but also between the same crop with different growing pattern. The duration of crops in Punjab during Kharif season ranged between 90-140 days,

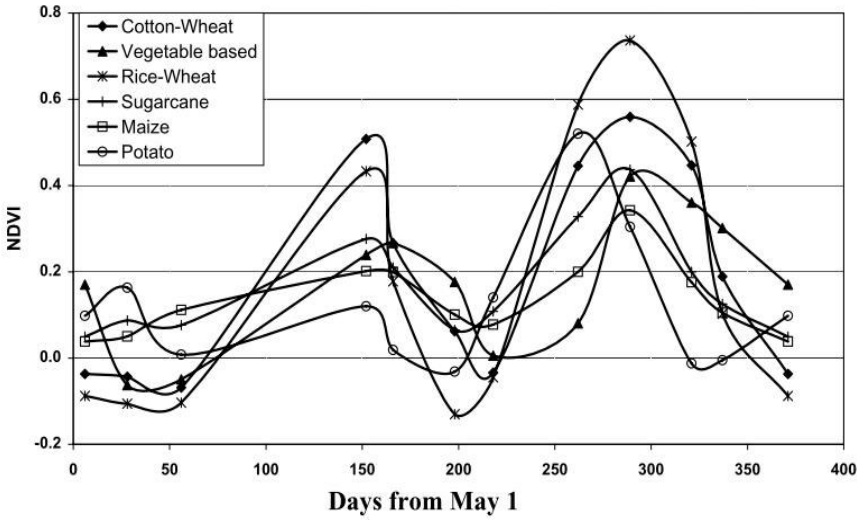


Figure 1 : NDVI Profile of different cropping systems in Punjab (Source: Panigraphi et al. 2003)

Table 1: Number of days after May 1 when maximum greenness occurs for Kharif Crops in Punjab (Source: Das et al., 2005)

Sl. no	Crops	days after May 1 when maximum greenness occurs for Kharif Crops
1.	Rice	108 (0.677)
2.	Maize	112 (0.749)
3.	Cotton	116 (0.808)*

*Numbers in parentheses show the NDVI value during maximum greenness

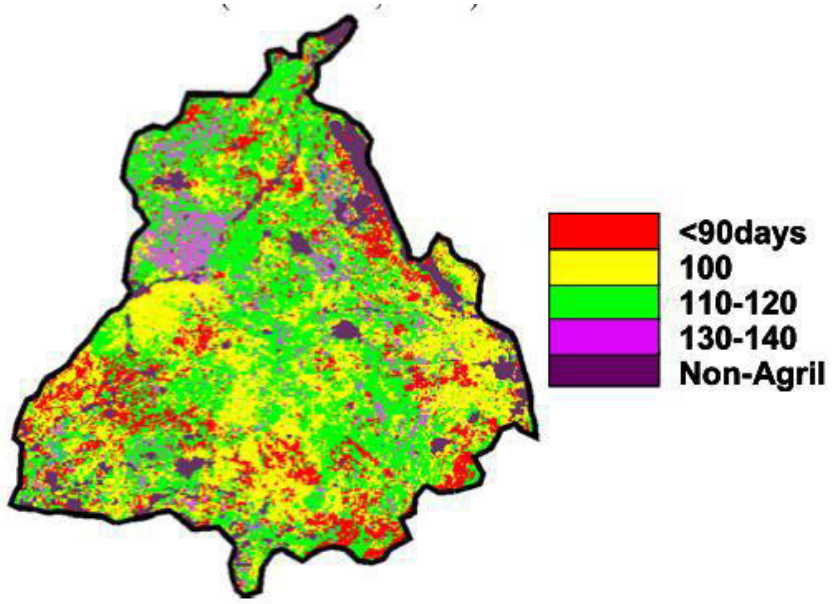


Figure 2 : Kharif season crop duration in Punjab computed using remote sensing data (Source: Das et al. 2005)

with majority between 110-120 days (Figure 2). Maximum greenness has also been calculated (Table 1) by fitting the NDVI profile with a second order polynomial for different major crops of states in IGP (Das et al., 2006).

Cropping System Performance Evaluation

Evaluation of the efficiency of cropping systems is one of the essential components of a cropping system research. To define the efficiency of cropping systems, various indices have been developed. These indices describe the intensity, productivity and diversity of cropping systems. However, most of these indices have been used for a single farm and not on a regional scale. In our study we have tried to derive three of these indices using RS data. These are: Multiple Cropping Index (MCI), Area Diversity Index (ADI), and Cultivated Land Utilization Index (CLUI). MCI is an indicator of crop intensification in time domain. The ADI represents diversity of crops grown and indicates sustainability. CLUI is an indicator of land utilization efficiency, and identifies when and where the land lies unutilized. MCI was estimated from crop rotation maps, ADI was derived from seasonal cropping pattern maps and CLUI was derived from the NDVI temporal profile, which provided estimation of crop duration (Ray et al., 2005a). The analysis showed that there has been an alarming decrease in crop diversity in Punjab (Figure 3), while West Bengal needs crop intensification in many parts of the state (Panigrahy et al., 2005).

Crop Forecasting and Yield Modeling

Crop Acreage and Production Estimation (CAPE) project was formulated under the Remote Sensing Applications Mission in 1986. CAPE project, provides district level crop production forecasting for major crops viz. wheat, rice and cotton in all the districts of Punjab. The district level RS based yield models have been developed using the empirical relationships between yield and single or multi-date (spectral profile) RS parameters (Dadhwal and Ray, 2000). In some of the yield models RS parameters have been used along with other agro meteorological variables and/or a time trend variable.

FASAL (Forecasting Agricultural output using Space, Agro meteorology and Land based observations) is a new system, whose

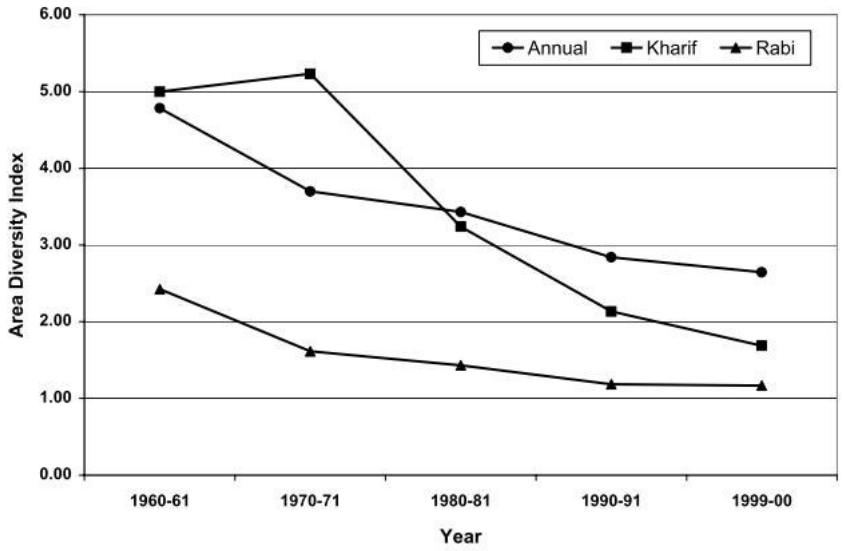


Figure 3: Kharif season crop duration in Punjab computed using remote sensing data (Source: Das et al. 2005)

objective is to integrate various approaches and organizations for creating a hierarchical information system, which will help in providing information, related to crop condition and crop production any time of the season from sowing to harvest (Dadhwal, 1999). A pilot study of FASAL multiple forecasting system has been implemented in Orissa. As a part of the techniques development for FASAL project, national level rice (Chakraborty and Panigrahy, 2000) and wheat (Oza et al., 1999) forecasts are being provided using multidate microwave and optimal data, respectively, following a hierarchical classification approach.

Crop Condition Assessment

Efforts have been made to develop procedure for crop stress detection and condition monitoring using satellite data at SAC. Landsat MSS data has been used to detect the moisture stress in groundnut crop in Vanthali taluk of Junagadh district. Resource satellites like IRS or Landsat can provide detailed spatial information on the condition of the crop but the utility of such data to regional or large area crop condition study is restricted because of their comparatively long repetition cycles and the substantial volume of data. To handle the problem of crop condition assessment, Ajai and Sahai (1986) have proposed a hybrid approach, which uses both the comparatively high resolution earth resources satellite data together with the coarse-resolution meteorological satellite data (NOAA-AVHRR). Liu and Kogan (1996) have used the NDVI images generated from NOAA-AVHRR GVI (Global Vegetation Index) data to monitor large-scale drought patterns and their climatic impact on vegetation. Kogan (1994) has developed two indices, like. VCI (Vegetation Condition Index) and TCI (Temperature Condition Index) for monitoring drought. While VCI is the percentage of NDVI with respect to its maximum amplitude, TCI is the percentage in brightness temperature (derived from channel 4 of NOAA-AVHRR) with respect to its maximum amplitude. In India a National Agricultural Drought Assessment and Monitoring System (NADAMS) was initiated in 1986, using RS data from the NOAA satellite and ground observations of rainfall and agricultural conditions (NRSA, 1990).

District-wise Crop Acreage and Monitoring

Agriculture is the livelihood of our nation. It is the key to food security, export earnings and local employment generator. Increasing competition among grain exporters and the instability of grain markets have underscored the importance of having accurate and timely information on supply and demand by exporting and importing among the different countries. For this purpose accurate crop production forecasts are required along with its geographic distribution, and the associated crop yield which determined by local growing conditions.

Acreage estimation using multidate IRS Resourcesat2 AWiFS (coarser spatial resolution ~56 m), LISS-III (medium spatial resolution~24 m) and LISS-IV (medium spatial resolution~5 m) data, depending upon its availa-

bility. Area estimated under different crops is presented in the table given below:

Sl. no	Crop (2016-17)	Acreage ('000 ha)
1.	Kharif Maize	130.46
2.	Kharif Rice	2905.92
3.	Cotton	274.58
4.	Winter Vegetables	241.17
5.	Wheat (Preliminary)	2940.50

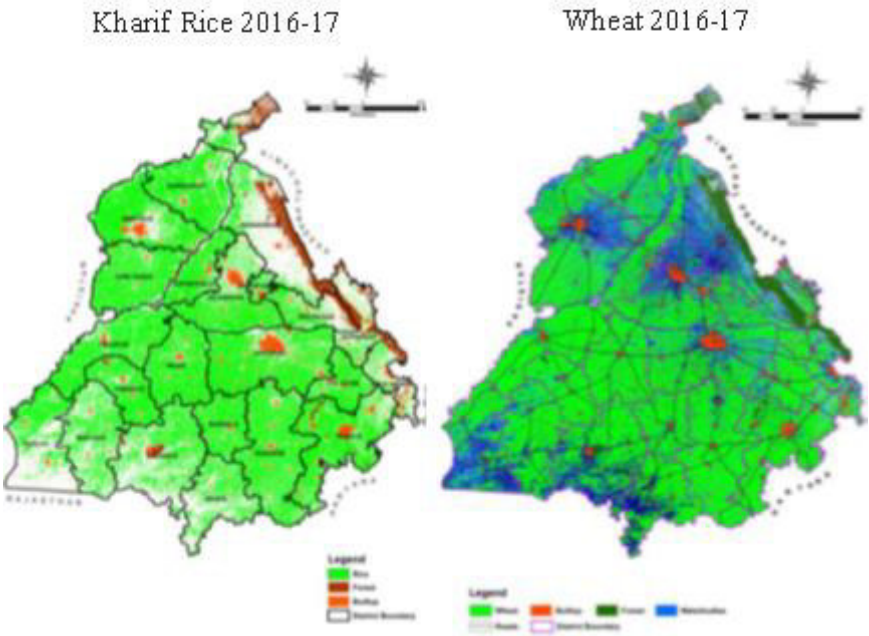


Figure 4: Monitoring of Kharif Rice and Wheat

Monitoring Crop Residue Burning

Burning of agricultural biomass residue, or Crop Residue Burning (CRB) has been identified as a major health hazard. In addition to causing exposure to extremely high levels of Particulate Matter concentration to people in the immediate vicinity, it is also a major regional source of pollution, contributing between 12 and 60 per cent of PM concentrations as per various source apportionment studies. In addition, it causes loss of vital components such as nitrogen, phosphorus, sulphur and potassium from the topsoil layer, making the land less fertile and unviable for agriculture in the long run. Month of November each year in the Indo-gangetic plains (IGP) primarily to clear up the waste post harvesting, so as to prepare the field for the next cropping cycle in a short time. For farmers, burning seems to be a quick fix to remove post harvest vegetative material for vacating the fields because of high labour wages, declining number of livestock, long time period required for composting. Moreover, their concern to get the crop produce collected and marketed at the earliest and to timely plant wheat also adds up to their agony which has lead to open burning of stubble. Every year we grapple with the menace of stubble burning in Punjab, Haryana, Uttar Pradesh which particularly engulfs Delhi and the adjoining areas with haze. Although, the practice has been there for long time but the intensity of pollution was less. The technology to dispose paddy residue is available but the operational costs are very high for small and marginal farmers to introduce on their own. District-wise total paddy residue burning was estimated at state-level and it was 2134.15 '000ha (70.90% of paddy area) in Punjab.

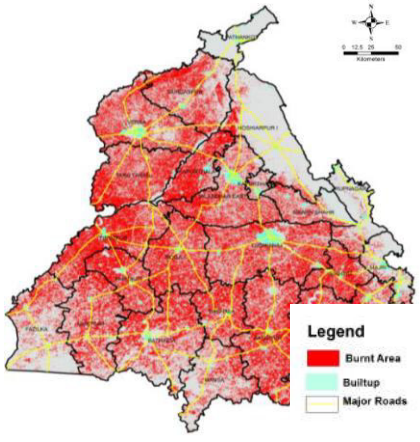


Figure 5: Area under paddy residue burning

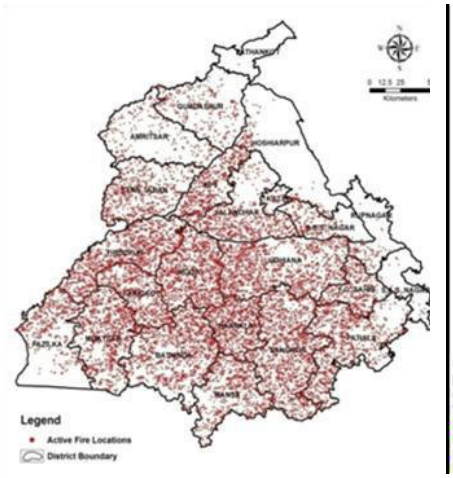


Figure 6: Active fire events captured by MODIS in Punjab for the period 15Oct – 15 Nov., 2016

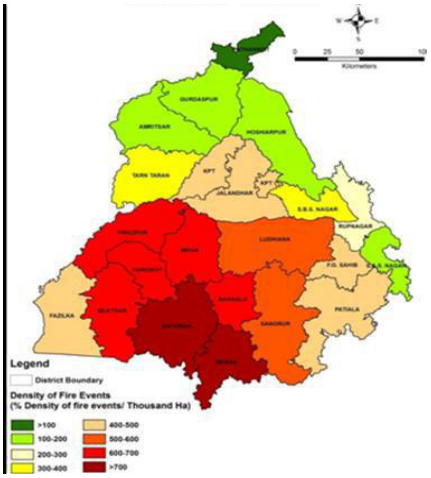


Figure 7: Fire event Density in Punjab for the period 15Oct – 15 Nov., 2016

An overall comparison of fire occurrences in all districts during the period from 15th October to 15th November, 2016 (Figure 8), revealed that the maximum number of fire events were found in Sangrur (1498) followed by Ludhiana (1450), Bathinda (1244), Moga (1135) and Firozpur (1125) . Pathankot (2), SAS Nagar (32), Rupnagar (94) and Hoshiarpur (125) being kandi area districts comprised minimum number of fire events as compared to the rest of the state districts during this period. Amritsar (235) is also a major rice growing district but it has less number of fire events as compared to other districts. This may be attributed to the cultivation of basmati rice in Amritsar wherein it is harvested through sickles.

Precision Farming

The conventional agronomic practices follow a standard management option for a large area irrespective of the variability occurring within and among the field. By catering to this variability, called precision farming, one can improve the productivity or reduce the cost of production and also diminish the chance of environmental degradation caused by excess use of inputs (Pierce and Nowak, 1999). Remote sensing can provide key inputs for the implementation of precision farming (Moran et al., 1997; Ray et al., 2001).

Site-specific Management Plan

Creation of homogeneous site-specific management zones

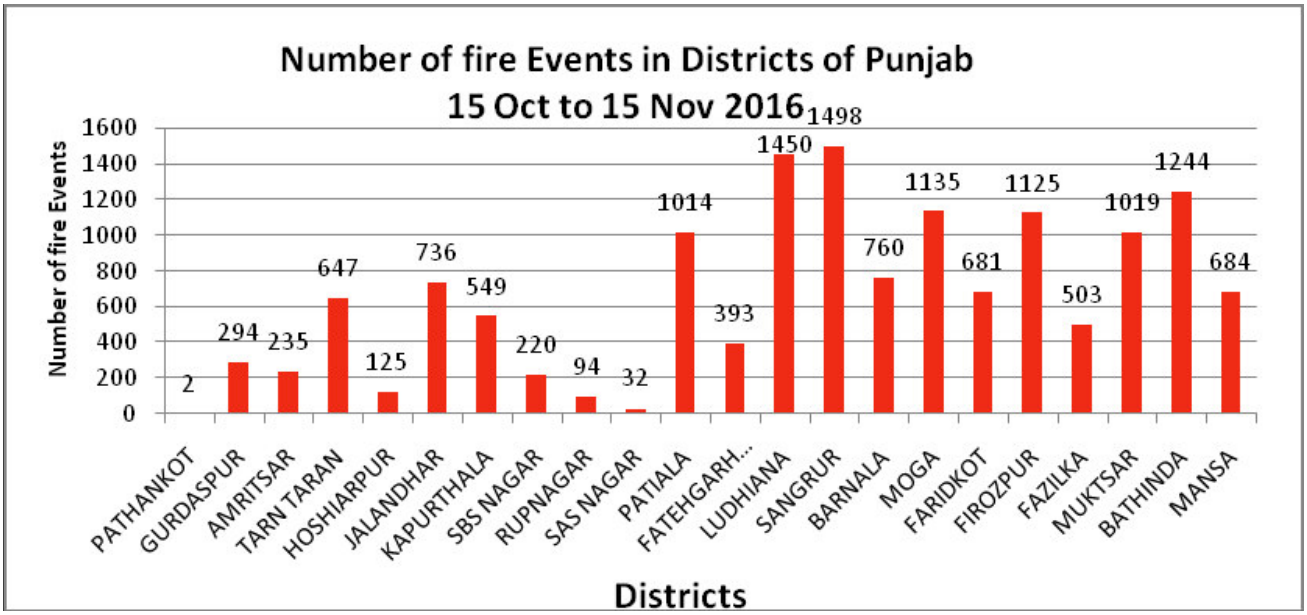


Figure 8: District-wise Fire events captured by MODIS for the period 15Oct to 15 Nov., 2016

through mapping the variability existing within the region is essential for precision agriculture. A study was conducted for the pulse-growing farmers of Sriramputam village of Dindigul district in Tamilnadu (Ray et al. 2005c). RS data during fallow period was used to stratify the soil into various categories. Soil sampling was carried out both using conventional grid method and RS data based stratified random sampling method. Analysis of soil samples showed that RS based stratification could reduce the sample size as well as it could capture the soil variability better than the conventional method. Various geostatistical methods and input parameters were evaluated for generating soil management zones. Site-specific soil management plans based on RS data were found to be better than those based on only soil data.

Soil Nutrient Management

Soil test-based fertility management is an effective tool for increasing productivity of agricultural soils that have a high degree of spatial variability. However, major constraints impede wide scale adoption of soil testing in most developing countries. In India, these include the prevalence of small holding systems of farming as well as lack of infrastructural facilities for extensive soil testing Under this context, GIS-based soil fertility mapping has appeared as a promising alternative. Use of such maps as a decision support tool for nutrient management will not only be helpful for adopting a rational approach compared to farmer practices or blanket use of state recommended fertilization, but will also reduce the necessity for elaborate plot-by-plot soil testing activities. However, information pertaining to such use of GIS-based fertility maps has been meager in India.

The maps of Ludhiana district showing the spatial distribution of micronutrient cations clearly indicates that 4 per cent area of the district is deficient in DTPA extractable Zn, only 0.6 per cent area is deficient in copper, nearly 7 per cent of the district area had Mn content below the threshold value and 3.6 per cent area of the district is deficient in Fe (Sharma et. al. 2004).

Deficiency of all the four micronutrients (Zn, Cu, Fe, and Mn) at a particular place has not been observed in the soils of the Ludhiana district. Nearly 79 per cent area in the district represented by category "S-S-S-S" i.e. all the micronutrients are sufficient for the normal growth of the crop. The multi-micronutrient map showed that the deficiency of two or more elements at a single place is less prevalent than the deficiency of individual micronutrient.

Ground Water Quality for Irrigation

The ground water is a major source of irrigation in Muktsar district, however, it is not always suitable for irrigation due to its brackish nature. As a consequence of low and erratic rainfall and inadequate supply of canal water, farmers have no option except to use these brackish waters for meeting their irrigation requirements. The indiscriminate use of such waters could lead to deterioration of soil environment and reduce soil productivity.

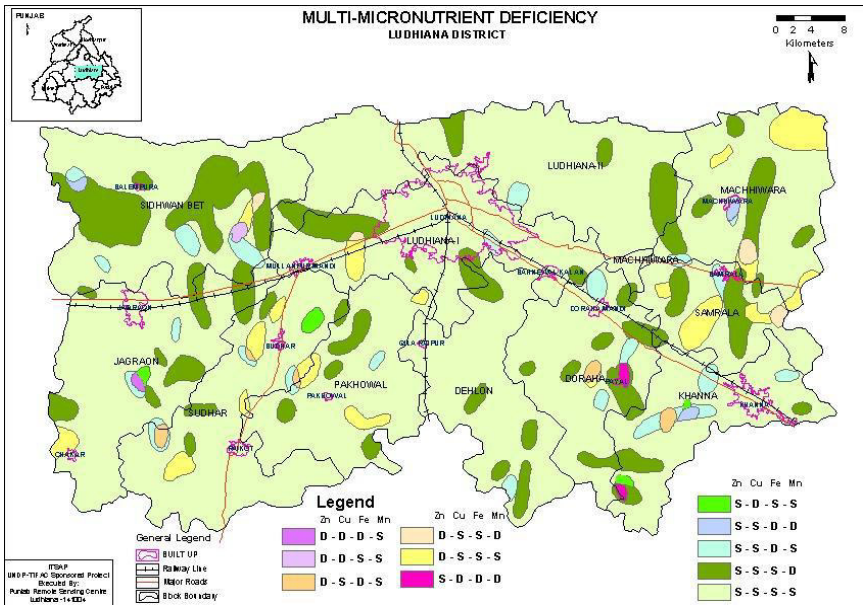


Figure 9: Multi-micronutrient status in Soils of Ludhiana District

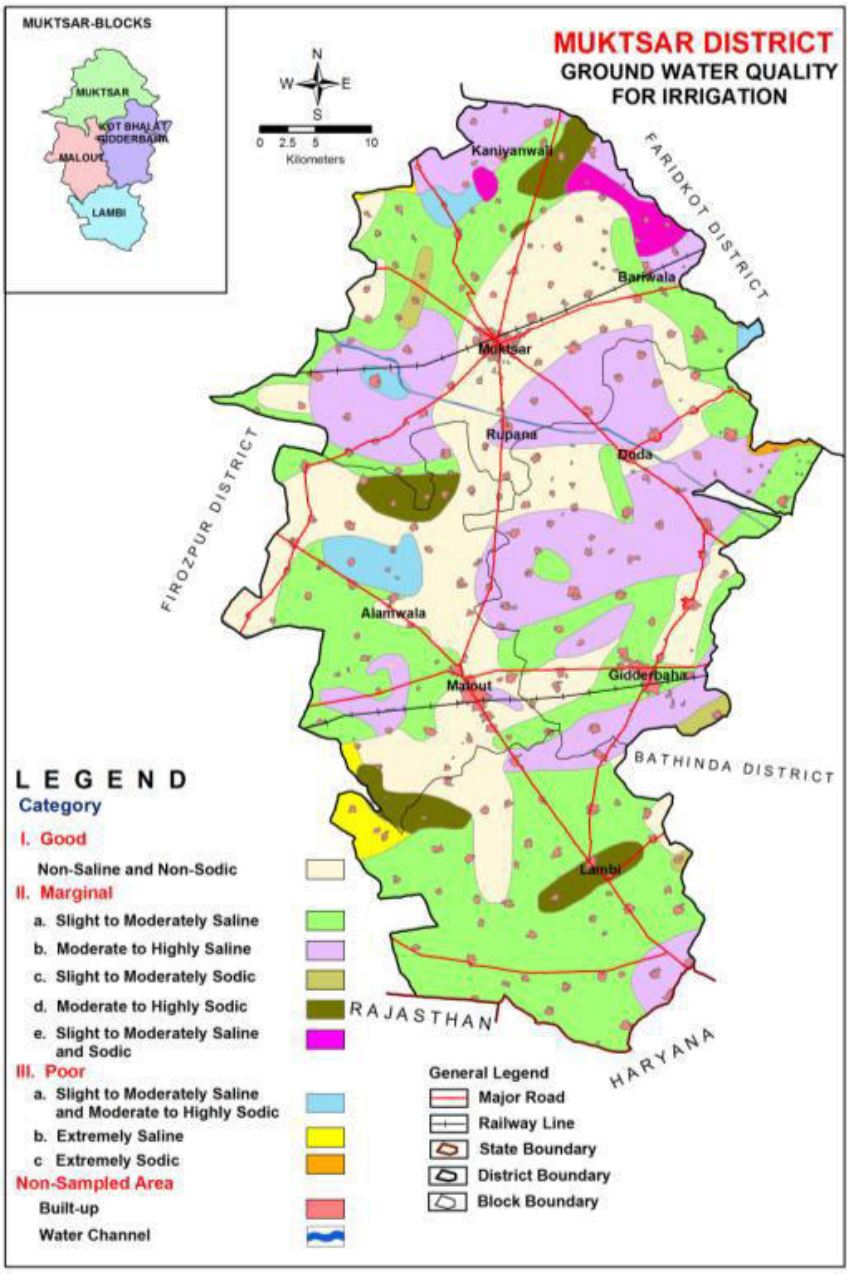


Figure 10: Ground water quality for irrigation in Muktsar district

In order to assess the quality of ground water in Muktsar district water samples were collected randomly from 247 tube wells distributed in almost all the villages of Muktsar district The analysis of water samples for various constituents was undertaken following the methods outlined by Richards (1954). The water quality was assessed as per the standard criteria. Boundaries of ground water quality zones (1-5) were finalized and digitized. The data base file has been attached to the map and query system developed.

Conclusions

Sustainable agricultural development and increase in crop production could be achieved by adopting a variety of agricultural technologies, which may be summed up as:

- Suitable cropping systems for different agro-ecological regions based on soil, terrain and climatic suitability
- Integrated nutrient management for improving soil productivity and minimization of the risk of pollution of soil, water and environment;
- Integrated pest management for effective pests control as well as to reduce the adverse effects of pesticides on environment;
- Soil and water conservation for controlling soil degradation and improving moisture availability.
- Input use efficiency maximization in terms of economic return with minimal input
- Remote Sensing and GIS technologies are very effective tool for suggesting action plans /management strategies for agricultural sustainability of any region.
- To educate, monitor and plan preventive measure due to poor practices of post harvest such as crop residue burning by farmers.

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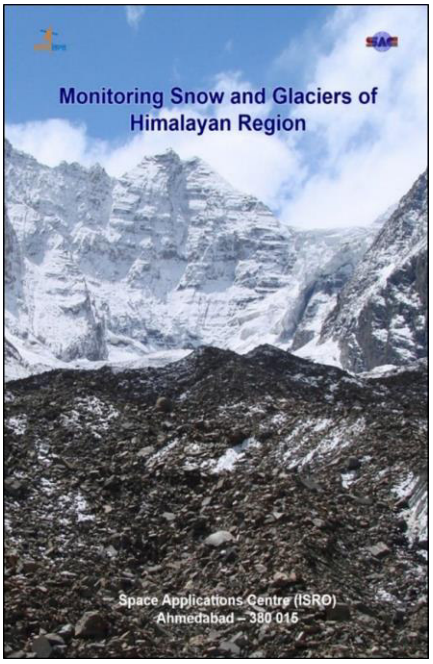
Release of Book entitled, "Monitoring Snow and Glaciers of Himalayan Region", published by Space Applications Centre, ISRO, Ahmedabad

A. S. Rajawat and Manish Parmar
Space Applications Centre, Ahmedabad

Space Applications Centre (SAC), Indian Space Research Organisation (ISRO), Ahmedabad has published a Book entitled, "Monitoring Snow and Glaciers of Himalayan Region". The Book has been released on the occasion of "ISRO Awards Function", on November 18, 2016 by Shri A.S. Kiran Kumar, Chairman, ISRO and Secretary, Department of Space at Space Applications Centre, ISRO, Ahmedabad. This document provides details of the salient findings of a national project entitled, "Monitoring Snow and Glaciers of Himalayan region (Phase-II)", taken up under National Natural Resources Management (NNRMS) Program and jointly sponsored by the Ministry of Environment, Forest and Climate Change (MoEF&CC) and Department of Space (DOS). The project has been successfully completed by Space Applications Centre, Indian Space Research Organisation (ISRO), Ahmedabad as a nodal agency along with eighteen partner institutes.

The document provides details of the current status of Himalayan snow and glaciers based on the analysis of time series multi-sensor satellite data supported by field based observations. It covers details about the types of satellite data used, methodology developed and salient findings related to snow cover, glaciers and Himalayan Glacier Information System. Studies have been carried out using Ground Penetrating Radar (GPR), hyperspectral data, SAR Interferometry and Photogrammetry for glacier ice thickness, snow pack characterization, glacier flow determination and glacier mass balance estimation. Development of advance technique using INSAT-3D, RISAT-1, Gravity Recovery and Climate Experiment (GRACE), ICESat/GLAS



Shri A.S. Kiran Kumar, Chairman, ISRO releasing the Book

Dignitaries releasing of book (from left to right: Dr. Raj Kumar, Deputy Director, EPSA/SAC, Shri Lalit Kapoor, Advisor, MoEF&CC, Chief Guest Shri A.S. Kiran Kumar, Chairman, ISRO, Shri Tapan Misra, Director, SAC and Dr. A.S. Rajawat, Project Director, SAC)

Shri Lalit Kapoor, Advisor, MoEF&CC, Government of India, New Delhi briefing about the Contents and significance of the book.

laser altimetry data for snow cover, detection of glacial lakes buried under snow, estimation of regional water mass variations and monitoring ice thickness changes have been well documented.

Major highlights are as follows:

- Himalayan snow cover monitoring has been carried out for the time frame 2008 -14 using AWiFS data. Sub -basin wise snow cover maps (5 and 10 daily), statistics and depletion curves compiled in 42 Snow cover Atlases. In addition, three Atlases for Nepal and Bhutan were also prepared covering three additional sub-basins for time frame 2012-13 and 2013-14.
- The analysis of snow cover data of 33 sub-basins for the period 2004-2014 (includes 2004-07 of Phase -I) shows 1-7 % increase in snow cover. It has been observed that snow line has come down to lower altitudes during the time frame 2010-2014 as compared to previous years. It is also observed that variation in snow cover changes are higher during October to February time frame.
- Characteristics of snow cover extent in western (Indus, Chenab and Satluj), west-central (Ganga) and eastern (Tista and Brahamaputra) sub-basins are distinctly different i.e., western sub-basins (max. 71—100%, min. 3 – 54% and variability 39-90%), West-Central (max. 59-66%, min. 9-17% and variability 42-57%) and Eastern (max. 20-72%, min. 3-13% and variability 17-64%).
- Around 2800 glaciers representing 21 sub-basins well spread over entire Himalayan region have been monitored using multi -date satellite data and the analysis depicted that 87% of the glaciers showed no change, 12% retreated and 1 % glaciers have advanced.
- Glacier mass balance esti-

mated for ~ 1000 glaciers in 12 selected sub-basins using AAR Approach for 2008-2013.

- A Himalayan Glacier Information System (HGIS) has been developed based on geospatial database of glacier inventory carried out on 1:50,000 scale using Resourcesat-1 satellite data of 2004–2007 time frame. Inventory results show that there are 34919 glaciers covering 75, 779 sq km area in Himalayan region.
- A Glacier health assessment model for Alaknanda and Bhagirathi sub-basins of Ganga basin has been developed in GIS environment.
- 15 glacial expeditions were organized for ground truth data collection, including establishment of AWS and glacial lab near Chota Shigri glacier in H.P.
- Some of the advanced techniques such as demonstrating penetration capability of RISAT SAR data in detecting buried moraine dammed lakes under ~ 2 m dry snow cover, glacier velocity estimation using CO-SI-Corr techniques, depth estimation using ice flow model, estimation of regional mass anomalies over Himalayan region using GRACE data etc were demonstrated.
- The scientific outcome of the project has been brought out in 26 publications in peer reviewed International/National Journals, 3 in International Symposium proceedings and 45 Snow cover Atlases. In addition, human resource development for around 25 persons (Includes 2 Ph.D. dissertations; 5 M.E./ M.Tech./M.Sc. dissertations and training) could be done.
- The information generated under the project provided accurate and reliable information on Himalayan snow cover and glaciers based on space based observations. It provided up-to-date information on the state of the Himalayan cryosphere and could be utilized in climate change research, snow and glacier melt runoff modeling, hydropower potential estimation and glacial lakes monitoring. R&D elements demonstrated demonstration of advanced techniques of satellite data analysis and potentials of new sensors put on recent satellites for improved understanding of Himalayan Cryosphere.
- Geospatial databases, Atlases and Report/Book has been put on SAC Web Portal VEDAS.

Contact for Details:

SAC (2016) Monitoring Snow and Glaciers of Himalayan Region, Space Applications Centre, ISRO, Ahmedabad, India, 413 pages, ISBN:978- 93 – 82760 -24 -5.

Copy of the Book can be downloaded from SAC Web Portal VEDAS using Link: http://vedas.sac.gov.in/vedas/downloads/SAC_Snow_ Glacier_Book.pdf

Training and Research in Earth Eco-System (TREES)

An initiative by VEDAS Research Group (VRG), EPSA, Space Applications Centre

Hiren Bhatt and S. P. Vyas,
Space Applications Centre, Ahmedabad

The overarching purpose of the TREES is to expand the societal benefits of the nation's investments in ISRO Earth science research. Through academia and research institutions, it enables the use of Earth science research to enhance the remote sensing research, applications and human resources. This would benefit the larger part of the society through decision support tools which organizations use to serve their management and policy responsibilities. This would enable the institutions to assess the potential value of Indian space borne data/products and work to determine ways to use the Earth science products on a sustained basis.

The Rich source of data available satellite data sets available in Satellite Data Information System (SDIS), historic data of RISAT, IRS WiFS, LISS-I and LISS-II, Resoursat-1 and 2 data from moderate resolution sensors AWiFS, LISS-III, high resolution data from LISS-IV, CARTOSAT- etc. is available. The all-weather active SAR data from RISAT will be of immense importance and use This upcoming era of active SAR with different polarisation options has created a great enthusiasm in scientists and researchers. All of these data is accessible for analysis to the researchers. This is ISRO's initiative to support Graduate and Post graduate students, professionals from academics and researchers across the country to pursue research in the field of Earth Eco systems research using earth observation satellite systems

The Research and training programme is designed for the target audience of Science and technology Graduate and Post graduate students, Researchers from R & D institutes and Academia. The broad area will be applications of remote sensing. The data base contained in VEDAS is used as a source.

We are providing following support for students, academics and researchers Two outreach initiatives namely (i) Training Initiative and (ii) Research Initiative are planned to accomplish its objective.

I. Training Initiative:

Under this training, satellite data familiarity training programmes are planned to organise at regular intervals to popularise Earth data among students, academics and researchers. It is of a short duration three to five days. The maximum possible number of participants are admitted to this programme. Basic understanding and handling is part of this training initiative. Calendar of training initiative are announced in advance.

Training programs related to the applications of Satellite data conducted at SAC under TREES initiative are listed in Table 1. TREES has thus far organized seven training modules resulting in training of 162 participants from more than 75 organizations / institutes distributed to all over country.

II. Research Initiative:

Research initiative offers programmes to cater the needs of students, academics and researchers across the country. This programme is designed to initiate research aptitude among students, academics and researchers in the field of earth Eco-Systems. Post-graduate students of Remote sensing, Geo informatics and other

Table 1: TREES Training Events

Sr. No.	Event Name	Date	Participants	Institutes
1	Satellite Calibration and Validation	13-17Jun, 2016	04	02
2	Remote Sensing & Geo-Informatics – Basics	30 Aug-02 Sep, 2016	20	10
3	Satellite based Hydrology and mod-elling	12–16 Dec, 2016	17	09
4	Polarimetric SAR data Processing and Analysis	20–21 Dec, 2016	21	12
5	Hyperspectral remote sensing with AVIRIS-NG data over India.	4–6 Jan, 2017	50	25
6	Handling of MARS Orbiter Mission (MOM) Data (MCC, MSM and TIS)	28 Feb -1 Mar, 2017	29	24
7	Training on Chandrayan-1 TMC and HySI data analysis	2-3,March, 2017	21	18

Satellite Calibration and Validation

Remote Sensing & Geo-Informatics – Basic

Polarimetric SAR data Processing and analysis

Chandrayaan-1 TMC and HySI data analysis

Participants at Various Training Programmes

basic sciences intending to do their final year/semester project, young researchers and academics may apply for this programme. They will be introduced to Satellite Remote sensing providing research guidance to carry out research for three months to one-year project.

We are providing following support for students, academia and researchers

- Familiarity of VEDAS
- Advanced Visualization of Earth data on VEDAS database available on large networked storage
- Access to VEDAS Computer Workstations, Image processing and GIS Software
- Data Analytics
- Research guidance

Twenty-five students are presently working on Research initiative in various fields as listed below:

- Crop suitability analysis (3 students, states namely Uttar Pradesh, West Bengal and Tamilnadu)
- Development of Bluetooth interface between Android device and S- band reporting terminal
- Urban feature extraction using Very High Resolution Remote Sensing Data
- Modeling growth of Varanasi city using logistic regression.
- Coal / mineral identification using hyperspectral data
- Water resource management in parts of Surendranagar district
- Wetland mapping in Surendranagar district
- Development of system to send images to S- band reporting terminal
- Scalable data mining algorithm for Big-Data
- Studies on urban environment
- Roof-top solar photovoltaic energy potential estimation
- Mineral identification using Hyper spectral data for exploration
- Classification of hyper spectral data over urban area based on morphological operators
- Ukai dam catchment runoff capacity estimation of Tapi River for flood risk assessment for Surat city

Training and research works under TREES programme are managed by Earth-ecosystem Research and Training Division (ERTD) under VEDAS Research Group (VRG) at SAC., Ahmedabad

The prime motivation for undertaking training at SAC is to get associated with ISRO, a premier institute of national and international repute. The students get opportunity to work/discuss with scientists of ISRO in various fields. The geospatial technology applications with advanced image processing are an interesting field in which students and academia are getting more and more interest. The satellite data and derived products are made available free to the researchers/students. The software and hardware are made available for research free to them. In-addition the training required for understanding/analysis would also be provided to them. The finding would be allowed for scientific reporting and/or publication with acknowledgement of institute/ data. The candidates are given certificates by SAC.

Visit us at vedas.sac.gov.in

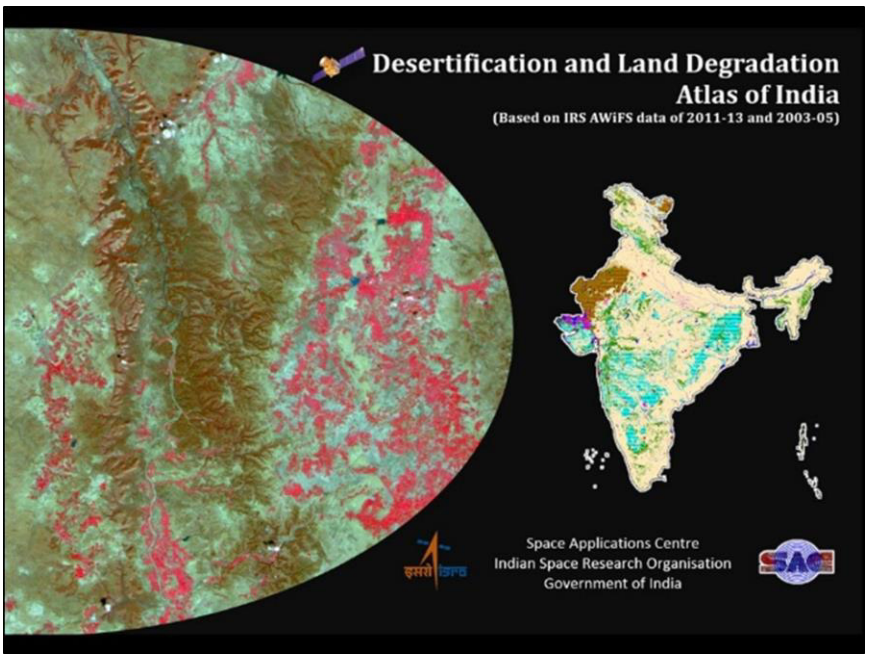
Release of "Desertification and Land Degradation Atlas of India", published by Space Applications Centre, ISRO, Ahmedabad

A. S. Rajawat and Manish Parmar
Space Applications Centre, Ahmedabad

Space Applications Centre (SAC), Indian Space Research Organisation (ISRO), Ahmedabad has published "Desertification and Land Degradation Atlas of India (Based on IRS AWiFS data of 2011-13 and 2003-05)". The Atlas has been released on the occasion of "World Day to Combat Desertification", on June 17, 2016 jointly organised by the Ministry of Environment, Forest & Climate Change (MoEF&CC), Government of India, New Delhi and Arid Zone Forest Research Institute (AFRI) at Jodhpur, Rajasthan. Theme of the "World Day to Combat Desertification – 2016" is "Inclusive Cooperation for Achieving Land Degradation Neutrality", with Slogan "Protect Earth, Restore Land, Engage People".

This Atlas is one of the outcomes of an ongoing national project entitled, "Desertification Status Mapping of India", sponsored by the MoEF&CC under Standing Committee on Bio-resources & Environment of National Natural Resources Management System (NNRMS SC-B). The project is being executed by SAC along with 19 concerned Central/State government departments and academic institutes.

This Atlas presents Desertification and Land Degradation Status Maps depicting Land Use, Process of Degradation and Severity Level along with area statistics consolidated for entire country as well individual states for 2011-13 and 2003-05 -time frame and reports the changes. This geospatial database is extremely useful for identifying vulnerable areas of desertification and land degradation and easy updation in future. Further work on Desertification and land degradation mapping, vulnerability modelling and preparing action plans for combating desertification using high resolution IRS LISS -III, LISS-IV and Cartosat data for selected vulnerable districts and micro watersheds is in progress. The status of India's desertification and land degradation along with the changes can be used for India's reporting to United Nations Convention on Combating Desertification (UNCCD) by Desertification Cell of MoEF&CC. The maps and salient findings compiled in the form of Atlas can also be used as a ready reference by concerned policy makers, regional planners and researchers.



Dignitaries Releasing the Atlas on World Day to Combat Desertification – 2016 at AFRI, Jodhpur on June 17, 2016. (from left to right: Dr. Y.V.N. Krishnamurthy, Director, NRSC & then Scientific Secretary, ISRO, Shri Rajani Ranjan Rashmi, IAS, Additional Secretary, MoEF&CC, Chief Guest Shri Gajendra Singh Shekhawat, Honorable Member of Parliament, Jodhpur, Shri Surendra Singh Chaudhary, PCCF & HOFF, Rajasthan and Shri N.K. Vasu, IFS, Director, AFRI)

Dr A.S. Rajawat, Project Director, DSM, briefing about the Atlas

Shri Shashikant A. Sharma, Group Head, VRG, briefing about SAC Web Portal VEDAS

Highlights of the Atlas:

- The study reveals that 96.28 mha area of the country is undergoing process of land degradation (29.29 % of the total geographic area of the country) during 2011 -13, while during 2003-05 the area undergoing process of land degradation is 94.41 mha (28.72 % of the total geographic area of the country). Thus there is an increase of 1.87 mha area undergoing process of land degradation (constituting 0.57 % of the total geographic area of the country) during the time frame 2003 -05 and 2011-13.
- Area under desertification (arid, semi-arid and dry sub -humid regions of the country) during 2011-13 is 79.86 mha whereas during 2003-05 it is 78.78 mha. Thus there is an increase of 1.08 mha area under desertification.
- Preparation of Desertification Status Maps at 1:50,000 scale for selected 78 vulnerable districts using IRS LISS-III data for 2011-13 and 2003-05 time frames in GIS environment is in progress. 82 maps out of targeted 178 have been completed including change detection analysis and final map composition. Completed maps have been put on SAC Web Portal VEDAS.
- Copies of the Atlases have been sent by the Desertification Cell of MoEF&CC to United Nations Convention on Combating Desertification (UNCCD), HQ, who have appreciated the work.

For Details: SAC, 2016, Desertification and Land Degradation Atlas of India (Based on IRS AWiFS data of 2011-13 and 2003-05), Space Applications Centre, ISRO, Ahmedabad, India. ISBN:978-93-82760 -207, June, 2016, 219 p.

Geoinformatics Education & Career

Dr. P M Udani
ISG Executive Council Member and Director ISTAR

Geoinformatics programs conducted by science and engineering institutes generally emphasizes on imparting below mentioned skills.

- GIS Skills: Data Entry, Data Conversion, Data Maintenance, Metadata Creation and Editing, GIS Workflow, Map Design and GIS Analysis.
- Programming Skills: Programming Languages, GIS Platform Architecture, Model Building, Web GIS Services.
- Database Skills: Database Design, Data Model Design, SQL Services;

Collectively the above mentioned skills are considered as academic competency in Geoinformatics and would ensure employability at entry level or as a team lead. Personal competencies (Integrity, Interpersonal Skills, Professionalism, Initiatives, Dependability & Reliability), workplace competencies (Team Work, Creative Thinking, Planning & Organization, Problem Solving & Decision Making, Technology Grasp, Business Fundamentals), management competencies and multiple domain competencies demonstrated by Indian IT professionals is now equally important for geoinformatics professionals because of widespread applications of geospatial technology, which are now considered as daily consumable.

GIS database development using RS, GPS, LiDAR, Drone, conventional surveys and GIS-MIS integration, is providing more job opportunities at entry level or as team lead. Geospatial industry is following IT model and more and more services are migrated from desktop solution to server centric solution. Skilled professional are required for large database handling, GIS automation and building enterprise GIS services for desktop and mobile clients.

GIS Jobs Posting (Feb-Mar 2017)

Organization	Designation & Job Requirements
iSpatial Techno Solutions Pvt. Ltd. Hyderabad	GIS Data Specialist; Extensive experience in data migration and analysis ArcGIS Server, SQL and Oracle
AAM Group, Hyderabad	LiDAR Survey
TwoDMapping, Rajkot	GIS Executive; Cadastral Mapping for NLRMP Project
Micro ITG India Ltd., Ranchi	DPR expert for Water Supply; Knowledge of Rural Water Supply , DPR preparation and AutoCAD
Wipro Ltd., Bengaluru	GIS Developer; ArcGIS Server, Python Scripting, Oracle
MapMyIndia (CE Info Systems Pvt. Ltd.), Delhi NCR (Okhla)	GIS Developer; Working experience of ESRI ArcGIS Platform (ArcObjects and ArcGIS Server), Good knowledge of Oracle/MS SQL/PostgreSQL Server, Web Technology (VB.NET/C#/Asp.Net)
Reliance Jio Infocomm Limited, Meerut	State GIS Engineer; Geographical analysis for location specific data and finding connectivity,
AECOM India Pvt. Ltd., Dharmasala / Shimla/Gurgaon	GIS & RS Expert for water and sewer analysis
ADCC Infocad Ltd. Bhopal	GIS Executive; AutoCAD and ArcGIS

Annual Report - 2016

N. S. Mehta, Secretary, ISG, Email: nsmehta55@gmail.com

It gives me great pleasure to present the 21st Annual Report of ISG for the Year 2016. During this period, various activities were planned and executed to realize the objectives of Indian Society of Geomatics. The details are as follows:

1. Membership

This Year 136 Life Members and 07 Annual members have been enrolled. The total membership of ISG is now 1976 The details of membership are given bellow:

Membership Type	December 2015	December, 2016
Life	1799	1935
Patron	34	34
Annual/Student	28	07
Grand Total	**1861**	1976

In addition, one ISG Fellowship has been awarded this year.

Total number of ISG Fellows is now **14.**

2. Annual Convention and National Symposium

ISG Annual Convention – 2016 is being held along with ISRS – ISG National Symposium - 2016 on **"Recent Advances in Remote Sensing and GIS with Special Emphasis on Mountain Ecosystems" during December 7 - 9, 2016.** The Symposium being hosted jointly by Indian Institute of Remote Sensing (IIRS) and Indian Society of Remote Sensing – Dehradun Chapter, at IIRS Campus, Dehradun.

3. ISG Fellowship and Awards

ISG Fellowship:

Dr. Shailesh Nayak : Distinguished Scientist and former Secretary MoES, New Delhi (Awarded last year but conferred this year).

Dr. I.V. Murlikrishna: Dr. Raja Ramanna Distinguished Fellow, DRDO / RCI- Government of India, Hyderabad**.**

The following are the recipients of various awards:

National Geomatics Award for Excellence: Shri A.R. Dasgupta, Former President, ISG and Ex. Dy. Director, SAC, Ahmedabad.

National Geomatics Award (Applications): Dr. P.L.N. Raju, Director, NESAC, Shillong.

National Geomatics Award (Technology): Dr. Ashish Shukla, Scientist, SAC, Ahmedabad.

Prof. K. Nageswara Rao Endowment Young Achiever Award: Dr. Kommireddi Chinni V. Naga Kumar**,** Scientist, Geomatics Division at Centre for Water Resources Development and Management (CWRDM), Kozhikode, Kerala.

President's Appreciation Medal for Contribution to the ISG: Dr. G. Sandhya Kiran, Chairman, ISG – Vadodara Chapter & Professor and Head, Department of Botany, M.S. University, Vadodara.

The Best Chapter Award: ISG - Jaipur Chapter, for organizing National Conference on "**Geoinformatics for Digital India",** at Jaipur during December 16-18, 2015 and various activities towards the promotion of Geomatics technology in the Jaipur region.

Millennium Lecture Series

12th lecture under this series has been delivered by **Dr. Madhvan Nair Rajeevan, Secretary, MoES, New Delhi**, on the topic **"Changes in Global and Regional Hydrological Cycle"** on December 07, 2016 at Dehradun, during ISRS – ISG National Symposium – 2016.

4. Chapters

(a) Chapters & Activities

ISG has **Twenty Four - Local Chapters** located at : Ahmedabad, Ajmer, Bhagalpur, Bhopal, Chennai, Dehradun, Delhi, Hisar, Hyderabad, Jaipur, Kharagpur, Ludhiana, Mangalore, Mumbai, Mysore, Pondicherry, Pune, Shillong, Trichy, Srinagar, Vadodara, Vallabh Vidya Nagar, Visakhapatnam and Trivandrum.

There is a good progress in activities carried out by various Chapters. Three new Chapters one each at **Kharagpur**, **Ludhiana and Pondicherry** were opened. Efforts were made to re-activate some of the Chapters, resulting in good success at Hyderabad, Bhopal & Trichy. Dehradun Chapter has also initiated some efforts towards re-activation. In addition to this, there are initiatives to open Chapters at Lucknow, Varanasi, Ranchi and Guwahati.

ISG has given guidelines to all Chapters to conduct : **Science Day** (February, 28), **Technology Day** (May, 11) and **GIS Day** (November, 20) as mandatory activities during the year.

Brief activities carried out by various Chapters are as follows:

Ahmedabad Chapter:

Training programme on "Applications of Microwave Remote Sensing" during May 23-28, 2016. Organised jointly by Centre For Continuing Education Department of Civil Engineering, Nirma University & GRSS - IEEE - Gujarat Chapter, Indian Society of Geomatics - Ahmedabad Chapter at Nirma University. **About 16 participants** attended including students, researchers and academia with diverse field of interest.

GIS day celebration at CEPT. Organised by CEPT University in collaboration with Indian Society of Geomatics – Ahmedabad Chapter on November 12, 2016. Mainly students of M.Tech in Geomatics 2015 and 2016 batches from CEPT participated in the programme. Expert lectures and various activities like puzzle quest, Quiz , Spatial Thinker, Debate, Map Designing Contest, Memory Game, Find me if you can were organised.

Hisar Chapter

New Chapter opened recently under the **Chairmanship of Dr. R.S. Hooda, Chief Scientist, HARSAC, Hisar** and Secretary Dr. Anup Kumar. **Regional Conference on "Space Technology for Sustainable Development" is planned during March 21 – 22, 2017 at Hisar.**

Hyderabad Chapter

Popular Lecture: Dr. Y.V.N. Krishnamurthy, Director, NRSC delivered a popular lecture on "Space Technology and Applications for better Governance" on August 26, 2016 at NRSC Auditorium. Many senior scientists from NRSC and other institutions from Hyderabad participated in the lecture.

The ISG- HC and IEEE Industrial Relation arranged one lecture at Institute of Science & Technology (IST), Jawaharlal Nehru Technology University (JNTU) Hyderabad. The lecture was delivered on August 06, 2016 by **Mr. P Krishnaiah,** Scientist NRSC on the topic **"Is Location Important? An Overview of Positioning Systems".**

Remote Sensing Day Celebrations: ISG – HC and ISRS – HC jointly organized GIS and RS based activities on August 12, 2016 at NRSC, Hyderabad. Lectures on "Vedic Saraswati" by Dr. B.K. Bhadra and on "Bhuvan's Journey" by Dr. Vinod M Bothale were delivered.

Jaipur Chapter

Tree Plantation (Ek Aadmi Das Ped Drive) : Setting a plantation target of 2500 trees plantation during monsoon months of July & August 2016 in various parts of Jaipur city with NGO Arpan: Ek Prayas. Members of ISG, Arpan, JK Lakshmipat University, Birla Institute of Technology, and Government of Rajasthan took part in total nine plantation drives.

A lecture was delivered by Prof Anupam Kumar Singh at Hotel Souvenier, Jaipur on 23 April 2016 on "Applications of indigenous GPS (IRNSS) in mapping and navigation" for ISG Jaipur Chapter members.

Demonstration session of GPS and Total Station Navigation for students of various Engineering colleges across Jaipur on 23 August 2016 and Map your campus GPS and Total Station Applications for Navigation and Mapping in association with ISG Jaipur Chapter, JK Lakshmipat University and Geomap Private Limited Ahmedabad on 20-21 October 2016 at Jaipur.

GIS Day celebration by ISG Jaipur Chapter on 20 November 2016 at Jaipur.**Star Icon Award from Computer Society of India Jaipur Chapter** was given to Prof Dr-Ing Anupam Kumar Singh in recognition of his work on ICT Applications in Water Resources Management on 6 August 2016.

Lions Club Pink City Jaipur felicitated eight teachers of JKLU for their contribution in engineering & technology including Prof **Dr-Ing Anupam Kumar Singh on the occasion of teacher's day on 05 September 2016.**

Ludhiana Chapter

The chapter celebrated the World Environment Day on 6th June, 2016 at Punjab Remote Sensing Centre, Ludhiana in association with Indian Ecological Society, Ludhiana and Punjab Remote Sensing Centre, Ludhiana by organizing various activities for college students (Poster making competition, 10 minutes Oral presentation on given topics, Essay Writing competition and a Invited Popular Lecture). Around 175 students/staff attended the programme. They have also proposed RC on **"Role of Geomatics for narrowing the Rural and Urban divide"** some time during next year.

Pune Chapter

A one-day seminar was organised on "**Smart Cities and Geo-ICT Initiatives - GeoVision 2016"** by ISG - Pune Chapter in collaboration with Indian Water Resources Society (IWRS), Pune centre, jointly with the Centre for Development of Advanced Computing (C-DAC) and Symbiosis Institute of Geoinformatics (SIG) of Pune on the 18th of June 2016 at Symbiosis Institute of Geoinformatics, Pune. The dignitaries and speakers were from both industries and research organisations to give the participants an overall view of the applications being developed and how they are being used and what the future will look like.

Shillong Chapter

Indian Society of Geomatics (ISG)-Shillong Chapter in association with North Eastern Space Applications Centre (NESAC) celebrated the Remote Sensing Day 2016 on 12th August at NESAC Auditorium. A total of hundred students, twenty selected students of IX to XII standards from each of the five selected schools viz., Kendriya Vidyalaya, Umroi Cantt., Christ School International, Nongsder,Kendriya Vidyalaya, NEPA Campus, MeECL School ,Umiam and Bethany School, Nogsder along with their teachers were invited to the programme. Dr. Handique gave an account of life,work and the vision of Prof. Vikram Sarabhai, whose birthday is celebrated as National Remote Sensing Day. Shri P.L.N. Raju, Director, NESAC & Secretary, ISG-Shillong Chapter delivered a talk on **'Harnessing Space Technology for National Development'.**

Tiruchirappalli Chapter

Chapter activated recently. New EC elected under the Chairmanship of Dr. C.J. Kumanan and Secretary Dr.J. Saravananavel.

It is proposed to organise shortly a DST-NRDMS sponsored 21 days Training programme on **"Geospatial Technology for Natural Resources and Natural Disaster Management",** in the Centre for Remote Sensing, Bharathidasan University, Tiruchirappalli.

Trivendrum Chapter

Chapter formed recently under the Chairmanship of **Dr. Suresh Das**, Executive Vice – President of KSCSTE and Secretary **Dr. L.Gnanappazham,** Assistant Professor, IIST.

A Lecture on **"High resolution remote sensing and information technology in local level planning" by Dr. Samsuddin, Head,** National Centre for Earth Science Studies (NCESS) was organised on May 23, 2016 at, NCESS, Akkulam, TVM – 695011. All members from the Trivendrum Chapter participated in the programme.

Popular Lecture: On the occasion of Dr. Vikram Sarabhai's birthday, Dr. V.K. Dadhwal, Director, IIST delivered a talk on "Challenges in Developing new Operational Remote Sensing Applications : NRSC Experiences" at IIST on August 12, 2016. Many faculty members from IIST and other institutions from Trivendrum participated in the lecture.

National conference on geospatial technology is planned during Dec. 22 – 23, 2016 at LBS Institute in association with ISRS and ISG Trivandrum chapters.

Vadodara Chapter

National Seminar on **"Remote Sensing: Enabling Our Future" As a part of "World Space Week – 2016" was organised on October 7 - 8, 2016, jointly by** Indian Society of Geomatics (Vadodara Chapter) & Institute of Leadership and Governance in collaboration with Department of Botany, The MS University of Baroda, Indian Science Congress Association (Baroda Chapter), Indian Women Scientist's Association (Baroda Branch) and IEEE Geoscience and Remote Sensing Society (Gujarat Chapter). More than 150 registered delegates participated in the Seminar.

Indian Society of Geomatics, Vadodara Chapter in collaboration with UGC DRS program of Department of Botany, Faculty of Science, The MS University of Baroda and Indian Science Congress Association and Indian Women Scientist Association (Baroda Chapters) organized a **National Seminar on "Impact of Climate change on Biodiversity-II" on March 12, 2016. Many students from Gujarat and surrounding states participated in the programme.**

Vallabh Vidyanagar Chapter

Two days State Level Workshop on GIS & Space Technology was jointly organized by ISTAR, ISG Vallabh Vidyanagar Chapter and Indian Science Congress Association, Baroda Chapter during 27th -28th February, 2016. Total 93 participants from various colleges of Gujarat and from diversified fields like Civil Engineering, Agriculture, Environmental Science, IT, MCA, Physics, Instrumentation and Geoinformatics attended the workshop.

Expert talk on GIS Project Management by Shri Chandrashekhar Vaidya, Compusense Automation, Ahmedabad was arranged on 17th September, 2016. ISG Vallabh Vidyanagar Chapter members, faculty members and students of IT, MCA, Environment Science and Geoinformatics participated.

Two Days workshop on RS- GIS Applications in Biological Science during 7th & 8th September, 2016 was organized jointly by ISG Vallabh Vidyanagar Chapter and Biology Department of V.P. & R.P.T.P. Science College at ISTAR. Faculty members and students of Biology, Botany & Zoology students of V.P. & R.P.T.P. Science College attended.

One week STTP on "Applications of Remote Sensing & GIS in Civil Engineering" was jointly organized by Civil Engineering department of GCET Engineering College and ISG Vallabh Vidyanagar Chapter during 25th to 30th April, 2016.

One Day workshop on GIS-RS-GPS Technology was jointly organized by ISG Vallabh Vidyanagar Chapter and Arts & Science College, Petlad on 12th August, 2016. Faculty members and 70 students of Physics and Mathematics departments attended.

(b) Financial Support to Chapters

Once in a year, the ISG provides funding support to organize the mandatory activities such as Science day, GIS day and Technology day to the Chapters. This year on request, Society has funded **Pune and Vadodara** Chapters for carrying out various activities.

5. Journal of Geomatics

ISG is bringing out bi-annual peer-reviewed journal named “Journal of Geomatics”. **The 17th and 18th issues of JOG Volume 10. No 1&.2. were brought out during April and October, 2016 respectively**. The Journal is also available to viewers online through society's website and attracting good number of papers from out side India.

6. ISG Newsletter

ISG regularly brings out a **Newsletter** (ISSN: 0972-642X) for circulation to its members. During this period soft copies of **January and July’ 2016** issues of NL are already circulated to all members and also available on ISG Website.

7. EC Meetings

The Executive Council of ISG met two times (April 02 and December 08) during the year 2016 to formulate various policies and guidelines to conduct different activities of the ISG.

8. ISG Website

In last EC meeting Shri Rajendra Gaikwad, Webmaster, expressed difficulty in transferring data from present website to newly designed web. EC suggested to explore the possibility of maintaining website commercially. Quotations are received & compared and order is being placed for restructuring Website and work is in progress.

9. ISG Office Space & Augmentation

SAC has allotted one quarter (A - 7/10) to be utilized as ISG Office at DOS Colony, Vastrapur. The office was inaugurated on August 10, 2015. Office Bearers of ISG and ISG – Ahmedabad Chapter are utilizing office space for conducting meetings and other ISG related activities.

10. ISG – EC for the term (2017 – 20)

The notification for new ISG – EC for the term (2017 – 20) was issued by Shri K.R. Manjunath, Returning Officer appointed vide minutes of EC meeting held on April 02, 2016 at MPCST, Bhopal, on September 01, 2016. The ISG - Executive Council for the term 2017 – 20 as announced by Returning Officer is attached as **Annexure – I.**

11. ISG Accounts and Audits

The audited accounts for the Year ending on 31-March-2016 is circulated and is being presented by the Treasurer. Trial balance for the period from April -December, 2016 and budget estimates for the year 2017 – 18 has been prepared and same are also presented by the Treasurer.

12. Acknowledgements

The Executive Council of ISG would like to place on record its appreciation to its members and various organizations for their kind support and co-operation to carry out various activities of the Society. Concerned officials of IIRS and ISRS, Dehradun Chapter are thanked for their valuable support in organizing Annual Conventions and ISRS-ISG National Symposium-2016. We are thankful to Director, SAC for providing all necessary support and facilities to the society from time to time. Shri K.R. Manjunath, deserves a special thanks for conducting ISG – EC elections for the term 2017 – 20. Thanks are also due to members of ISG-EC for providing whole hearted support in organizing various events.

December 08, 2016
Dehradun

(N.S. Mehta)
Secretary, ISG

Annexure—I

ISG
Indian Society of Geomatics

K.R. Manjunath
Returning Officer, ISG-EC (2017-2020)

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November 08, 2016

Subject: Results of election of Executive Council of ISG for the term 2017-2020

Dear Sir,

This is to inform that election for the *Executive Council of ISG for the term 2017-2020* was announced on Aug 04, 2016 and nominations received were intimated on October, 17, 2016 after scrutiny. The following members are hereby declared elected for the Executive Council of ISG for the term 2017-2020:

Sl No.	Name of the Post	No. of Posts	Declared Elected	Affiliation
1	President	1	Shri Tapan Misra	Director, SAC, Ahmedabad
2	Vice President	2	Dr. Y.V.N. Krishna Murthy	Director, NRSC, Hyderabad
			Dr. Raj Kumar	Dy. Director, EPSA/SAC, Ahmedabad
3	Secretary (HQ only)	1	Shri S.A. Sharma	Group Head, VRG/SAC, Ahmedabad
4	Joint Secretary	1	Dr. K.P.R. Menon	Director, KRSAC, Thiruvananthapuram
5	Treasurer (HQ only)	1	Shri P. Jayaprasad	Scientist, SAC, Ahmedabad
6	Members	**5**	Shri P.L.N. Raju	Director, NESAC, Shillong
			Prof K.S. Jayappa	Professor, Mangalore University
			Prof. A.K. Singh	Director, JK Laxmipat University, Jaipur
			Shri R.J. Bhanderi	Scientist, SAC, Ahmedabad
			Shri K.L.N. Sastry	Scientist, SAC, Ahmedabad

I wish the new office bearers of ISG all the best for their new endeavours.

Yours sincerely,

K. R. Manjunath

(K.R. Manjunath)

To: All Concerned

cc: President, ISG
Secretary, ISG

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Send your contributions/comments to the Editor -ISG Newsletter at
rpdubey@hotmail.com

Seminars / Workshops Organized by ISG V V Nagar Chapter & ISTAR

Two Days State Level Workshop on 3S Space Technology Jointly organized with H. & H. B. Kotak Institute of Science, Rajkot at Rajkot (Total participants: 98) during 17th & 18th February, 2017.

Two Days Workshop on 3S Space Technology Jointly organized with V. S. Patel College of BCA & BBA, Billimora at Billimora. (Total participants: 75) during 30th & 31st January, 2017.

Two Days Workshop on GIS, RS & GPS Technology and Application Jointly organized with computer science department of V.P. Science college and N.V.Patel college, V.V.Nagar at ISTAR, V.V.Nagar (Total participants: 57) during 24th & 25th January, 2017.

Two Days State Level Workshop on "Concept of Physics in RS & GIS Technology & Applications" Jointly organized with Physics department of V.P.& R.P.T.P. Science college, V.V.Nagar, at ISTAR, (Total participants: 128) during 3rd & 4th January, 2017.