FIELD FORESTER

Voices from the field

Editorial Board

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From the Chief Editor's Desk

The Information and Communication Technology (ICT) has been the most important phenomenon in the 20th century. The ICT has touched all spheres of human life in the recent years and no country, state, department or individual can ignore its importance. The 11th report of the Second Administrative Reforms Commission established the Government's position that an expansion in e-Government is necessary in India. The National e-Governance Plan, formulated by the Department of Information Technology and DoPT, aims at reducing the Government costs and improving the access to services. The Forest Department is a major part of the Government. In order to be in tune with the Government policy and to keep pace with the technological advancements in the contemporary world, the adoption of ICT in a major way has become a priority and necessity.

The interaction of human activity and the state of forests has always been at the core of forest management. Since the late 1990s, the legality and good governance in the forest sector has been the central theme of global forest policy, as these two are essential for economic benefits, livelihoods, and environmental sustainability. The World Bank in 2009 identified five dimensions of forest governance where ICT can be applied. These are (a) transparency, accountability and public participation (b) stability of forest institutions and conflict management (c) quality of forest administration (d) coherence of forest legislation and rule of law and, (e) economic efficiency, equity and incentives.

So far, much of the focus on ICT in forestry has focused on inventories and computerisation of administrative tasks. But working only within the forest sector and with forest administration is not feasible. The technological change enables stakeholders to explore data from anywhere in the world and collaborate with others. Because of focus being on the increased openness, transparency and participation, the Forest Sector can no longer work in isolation or vacuum; it must share information with all the stakeholders. The Forest Sector influences other sectors and *vice-versa*. Therefore, in information system development, the Forest Department should keep itself in tandem with the national e-strategies and e-development programmes.

In the present issue of *Field Forester,* a humble attempt has been made to assess the present status of ICT application in various State Forest Departments across the country. The case studies give a clear picture of ICT applications made in the SFDs, new initiatives that are being taken in different SFDs, the problems being faced in adopting ICT in SFDs, success stories in ICT applications, the future course of action to be taken and a host of many other ICT-related issues in the SFDs. The case study in Odisha indicates that the Odisha SFD has taken many initiatives and in near future it will emerge as an important State in the field of IT applications in the Forest Sector. The project like "Plantation made Easy" of Tamil

Nadu Forest Department, "Hejje" (Pug mark), Huli (Tiger) software of Karnataka Forest Department are worth replicating elsewhere. Many other articles in this issue have highlighted problems like scarcity of funds, lacklustre attitude in the staff towards ICT applications, lack of technically trained HR, discontinuation of initiatives, power and connectivity problems in remote areas, etc.

It is sure that study of this issue of *Field Forester* shall give the officers of Forest Department and other stakeholders an insight into the current scenario of ICT applications in Forestry Sector.

MP Singh

Role of IT in forest cover assessment and monitoring

Iimprovement in the technology and methods has helped generate precise area and map information that serves as primary data in many schemes and programmes

Dr Sunil Chandra[1], Prakash Lakhchaura[2], Saibal Dasgupta[3]

Forest cover assessment and monitoring has been one of the challenging tasks owing to various factors including heterogeneity in forest cover, tree age and health, topographic constraints, biodiversity impact, seasonal variations and other factors. Although precise mapping and characterisation of forest cover has been a rather difficult task using traditional methods, yet satellite remote sensing methods along with GIS tools has been of immense help in mapping of forest resources at national level. Forest Survey of India (FSI) has been carrying out national level forest cover mapping using satellite data at 1:50k scale. Over the years, improvement in the technology and methods has helped generate precise area and map information that serves as primary data in many of the centrally sponsored schemes and programmes of national interest. Nowadays the processed data and overlaying of such data using web-GIS tools has been widely used for deriving meaningful information.

Role of space and IT technology in forest resources management and monitoring

Forest Survey of India has been exploiting the potential of remote sensing, GIS and GPS tools for different activities involving forest cover assessment, environmental impact assessment, decision support system, e-Greenwatch, national forest inventory, assessment of carbon estimates in India's forests, forest fire and programmes on national spatial data infrastructure. Some of the activities where the technology has been largely used are described as follows:

2.1 Forest Cover Mapping

Forest Cover Mapping using satellite remote sensing technology has been a major mandate of Forest Survey of India. The exercise involves a series of steps including downloading of data, pre-processing, classification and area estimation of the forest cover and forest density classes. Use of image processing software, customised algorithms and spatial models helps in generating precise and accurate information on forest cover.

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2.2 Forest Type Mapping

This was another major work done by FSI where forest type maps of the country have been created using remote sensing and other ancillary data supported by intensive ground truthing.

2.3 Environment impact Assessment in the mining affected areas

An important contribution of the technology has been in understanding the impact of mining in the mineral rich states of Karnataka, Rajasthan and Haryana. Use of medium and high resolution satellite imageries has helped to study the amount of degradation caused to the forest land and the leased area due to mining activities. The image processing and GIS technology has helped to generate valuable information of forest cover losses and degradation to the environment so that the decision makers can take effective steps to control environmental degradation.

2.4 Decision Support System (DSS)

DSS is a Web based GIS System to create qualitative, quantitative & administrative attributes of forests to facilitate, informed, unbiased and expeditious decisions on management of forest and forest clearances. The different parameters including forest, biodiversity etc. that have a considerable impact in the region are overlaid and integrated to generate meaningful information for the area of interest using web-supported GIS software. Based on the directions from MoEF& CC, FSI has developed a web based GIS System in FSI for speedy disposal of cases related to Forest Conservation Act and other

applications. FSI started working on the project in September 2013, with ESRI as service provider. This application software has been developed using Arc GIS server software with Flex technology *(http://fsigeoportal.gov.in/fsidss).* The GIS layers used in DSS include Forest Cover Map (FCM), Forest Type Map (FTM), Biological Richness (BR), Landscape Integrity (LI), Hydrological Layer, Protected Area (PA),Tiger Reserves (TR). Using this application, the information on different layers can be extracted for a polygon and appropriate decisions can be taken using two Decision Rules inbuilt in the application.

2.5 e-Greenwatch

The e-Green Watch is a web-based, user friendly system which first came into picture in July 2012. The proposed system 'e-Green Watch' is aimed to facilitate the automation of the various processes involved in monitoring and evaluation of various projects undertaken by the State Compensatory Afforestation Fund Management and Planning Authority (CAMPA). The system is capable of showing the Compensatory Afforestation, Diverted Land, Plantations, other Plantations and Assets categories on the Google earth imageries. It facilitates the temporal change detection for proper online monitoring and evaluation.

Project was initiated in five pilot states – Andhra Pradesh, Karnataka, Madhya Pradesh, Sikkim and Tripura. Later on, with the discussions with the State Forest Departments (SFD's), other states too have got linked to the e-Green

Watch portal. At present 24 states and 2 Union Territories are a part of this project. Monitoring of polygons on e-Green Watch portal, training of SFDs along with National Informatics Centre (NIC) and sending monthly reporting to MoEF& CC are the roles of FSI.

Forest Fire Studies
Forest fire monitoring, burnt area assessment and pre-warning alert system are three major areas where FSI is using the potential of satellite remote sensing technology for generation of meaning information at country level.

Real Time Monitoring of Forest Fire
Forest Survey of India (FSI) is involved in forest fire studies involving real time monitoring of forest fires, burnt area assessment and related studies. FSI has been carrying out forest fire monitoring at national level since 2004 using Remote Sensing and GIS technology with the objective of detection of active forest fires at a nascent stage and to inform SFDs about the forest fires on near real time basis. Forest Survey of India (FSI) have been using Moderate Resolution Imaging Spectro-radiometer (MODIS) data onboard Terra and Aqua satellites providing data at every 6 hours thus helping in close period monitoring of forest fires. The active fire spots or hotspots are the locations of fires irrespective of forest or agricultural land. These coordinates are projected on the forest cover map of India prepared by the Forest Survey of India to pinpoint active fire locations within forest cover called forest fire locations. Attributes like state, district, Survey

of India toposheet numbers are then attached with each coordinate of the forest fire locations so as to enrich the information carried forward. The entire processing at FSI takes approximately 1 hour's time. The information is also disseminated through SMS to the State Forest Department's registered users to our website (www.fsi.nic.in) for confirmation as well as quick remedial measures.

FSI is using an advanced system for processing and dissemination of fire signals using this kind of monitoring. Online feedback forms are also made available to the State Forest Departments where the nodal officer nominated for forest fire monitoring from the respective states can login and fill the feedback forms for the validated forest fire points by SFDs on ground during their ground checking work.

Forest Fire Burnt Area Assessment by FSI
The assessment of burnt area gives an extent of forest cover loss and indicates biodiversity loss to a greater extent. Very small fires less than 100m in extent are not usually captured by coarse resolution sensors, owing to the limitations of the sensor. Assessment of such areas affected by forest fire through ground survey is extremely difficult due to constraints of time, money and human resources. However, with the availability of mid resolution satellite data, it is possible to delineate areas burnt by forest fire as the scar of the burnt area have a distinct signature in the imagery and can be delineated from other features. FSI has started estimation of burnt area
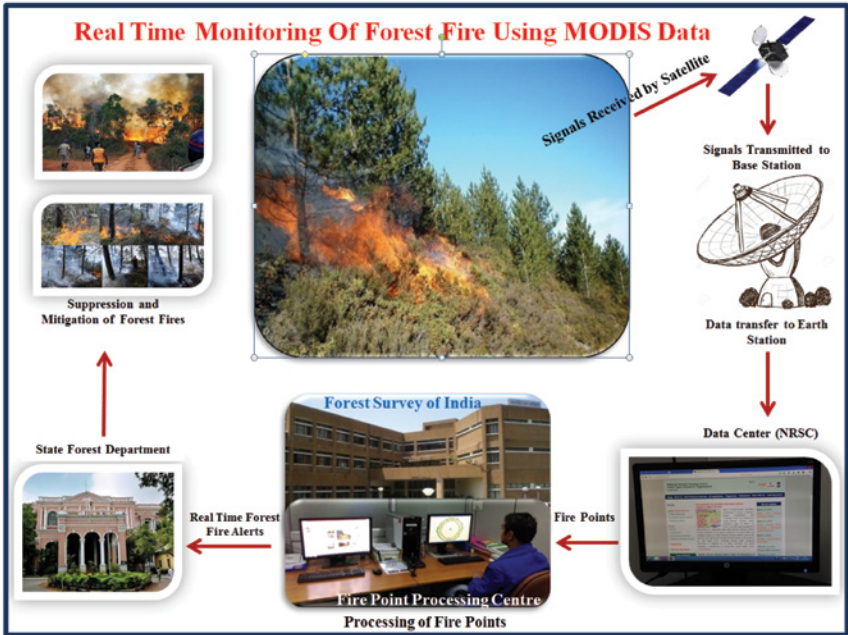
Methodology of the forest fire data processing

on an experimental basis from 2015 onwards using AWiFS imagery. A in-house model has been prepared by FSI where the fire points are filtered using various information including Forest Cover Map (FCM) layer from FSI. These state-wise filtered forest fire points are converted into KML file using Export to KML tool. The KML file not only contains the latitude /longitude for the fire point but also contains information of the toposheet at 1:50,000 scale in which the point resides.

Dissemination of Information
Details of the points falling within the forest cover like date of occurrence, geo-coordinates, state, district, and SOI toposheet number are transferred to the Excel sheet. The information

so generated is uploaded on the official website of Forest Survey of India (www.fsi.nic.in) and the SMS/e-mail alert, KML Alert is sent to the concerned nodal officer/official of the SFD for taking remedial measures. Information is disseminated at three levels-National,State and the District level. The forest fire spot data can also be downloaded as an excel file from official website of Forest Survey of India (www.fsi.nic.in).

Pre-Warning Alert System for Forest Fires at Country Level
The national program on creation and dissemination on a pre-warning alert system for forest fire based on numerous parameters such as forest cover, forest types, climatic variables, recent fire

Flow Chart of real time monitoring of forest fire

Fire points are provided by the NRSC (ISRO)

Fire points falling inside the forest cover are filtered in and rest are rejected

Fire points with temperature value greater than 318 K and confidence greater than 0 are processed

Value addition of the attributes such as state, district and toposheet no. information to the selected fire points

Finally, these fire points are uploaded in FSI Website (fsi.nic.in) for dissemination

signals etc. is being finalized. However, since February 2016, FSI has been attempting to disseminate information for pre-warning alerts at division and range level, thus providing information at the base administrative level of the SFD's. The system sends warning to the state where forest areas are having higher risk of fire in the coming days.

National Forest Inventory

FSI has recently started a new design for national forest inventory. Under the new design, nationwide grids have been created and sample points are generated using remote sensing and GIS for both forest and trees outside forest. For carrying out the field work, GPS is used for approaching the sample plots. Thus the application of RS/GIS and GPS is immensely useful for spatial analysis of national forest inventory data.

Assessment of Carbon in India's Forests

FSI has been assessing the carbon stored in the country's forest on a regular basis using the field inventory data. While estimating the total carbon stock at the national level, the information on forest cover and forest types is also used. The synthesis of the data is done on a GIS platform.

National Spatial Data infrastructure(NSDI)

FSI is a stake holder in the national program called NSDI. Under the program various layers and data available with the various organizations needs to be brought on one platform with common projection, datum and have a common standard for data generation. The layers for forest cover and the forest type have been generated as web map service (wms) using the software. The map service using the NSDI application can be visualized and accessed using the required server link. The server established at FSI, Dehradun is connected to the NSDI portal that provides the gateway for any user to access the domain server. Interoperability is an important component of NSDI where any stakeholder can overlay two or more layers using webGIS and generate meaningful information for a particular area of interest.

Other studies

In addition to the mandated activities, FSI

has completed many projects/studies on the request of central ministries and state forest departments using remote sensing and GIS. The reports and studies of FSI are considered very authentic. Study on the mangrove vegetation cover, corals, forest cover change assessment in the tiger reserves have largely depended on the satellite technology and data for precise assessment of the objectives. Working plan preparation and creation of management plans have largely used remote sensing data and GIStools. The projects taken up for the states of Mizoram, Nagaland, Punjab have been completed.

Conclusion

FSI keep pace with advancement of technology. The use of remote sensing and GIS is very effective in measurement, monitoring and visualization of the forest and the related activities. Whereas the remote sensing technology has been of immense help in providing instant and precise data on forest resources, tools such GIS and webGIS has been helpful in fast and easy processing of data. This has resulted in deriving the required and meaningful information from national to the landscape level. Use of commercial as well as open source software's has resulted in precise

and periodic monitoring of event particularly forest fires at national level. Application such as Decision Support System (DSS) and E-Greenwatch has been based on the GIS platform where spatial layers in the form of vectors can be overlaid for analysis. Web supported initiatives has largely resulted in making the communities aware for better understanding of their data and thereby working closer for harmonization of the total dataset. Coarse resolution, mid-resolution, high and very high resolution datasets have been helpful in the different areas. While data from MODIS sensor have been providing valuable data at close periods for forest fires, multispectral data from LISS-IV has been quite helpful in studies on agroforestry plantations and trees outside forest assessment. Apart from the various satellite data, different classifiers and the software's for processing these data are important. Algorithms and modules available with the commercial and open source software's has facilitated easy and fast processing of these data. Thus information technology is playing an important role in monitoring and management of forest resources of the country.

IT driven spatial decision making in forest departments – a need of the time

On-screen computer based investigation of information helps in easy updation of records, considering multiple themes together and making customised maps

Manish P Kale* and C Ramesh#

Conservation of forests has become important like never before. In India, the Forest Department is responsible for overall management and governance of forests. In order to take effective management decisions, different spatial and non-spatial information is required in a standard format. 'Aranya', a Spatial Decision Support System (SDSS), has been developed by the Centre for Development of Advanced Accounting using open source technology. This facilitates decision making in different domains of forestry, including protection, monitoring, management, research and planning, where each module broadly correspond to administrative working section of the forest departments in India, such as Territorial, Working Plan, Biodiversity, Wildlife, Research, Carbon calculator, etc.

Information technology has revolutionised the way different departments worked 15-20 years back. The Forest Department is no exception. The Geographic Information System (GIS) datasets have now been generated and used in different forest departments across India. Such datasets have helped the department in numerous ways. The most important change is shifting from traditional hard-copy map based analysis to on-screen computer based visualisation and investigation. Forest departments carry out geographic investigations for different purposes i.e. defining territories, ground referencing, classification of forest types, climate patterns investigations, location identification, etc. On-screen computer based investigation of such information helps in easy updation of records, considering multiple themes together and making customised maps as per the departmental needs. The GIS data can be captured in the forms of point, line and polygon which help in modeling the real world locations (habitation, watch towers, crime locations, etc), linear features (rivers, drainages, roads, etc) and area (forest types, administrative units, elevation zones, soil types, etc). This has made it handy to integrate and query such datasets programmatically and visualise using open source/commercially of the

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Fig. 1. **Aranya – A comprehensive Spatial Decision Support System (SDSS)**

shelf (COTS) tools.

Another major reason is availability of free remote sensing and GIS datasets. Utility GIS datasets such as roads, city locations, etc; climate datasets such as temperature, rainfall; topographic datasets such as elevation; value added datasets such as land-use land-cover (LULC), fire locations, etc., have been made freely available through different satellite programmes. Multi-band and multi-resolution satellite datasets such as LANDSAT are available since 1975 and are capable of providing good

chronological information about LULC change. Though such vital information has been used by forest departments, but mostly in fragments. Little efforts have been made to use such dynamic datasets continuously for decision making purpose. One of the important reasons for this is, lack of national level collaborative cloud/grid based decision support system infrastructure that supports sharing of vital system data for ubiquitous decision making and provide significant processing power. Such infrastructure may enable the

Forest Department to carry out routine to scientifically and computationally intensive tasks such as fire simulation modeling, species niche investigations etc. in a faster and efficient manner.

Centre for Development of Advanced Computing (C-DAC), under its North-East India initiative, has carried out many projects related to application of information technology in many North-East Indian states. One such initiative was development of ARANYA – A Comprehensive Spatial Decision Support System (SDSS) tool for forest department, Bodoland Territorial Areas District (BTAD), Assam in the year 2011 (Fig.1). Aranya is a modular GIS-based tool which caters to the day to day management needs of the forest department. The forest division level decision support is the prominent feature of Aranya. The different modules include Territorial forestry, Joint Forest Management and Social Forestry, Wildlife, Working Plan,

Village Development Plan and Research and Analysis.

Territorial forestry deals with the challenges of forest crimes, plantation initiatives, encroachments, etc. The user has the flexibility to visualise the patterns of the crimes that have happened in a particular division or along linear and point features such as roads, fire lines, habitation, etc(Fig. 2). Prominent feature of the Joint Forest Management includes instant investigation of land use (Fig.3), elevation, soil and patterns (along with area statistics) along a single or groups of Joint Forest Management Committees (JFMcs). Aranya also provides the flexibility to investigate the best habitats available for conservation of a particular wildlife. User may define the suitability criteria taking different GIS themes as input and can get results (suitable sites) accordingly (Fig. 4), which are displayed in the form of a map.

Working Plan is a comprehensive module which mainly facilitates
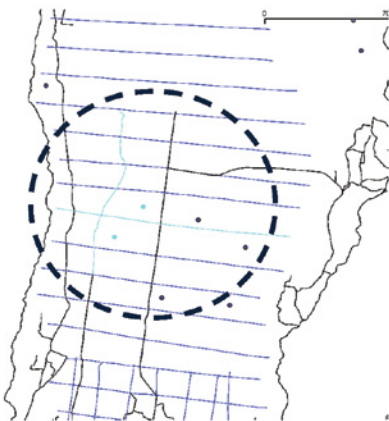
Fig. 2. **Crime locations within 4 km buffer of selected road and ride parallel**
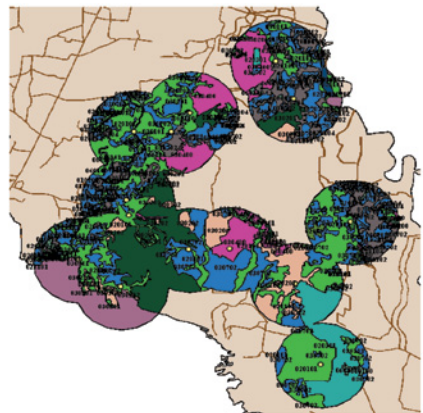
Fig. 3. **Instant analysis of landuse-landcover patterns around the selected Joint Forest Management Committee**

Fig. 4. **Habitat suitability analysis module**
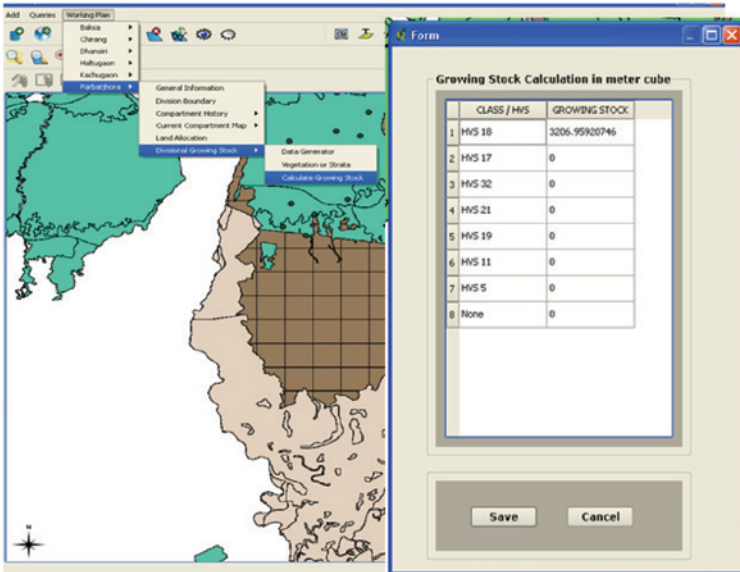
Fig. 5. **Growing stock estimation through Working Plan module of Aranya module**

estimation of volume of trees (based on the sample plots point map); estimation of growing stock of the division (Fig. 5); and identification of the area which can be allocated to a particular working circle. For example if the user wishes to allocate the gently sloping shrubby lands to plantation working circle he can do so by assigning rules and instantly gets the working circle map along with the compartment numbers as output. This facilitates preparation of customized digital maps of a particular tract of a land of a particular working circle. Village development planning is useful in identification of lands according to user defined criteria. This module was primarily developed for
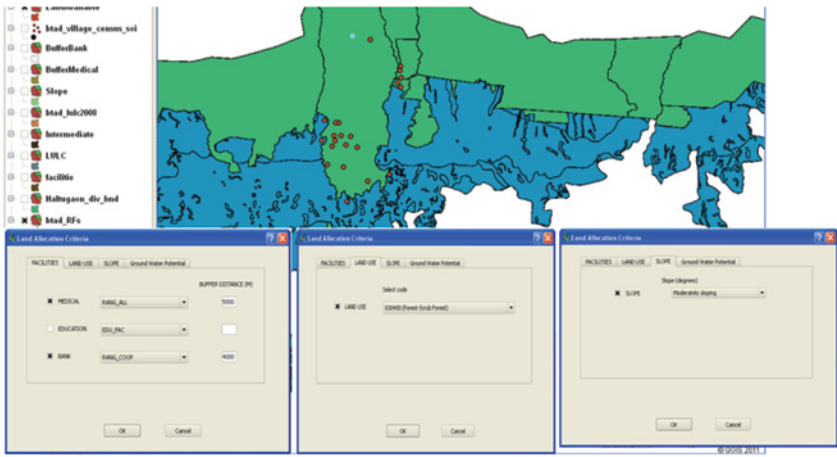
Fig. 6. **Village development planning based on the user defined criteria**
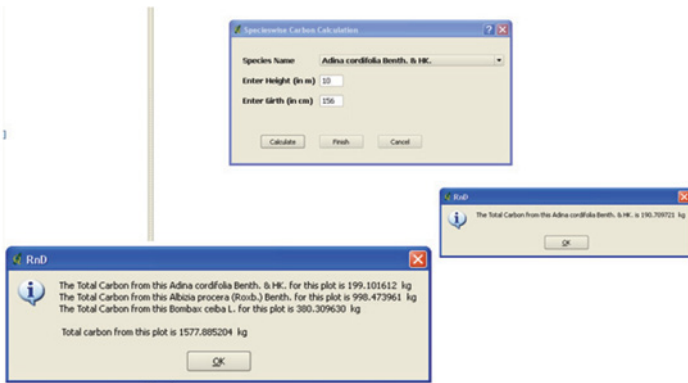
Fig. 7. **Species-wise tree carbon estimation using Aranya**

rehabilitation of households,in the areas which are more or less similar or better than their earlier habitation. The software searches the areas (as per the set government norms) outside the restricted boundaries as per given criteria (i.e proximity to road, banking facility, school, medical assistance, etc) and provides the map of most appropriate locations along with the area statistics (Fig. 6). This helps in

rehabilitation of villages or households in a sequential manner.

Considering the strong role played by the forest in sequestering atmospheric carbon, it is important to have carbon inventory of each tree belonging to a particular species. Thus the provisioning has been made in Aranya to estimate the carbon stored in each tree based on three simple inputs from the user i.e. name of the

CENTRALISED FOREST MONITORING AND MANAGEMENT SYSTEM
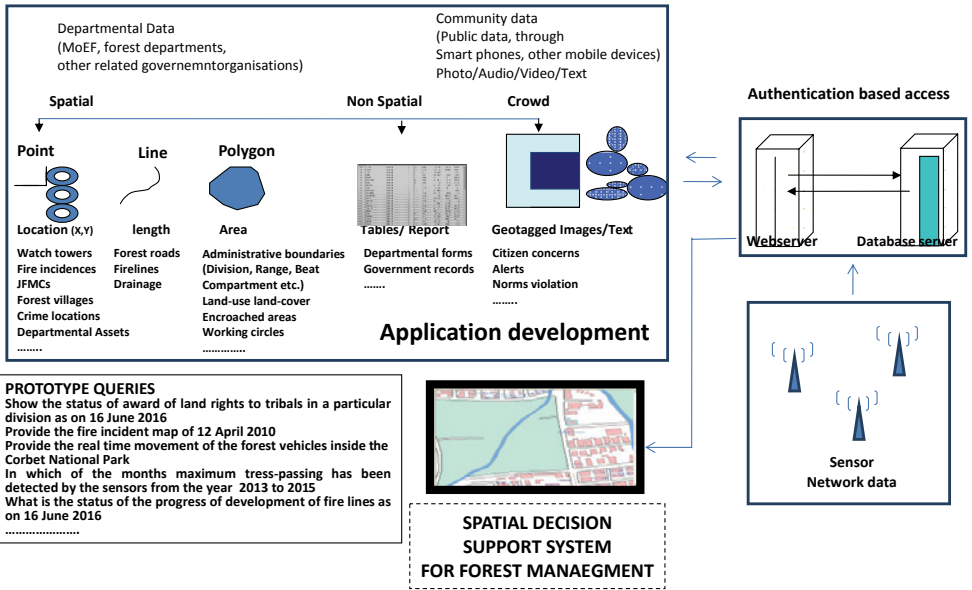
Fig. 8. **Authentication based online monitoring and management system for forest departments**

species, its girth and its height (Fig. 7). The python codes have been written in such a manner so that first the biomass of each tree (of a particular species) is estimated using internally fed species specific volume equations developed by Forest Survey of India (FSI) and specific gravity information (through available literature). The biomass is then converted to carbon by applying standard factors. This module is extremely useful in divisional carbon accounting i.e. carbon sequestered or lost in a particular division can be instantly estimated.

Aranya has been developed using open source tools and technologies to ensure ease of use and wider dissemination. The Quantum GIS (QGIS) and Python are the major open source technologies that have been applied. In the present scenario, many python bindings are available which are useful in development of efficient decision support systems. Liberal licensing policies such as GNU-GPL, ensure more freedom to use the core technologies. Unlike the proprietary software in which code is not open and thus makes scientific investigation of outputs difficult, the open source technologies make it possible to improve the codes to accommodate more efficient algorithms.

Future prospects

With the revolution in internet and smart phone technologies,it has now become possible to get and send information and carry out analysis

from anywhere. Cloud and grid-based systems have evolved like never before. The devices are becoming smarter with high compatibility among them. Thus it is possible to harness the strength of cloud/grid to process the significant data on real time basis. The devices such as smartphones/PDAs can be linked with the system so as to ensure the easy flow of the data from the field or offices. The authentication based logins ensure the hierarchical access to real-time decision making.

Different related departments, such as forest departments, ministries and Non Governmental Organisations (NGOs), can work in a collaborative manner. The inter-departmental data may be shared by providing relevant authentication. The datasets may be modeled in the standardised GIS format so as to develop and disseminate on-demand customised maps. The data from the cloud may also be diverted to servers. Different applications may be developed so as to use and mine such data in the most efficient manner. Some applications may be Divisional carbon budget estimation; Encroachment analyser; Grievance redressal system; Forest Human Resource Deployment System; Forest work monitoring system, etc (Fig. 8).

In the present times a considerable amount of data is coming through sensors such as radio frequency based systems, camera traps, vehicle detection systems, GPS based navigation, etc.

Such data needs to be analysed through development of specific applications. This data when combined with other spatial and non-spatial data provides very useful information and can be used for efficient forest monitoring and management.

Considerable developments have happened in the field of acquiring and processing the data. The huge amount of data has now been made available through satellite sensors, drones, environmental sensor networks etc., nevertheless developments that have happened in analysis of big-data such as high performance computing (including grid computing and GPU based systems) have made it possible to remotely process and analyse the significant amount of data. Due to these reasons the forest management of tomorrow seems to be significantly different than what it is today.

Acknowledgement

Using IT for decision-making

With the recent initiatives taken by the Odisha Forest Department in the field of IT application, its name will soon be on the list of technically advanced States.

Ashish Vyas & Yadvendra Singh

The Odisha Forest Department has four wings headed by four PCCFs – PCCF (General and HoFF); PCCF, Wildlife; PCCF, Kendu Leaves (KL); and, PCCF, Projects. The IT and GIS Facility in the office of the PCCF, Odisha, Bhubaneswar, is headed by PCCF, Odisha The wing head is Additional PCCF (GIS), who is assisted by CCF(GIS) and Deputy CF (GIS).

The GIS Cell in the office of the PCCF, Odisha, was renamed and redesignated as the Forest Information Technology and Geomatics Centre (FITGC) on January 7, 2014. Apart from the IT and GIS Facility in the PCCF office, each of the wings, except the PCCF (KL), have a GIS lab of their own for regular small GIS works such as map printing and composition. The office of the PCCF, Projects, has a well maintained GIS lab which caters to the needs of GIS works in 15 forest divisions covered under the OFSDP (Odisha Forestry Sector Development Project).

The management of huge natural resources, which are done through 50 forest divisions and 282 ranges, needs IT support in most of the activities.

IT is being used in decision-making, inventory-making, delivery of citizen services, digitisation of forest maps, videoconferencing, media management, etc. The development of IT facilities, maintaining the infrastructure, capacity building of the staff in IT sector and effectively applying the facilities available in resource management are the main areas of challenge to the State Forest Department.

Availability of IT infrastructure

The server room is fully equipped with all necessary components. The servers have been divided into Windows stack and Linux stack. Various applications have been developed for MIS report generation and GIS. These have been hosted from these servers. One server has been dedicated for server-side integration of the GPS PDA devices designed by the Forest Department and in the process of procurement.

The infrastructure available in the GIS Lab is A0 Plotter, Scanner, A3 Colour Printer, 4 HP Z 640 Workstations and 5 HP Z Book 15 Workstations. The lab is in the process of upgradation and the office of the PCCF, Odisha, is

Officers Trainees, 2015-17 Batch, CASFOS, Coimbatore

planning for Enterprise GIS, which will cater to the needs of the public in decision making under the Aegis of the Data Dissemination Cell – a mandate of the Odisha State Data Policy-2015 in which various GIS layers will be hosted from the department's own dedicated servers having facilities of recovery and back up at the Odisha State Data Centre.

At the ground level, the field-level offices are connected with the State headquarters through internet. All the applications hosted from the centralised servers at Aranya Bhawan, Bhubaneswar, are accessed by field clients through internet. There are 50 (territorial and wildlife) forest divisions

Fig: **Server Room:**
Windows stack and Linux Stack

and 282 (territorial and wildlife) ranges which are connected through internet bandwidth provided by BSNL, mostly through broadband.

Availability of experts at the State level

There are GIS and MIS experts posted on contractual basis in the offices of the PCCF, Wildlife, and PCCF, Projects. However, in the office of the PCCF, Odisha, the process of recruiting such skilled manpower on contractual basis is on and it will be completed soon. In the meantime, 15 IT literate Forest Guards and Foresters, having a background of B.Tech/BSc IT, have been trained on Network Management and Server Administration at the Central Tool Room and Training Centre under the Department of MSME, Government of India.

ICT & GIS training facility at the State level

Training facility for GIS activities is generally done with the help of the experts at the office of the PCCF, Projects, and with the collaboration of Odisha Space Applications Centre (ORSAC), Bhubaneswar. For IT activities, the Central Tool Room and Training Centre is requested for arranging theme-based training as per requirement of the Department.

Connectivity to the internet

Wi-Fi LAN has been established in the office of PCCF, Odisha, with enterprise UTM system and content filtering. The office is provided with internet over Wi-Fi at a bandwidth of

20Mbps, through a dedicated RF-Based leased line connection from Software Technology Parks of India, Department of IT, Government of India. The office of the PCCF, WL and KL, are connected to internet through BSNL broadband. The office of the PCCF, Projects, has opted for an optical fibre-based dedicated leased line from BSNL. However, video conferencing facility is not available either at the field level or at the State Level. It will be installed soon after due permission from the government.

Application of IT in forestry & allied fields

Digitisation of forest records and maps: All the working plans of the Forest Department, the service books of all the employees, administrative boundaries of 42 divisions, 3,985 forest blocks of an area about 4,471,411 ha and village boundaries have been digitised. A new exercise is being taken up to synchronise the forest boundaries of the State by resolving the conflicts in boundary raised by both the revenue and the Forest Department.

Use of ICT in decision-making: The use of ICT in decision-making is gradually on an increase in the State. The various applications in roll out and decisions made from them are:

- *Treasury HRMS portal* – Automated salary bills, appraisal reports, apply of leave, property statement, automatic updated service books in electronic format.
- *Forest HRMS Portal* – Scanned service books with facilities of updating, monitoring of increment sanctioned,

pending departmental proceedings, court cases with scanned copies, list of employees with sanctioned pension, retired employee list, etc.

- *CAMPA Tracker* – Module for electronic generation of MPRs (Monthly Progress Reports) and QPRs (Quarterly progress reports) for CAMPA accounting.
- *Accounts module* – For electronic allotments of funds, generation of requisitions, preparation of vouchers, generation of monthly accounts and Form 60 P, etc.
- *Kendu leaves Procurement and Processing Module* – For detailed information on pluckers and maintenance of database regarding their period of work, wages, etc.
- *GPS PDA Application* – For server side integration of the customized GAGAN-enabled GPS PDAs being procured by the Forest Department.

Use of GIS in decision-making: Customised GAGAN-enabled GPS PDAs will be supplied to all the field offices for capturing data on a real-time basis, preparation of maps and incidence reporting through data push into the GPS-PDA server established in the data centre of FITGC and work by pulling data from the server by creation of AOI. Other GIS-based decision support systems are:

- The forest fire management is done through geo-coordinate data obtained from the FSI website through MODIS Satellite Data.
- Mining activities in the State are properly monitored throughout the State by DGPS survey of the

boundaries of the Mining Lease Areas.

• Forest Type mapping and Temporal Forest Cover change mapping is done through GIS-based decision support system by procurement of satellite imageries of different years and areas of negative forest cover change are afforested.

Use of cloud technology: The office of the PCCF, Odisha, is going to use Office Automation System, which will extend over the whole State gradually. Hence, the use of cloud technology is restricted to use of Google Drives, One drives, etc., for things like folder sharing.

Intranet: The Department of IT, Government of Odisha is going to connect the horizontal offices of all the districts through Odisha State Wide Area Network (OSWAN). Hence, steps have not been taken by the Forest headquarters to create a local network to connect with parallel offices.

Use of social media: WhatsApp groups are used for communicating official matters with the authorities. Youtube videos are meant for the purpose of training. Use of social media is only for the purposes of communicating tasks.

Website of the Odisha Forest Department: The official website for the Forest Organisation has been developed by FITGC with the domain name *www.odishaforest.in*. It has about 70 static and 20 dynamic web pages hosted in the server placed at FITGC,

Forest Headquarters, Odisha. All the dynamic web applications have been hosted under Forest Apps Tab of the website. Here the admin can upload tenders, photos, videos, events, etc. On the website, there are links to open various software and applications. The website is developed in java and sql server.

The list of G2C services

i. Online booking of the Forest Rest Houses for eco-tourists.

ii. Steps to make functional the Data Dissemination Cell under the framework of the Enterprise GIS Solutions, which will cater to the needs of public.

iii. Website is the information repository of the State and furnishes data on various forestry activities.

iv. Web dynamic applications have enabled transparency in the department and now funds and wages are getting transferred online to the individual savings bank accounts of the labourers.

v. Information on recruitments, forest works to be executed, employment generation, etc.

Future projects

FITGC in the office of PCCF, Odisha, at Aranya Bhawan, Bhubaneswar, plans to centrally roll out / webhost 8-10 numbers of Enterprise Class Forestry MIS Application along with the Enterprise GIS Solutions for the entire State of Odisha.

MIS Applications Development: This comprises Forest Works Monitor, JFM

Monitor, Forest Fire Alert System, Forest Helpline System, Library, Documents and Publication Information System and Crowd Sourcing Mobile Application for Forestry and Wildlife (Citizen's Forestry Mobile App)

GIS Applications: Centrally Web-hosted Enterprise GIS Solutions have been enabled for all forest divisions and all Field Forest Officials on Smart Client Mode and use of Customised GPS PDAs and rugged mobiles for all forest officials up to Foresters; have been protected. This has to be integrated with Enterprise GIS.

Conclusion

Compared to other States like Madhya Pradesh., Karnataka, Andhra Pradesh, Tamil Nadu, etc., the Odisha is lagging behind in IT applications. But, with the recent initiatives taken by the Odisha Forest Department in the field of IT application, its name will soon be on the list of technically advanced States. The department has a well-maintained website along with various applications like HRMIS, CAMPA Tracker, Forest automation system, Forest account monitor, etc., to make maximum use of IT in routine work as well as in forest management and protection.

Plantation Made Easy, a Digital India initiative

The app is aimed at bridging the gap between the resources and the people, as the people need to be educated about various tree species available for plantation

Sudha S

With increasing population and growing consumerism, there has been severe pressure on food production and employment generation, particularly in agro-based development countries like India. This has had a direct impact on deforestation, increase in soil erosion and run off of rainwater, resulting in depletion of natural resources and environmental pollution. Adding to this, the gap of demand and supply of forest produce in India is also widening and the forests are unable to fulfil the demand of the growing population. Trees outside forests (TOF) is the single most important and cost-effective strategy in achieving important goals like meeting the demands, poverty alleviation and increasing the tree cover percentage. India is known for its Forestry knowledge and expertise, but what we lag in is the access to these repositories and the resources.

In the era of Information Technology, the Forest Department has to utilise the ocean of opportunities available to reach people and to emphasise the importance of raising trees. The project of developing a mobile application – 'Plantation Made Easy' – was aimed at bridging the gap between the resources and the people, as the people need to be educated about various tree species available for plantation. As there are only few tree-based industries popular in the country, there is a heavy demand only for those selected tree species. The Forest Department has to play a vital role in exposing the opportunities and exploring the unpopular trees species by using technological advancements as emphasised by 'Digital India'. 'Plantation Made Easy' is one such initiative.

Why a Mobile Application

Mobile apps could be an effective medium for farmers, home gardeners, industries and individuals to get a quick reference to the plantation guidelines when they are in their fields. In this digital world, mobile phones are available even in the remote corners of our country. The major advantage of 'Plantation Made Easy' android application is that this does not require continuous data connectivity

IFS, 2013 Batch, Tamil Nadu cadre

as many other mobile applications. Once this application is installed, all the details related to plantation can be accessed offline. It acts as a readymade reference when the users are out in their fields. The idea is to target the generation with technology for betterment. Technology and gadgets will be a revolutionary tool to achieve our goals effectively and efficiently.

Features of 'Plantation Made Easy'

'Plantation Made Easy' Version 1.0 has four routes to direct the user to the most suitable tree for his plantation. These are:

1. Choose by tree species.
2. Choose by tree type.
3. Choose by location.
4. Search by query.

'Choose by tree species' directly takes the user to the list of 43 tree species. The user can click on the tree he desires and to know about the details on plantation technique.

'Choose by tree type' has eight different tree types –– timber trees, pulpwood trees, matchwood trees, firewood, fuelwood and fodder trees, other beneficial trees (NTFP), bio-fuel species, pencil wood/ plywood trees, industrial/ institutional plantation trees.
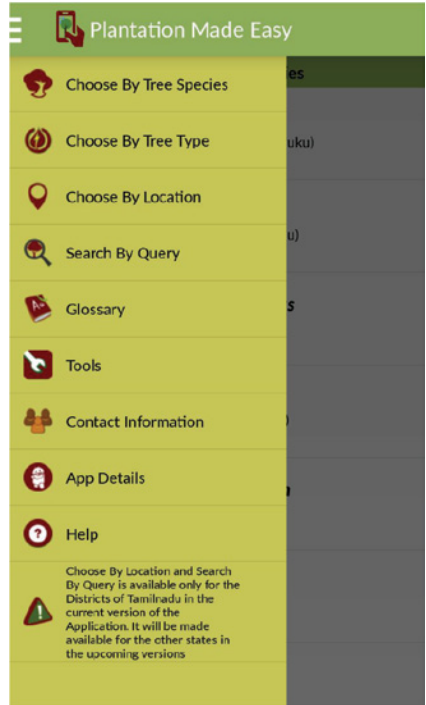
'Choose by Location' is available only to districts of Tamil Nadu in the current version. In the upcoming releases of the mobile application, it will be made available for other States too.

'Search by Query' provides an option for a refined search to get the best suitable tree. It helps the farmer to feed in the details of his land to arrive at the right tree species.

Plantation Made Easy
Choose By Tree Species

Acacia auriculiformis
(Australian Wattle / Kathi savuku)

Acacia holosericea
(Silver Leaf Wattle / Mankathu)

Acrocarpus fraxinifolius
(Pink Cedar /Malaikonnai)

Ailanthus excelsa
(Tree of Heaven/ Perumaram)

Ailanthus malabaricum
(Mattipal)

Albizia falcataria
(Batai)

Albizia lebbeck
(Indian siris, Vagai)

Choose by Tree Species

Plantation Made Easy
Choose By Tree Type

Timber Trees

Pulpwood Trees

Matchwood Trees

Firewood, Fuelwood and Fodder Trees

Other Beneficial Trees(NTFP)

Biofuel species

Pencilwood /Plywood Trees

Choose by Tree Type

Plantation Made Easy
Choose By Location

Ariyalur

Chennai

Coimbatore

Cuddalore

Dindigul (except for Kodaikanal)

Dharmapuri

Kodaikanal (Dindugal)

Erode

Kancheepuram

Kanniyakumari

Karur

Krishnagiri

Madurai

Nagapattinam

Namakkal

Perambalur

Pudukkottai

Ramanathapuram

Choose by Location

Plantation Made Easy
CHENNAI
Industrial / Institutional Plantation Trees

Timber Trees

Pulpwood Trees

Matchwood Trees

Firewood, Fuelwood and Fodder Trees

Other Beneficial Trees(NTFP)

Biofuel species

Pencilwood /Plywood Trees

Industrial / Institutional Plantation Trees

Peltophorum pterocarpum
(Copper Pod Tree)

Select Tree Type in Selected Location
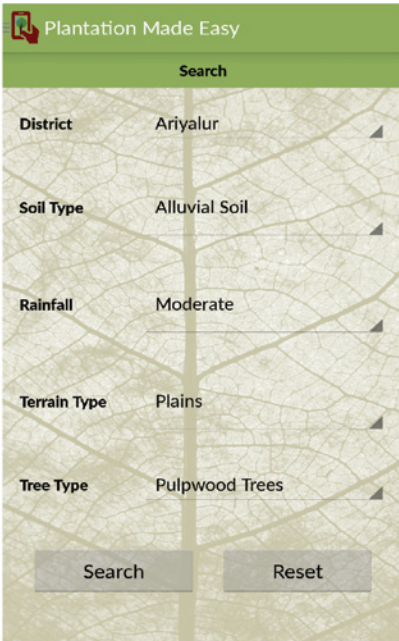
Search by Query

Tree Details Screen

Widening the Choice of Tree Species

Though the State Forest Departments recommend several tree species for plantation, people do not come forward to opt for many those species. The reasons behind the hesitation are:

a. Lack of mass production of planting materials.
b. Ignorance about their plantation techniques.
c. Lack of access to the resource material related to the silviculture of these species.
d. Less guidance available to choose the right species for their land.
e. Less knowledge about the market value and the usage.

In order to decide on the right species for plantation, the factors that influence the decision are profitability, gestation period, demand for produce, level of investment, access to market and availability of planting material.

Most small farmers are driven by the publicity and attractive benefits as highlighted by the promoters while selecting tree species for planting on their lands. The popularity of the species also varies from region to region, based on the demand for produce, marketing infrastructure, agro-climatic conditions, available inputs and the extent of awareness and publicity created by the programme implementing agencies.

'Plantation Made Easy' was developed to address these issues and to help the farmer choose the species of his choice giving a wide choice of 43 tree species.

Choosing the right tree species

The selection of right tree species is very important. There are several factors which govern this selection –choice of the farmer, soil type, climate, rainfall, terrain and tree type/ tree value. 'Plantation Made Easy' considers all these factors and helps the farmer to select the most suitable tree species which will meet all the above conditions. This ensures the healthy growth of the tree species and protects the farmer from incurring heavy losses.

Guiding through the plantation

'Plantation Made Easy' not only helps the farmer in deciding the right tree species, but also guides them throughout its plantation. The parameters that are crucial for any plantation are:

a. Choosing the correct planting material.
b. Selection of the right time to plant a tree.
c. Selection of the right place for tree plantation.
d. Preparing a pit of right size for the planting material.
e. Choosing adequate spacing for plantation.
f. Immediate care soon after planting.
g. Post plantation care, which includes, weeding, cleaning, pruning and thinning, to improve the quality and the health of the trees.
h. Recommended harvest year.
i. Suitable intercropping systems.

'Plantation Made Easy' provides the information handy to the user, under the tree details of all the 43 tree species.

Other features offered in this application are:

a. Contact information of district offices from where more information can be obtained.
b. Tools, where the user can enter the land area and the spacing details to calculate the number of planting materials required.
c. Glossary, which helps the user to understand plantation terminologies.

Future of 'Plantation Made Easy'

In the future releases and the upcoming versions, 'Plantation Made Easy' will focus on upgrading the application with the following details, with the help of the Tamil Nadu Forest Department:

a. Adding more tree species to the tree list.
b. Finer search (region wise).
c. Providing broad details about plantation techniques.
d. Market details for the specific tree species.
e. Cost-benefit analysis of plantations.
f. Intercropping models.

Integrating the traditional forestry knowledge with the technologies will yield sustained positive results. We have enough resources to guide and help people, but there is a problem in accessibility and establishment of linkages. Projects like 'Plantation Made Easy' will help to bridge the gap. This application is available for download from Google Play Store for all android phones. Such projects will promote

more plantations and people will come forward to plant non-popular species too. Promoting tree planting on private lands, based on the preference of farmers, should be considered. For the success of any afforestation programme on private lands, income being the primary consideration, arrangements should be made for backward and forward linkages. The extension programme to promote afforestation should be based on well-tested technical and economic data to guide the farmers and general public in the right direction.

Digitisation of forest resources and services

The application of IT sector in the Forest Department has increased efficiency as it makes controlling and monitoring easy

Dr Amit Chouhan and Vijay*

The Gujarat Forest Department introduced IT (Information and Technology) Wing in 2005 to improve and fasten the technical area of department to cope up with the digital world. IT Wing mainly looks after the growth and development of technical areas and is responsible for the formulation and implementation of some important activities of PCCF office in digital form to make process more accurate and efficient.

GujInfo Petro Ltd. (GIPL) is the Total Solutions Provider (TSP) / Nodal Agency which prepared and implemented the IT/e-Governance Roadmap for the Gujarat Forest Department and regularly provides IT Project Consultancy and Facility Management Services (FMS) to the department.

The Gujarat Forest Department has more than 1,500 systems with latest updated configurations, with internet and GSWAN (Gujarat State Wide Area Network) connectivity. The department has an Information and Communication Technology (ICT) lab/ support centre along with a command control room/ lab equipped with 10 systems with latest configuration at Aranya Bhawan, Gandhinagar, and a GIS cell at Vadodara under CCF working plan.

The upgradation process of desktop computers and preparation of IT assets inventory is being carried out all over the State. In continuation to the advanced technology, the Forest Department has purchased licenses of ArcGIS 10.0, Dashboard software.

The following projects are under progress at the Gujarat Forest Department:

1. eGujForest web portal (egujforest.gujarat.gov.in).
2. Calling Solution.
3. Digitalisation of Forest Maps.
4. Forest GIS.
5. PDA (Personal Digital Assistance) application.
6. Bulk SMS is developed for Public Liaoning Officer (PLO) office.
7. Gujarat Forest Department Mobile Directory is developed in 2015 and successfully running in android system.
8. Digital Flora Application.

*SFS Trainee, 2015-17CASFOS, Coimbatore

9. Mobile GIS Application developed to report different type of events like illicit tree felling, poaching, boundary situations, etc.

In the Gujarat Forest Department, mainly Forest Management and Information System (FMIS), Geographic Information system (GIS) and Mobile applications are working till the ground level and a e-Mitra Support Centre is established as a command control room which provides support and training related to Forest Management Integrated System. Technical team of IT wing had also provided support and contribution in the Lion Census 2015.

Most of the digitisation work has been completed by Bhaskaracharya Institute for Space Applications and Geo-Informatics (BISAG) with the help of ground staff by providing the data in Excel format with the PDA Application.

PDA Application

It is a smartphone-based forest protection surveillance tracking system developed by GIPL. This application was initially established for window-based mobile phone and at present its android version is nearing completion. The department has given mobile phones integrated with PDA Application to all beat guards. Its main functions and scope of work are:

1. Events like illicit tree felling, encroachment, transit offence, grazing, mining, boundary alteration,
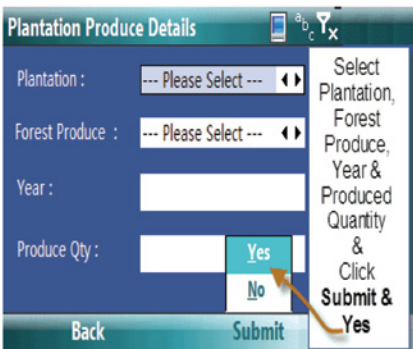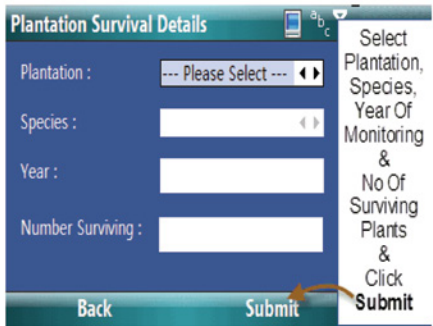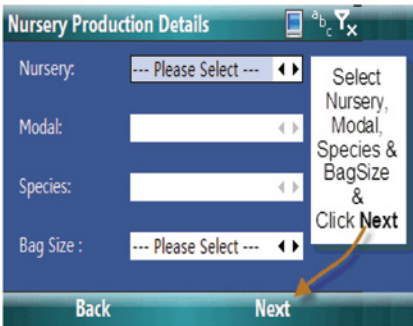
Map display

Zoom Out

Zoom In
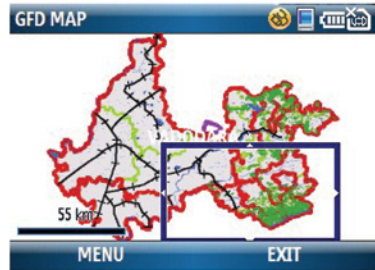
poaching, etc., is registered by the PDA instrument and FMIS database is updated immediately.

2. Creation of transit pass in forest produce, submission and passing of voucher in finance module, event registration in wildlife module – animal sighting, rescue, conflict etc. – nursery production details and survival details of plantation in physical module, etc.

3. In case of an emergency, message can be sent to the nearest PDA user by the central server.

4. Hot keys are available for calling/ sending messages to the higher officer in emergency, so that beat guards can easily contact their superiors.

5. Online tracking of forest personnel in Web GIS application and tracking of log of forest personnel movement is possible.

Forest Management Information System with GIS integration

The FMIS with GIS integration has been developed by GIPL with collaboration with BISAG. The department has developed a web portal, http:// egujforest.gujarat.gov.in, with various modules which connects the range, division and circle to a data server at State data centre at Gandhinagar. All the modules can be operated by forest officials at the ground level through GSWAN connectivity and accessed and monitored by senior officials.

The portal has modules on Land, Forest Officials, Working Plan, Plantation, Nurseries, Treatment Plan, Participatory Forest Management, Forest Produce, Depot Management, Auction, Court Cases, Saw Mills, Wildlife Management, Research and
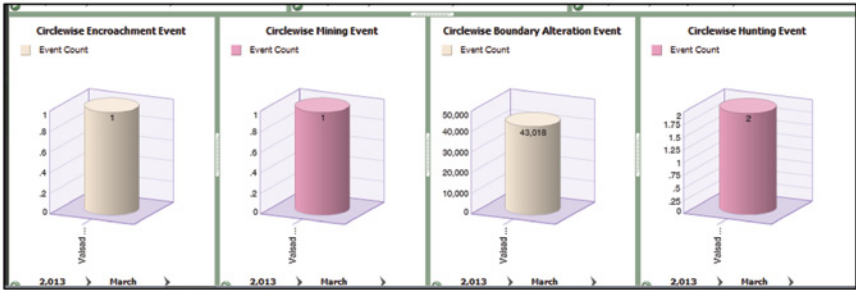
Tracking the progress with Dashboard tool of egujforest portal

Alert of employee retirement status by Dashboard

Training, etc.

This FMIS system helps in tracking the pendency and to decide the priorities which make management and maintenance easy. Tools like Dashboard and Alerts systems has helped a lot in decision making and removed the delay period by quick and responsive functioning.

E-services

The Gujarat Forest Department has provided the following e-services on their official website which are related to social forestry and protection and saw-mill licenses.

1. Kissan Nursery Application.

2. Regeneration of Degraded Forest Land (RDFL) Plantation for individual beneficiary.

3. Vanmohotsav species application for seedling distribution.

4. Energy saving equipment.

5. Smashan Sagdi application

6. Cattle death compensation request application.

7. Permission for research work in Restricted Areas.

8. Barbed wire fencing application.

9. Constructing parapet walls around open wells.

10. Permission for film shooting/ photography in Restricted Areas.

11. Renewal of saw-mill license.

Ongoing projects

1. eGujforest Phase II.
2. Conversion of Windows-based Mobile Application to Android-based Application.
3. Integration of PCCF office website with eGujforest Application.
4. Annual Maintenance Contract (AMC) of eGujforest Phase I.
5. AMC of PDA/ smartphone-based Forest Surveillance Application.
6. Shifting of eGujforest Application to the State Data Centre.
7. Calling Solution Expansion.
8. Online Reservation of National Parks and Sanctuaries/ Ecotourism Sites, etc.

Conclusion

The application of IT sector in the Forest Department has increased efficiency as it makes controlling and monitoring easy. The FMIS system is easy to upgrade at any level and the communication is paperless. This results in huge time saving with proper security and transparency.

Training of the various IT applications to the existing ground level staff and their resistance to adapt new technology is the main hindrance in the application of FMIS. Due to lack of skilled and trained staff, most of the resources are under-utilised.

Integration of various technologies

The Forest Department has done some interesting innovations that can be replicated elsewhere, like the Daily Progress Report in Plantation Monitoring System

Anand Kumar & Balram Sharma

The main objective of the ICT application in the Forest Department is to systematically organise planning, implementation and monitoring of forestry and other related operations by systemic collection, storage and retrieval of MIS and Geo-spatial data through a computer-based communication network. The Uttar Pradesh Forest Department (UPFD) is executing its technology initiatives in an integrated manner wherein all its key functions are being carried out through web-based workflows which facilitate each role player to log on to the departmental portal and enter his/her work/data/information and which also facilitates every employee to remain in constant touch with the latest happenings in the department. This working methodology has not only brought transparency, responsibility and accountability, but also efficiency.

To bring about these, the following features were essentially required:
• Development of applications.
• Procurement of Data Collection Devices.
• Creation of a Server Farm.
• Development of computer-based communication network.
• Sharpening the ICT skills of the manpower.

IT infrastructure of UPFD

UPFD has taken many ICT initiatives since 2007 after the signing of Terms of Reference (TOR) with the Madhya Pradesh Forest Department (MPFD) for effective protection and management of forests and wildlife in the State. Several applications have been developed by integration of various technologies–Space Technology (Remote Sensing, GPS, etc.), GIS, Communication Technology, etc., in-house and successfully implemented in the field. All the applications are web and workflow-based for management and monitoring. Accordingly, APPCF (IT) post was also created in UPFD and separate Aranya Sadan established at the Forest Headquarters, Lucknow, for the functioning of the IT cell.

MIS and GIS labs are established at Aranya Sadan under the Japan International Cooperation Agency (JICA) project and the main server lies with Cybertech IT Solutions at Bangalore. Departmental data are routed through the NIC. A departmental data centre has been established. A large

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number of transactions are done daily through this data centre and a huge database of MIS and Geo-spatial data has been created. The data centre has been protected by world class Unified Threat Management System (UTM) and anti viruses. It provides protection against threats like hacking, port scanning, viruses, junk emailing, etc. A forest network has been developed for speedy transfer of data in all forms by establishing Virtual Private Network over Broadband, covering all the DFOs of Uttar Pradesh. It is planned to be upgraded to 2 mbps connectivity. In PMU (Project Management Unit) under the JICA project, internet leaseline of 7 mbps (out of which 3 mbps is diverted to the IT cell and 4 mbps to PMU – MIS and GIS cell under JICA) of Sikka Broadband Pvt Ltd has been provided. Out of 494 forest Ranges in the State, 175 Ranges have been provided computers with data connectivity. Some of the Range headquarters where broadband connectivity is not available are being connected by Wi-Max technology. Video conferencing facility of maximum 7 persons interacting at a time has also been recently established at 14 locations which will help in faster and economic decision making.

What UPFD delivers

The target groups can basically be divided in five classes –forest field staff, middle-level managers, policy makers, media & press and public. The content and service delivery to these target groups is as follows:

Forest field staff: Ease in reporting, saving of time, on-the-spot data entry, electronically tagged follow-up, increase in efficiency, better access to data and better understanding of their works and responsibilities. Also, training in use of modern technology even in the remote areas.

Middle-level managers: Quick on-the-desk access to live data, better tools for objective and informed decision making, electronically tagged follow-up, quicker data updation and analysis.

Policy makers: Holistic view of live data at finger tips on live dashboards, on the fly reporting, comprehensive access to structured database for in-depth analysis.

Media & press: Live data availability with dynamic web content and structured presentation.

Public: Training in use of modern technology in remote areas, products like digital maps, free access to data on web.

The practices are based on various technologies and are a fine example of integration. Technologies used are, space technology; GIS; mobile computing; communication technology; and, centralised server-based processing on content-based web principle. It brings about accountability, transparency and efficiency of individuals for management and monitoring. The ICT cell is running the following Applications with the help of UPDESCO and data is routed through ICT cell's server and then through NIC:

1. Map digitisation, information collection system. Details of the plan to monitor and map the boundary pillars.
2. Plantation Monitoring System

(6 crore plants to be planted in one day in 2016).

3. Nursery Stock Information System.
4. Online Felling Permit System.
5. Class-wise details of forest areas.
6. Forest Employee Database System.
7. Online GPF System.
8. Online library.
9. Online Vehicle Information System.
10. Telephone directory, NIC e-mail.
11. FOMS, Forest Crime Management system.
12. FLMS, Forest Land Management System.
13. FFAMS, Forest Fire Information System.
14. WLMS, Wildlife Management Systems.
15. E-Green watch system of the government.
16. Forest clearance monitoring system of the government.
17. Online note sheet dispatch system (E-Note sheet).

GIS and MIS cells are running the following Applications with the help of in-house development of application (earlier with the help of MPFD) and data is routed through MIS cell's server and then through Cybertech IT solutions, Bangalore:

1. Financial Management System.
2. Forest Area Development & Management System.
3. Community Development & Livelihood Security Enhancement System.
4. Capacity Building System.
5. Institutional Strengthening.
6. Project Monitoring Management System.
7. Wildlife Management System.
8. MIS Administration.
9. Reports.

Daily Progress Report (DPR) in Plantation Monitoring System (PMS) is an innovation in monitoring the progress of plantation work, which will make the record plantation of 6 crores plants in a day timely and systematic as per their plan. GIS digitalisation and mapping on a scale of 1:5000 of all the plantation sites with GPS coordinates of pillar marks and other point of interest along with photo uploads of the site will provide detailed data which will be very useful in the analysis of the project success.

All the maps of 20 forest divisions (selected under the JICA project) have been digitised and the Geo-spatial data is stored on a common server of the MIS and GIS cells. The digitised data is published on the web, using GIS Map Services. A Geo-spatial query system is being developed for querying this data for facilitating effective management of forests and wildlife. The department is using GPS-enabled PDAs to capture real-time data with Geo-spatial details. So far, PDAs have been provided only in Dudhwa and Katarniaghat wildlife sanctuaries.

Among other IT applications, The Forest Fire Alert and Messaging System (FFAMS) uses Remote Sensing Data of locate fire locations within the administrative units of the UPFD. SMSs are sent to the concerned field staff for immediate action and to send feedback through the web. Wildlife Management System (WLMS) monitors all the Protected Areas with respect to habitat status and population variance

of various wildlife species. It is also helpful in keeping a close watch on patrol camps and their parties. This system helps the user to capture wildlife sighting data electronically through PDA, including geo-coordinates.

Future prospects

Though the UPFD is among the pioneer States in the India for ICT initiatives in the Forestry Sector, there is still a long way to go. Many ICT applications are running under the JICA project, which is only in 20 Forest Divisions (out of total 82 divisions). After the completion of the JICA project, all the technology should be handed over to the UPFD and should be applied in all the divisions. Contractual experts should be retained with the department. Effective use of ICT not only helps in faster, economi-cally superior and effective decision making, but also brings transparency, responsibility and accountability in the governmental working and creates awareness among the public. It also helps in the uplifting of the economi-cally backward community. There is tremendous scope of future develop-ments in ICT applications such as cloud technology, e-filing, e-accounting, etc., to utilise its full potential.

Acknowledgements

Towards a new world record in tree planting

The Uttar Pradesh Government has come out with an initiative of keeping a digital record of the plants and nursery being sown, under the inspection of UPFD

Anand Kumar & Balram Sharma

Mention of vast forests over large tracts of this State is found in the great epics, *Ramayana* and *Mahabharata*. At present, geographically, Uttar Pradesh is the fourth largest State in the country and according to the Indian State of Forest Report 2015, the forest cover of the State is 14,461 sq. km and tree cover is 7,044 sq. km, a total of 21,505 sq. km, which is 8.93 per cent of the State's geographical area. There is an increase of 112 sq. km of forest and tree cover in the State since the last assessment in 2013. According to the report, the main reason in the increase in the forest and tree cover is plantation activities and better protection.

The massive plantation programme

Keeping a sustained pace of plantation activities, the Uttar Pradesh Forest Department (UPFD) is organising plantation of 6 crore saplings in a day – to create a world record – in July 2016, under Mission Greening UP, 2016. It would involve local people,

schoolchildren, village panchayats, armed forces, media, industries, NGOs, etc. This mega activity is based on the past successful plantation drive of 2007, in which 1 crore saplings were planted in a single day (the previous world record). It had resulted in an increased green cover.

The plantation will further enhance the green cover in the country and facilitate carbon sequestration to cater to the INDCs goal. The Project Area covers the entire state of Uttar Pradesh, encompassing all forest divisions. The saplings will be planted at more than 10,000 sites throughout the State in 85 forest divisions at every vacant spot, including along highways, forest blocks, nurseries, roads, railway lines, canals, etc.

Role of IT products in mega planting event

The Uttar Pradesh Government has come out with an initiative of keeping a digital record of the plants and nursery being sown, under the inspection of UPFD. Online Plantation Monitoring System (PMS) along with the use of Geographical Positioning System (GPS)

Officer Trainees 2015-17 Batch, CASFOS, Coimbatore

GIS Lab, Aranya Sadan, Lucknow

Server Room, Aranya Sadan, Lucknow

for this purpose has set an excellent example of ICT and GIS technology application in the forestry sector. These tools are making the simultaneous monitoring of more than 10,000 sites possible in an efficient and economic manner. All the site details, including GPS coordinates along with the photographs of all the sites, are taken and being uploaded in PMS application on the website of UPFD (http://www. upforest.gov.in/DynamicPages/ Plantation.aspx). This geo-spatial data of each site helps in easy monitoring of plantation activities and quick access to the plantation sites. Photographs of the plantation sites before, during and after the plantation work will help in better comparison and transparent analysis of the project's success. Individual login details are given to Range, Division and Circle level officers to access PMS

application. An Android-based Mobile App and a Android-based/ web-based Application (downloadable from http://www.pms.data-center.co.in) is to be developed to make it mobile friendly so that the regular updates can be uploaded by mobile even from remote locations where computers are not available. Online Nursery Stock System (NSS), or Nursery Monitoring System (NMS), helps in providing all the nursery details, like its location, number of saplings, species availability, etc.

The Daily Progress Report (DPR) in PMS helps in effective supervision of the progress of work at the Range, Division and Circle level. User Id and passwords (login details) given in PMS application to Range-level officers results in ease in reporting, saving of time, on-the-spot data entry, electronically tagged follow-up, increase in efficiency, better access to data and better understanding of their works and responsibilities. The availability of status of the work and other details like number of sites selected, their areas, number of pits dug, number of seedlings to be planted, details of the site-in-charge, etc., through a single click helps in better analysis and guidance for middle-level officials. The holistic view of the live data at finger tips on live dashboards, on-the-fly reporting and comprehensive access to structured database for in-depth analysis helps in effective decision making by higher officials. The effective use of PMS has not only helped in systematically faster, economically superior and effective decision making, but has also brought transparency, responsibility and accountability in the governmental working and has created awareness among the people.

Conclusion

Uttar Pradesh, in spite of being late in IT products application in the Forestry Sector, is going to help in setting the new world record of 6 crore sapling plantations in a single day and its credit goes to the application of IT products mainly. This example beautifully fulfils UPFD's Vision-2025 to endeavour

Aranya Sadan, Lucknow

nurturing forests through world-class forest management practices for conservation of biodiversity, accrual of sustained goods and services and large-scale plantations for green cover extension, and to provide a clean and green environment to society at large. It also meets its aspiration to adopt innovative approaches for inculcating conservation ethics in the minds of the people and to have personnel trained in the best modern technologies and exposed to the latest global research. It proves UPFD's relentless strive in pursuit of excellence to set world-class standards in global forestry.

The evaluation of this programme shall be done up to 3-5 years, or till the saplings are fully established. If it is successful, as compared to plantation programmes without IT, then this practice will be worthy of adoption in all other State Forest Departments of the country.

Using ICT and GIS to address governance challenges

Haryana is far ahead in IT applications whereas Punjab needs a lot to do to catch up with. In the Union Territory of Chandigarh, IT applications can be used for public interaction services of the department.

Anil Yadav, Ramesh Kumar and Vikash Arora

It was in the late nineties that use of computer in forestry sector became more extensive and intensive. But the use of computers remained limited only to managing information either in Excel or in MS Word for a very few jobs. Later on, ICT initiatives in Forestry were planned to ensure smooth integration of multiple technologies like Remote Sensing, GIS, GPS, GSM, GPRS and Mobile computing, etc., to the best advantage of the sector. The main objective of the ICT application in the Forest Department is to systematically organise planning, implementation and monitoring of forestry and other related operations by systemic collection storage and retrieval of MIS and geospatial data through a computer-based communication network. The State governments of Punjab and Haryana have taken several steps to use the emerging information and communication technologies for developing better governance system with greater transparency and enhanced public involvement. Use of information technology in people's participation may play a vital role in their active involvement and decision-making for protection, development, planning and monitoring various programmes. Now, it is moving towards executing its technology initiatives in an integrated manner wherein all its key functions will be carried out through web-based workflows, which facilitate each role player to log on to the departmental portal and enter his work/ data/ information and which also facilitates every employee to remain in constant touch with the latest happenings in the department. This working methodology will bring transparency, responsibility, accountability and efficiency.

The study puts emphasis on analysing how ICTs/ GIS have been utilised and can be utilised to address the governance solutions and challenges identified during the analytical process in the States of Punjab, Haryana and Chandigarh.

SFS Trainees, 2015-2017, CASFOS, Coimbatore

IT initiatives by Haryana Forest Department

The Haryana Forest Department (HFD) is in the process of taking new initiatives in e-Governance to systematically organise planning, implementation and monitoring of forestry and other related operations by systematic collection, storage and retrieval of Management Information System (MIS) and Geographical Information System (GIS) data through a computer-based communication network. The department aims to execute its technology initiatives in an integrated manner, wherein all its key functions would be carried out through web-based workflows which facilitate each role player to log on to the departmental portal and enter his work/data/information.

S.N.	Name of Module	Details
1	Court Cases Monitoring System http://web1.hry.nic.in/courtcases/	• Implemented since April 2010. This Module generates reports & summaries – hearing date wise, court wise, location & cases status wise.
2	Public Grievances Portal of Government of Haryana (Harsamadhan) http://harsamadhan.gov.in	• Implemented since April 2011. • Grievances are received online & monitored on daily basis through this module.
3	Online Budget Allocation System http://www.hrtreasuries.gov.in/	• Implemented since April 2011. • Budget is monitored & distributed through this module on daily basis from BCA to BCOs & from BCOs to DDOs.
4	E-billing, Haryana http://esalaryhry.nic.in/	• Implemented since November 2011. • The salary & other bills are submitted by all DDOs and passed online by Treasury officers through this module.
5	Online Submission & Monitoring of Forest and Wildlife Clearance Proposals http://forestsclearance.nic.in/	• Implemented since August 2014. • Status of clearances under FCA being monitored through this module
6	Personnel Information System http://web1.hry.nic.in/intrapis/	• Implemented since October 2014. • Personal Information, promotion, transfer and postings are being monitored through this module.
7	CM Grievances Redress & Monitoring System Haryana cmharyanacell.nic.in/	• Implemented since January 2015. • Grievances are received online & monitored on daily basis through this module.
8	Aadhaar Enabled Biometric Attendance System (AEBAS) http://hrforest.attendance.gov.in/	• Implemented since July 1, 2015 • Employees register on this system at HQ & Division Level.

9	e-Citizen Services https://haryanaeseva.gov.in	• Being launched soon • Permission for felling of trees • NOC in respect of PLPA or Forest or Restricted lands
10	Centralised File Movement and Tracking Information System http://web1.hry.nic.in/cfmsharyana/	• In process of being implemented at the HQ.
11	Master Database Management System http://www.mpforest.org/haryana.htm	• Implemented since August 2012. • Reports can be generated as per hierarchy and forest area type.
12	Forest Offence Management System http://www.mpforest.org/haryana.htm	• Implemented since January 2014 • 20,827 offence cases from April 1, 2000 till December 31, 2015 have been entered & are being monitored through this module
13	Nursery Stock Management System http://www.mpforest.org/haryana.htm	• Implemented since May 2015 • Data entry process has been started.
14	Assets Management System http://www.forest.gzdevelopers.com/	• Implemented since May 2015 • Data entry process has been started.

Use of advanced GIS Technology for Forest Management

The Haryana Forest Department now has a well-equipped GIS cell at Panchkula to collect spatial data of forest resources, assets and forestry interventions. Such spatial data is overlaid with various feature layers of interest – like, forest type classification, forest cover, protected areas, wetlands, village boundaries, watersheds of Haryana, soil types and environmental layer – for the development of GIS-based Decision Support Systems (DSS) for effective management of forest and wildlife areas. This initiative is in congruence with the current IT policy of the department to support the endeavour of scientific forest management using GIS and remote sensing data.

Major GIS applications in forestry in the department being developed are:

1. Re-organisation of forest beats on village basis.
2. Digitisation of block forest boundaries and preparation of geo-referenced forest maps.
3. Preparation of forest and wildlife resource maps.
4. Demarcation of eco-sensitive zones.
5. Hosting of geospatial server.
6. Mapping of water harvesting structure locations on GIS.

IT Applications in Chandigarh Forest Department

Since it covers only the city of Chandigarh, the Chandigarh Forest Department does not have much scope of IT applications specific to forest. But e-Governance is the most significant

aspect of the IT Policy of Chandigarh Administration, of which Chandigarh Forest Department is a part. The vision of the Administration is to create a knowledge-based society, wherein every citizen of Chandigarh shall be able to excess the benefits of IT. IT is to be used as a medium for effective interaction between the Administration and the public to make exchange of information and access to government departments speedy and easy.

Future prospects of IT in Chandigarh Forest Department

IT may found its application in the following fields in the Forest Department.

- Digitalisation of Maps and land use pattern.
- Development of MIS and Decision Support System (DSS).
- Development of State-level data base.
- Tenders and purchases.
- To develop a platform for online availability of services related with forest department.
- Ecotourism bookings.
- To design SMC works in Sukhna Lake catchment areas.
- To make various rules, regulations and Acts available to people.

IT Initiatives by the Punjab Forest and Wildlife Preservation Department

In the Punjab Forest Department, computerisation started in late 1990s. Initially, computers were seen with awe and their use was confined to few offices. Now, offices up to the Division

Office are equipped with requisite basic IT infrastructure like computers, printers and internet connection. Information assistants are engaged in Division Offices.

Current GIS infrastructure in Punjab Forest department

All ranges have been provided with GPS Handheld Sets whereas Division Offices have Arc View licenses v9.2 for analysis and simple editing along with DGPS set up, computers and printer. Head Office has the latest Arc Info licenses v 10.2 for editing for shape files and geo databases for analysis and Erdas v 2013 for image processing.

Punjab in field of GIS so far

- Procured LISS, an PAN merged data from NRSA, to assess Tree Outside Forest (TOF) in 2002 with help of Survey of India (SOI) under the JBIC project. High Resolution Panchromatic data from IRS-LISS IV with 5.8 m resolution was used. Based on the TOF report, the State of Punjab could get the wood-based industry regularised as it was assessed that growing stock in TOF is more than that of forest areas.
- Procured 104 digitised topo-sheets covering the whole State from SOI to prepare administrative maps of Divisions, Ranges and Beats of 1:50000 scale.

Way Forward

- The department is planning a real-time plantation module, which will facilitate the Head Office to get the plantation-related RKVY

scheme data in real time from the forest divisions. This will ensure transparency.

- FSI will provide the Forest Department with forest cover maps of the Divisions on the scale 1:25,000 from NRSA data. Since the State does not have large forest areas, threshold area limit for forest cover mapping has been reduced to 0.125 ha from 1 ha to capture strip plantations along railway track, roads and canals.

- The department has obtained data of 0.5 m resolution World View II imageries from the Department of Disaster Management for forest protection and management. The department is making 1:15,000 scale maps up to the beat level using these imageries.

- 0.5 m resolution World View II imageries are being overlaid with available beat level maps for better analysis and management purposes.

- The department has obtained images from year 1980 and used them in certain important FCA cases after geo-referencing the images.

Summary

Out of the two States of Haryana and Punjab, Haryana is far ahead in IT applications whereas Punjab needs a lot to do to catch up with. In the Union Territory of Chandigarh, though there is not much forest area or forestry work, IT applications can be used for public interaction services of the department. A centralised approach with availability of sufficient budget is required to avoid duplication of efforts and to maintain uniformity and compatibility.

Greater transparency and access to information

GIS-based tools and models for forestry management have been in the use in the State Forest Department since 1995

Chandrapalsingh Chouhan & Sunil Gupta

Maharashtra has been one of the pioneer States in India to have adopted promotions of ICT (Information and communication Technology) and e-governance. Greater transparency and access to information on public administration processes has been the thrust area of e-governance in the State. GIS-based tools and models for forestry management have been in the use in the department since 1995. Forestry sector in Maharashtra is the second largest after Agriculture in terms of land use. The Forest Department is entrusted with the responsibility of conservation and development of the State's forest, spread over about 20 per cent of its geographical area.

Milestones of e-governance

The Maharashtra government issued directions for regular use of IT in all its government departments in 2009. The government made compulsory the allotment of 0.50 per cent budget of the total State budget for e-governance since June 2010. It was reiterated by the government in 2010 that performance in e-governance was compulsory for Performance Appraisal Report (PAR) of All India Services officers. Maharashtra issued an e-governance policy in 2011. The policy aims to maintain and strengthen the leadership of the State in e-governance and take it towards good governance. The policy would enable citizens to avail of various services online, or at a place near their home, without having to visit government offices, at a minimum possible cost. Implementation of e-tendering for tenders above Rs 10 lakh and above in all the departments has been made compulsory by the government since January 2013. Installation of CCTV cameras in all government offices was done to monitor and check the functioning of officials in March 2013. E-auctioning has been made compulsory in all departments since February 2014. Detailed guidelines were issued for internet bandwidth with procurement of 10 mbps and above and to increase the IT knowledge and efficiency among government officials. Laptop/ tablets/ i-pads/ PDAs were procured and supplied to them since February 2015.

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Infrastructure in the Forest Department

The Maharashtra Forest Department (MFD) has 15 Circle offices, 65 Divisions and 436 Ranges. Maharashtra has signed MOU with NIC (National Informatics Centre), BSNL, KPMG, and MRSAC for development of GIS (Geographical Information System) and MIS (Management Information System) based applications in MFD, Ministry, HOFF offices, all 15 circle offices, 65 divisions and up to Range level. They are connected by VPN (virtual Private Network). MFD has a website, mahaforest.gov.in, and has its own intranet portal and IT infrastructure and connectivity up to Range level has been provided – 360 Ranges have good connectivity while remaining 76 Ranges are to be connected with VSAT facility. Work has been completed in 45 Ranges. Video conferencing facility is available up to the Division level. Forest Guards have been given 6,000 PDAs to enable them to send e-mails and message related to tree felling and poaching. The new system will also help in tracing the activities of forest guards and dereliction of duty will be easier to detect.

Security solutions

Networking is protected by a firewall provided by CISCO. Intrusion Prevention System is there. System has URL filtering facility. Patch management is regularly done. While anti–virus solutions are done, security auditing is not done. ICT lab in MFD has 5 servers – two web security servers, two application servers, one database server and one anti-virus server.

GIS' journey of MFD

1. Mr JS Grewal, Ex-PCCF. with the World Bank aid starts digitization of Forest Division maps since 1995 by preparing forest Working Plans on the topo-sheets of 1:50000

2. After boundary corrections of above maps, same were shared with MRSAC and NRSC, Hyderabad.

3. MFD also signed a MOU in 2014 with MRSAC, under the project IFIS (Integrated Forest Information System) for development of in-house GIS-based applications for MFD.

4. Accordingly, MRSAC (Maharashtra Space Application Centre) has completed geo-referencing of Nagpur Divisions boundaries and development of certain applications is under progress.

5. For registration of offences, 6,000 PDAs were distributed to Forest Guards in the entire State.

6. Separate MOU was signed in 2015 with NRSAC to develop SMS fire alert system based on Bhuvan geo-portal. Fire alarm alert is sent to the concerned beat guard on his cellphone.

7. The system is active since January 2016, providing near real-time forest alerts to field personnel.

8. The GIS cell functioning under CAMPA has carried out geo-referencing of 6,426 plantation sites and uploaded it on the State geo-portal.

9. Peak point analysis in each compartment of the Nagpur Division through satellite imagery was done to construct watch towers according to remote sensing analysis reports.

10. Last but not least, rapid vegetation alert reports were generated by NRSAC of Yawal-Dhule Divisions and responsive action was taken by the MFD**.**

MIS applications in the MFD

NIC has been a supporting partner for development, monitoring and uploading of MIS-based applications for the department. The following applications have been developed for internal management by the department:

Burad community bamboo management: In this system, Burad community is provided 1,500 bamboos free of cost annually. For this they have to apply online and get registered on departmental website. Applications are checked online and within 15 days applications are sanctioned and necessary orders are issued for supply of bamboos from the nearest sale depot.

Compensation for wildlife-human conflict: On the death of a human being, the department pays Rs 8 lakh per casualty. On serious injury, Rs 50,000 is paid as compensation. Compensation is paid for crop damages caused by monkeys, jackals, wild pigs, elephants, etc. Cattle death is also compensated for according to its market rate and system also helps in tracking every claim and disbursement status. Compensation is finally settled within 15 days after sanction of claim application by the concerned Range officer.

Photography in NP and sanctuary: Permission in one NP and one sanctuary is there For Rs 500 per day for still camera and Rs 5,000 per video camera per day.

Sawmill registration, renewal, and shifting: All valid sawmill owners have been registered and have been given username and password by the department. Renewal is done every year by taking a fees of Rs 750 per sawmill. In the next phase, same will be integrated with a GIS map. Renewal process starts in October and concludes on December 31. Renewal for 2015 has been completed.

Permission for tree cutting: A farmer has to take permission for tree cutting for trees standing on his own land from the Forest Department. But, 13 species do not require permission by the Forest Department. The Range officer is authorised for sanction of tree cutting.

Tendu registration and auction: Before the auction of Tendu unit, customer has to get registered with the MFD. Tendu leaves are collected by the contractor at various collection centres. Daily weekly progress of collection is uploaded on the Net. People who get employment are added as beneficiary and information of leave collection is done by Munshi of contractors. Per day collection at collection centre of standard bundles (100 leaves) of Tendu leaves and dispatch of leaves from collection centre to temporary or permanent depot is updated.

Forest nursery management: Details of all forest nurseries have been uploaded on internet with their map, location, Ranges and Divisions and details of species and their numbers. Details about shifting/ sale of plants are updated form time-to-time.

Forest offence management system: The system takes the preliminary offence report data directly from the mobile devices. The workflow-based system uses to manage the offence cases and generate various MIS reports.

Encroachments: Regular monitoring of satellite imageries of forest maps through the techniques of change analysis can identify encroachments and deforestation and timely action can be taken.

Wildlife offences: This system contains data related to wildlife cases, like hunting of tiger, panther, deer, gaur, reptiles, birds and others. Details contain number of animals hunted, male or female, type of offence, and evidences found and action taken.

Plantation monitoring: It is an online tool for planning and monitoring of plantation sites across various phases of plantation life cycles. The system tracks both, the physical work progress along with financial expenditure incurred. Twenty modules of estimates have been included.

Some other applications are, online eco-tourism booking, e-tendering, e-auction, and online FCA cases. Citizens can book resorts, lodges and safaris maintained by the department online.

Advantage of IT application

1. The department is offering 10 citizen services under the Right to Services Act, 2015. These services are available on the MFD website. They do not have to visit offices to sort out their grievances.
2. Through the technique of change analysis, the department can identify encroachment, deforestation, and can develop action plans to address these issues.
3. The fire alert system will go a long way in detecting and managing fire in the remote and inaccessible forest of MFD.
4. Web GIS portal can help officers to take quick decisions and forestry management becomes result-oriented on a mouse click.
5. VC facility saves time, energy and public money of the government.

Challenges and suggestions

Two-thirds of total cost of implementing a GIS involves building a GIS database which should be accurate. Thus collection of data is a challenging and costly thing. Moreover, considerable details on ground could be obscured in areas having clouds and shadows. It is difficult to interpret such areas without the help of collateral data. Also, apathy of forest officials has been observed towards adoption of new technology. Further, there is shortage of manpower and lack of infrastructure at the Range level. All information and applications are not available in Marathi, which is more beneficial to common man. Also, security auditing of network has not been done till now. It should be periodically done by competent authority.

Working on the move

*Forest guards are using PDA and Android phones to book PORs, making
the process faster as well as more effective and transparent*

Khopade Ashwini Santosh

A sophisticated mobile-like device called Personal Digital Assistance (PDA), or an Android Phone with POR Application, is given to all forest guards to effectively monitor the forest areas and help conservation efforts. PDA enables them to send e-mails and messages to higher officials as soon as they detect crimes like tree felling and poaching. The new system also helps in tracing the activities of forest guards, making it easier to detect any dereliction of duty.

In Maharashtra, 'Internet and Communication Project' was started in 2013, but on large scale it was started in 2014. For immediate booking of POR after offence in field, this project was started. Forester in the field can book POR. Once POR is booked and submitted, then it is displayed at the Range level immediately. Hence, RFO can take further action on it.

There is a Government Resolution dated August 4, 2013, which provides guidelines regarding 'Providing PDA and its Application'. Based on that, the Pune Forest Division gave Android phones worth Rs 8,000, along with BSNL sim card and internet pack
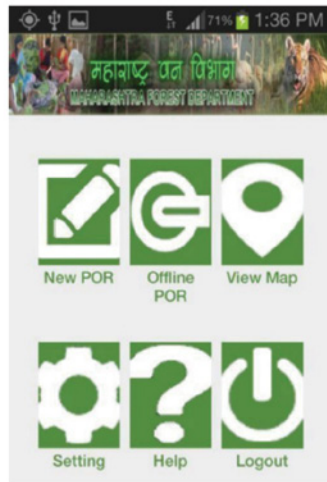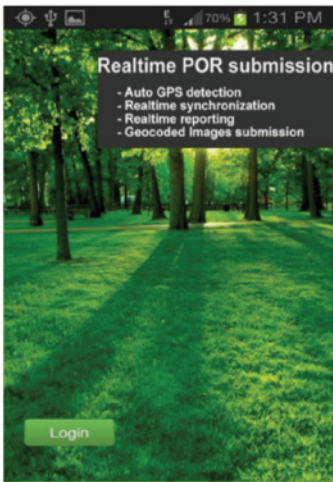
SFS 2014- 16, CASFOS, Dehradun
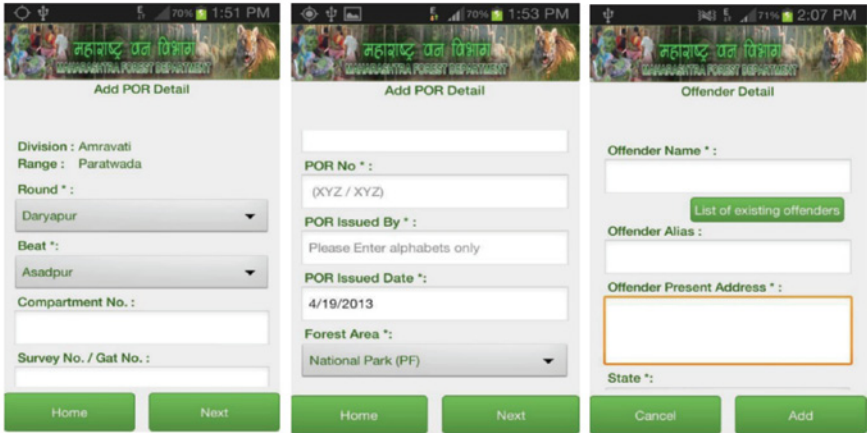
to each forester. Training about the application and its uses were given at Circle and Division level. Training for PDA to all field staff in Pune Division was arranged in 2015. The application is available on the official website of the Maharashtra Forest Department (MFD). On the Home page, 'MFD Intranet' option is available and when the user clicks on it, 'Application' icon is seen. The user then needs to click on MFD POR Mobile Application and install it on the mobile.

To operate the application, user needs to provide the GPS location. Through this application, details about offence can be filled and submitted to the Range Office online. Whenever an offence is committed, the forest guard can book the POR by clicking on option 'New POR'. But, for using this application, one has to 'Log In' into the page. Each Range office has its User ID and Password to do so.

Details about the place of offence are to be given along with the date and name of the person who issued

the POR. Then, a description is to be filled in about the forest area (RF/PF/PA, etc). After filling these details, one has to fill information about the offence, offender and witness with Act/ Section. One can add more than one section according to different Acts. There is a provision for adding photos of the offence place, offender and the witness. One can also add a PDF file related to the offence details. If any material is seized, then that information can be added by clicking on Add Stump, Add Log option.

If the forest offence is committed in any remote part of the forest, the problem of internet connectivity can arise. So, the POR can be added offline also through 'Offline POR' option. One can fill all the information regarding the offence and save it where there is internet connectivity and then submit the POR. After completing the process, 'Logout' option is used to exit from the application. All these booked PORs are shown in the window at Range level on MFD Intranet website under the

option, Offence Management (Mobile Report Status).

As forest guards use this PDA for booking PORs, they can file it immediately at the place of offence; hence the process of booking of PORs becomes faster. Also, as there is a provision of taking images of the offender, witness and offence place, one can get strong proof against the offender at the place of offence itself. As the POR booked is send to Range Office immediately, RFO can take further action without delay in case of an emergency. The POR report is also seen at the Division level, investigation and completion of offence case is faster. POR booking also makes it easy to fix the responsibility as the online status shows at which level the case is pending.

The department got many benefits from using the PDA, but there some practical difficulties arise during booking of POR. When the user clicks on 'Submit POR', then the POR is send to the Range Office. Once he submits the POR, he can't review/edit that POR again. Many forest guards don't know detailed information about Acts/ Sections, hence booking of POR can't be completed. Also, the user can't click the photo of offender as 'Name of Offender' column should be filled first, only then the 'Click Photo' option opens. As many forest guards are senior persons, they don't know how to use an Android Phone. Hence, they still prefer handwritten PORs. Also, whenever a forest guard is transferred, the question arises what to do with the PDA assigned to him as POR booked by him are stored in the machine. Also, as responsibility is fixed and name of the person who issued the POR is filled in the PDA form, forest guards most of the time don't book a POR.

To overcome these difficulties, regular training programmes are arranged for the use of PDA at Range, Division and Circle level. But, for better use, practical sessions can be arranged at the Range level so that problems arising can be solved immediately. Experts can easily solve the problem of each forest guard trainee during the practical only. Also, forest guards should be encouraged to book the POR online without fear.

Using GIS to map forests

Processing of GIS data models can help prepare working plans by identifying specific land characteristics and analysing its potential

Sandeep Kumar &
Dr Sunil Kumar Gaur

Development and application of an interdisciplinary approach integrating satellite Remote Sensing, Geographic Information System (GIS) and Global Positioning System (GPS) can solve specific problems of decision making in resource management. Satellite Remote Sensing techniques can be used to generate spatial data on vegetation and land use types while GPS locates sample plots. The spatial data can be combined to produce thematic maps that are useful in forest management.

These advanced technologies facilitate a regular feedback to policy makers and planners engaged in the field of forestry on the state of forest resources and degradation of land. Processing of GIS data models can help prepare working plans by identifying specific land characteristics and analysing its potential. GIS is useful, for example, in detecting changes in vegetation cover, predicting the susceptibility of land to erosion, for suitability of timber harvest, identification of high-risk zones of forest fire incidents and preparing remedial measures.

West Bengal has the highest population density in India. In West Bengal, 7.54 per cent population of the India resides on just 2.69 per cent of the country's geographical area. The total recorded forest land in the State is 13.38 per cent of the geographical area of the State. For proper utilisation of resources, identification of problems, making good policies and avoiding ecological catastrophe advance technologies are more and more useful.

The GIS cell – Working Plan & GIS Circle – was created in July 1999 in the office of the Conservator of Forests, Kolkata. The works undertaken and executed by the GIS cell of West Bengal Forest department are discussed below.

For the first time, the stock map of Jalpaiguri Forest Division has been digitised and stock map prepared from the digitised stock maps on an exact scale of 1:15000 scale. The Working Plan has been approved by the Government of India in 2008. Stock maps of the First Working Plan of Malda Forest Division, also prepared in GIS cell on an exact scale of 1:15000 scale, has been submitted to the Government of India for its approval.

Procured satellite imageries in digital form have been received from

CASFOS, Coimbatore

NRSC (National Remote Sensing Centre), Hyderabad, for the entire State. Procured satellite imageries, of BTR (Buxa Tiger Reserve) East and West Forest division, Baikunthpur Forest Division, have been digitised on the scale 1:12,500. Range, Beat, Blocks and Compartment maps of the forest divisions have been prepared on a scale of 1:15000 overlaid on the imageries and have been sent to Working Plan North Division, in order to prepare exact stock maps of three forest divisions from satellite imageries.

Now, the GIS wing has digitised the boundaries of all districts and police stations of the State. The GIS wing has also digitised the forest maps for all districts of the State as per requirement. Forest maps up to block compartment level in North Bengal and Sundarbans Tiger Reserve are available in the digital format. Forest Mouza maps in South Bengal have been digitised and extracted.

Fire alerts are being issued since January 2008, using forest maps and fire alerts available on MODerate-resolution Imaging Spectroradiometer (MODIS) (http://earthdata.nasa.gov/earth-observation-data/near-real-times/firms/active-fire-data). The river map of the State is digitised by the GIS wing and watershed data of Range, Mouza, forest portion and location nearby the rivers for the State is computed and extracted by ARC software. This work is under process with collaboration under the Green India Mission.

Namami Gange Project, or Namami Ganga Yojana, or Integrated Ganga Conservation Mission project, is the Union Government Project which integrates efforts to clean and protect the Ganga river. The government announced Rs 2,037 crore towards this mission and plans to complete this project by 2022.

The work done or under process by the GIS wing of the West Bengal Forest Department for Namami Gange Project is:

- Digitising the river map of the West Bengal districts by ARC map software.
- Mapping of buffer zone on both sides of river by ARC map software.
- Marking of treatment zones on the river map by ARC map software.
- Treatment zone if the continuous forest patches nearby or in the buffer zone.
- Marking of Mouza, Range and Division on the river map by ARC map software.

The Working Plan is a unit of scientific sustainable forest management, aiming at continuity of policy and action controlling the treatment of a forest, preservation of biodiversity and forest resources. Working Plans of West Bengal have three Volumes. The first Volume deals with the summary of facts and mainly describes forest resource survey, land schedule and status of forests land, past system of forest management, formation of new working circles and others. The second Volume deals with future management prescriptions. Volume three contains all stock maps and maps of the Working Plan generated by the GIS wing of the West Bengal Forest Division.

The GIS wing of West Bengal has

centralised information of all map types of the state. All digitised maps are comparatively at a good scale i.e., 1:15000. By the use of thematic maps, forest resources are managed scientifically and effectively. Micro level or requirement-based management is also monitored by the information technology products. Information technology product-based management is fast, user-friendly and cost-effective.

Fire alert through SMS is not functioning right now due to financial problems, so funds should be increased. Experts of the field should be permanently recruited by the department. For the optimum use of resources, for fast processing and for better results, GIS, Information Communication Technology, Management Information System laboratories should be centralised, headed by a single person and cloud technology should be used. Security system for cloud technology must be focused because data can be hacked very easily if it is shared by cloud technology. Security aspect of Caller ID data must be increased because if data is hacked, than any illegal person can track the location of wild animals and misuse the data.

Integrated web-based workflows

Madhya Pradesh is the pioneer in developing IT applications for various forestry management practices

Sanjay Kumar Gupta & Vikram Singh Shekhawat

Managing forest and wildlife is a very demanding task in the present scenario owing to the vast extent, dynamic nature of ecological systems and ever increasing anthropogenic pressure. Earlier, forests were only looked upon as a source of revenue for the State exchequer. This affected development of the forestry sector, including technological innovations. Now, when India is regarded as hub of Information and Communication Technology (ICT,) every sector in the country has started using ICT. Though a late starter, forestry sector is not lagging behind. Nature and diversity of works executed by the Forest Department also speaks of the magnitude and complexities involved in management. Therefore, monitoring and decision making becomes very critical.

Madhya Pradesh has nine National Parks, 25 Wildlife Sanctuaries and numerous Forest Blocks. It is one of the most blessed States of India in terms of natural resources, including rich and diverse forests. Forests cover about 30.72 per cent of its total area of 3.08 lakh sq km. Therefore, use of IT is very much required and is inevitable for effective and efficient management.

Objective

- To systematically organise planning, implementation and monitoring of forestry and other related operations by systemic collection, storage and retrieval of Management Information System (MIS) and Geospatial data through a computer-based communication network.
- To execute technology initiatives in an integrated manner through web-based workflows.
- To ensure transparency, efficiency, responsibility and accountability by providing online services and dissemination of information to stakeholders and general public.

Major Applications

Forest Offence Management System: This system facilitates monitoring and disposal of forest offence cases. A case is registered by the field staff and presented in the Range Office. The Range clerk makes the entries in the system and forwards it to Range Officer who, in turn, appoints an inquiry Officer. After inquiry, the

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SFS Trainees (2015-17 Batch)

Inquiry Officer again forwards it to Range Officer, who sends it to the Sub-Divisional Officer. If Sub Divisional Officer deems it correct, he forwards it to Divisional Forest Officer for final disposal. The Divisional Forest Officer may compound the case or may order to prosecute.

Fire Alert Messaging System: This uses processed remote-sensing data of active fire locations obtained from MODIS satellite and sends alerts to the concerned field staff – from the Beat Guard to the Chief Conservator of Forests – through SMS. It also builds a database of fire locations which can be used to identify fire sensitive zones scientifically and also to plan fire control strategy. The response module is designed to collect feedback about correctness of alert locations, extent of fires and also the time taken to control the fire.

Forest Dwellers Survey System: The Forest Department, Revenue Department and Tribal Welfare Department are collectively using this application for managing land *pattas* given to traditional forest dwellers under the Scheduled Tribe and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. A PDA is assigned to a particular village and allotted to a joint team, which surveys the plot and takes photographs of the *patta* holder. The PDA is connected to the system and data is uploaded to the server.

Forest Financial Management System: This application was designed to manage budget allocation and expenditure. The application though is not being utilised to its full potential. Madhya Pradesh Forest Department is trying to improve upon this system and introduce voucher level management system.

Plantation Monitoring System: This application facilitates effective management and monitoring of plantations. It provides date-wise geo-mapping summary and State-wise plantation summary, along with detailed reports of plantation status, geo-mapping status, evaluation status, scheme-wise summary and Hariyali Mahotsav reports. Query-based system provides detailed information of plantations carried out in a particular Circle, Division or Range. KML file of plantation sites are uploaded which facilitates monitoring of the site on Google Earth.

Nursery Stock Management System: This application is an effective tool for nursery stock management. It provides detailed information about the location, species- and scheme-wise targets and species- and height-wise seedling stock in the nursery.

Beneficiary Management System: This module is developed for effective management of Joint Forest Management beneficiaries. It provides detailed query-based information about beneficiaries, their allotments, income generation, etc. It also provides information about livelihood activities, profit sharing and income generated through various activities.

JFM Monitoring System: This system has a monitoring tab which provides query-based information of the desired Forest Division, Range,

Beat or Compartment. It gives detailed information about account balance, sharing, assets, livelihood and beneficiaries. It also provides information regarding due date of elections and generates alerts.

Mines Monitoring System: This application helps in monitoring mines through Geographical Information System (GIS) database and Google Earth. KML files of all the mines are uploaded on Google Earth. Through visualisation of various layers of satellite images over a period of time, it is quite easy to detect any breach in the mine.

E-Registration: Registration of timber merchants willing to bid in open auction conducted by the Madhya Pradesh Forest Department is done through this online application.

Geoportal: The main objective of this GIS-based application is to develop Forest Resource Inventory and its annual updating using remote sensing, so as to facilitate forest management planning with high degree of accuracy. The GIS-based query system has made it possible to access all the information about forest stock up to the Compartment level at the click of the mouse from any location through internet. Various data of different resolutions, like LISS 3, LISS 4, Cartosat 5, and Wordview2 have been obtained from external sources which help in detecting any change and decision making.

Forest Land Management System: The Block record contains all the information about various *khasras* of revenue records which have been included in the Forest Block. It is also accompanied by a map. A query-based system has been developed, containing records and maps of all the Forest Blocks, digitised and linked with GIS application.

Training

Following training facilities have been created for various groups of Human Resources:

- IT Lab at the headquarters (HQ) for training of personals of IT Cell and Master Trainers. IT Lab is set up using latest state-of-the-art technology and is fully equipped to accommodate 30 trainees.
- 16 Regional Centres for Monitoring and Supervisory Staff. Training in these centres is given from HQ directly and in live interactive environment through the Video Conference System specifically designed and implemented for the purpose.
- 54 Satellite Interactive Terminals (SITs) at the Divisional level have been established using EDUSAT facility of Indian Space Research Organization (ISRO). Teaching in these SITs is also centralised from thr HQ for the purpose of uniformity and utilisation of best resource.

Observations

- Madhya Pradesh is the pioneer in developing IT applications for various forestry management practices.
- Frequent training programmes are organised for officers, frontline staff and computer operators. These

trainings are conducted by central lab experts, or ESRI, either through physical presence or through EDUSAT facility.

- All the GIS, Remote Sensing, Management Information System experts and application developers are working on contract basis. These people have a tendency to shift to other more lucrative jobs.
- Some of the applications, like Forest Offence Management System, are too complicated and too detailed that the frontline staff finds it very difficult to work on.

Madhya Pradesh Forest Department website is serving the dual purpose of being an informative site as well as a web portal. This site is bilingual. The department in now developing a new website with better content, which will work on bootstrap technology.

Optimum use of HR and scientific management

The traditional way of management of forests and administration of the department is gradually changing due to integration of ICT

Subhash K.B and Pramod Kumar Dhakad

The integration of Information Technology (IT), Management Information System (MIS), Geographic Information System (GIS) and Remote Sensing (RS) in the management and protection of forests as well as the administration of department has led to better and faster flow of information, more rapid and precise decision making, improved efficiency, transparency and accountability. The Forest Department in Kerala is utilising these ICT and GIS tools in forest management and protection alongwith providing web-based services to public. It has helped in optimum use of human resources, greater protection and scientific management of the forest.

Introduction

The Forest Department in Kerala manages 11,309.5 sq km forest area, which constitutes 29.1 per cent of the total geographical area of the State. In all the five wings –territorial, wildlife, social forestry, timber sales and vigilance – there are 13 Circles, 65 Divisions, 149 Ranges and 473 Sections in the Department and more than 6,800 officers are working. The use of computers and application of ICT and GIS technologies commenced in the Kerala Forest & Wildlife Department (KFD) in a coordinated manner during the implementation of the World Bank-assisted 'Kerala Forestry Project' (KFP), during 1998-2003. The traditional way of management of forest and administration of the department is gradually changing due to the integration of these technologies.

Organisation structure for facililating ICT and GIS

At the government level, Kerala State Information Technology Mission (IT Mission) coordinates the Information and Communication Technologies. In the Forest Department, Forest Management Information System (FMIS) wing is responsible for implementation of various e-Governance initiatives, centralised procurement of electronic equipment, management and maintenance of database, GIS, FMIS modules, official websites and for imparting

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ute of Forest Genetics and Tree Breeding, Indian Council of Forestry Research and Education, P

training to staff. Additional Principal Chief Conservator of Forests (FMIS) is responsible for the administration of the FMIS wing.

Five Circle-level IT Cells were constituted in 2014 at each Territorial Circle, utilising services of 5-6 professionally qualified staff, for catering the ICT needs of various offices under different wings.

ICT & GIS infrastructure

Connectivity: Kerala is the first State to successfully link all its villages with broadband connectivity under the National Optical Fibre Network (NOFN) programme. Forest Headquarters and few sub-offices are provided with free internet connection through Kerala State Wide Area Network (KSWAN), the State's high speed network connection facility. Internet connectivities are given to all offices, down to Range Offices through BSNL broadband connection. CUG sim cards have already been issued to theexecutive and field staff and also to ministerial staff down to Head Accountants. Apart from mobiles calls and fax, e-mails, SMS alerts and social networking apps like Whats app and Facebook are officially used for quick and efficient communication.

ICT and GIS instruments: Under the Kerala Forestry Project, most offices, down to the Division, have been computerised along with LAN facility. Subsequently, computers are issued to the level of Range Offices. Laptops and smartphones have already been issued to officers down to ACFs. Global Possitioning Systems (GPS) are already provided to field staff up to the Section level. GPS-enabled 36 Personal Digital Assistant (PDA) systems, developed by KELTRON, are being used in patrolling operations in the Marayoor Division. Mobile-based applications for patrolling, called 'e-patrolling', is implemented in the Periyar Tiger Reserve. Department Officers have video conferencing facilities of State IT Mission that are installed in its head office and in all the District Collectorates.

Data storage & security: The Forest Department has two backend servers in the State Data Centre (SDC) at Thiruvananthapuram for data storage for its e-governance platforms. The department has two additional servers for its data storage and management of FMIS and MAS. In the forest headquarters, the Local Area Network, the database and its servers are protected by CYBEROAM, a multiple network monitoring, regulating and security system. In other offices, anti-virus software like SYMANTEC, KASPERSKY, etc., are used.

Institution for C2G and G2C sevices: Around 2,200 Akshaya Centres, State's initiatives, impart computer education as well as deliver G2C services and act as a payment centre for collection of fee, charges, etc. Single window 'no queue' integrated remittance centre, Fast Reliable Instant Efficient Network for Disbursement of Services (FRIENDS) has also been established for paying bills and other dues to the Government.

Research, Development and Training: Geo-Informatic Centre was established in 1999. It houses GIS cell and Cartography unit and is entrusted

with developing the State-wide forest GIS database, preparation of various type of maps using satellite imageries and development of ICT platforms like the Fire Alert System. The Forest Department has its training facility at the 'Forest Training Centre' at PTP Nagar, where training in ICT, GIS, GPS and e-Governance application platforms is given.

ICT & GIS tools

The Forest Department has a website, www.forest.kerala.gov.in, and individual websites for Wildlife Sacturies and National Parks for providing department-specific online services. Important ITES platforms used are:

Forest Management Information System (FMIS): The FMIS consists of 13 modules. Of these, 10 are online modules, covering almost all aspects of Forest Resource Management. These modules include, Offence Information, Court Case Monitoring, Fire Management, Sales Management, Plantation Management, Participatory Forest Management, Social Forestry and Nursery System, Store Tools and Plant Management, Natural Forest Management, Reserch Project Management, Civil Infrastructure and Industrial Raw Material and NWFP modules. These are used for periodic monitoring and reviewing of sub-offices, preparing reports and management plans.

Monthly Accounts System (MAS): Online monthly accounts preparing platform is implemented in all the 101 account rendering offices for preparing monthly accounts and generating monthly reports for submitting before the Accountant General.

e-Auction: It's a unique web-based auction facility implemented for the sale of timber and non-timber forest products. The system is managed by Metal Scrap Trading Company Ltd. (MSTC), a Public Sector Undertaking under the Government of India. Buyers should be registered on the website www.mstcecommerce.com. Registered buyers can bid in the auction online after submitting necessary earnest money deposit.

Forest Intranet Site: Intranet Site has been developed by the FMIS wing with various tools like Flora Search, Fauna Search, WPA Schedule Search, NR Nair Volume table query, Timber Volume calculator, Address Book, Mobile Directory, etc., for departmental users.

Forest Mobility Solution (FMS): The department has procured around 35 PDAs on a pilot basis to monitor patrolling. The solution includes realtime data transfer from PDAs to the server (using GPRS facility). The areas covered include Offence, Forest Fire, realtime tracking, etc

Maps Management System (MMS): Online system for viewing and downloading maps designed by the GIS wing.

Kerala Forest Geo-Portal: A online, GIS solution where field officers can download various layers of their choice and overlay it over Google map and Bhuvan images.

Service & Payroll Administrative Repository For Kerala (SPARK): It is a web-based G2E integrated solution for administration, payroll and other

accounts activities of government establishments. Each employee is allotted with a unique Permanent Employee Number (PEN) and the Service Book of each employee is digitised. Salary Processing and bill preparation, managing leave accounts, filing annual property return, income tax computation, LPC Generation, etc., are now done using this application. There is also an interface for individual employees to view their salary, loan, leave, GPF, accounts and personnel service details.

Information and Data Exchange Advanced System (IDEAS): It is a web-based online File, Petition and Government Order tracking system that provides real-time status of government files/ petitions and serves as a mechanism for reminding government departments about the pending status of files. This makes the government more transparent and approachable for the citizens, bringing benefits in its overall governance.

E-Tendering: All tenders above Rs 5 lakh in all departments and institutions under the State are being done through the web-based e-Tender system developed by the Natianal Informatic Center. The website is www.etenders. kerala.gov.in.

Effective Management Of Loc Issuance (EMLI): For submitting consolidated budget requirement to the government and for issuance of LoC.

NICEMAIL: Official e-mail system of the State. All heads of offices, down to the level of Forest Range Officers and Depot officers, are provided with an official e-mail ID.

e-District: It is a State Mission Mode Project under the National e-Governance Plan. E-District as a concept proposes integrated, seamless, and online delivery of citizen services at the district level through automation of work flow, backend digitisation, integration and process redesign. The services are delivered to citizens through Akshaya Centres and Range Offices. Five services from the Forest Department are included in the e-District project and currently two services –issue of trekking pass to Agastyarkoodam, online submition of application for compensation for damages due to wild animals – are operationalised. Other services, including issue for property mark registration, licence to wood-based industries, issue of permission for nature camps, research and online reservation in ecotourism centres, will be operationalised soon.

Use of ITES & GIS

ITES in decision making and forest management: ICT and GIS technologies are used to prepare various maps that can be downloaded by concerned offices through Map Management System available on the website. Throung the Forest Geo-Portal, officers can also download individual layers and overlay it over Google map and Bhuvan images for preparing reports and for decision making. Map for working plans and management plans are prepared by the Cartographt cell of Geoinformatic Centre.

Data from the FMIS module is used in decision making in allocation of budget for various purposes, deployment of

staff, patrolling routes and schedules, fire protection measures, preparation of working plan and management plan, creating consolidated reports, etc.

Intra and Inter-dDepartment services: SPARK, KSID, EMLI, etc., helps in department-to-department services through instant sharing of information and increased efficiency in governance. Official websites and use of official e-mails and departmental mobile phones enable quick communication.

G2C services: Departmental websites, programmes like IDEAS, e-Tender, e-Auction, e-District, etc., provide G2C services and brings transparency and accountability in governance.

Conclusion

Compared to many other departments, the Forest Department is lagging behind in the application of ICT in providing G2C services. This is due to lack of sufficient funds for providing infrastructure at the ground level, even though almost all staff members in the department are e-literate. Implementation of SPARK, e-Tender, e-Auction. etc., saved a lot of valueable time of officers and helped in timely delivery of quality services to public and bringing transparency and accountability in governance. GIS and GPS technologies in forestry and forest protection helps in scientific manage-ment of pristine forests of the State.

RAJASTHAN

Providing governance solutions and addressing challenges

Foresters of Rajasthan believe that there is potential for ICT to advance governance objectives, especially if utilised innovatively

Jagdeep Singh Dahiya, Akansha Joshi & Sarita Kumari

To replace the traditional time consuming, inefficient and manual methods of keeping and updating information, a computer-based Management Information System (MIS) has been developed in the Rajasthan Forest Department. ICTs, including mobile phones, internet, remote sensing gadgets, Global Positioning Systems and field level applications, have in many cases proved valuable in promoting transparent and equitable governance. Foresters of Rajasthan now believe that there is potential for ICT to advance these governance objectives, especially if utilised innovatively. Consequently, foresters in Rajasthan are starting to adopt and use ICTs in various aspects of forest resources management.

As per the initiative taken by the Chief Minister of Rajasthan to provide data to other departments for planning and monitoring as Decision Support System, the State Forest Department is also continuously making efforts in this direction. The IT wing of the Rajasthan Forest Department is mandated with the following tasks:

1. Maintenance of departmental website alongwith its content management and development.
2. Development of departmental MIS applications and database, their implementation and maintenance.
3. Development and maintenance of departmental GIS applications and their utilisation for development of plans, reports, thematic maps, etc.
4. Introduction and establishment of latest technology in the fields of communication, electronics, surveillance, etc., like Closed User Group, Global Positioning System, and internet connectivity.
5. Providing support and training on Information Technology activities for field offices and other wings.
6. Support for implementation of State Government IT applications through IT training and extension.

Conceptualising ICT for forestry in Rajasthan
Availability of ICT & GIS lab

The GIS cell under APCCF-IT as a centralised unit and e-governance cell,

SFS Trainees, 2015-17, CASFOS-Coimbatore

headed by DCF (directly under the administrative control of PCCF (HoFF) Rajasthan, are two independent wings looking after the GIS and e-governance related works, respectively.

Availability of experts at State level

- **Permanent** One ACF: GIS trained, MTech in RS & GIS
  Role: Overall supervision of all GIS activities and other IT support to field offices
  Nature of work: Technical and supervisory

- *One Forester:* MSc IT
  Role: To assist the ACF
  Nature of work: Partly technical, partly monitoring and compilation of information

- One Surveyor (Temporary posting)
  Role: To assist the ACF on map data work
  Nature of work: Monitoring, development of map data and support to field offices

Contractual

Hiring GIS-skilled manpower from NICSI under a project of GIS dataset maintenance and development

Past history

1996	GIS activity started from Kota and Bundi GIS study by ESRI on 50K scale and LISS III data, and PC ARC INFO & ARC ViewSoftware taken.
1999	GIS study for 6 districts (Jaipur, Dausa, Karauli, Dhaulpur, Bharatpur and Tonk) with better data set development on 50K scale and LISS III data.
2000	Initiation of GIS cell under Forestry Development Project at Jaipur.
2001	Capacity building by sending one RO to 4-week FSI training in GIS and Remote Sensing.
2003	Capacity building by sending one RO to IIRS for 9-month diploma course.
2006	MTech course done by RO.
2007	Departmental website started.
2008	Initiation of forest boundary digitisation under development of Forest Atlas with State Remote Sensing Application Centre Jodhpur, Science & Technology Department, Government of Rajasthan.
2009	Digitisation of forest boundaries are turned on higher accuracy (At cadastral scale). First time MIS application, known as JFMMIS and FCAMIS, initiated. Improvement of website.
2014	Development of GIS data sets, use of GIS data sets (for preparation of Working Plan, Green India Mission, Preparing Rajiv Gandhi Biosphere Reserve Plan and other study related to wetland. Also, initiation of new technology as procurement of GPS, DGPS(One), wireless with GPS, Vehicle Tracking Pilots, Forest Land Bank Application, MPR application, PIS, etc.
2015	Digitisation of forest boundaries (93%) and creation of e-governance cell.
2016	Hosting of new department website and FDMSS.

- Senior Programmer GIS
  Role: Preparing GIS datasets and its maintenance.
- Assistant Programmer GIS
  Role: Preparing GIS datasets and its maintenance

For effective nad smooth functioning of e-governance services at the field level, DoIT&C, Rajasthan, has completed the recruitment procedure for 70 posts of Informatic Assistant (IA) and they will be posted in the field soon.

Status of ICT infrastructure at Range level

There is a strong need to provide various types of hardware support to run the MIS (FMDSS) developed by Raj Comp Info-service Ltd (RISL) and other applications of the Government of India and Government of Rajasthan. Phase I of FMDSS is being launched in financial Year 2016-17. Information, data, etc., are to be entered from the Range to State HQ level. Equipment for these were procured gradually under various schemes. However, there is still a considerable shortage. A detailed assessment of the need for computers has been carried out by the department to ensure the use of modern technology. This assessment is based on the need for providing hardware till the Range level, where most of the information is generated and most of the field functions are carried out, managed and supervised.

Besides this, all IFS officers have been issued laptops and in 2016-17 all DCF (RFS officers) will be provided with them. In WLS and NP, laptops have been issued up to Range officers.

Availability of ICT & GIS training facility

- **At Forestry Training institute:** For field officers and staff (State-level) by executing trainings regarding GPS and GIS, and to use GIS datasets in field.
- **At GIS cell:** For field officers and

S. no.	Name of Office	Numbers	Requirement as per proposed desktop norm	Available desktop	Requirement
1	Regional offices Territorial	7	84	63	22
2	Regional offices WL, Projects, DO, FTI, SILVA	9	63	32	21
3	Divisional offices	70	490	283	207
4	ACF (including other than division HQ)	140	140		*
5	Range office	582			*
6	HQ (including o/o HOFF, TREE, WP&FS, CWLW)				60
	TOTAL				310

Source: e-governance cell PCCF, Rajasthan

* It is proposed to provide tablet with connectivity to ACF and Range Officers in 2016-17.

staff (regular work as per need of the officers for map, GIS data utility, GIS data preparation, use of GIS software and other related issues).;

- **At field level:** By conducting training of the field staff, including surveyors, FG, Foresters, RO, ACF and DCF at regional level, about the improvement of GIS data, use of GIS data and resolving problems.

- Also, DCF (P&M) are given training for upgraded version of e-green watch portal. Similarly, forest officials and concerned staff of establishment section of PCCF office are trained for Transfer and Posting Module.

Connectivity to internet

As per the directions and assistance given by DoIT&C, Rajasthan, all offices in Arnaya Bhawan, Aravali Bhawan, Jaipur Zoo, SILVA, FTI, DCF Jaipur North, Amber Range Office, Jaipur Range Office and Nahargarh Range Office in Jaipur are connected by Secretarial Local Area Network (SecLAN). Offices outside Jaipur are connected by Rajasthan State Wide Area Network (RajSWAN). Places where facility of RajSWAN is not available, those offices are connected by Rajnet.

Availability of video conferencing facility

Video conferencing facility is available at Arnaya Bhawan, Jaipur, and can be extended up to Panchayat Samiti, where it is available at all Atal Seva Kendras.

Status of digitisation

The hard copies of maps made earlier are under the process of digitisation. Gradually, map data – such as digital maps and scanned maps – are being linked with forest land details. Such data is being prepared with the help of the State Remote Sensing Application Centre (SRSAC), Jodhpur, Department of Science and Technology and Forest Department, Rajasthan, and is being used for creating digital maps for field functionaries, especially at cadastral scale. Of the total forest area in the State, about 93 per cent digitization of forest area has been completed based on various scales with reference to different objectives. But, a considerable work of digitisation of forest boundaries at khasra map scale is still pending and needs to be done. The major work of digitisation of forest block is on cadastral scale (4k) to get better accuracy, which is under progress with the SRSAC, Jodhpur, using khasra maps. Also, for broader planning and faster speed, some areas are taken under digitisation at topo-sheet map scale (50k).

Till now, digitisation of forest areas boundaries under 30 district has been completed on 50k+4k scale in territorial divisions of Jaipur, Dausa, Sikar, Jhunjhunu, Alwar, Nagaur, Tonk, Bhilwara, Bharatpur, Dholpur, Karauli, Sawai Madhopur, Baran, Bundi, Jhalawar, Dungarpur, Udaipur, Churu, Barmer, Jaisalmer, Jalore, Pali, Rajsamand, Sirohi, Banswara, Ajmer, Chittorgarh, Jodhpur, Pratapgarh and Kota. Outer boundaries of Protected Areas (Sanctuaries and National Parks) have been prepared using different available resources. Various thematic maps are prepared as Block-wise maps

and proposed Eco-sensitive Zone maps, based on the field-level information provided. Forest divisions in the desert zone of Bikaner Region (Districts Bikaner, Hanumangarh, Sriganganagar and part of some districts having IGNP areas) are pending due to unavailability of maps and special problem in identification of land features in satellite images for geo-referencing. For these areas, alternate methods have been discussed with the concern division and are being taken up as a sample case.

The progress of digitisation done so far is given in tables 1, 2 and 3.

The pending digitisation of Forest Blocks is that of Desert Areas (1,931 Forest Blocks having an Area of 2,499.22 sq km), which are mostly not notified areas and there is a problem of identification of Ground Control Points in Satellite Imageries for these Desert Areas.

- 3,909 Geo-referenced digital maps of Forest Blocks were composed with addition of attribute data and were distributed to 33 territorial divisions, with a copy to their CCFs, for error removal and ground trusting process. Also, single kml files having the Forest Block boundaries and error lists were prepared and given to field offices for utilisation of digital data and to facilitate the process of correction/ updation/ verification of the digital map data.
- Eco-Sensitive Zone (ESZ) maps of 8 PAs were prepared as per the demand by CWLW, Rajasthan, to give it to NTCA and other concerned government organisations.
- Working Plan digital maps (Stock and Management maps) were composed and uploaded on the departmental website for 17 Forest Divisions. Digital map data of 19 districts has been provided as per direction of the Rajasthan Chief Minister to Geo-spatial Data Centre. 3,109 khasra maps of 453 Forest Blocks of various divisions were scanned at SRSAC for map storage and other related works. Scanned khasra maps for Sikar, Jhunjhunu, Jaipur, Dausa and Tonk have been processed to be uploaded on Forest Land Bank Application (rflba.raj.nic.in).
- Forest Block maps of divisions under CCF Kota, CCF Ajmer and CCF Bharatpur, and scanned khasra maps of Dausa and Tonk divisions are uploaded and linked on the forest land bank application.

Use of ICT technology in decision making
- FMDSS summary can be given.
- Analysis can be done using digital map data with other department datasets. For example, GIS and remote sensing analysis for change detection, site quality assessment, assessment of forest cover periodical and impacts of development activities specially afforestation.
- Resource management activities by analysing the assets.
- Corridor planning.
- Planning of Eco--sensitive zone.

Use of GIS technology in decision making

Forest management has become more complex as there are now multiple

Table 1: **Division-wise status of Digitisation of Forest Block boundaries (31.12.2015)**

S. No.	Circle	Division	Total No. of Forest Blocks	Total No. of Blocks digitised	Total Forest Area in Division (sq km)	Total Forest Area digitised (sq km)
1	Ajmer	Ajmer	190	190	509.13	509.13
2		Bhilwara	339	339	796.17	796.17
3		Nagaur	78	78	228.73	228.73
4		Tonk	45	45	318.54	318.54
5	Bharatpur	Bharatpur	46	45	195.41	194.94
6		Dholpur	37	37	649.63	649.63
7		Karauli	98	98	1088.72	1088.72
8		Sawai Madhopur	33	33	218.19	218.19
9	Jaipur	Alwar	419	405	721.54	712.92
10		Dausa	49	49	282.99	282.99
11		Jaipur	40	40	164.06	164.06
12		Jaipur North	54	54	497.58	497.58
13		Jhunjunu	39	39	405.36	405.36
14		Sikar	99	99	619.39	619.39
15	Jodhpur	Barmer	195	195	587.97	587.97
16		Jaisalmer	38	38	197.99	197.99
17		Jaisalmer IGNP St. II	14	0	372.28	0
18		Jodhpur	111	111	201.38	201.38
19		Jalore	85	85	509.99	509.99
20		Pali	92	91	344.23	343.93
21		Sirohi	68	67	1317.01	1316.59
22	Kota	Baran	196	196	2140.66	2140.66
23		Bundi	117	117	1042.81	1042.77
24		Jhalawar	273	273	1190.19	1190.19
25		Kota	148	147	819.37	819.36
26	Bikaner	Bikaner	62	0	196.42	0
27		Bikaner IGNP St. II	722	0	407.64	0
28		Chhatargarh IGNP St. I	313	0	644.98	0
29		Hanumangarh	258	0	239.46	0
30		Sriganganagar	562	0	633.44	0
31		Churu	49	49	74.84	74.84

32		Banswara	189	188	1006.99	1005.19
33		Chittorgarh	153	153	1379.03	1379.03
34		Dungarpur	88	88	693.54	693.54
35	Udaipur	Pratapgarh	130	130	1605.44	1605.44
36		Rajsamand	90	90	157.48	157.48
37		Udaipur	201	201	1923.21	1923.21
38		Udaipur North	162	161	1277.54	1261.44
		Total	**5882**	**3930**	**25659.33**	**23325.36**
39	WL Area (28 PAs)				7085.15	7085.15
	Total				**32744.48**	**30238.50**

Source: GIS cell PCCF, Rajasthan

Table 2: **Digitisation of Wildlife Areas**

S. No.	Protected Areas	No. of Protected Areas	No. of Protected Areas Digitised	Area notified (approx. Sq. Km)	Area Digitised (sq km)
1	Wildlife Areas (including outer boundaries of WLS & NP)	28	28	7085.15	7085.15

Source: GIS cell PCCF, Rajasthan

Table 3: **Digitisation of Territorial Forest Areas**

S. No.	Forest Area	No. of Forest Blocks	No. of Forest Blocks Digitised	Area notified (sq km)	Area Digitised (sq km)
1	Territorial Areas	5882	3930	25659.33	23325.36

Source: GIS cell PCCF, Rajasthan

Total Notified Forest Area = 32744.48 sq. km

Total Forest Area Digitised = 30238.50 sq. Km (92.35%)

objectives to attain as well as multiple criteria and constraints to address. Since foresters have to deal with numerous objectives from a single patch of forest, a wide variety of spatial information is required and sources of reliable data are a prerequisite for developing a GIS in forest management. Geographical information systems (GIS) provide forest managers with tools to use in planning forest operations by allowing them to visualise and integrate data into the planning decisions during policy formulation, planning and management. Nowadays, with improved access to computers and modern technologies, GIS is becoming increasingly popular for resource management. In the Rajasthan Forest Department, GIS is being used to prepare working plan, RGBR Plan and identification of wetlands and landscapes under

Green India Mission. It is also used in providing digital boundary files, usable on Google Earth and digital geo-pdf maps, to field officers for decision making, monitoring encroachments and E-green watch for plantation monitoring, FCA application. Now the Revenue Department is trying to overlay the digitised map of Forest Department on their maps under e-Dharti project. After the completion of this project, such maps will be available to all citizens.

Availability/ status of GPS system at field level and GIS lab
- One DGPS in department.
- Handheld GPS devices till Range level field staff.
- Basic handheld GPS device for training purpose at GIS cell.

Functioning Applications and Strategic Plan Components
Following are the applications which are in running conditions under e-governance in the Forest Department of Rajasthan:
- **Monthly Progress Report (MPR):** Physical, financial and man-days reports of all schemes are monitored on a monthly basis at the Division, Regional CCF and HQ level by this online application developed by the department.
- **Posting Information System (PIS):** Developed for the administration wing to update the posting of officers.
- **Procurement:** Unique identity and password issued to all DDOs for uploading their tenders on the State Public Procurement Portal in eight working hours and the Fore-procurement Portal in 24 working hours.
- **Work Account Management system (WAM):** This is being implemented by the Finance Department for works departments. In this system, payments of the works are being done through treasury. Training to all DCFs and their AAOs was organised at FTI. All issues regarding the Forest Department were incorporated in the module. Presently, the system is implemented in Jaipur North division and its extension will be for Bikaner, Bharatpur WL, Jodhpur WL, Ajmer, Kota, and Udaipur North.
- **E-greenwatch:** Initially, e-greenwatch portal was launched by the Government of India for CAMPA works. But now, its upgraded version is being used for streamlining and effective management of processes related to plantation and other forestry works for all schemes. All DCFs (P&M) are provided with a unique identity and password and are instructed to upload the evaluation report online on this portal only.
- **Rajasthan Forest Land Bank Application**: This application regarding land records of the Forest Department has been developed through NIC. It has got the data of forest land according to notification and settlement maps and is available online.
- **Tour & Inspections Monitoring & Evaluation System (TIMES):** This

application has been developed to monitor the tours and inspections of Forest officers (DCF and above). This is made available on the Rajasthan Sampark Portal. Under this application, target for a particular month is made available and accordingly the concerned officer has to make his tour programme and has to enter the details of tour/ inspections done by him and to upload the report before the 10th day of the next month. After the fixed date, tour/ inspection reports cannot be uploaded. For this, all officers are provided with official e-mail IDs (@rajastha.gov.in), which is their unique identity also.

- **Litigation Information Tracing and Evaluation System (LITES):** This application is developed by the Justice Department of Rajasthan but is being used by all departments for monitoring legal cases pending at various courts. For its operation, all OICs have been given a unique identity and password. It is mandatory for each OIC to make all relevant entries related to that particular case. Once the entries are made, the case is monitored at the HQ level.

- **Online booking for wildlife tourism:** Under this application, any tourist can book the ticket as well as the vehicle to be used during the safari.

- **Uploading of IPR:** IPR of all RFS officers are uploaded on DOP website after verification by the administration wing. IPR of RO-I are uploaded on the departmental

website after authentication from the administration wing.

For better management and effectiveness and best use of technology, the Forest Department has decided to start Forest Management and Decision Support System (FMDSS), which is a web-based management and monitoring system and is being developed with the help of RISL. All information on this system will be available in integrated form and it shall have five Core Modules and four Backend Modules with interface/ integration with third party application. This application will work on Single Sign On (SSO) system and its salient features are:

- **Citizen Service Delivery Module:** This module is expected to facilitate submission and processing of request form, financial transactions and information exchange electronically.

- **Forest Development Management Module:** This module shall cover the entire cycle of development activities carried out by the department at the site location, covering budget allocation and approval, micro plan creation, committee management, work verification and project management.

- **Forest Produce Management Module:** This module is expected to maintain, manage and monitor all the produce at each site location till the time revenue is generated.

- **Forest Protection Management Module:** The module is expected to maintain, manage and monitor all the offences and illegal activities like illegal mining, grazing, transport,

encroachment, etc., carried out within the forest boundaries.

- **Forest Administration Module:** The function shall contain all the administrative departmental information available for public access.
- **Work Flow & Document Management:** The proposed Forest Management & Decision Support System shall have workflow-based mechanism to allocate, track, evaluate and monitor all activities.
- **MIS Reports & Dashboard:** The system shall be capable of generating MIS reports and also develop an integrated dashboard.
- **Financial Management:** The system shall keep records of all financial transactions at the Forest Department, that is revenue generation and payment processing.
- **SMS & Payment Gateway Management:** The system shall have the provision for sending/ triggering the SMS-based alerts for all transactions at all levels and simultaneously facilitate online payment processing.
- **Integration with Other Applications:** The system shall be tightly integrated with various applications like GIS-Decision Support System, FMDSS-Mobile App, e-Green Watch, IFMS, LITES, etc.
- **Right to Information module:** Based on SSO system, any citizen can seek information under RTI by applying on this module and will receive the desired information online only. For this purpose, email IDs of APIOs, PIOs and FAOs (first appeal authority) have been created

on domain @rajasthan.gov.in and the concerned officers have been provided passwords. These email IDs will also be used as their user IDs for applications. All RTI applications and their disposal is to be done online through this application.

- **Raj e-Sign-Integrated Electronic Signature Mechanism:** DOIT&C Department has introduced secure and authorised electronic signature system. This is Aadhar OTP-enabled electronic signature system which will not require DSC Dongle. Reports of FMDSS and transfer posting module will be integrated with Raj e-Sign. This electronic signature is valid according to IT Act 2000.
- **Mailing Solution:** E-mail IDs for officers – DCF and above – were earlier created on @rajasthan.gov.in. Now, email IDs of ACFs and ROs – a total of 426 – have been created.
- **e-Library:** There are more than 10,000 valuable books in Arnaya Bhawan Library. But due to shortage of staff, it is very difficult to manage this valuable source of knowledge. To overcome the problem, the Forest Department with the help of DoIT&C is developing the e-Library concept.
- **Leave application module:** Under this module, online leave applications for CL, EL and Medical leave up to ACF level will be sanctioned.
- **Vehicle tracking Module:** DOIT&C Department has developed Vehicle Tracking System under RASS. The department has decided to introduce it in Ranthambore Tiger Reserve, Sawai Madhopur (RTR)

on Registered Tourist Canters and Gypsys for real-time monitoring of the movement of the tourist vehicles in RTR. Proposal has been submitted to DOIT&C. GPS equipment will be purchased by the vehicle owner has per the agreement and guidelines. It is also proposed that all departmental vehicles will be monitored through this system.

- **Transfer and posting system under E-Office**: As per the directions of the government, transfer and posting of all government employees has to be done through E-Office generalised transferred and posting system. Team of officers under CCF (Estt.) has been constituted as per the direction of the DOIT&C. Training has been given to the officers and staff involved in transfers and postings. The module is ready for implementation.

Citizen Service Delivery Module

Citizen's interaction with the Forest Department is limited to permit and license request, online ticketing, query and concerns, seeking information and payment processing. At every touch point, there is an information exchange along with the transaction.

This module is expected to facilitate:

1. Submission and processing of request form
2. Financial transactions
3. Information exchange electronically

Types of Citizen Centric Services

The services provided by the Forest Department to a citizen may be categorised as:

(a) **Permission Services**
- **Fixed Land Usages:** Mining permission, sawmill permission, cable line permission, school permission, electricity lines, industry set up, hospital, road/highway, power plant, telephone line and applying for Forest Conservation Act.
- **Stakeholder services:** Contractor registration, JFMC registration, JFMC member registrations and work progress entry.
- **Offence Services:** Registration of offence, applying for compounding and applying for release of seized item.
- **Education Service:** Applying for research.
- **Misc Service:** Applying for organising camps and for shooting permission.

(b) **Online Booking:** Online ticketing.

(c) **Production Services:** Online purchase of produce and applying for auction permission for transit.

(d) **Grievance Service:** Applying on grievances and to file RTI.

(e) **Help Facilitation & Guidance:** IEC materials/ FAQs/ videos, etc., to understand the system and services provided by the Forest Department.

Process of Citizen Centric Module

Maker: Citizen may create his/ her application through a centralised web-based electronic form/ departmental kiosk, or e-Mitra kiosk.

Checker:
- The request/ application will be reviewed and validated by

the system and reviewer, as per requirement.

- Reviewer may reject/ reassign/ add comments/ forward the request.

Approver:

- Reviewed application may be reviewed and/ or approved.
- Approver may reject/ reassign/ add comments/ approve the application.

Availability of backend server infrastructure and data centre

The Rajasthan Forest Department's new website, forest.rajasthan.gov.in, is being hosted at the Rajasthan State Data Centre (RSDC) with shared rights with DoIT&C. All security issues and back up of the data is looked after by DoIT&C.

Use of cloud technology

Cloud computing is a model for delivering IT services in which resources are retrieved from the internet through web-based tools and applications, rather than through a direct connection to a server. Data and software packages are stored in servers. However, cloud computing structure allows access to information as long as an electronic device has access to the web. This type of system allows employees to work remotely. Cloud computing is so named because the information being accessed is found in the "clouds", and does not require a user to be in a specific place to gain access to it. Various departments may find that cloud computing allows them to reduce the cost of information management,

since they are not required to own their own servers and can use capacity leased from third parties. Additionally, the cloud-like structure allows departments to upgrade software more quickly. The Forest Department is also using this technology as it is connected with DoIT&C and all its applications and website are hosted at Rajasthan State Data Centre (RSDC).

Use of innovation

These include use of digital boundaries on mobile apps for monitoring and decision making, preparing digital data on higher accuracy, wireless with GPS drone at RTR, etc. Mobile apps (one is Locus Free App) are also being used.

Use of audio-visual equipment

Apart from the video conferencing facility available at Arnaya Bhawan, Jaipur and up to the Panchayat Samitis, Closed User Group (CUG) facility is provided to 5,545 field staff through CAMPA and 73 senior officers, from DCF to PCCF, are included in this system free of cost.This is providing a better way of communication.

State Forest Department's website

The Rajasthan Forest Department website, rajforest.nic.in, was hosted in 2007. Now, in compliance with the latest guidelines of the Government of India and directions of the State Government, a new website, forest.rajasthan.gov.in, is being developed with the help of RISL. This new website will be integrated as one umbrella portal of the Forest Department. It will be compatible on all

devices and will work as an 'app' and could be downloaded on all types of platforms, like Android, IOS, Windows, etc. It will be hosted at RSDC with shared rights with DoIT&C. This will also provide an online interface to the citizens for exchange of information and online services. The maintenance of this new website will be done by DoIT&C.

Use of social media

The Forest Department is not taking any kind of help from the social media. But What's App was used on temporary basis for monitoring the recruitment process in the current year with lots of information sharing, reporting and redressal of queries from field offices by making a group of stakeholder offices and higher authority.

Use of G2C services

The process of receiving online applications for recruitment was initiated first time in the Rajasthan Forest Department in 2012. The recruitment was done for the post of Forest Guards. Though the department was already working with some MIS online application, this was the first broad G2C application. The online application development was done through RISL.

The second experience was for the recruitment of Surveyors and Drivers and it was done at the CCF level in 2013.

In 2015-16, the third online recruitment process was taken up for more than 2000 posts of Forest Guards and Foresters. Recruitment of Foresters was done after a long period of more than 25 years. The online application process was done with the help of RISL. In the terms of number of applications, it was biggest exercise. In this recruitment process, about 12 lakh applications were received in 67 offices. It was a huge task, but the IT section of the Rajasthan Forest Department took up the challenge and made it a success.

Conclusion

A centralised approach with availability of sufficient budget is required to avoid duplication of efforts and to maintain uniformity and compatibility.

ANDHRA PRADESH

Developing different modules for better organisation

The GIS technology provides an opportunity to weigh costs and benefits involved in the adoption and usage of technology

Prashant Garg & Pankaj Kasana

The primary objective of introduction of Geo-informatics in the Andhra Pradesh Forest Department is to make use of the latest Information Technology available for data collection through effective MIS and GIS and its interpretation for monitoring and evaluation, planning and decision making.

Objective

- To computerise activities of the Forest Department.
- To improve efficiency in planning, implementation, monitoring and evaluation of various field activities through effective IT tools.
- Creation of database for helping all the field executives in day-to-day decision making.
- Bringing out consistency, accuracy and transparency in all types of data.
- Preparation of strategic plans at the State and District levels, management plans or working plans and micro plans.

Status of ICT infrastructure at the Range level

Every Range is equipped with a desktop system and broadband connection, maintained by a data entry operator. Every beat guard is equipped with a GPS instrument. The broadband facility is provided up to the Range level. In PCCF office (Aranya Bhawan, Hyderabad), entire building is connected with high speed wi-fi with leased line 1:1. Though no video conferencing facility has been provided by the department at the Division level – it is in a developing stage – yet 'Open Meetings' is used for the entire State.

Status of digitisation

Seven themes have been created on 1:250K scales (Administrative, Management, Drainage, Roads, Rail tracks, Village and Plantation) in the initial stage. Based on the experience gained in the database creation of 250k, Geomatics Centre started creation of database in 50K. There are about 30 basic and derived themes have been created/generated and updated on 1:50K scale, like Administrative, Management, JFM, Vegetation type and density, Slope,

SFS Trainee, 2015-17 Batch, C A S F O S , Coimbatore

Aspect, etc. This data is distributed to the Divisions for verifications and use in day-to-day management.

Use of GIS in decision making

Geographic Information System (GIS) and Remote Sensing (RS) provide near accurate documentation of positive and negative changes to the forest cover and aid faster remedial action to mitigate the negative impact on forest resources. Earlier, in the Geo-Informatics Cell of the department, the change points (polygons with locations and extents) used to be communicated by post and later by e-mails. Likewise, the feedback used to be collected by post or emails. In the process, a lot of time was lost which is crucial for prompt and effective decision making. The need was felt by the Forest Department to better ways of data sharing and also keep track of forest cover changes at regular intervals to the near accurate level.

Now the GIS technology provides an opportunity to weigh costs and benefits involved in the adoption and usage of technology, the utility of data documentation, the role of technology in enabling the officers in taking quick decisions, etc.

MIS applications

The ICTs have helped the Forest Department in developing various modules for better organisation, collection and documentation of data and thereby creating a better decision-making support system. Some of the modules include, School Nursery Management Information System (SNMIS), Neeru Chettu Management Information System (NCMIS), Water Absorption Trench Management Information System (WATMIS), Water Harvesting Structure Management Information System (WHSMIS), Forest Protection Management Information System (FPMIS), Beedi Leaf Management Information System (BLMIS), Plantation Monitoring Information System (PMIS), Nursery Management Information System (NMIS), Land Record Management Information System (LRMIS), Financial Management Information System (FMIS), Sawmills Monitoring Information System (SMIS), Tree Outside Forest Inventory Management Information System (TOFIMIS) – completed once in 10 years, Forest Inventory Management Information System (FINMIS) – Integrated, Forest Cover Change Monitoring Information System (FCCMIS), IT Infrastructure Management Information System (FITMIS), Forest Building Management Information System, Master Data Management Information System (MDMIS), Red Sander's Inventory Management Information System (RSIMIS), Budget Management Information System (BMIS), Research Development Management Information System (RDMIS), etc.

Use of innovation and utilisation of technology

TOF inventory, based on CARTOSET data and the output of Geomatics Centre, is used by field officers in their planning and management. With the advancement of GPS technology, the Geomatics Center has acquired

handheld DGPS and trained field officers to use it for data collection and survey. Methodologies were indigenously developed for different works, starting from GIS database creation to advanced analysis. These include, database creation and organization; manuscript preparation; digitisation and coding convention compatible to all databases; satellite data procurement; image geo-referencing and checking of spectral and spatial accuracy; image classification; ground truthing; accuracy assessment; vectorisation and generation of statistics; archiving of various databases, micro-level watershed modeling and site suitability for water harvesting structures; forest fire risk zonation; wildlife habitat mapping; site selection for eco-tourism; biodiversity characterisation at landscape level; DGPS survey and data analysis; and, inventory of trees outside the forest.

Department websites

The Andhra Pradesh Forest Department has two websites:

- Forests.ap.gov.in (static website); used technologies are HTML, CSS and JS (IIS-7.0) web server.
- Portal fmis.ap.gov.in (dynamic web); VS 2010, SQL server 2012 and IIS-7.0.
- The department has also created a Facebook page where information about e-auctions and global tenders of Red Sanders wood and other information is shared.

G2C and C2G services

E-Auction, E-Office, departmental website (forests.ap.gov.in), AP State forest report about forest cover change on an annual basis for the general public. 'Green corp' is a portal where schoolchildren can register themselves for getting free plants from the Forest Department for planting. On 'Tree felling permission', people can apply for tree felling for trees outside the forest area.

Stakeholders and beneficiaries

All the personnel of the Forest Department who use this project become direct stakeholders. They use it to hasten the information exchange and also faster decision making within the department. The stakeholders who take indirect benefit from the e-governance project are the general public, NGOs and educational institutions that can access the forest cover changes from time-to-time.

Future strategy

These include, near real-time vegetation cover monitoring; higher inputs for Working Plan preparation; plantation monitoring by higher resolution remote sensing data; wildlife habitat mapping for 6 districts; refinement of WHS and fire risk zonation layer; inventory of NTFP and timber resources and solid carbon once in 5-10 years; development of mobile application for online collection and dissemination of data; monitoring of forest fires and groundwater levels; development of web GIS; generation of new vegetation indices for the State; and, archiving training sets of different years' data for change detection studies.

Taking an innovative approach

One of the major projects undertaken by the Geomatics Centre is preparation of digital database based on data received from Divisions on 1:50,000 scale Survey of India maps

Ikbal Singh and Sajjan Kumar

The Tamil Nadu Forest Department is taking new initiatives in ICT and GIS to systematically organise planning, implementation and monitoring of forestry and other related operations by systematic collection, storage and retrieval of Management Information System (MIS) and Geographical Information System (GIS) data through a computer-based communication network. The GIS and MIS are significant tools for scientific planning and management. These are being developed to improve efficiency in accounts, administration, forest and wildlife management and personnel management in the department. This working methodology is not only bringing transparency, responsibility and accountability but also enhancing efficiency.

Geomatics Centre

The Geomatics Centre at the Principal Chief Conservator of Forests Office, Chennai, was established in the year 2000 under the Tamil Nadu Afforestation Project with funds from the Japan Bank for International Cooperation. The centre is operating with active technical cooperation from the National Remote Sensing Centre, Hyderabad, and the Forest Survey of India, Dehradun. It has units such as cartography, map and image library, analysis wing, production unit and training unit. It is manned by experienced and dedicated staff trained at the International Institute for Aerospace Survey and Earth Observation, Netherlands, National Remote Sensing Centre, Hyderabad, Forest Survey of India, Dehradun, and Indian Institute of Remote Sensing, Dehradun. This centre has earned the prestigious Special Achievement in GIS award during 2006 from ESRI.

Studies undertaken at the Geomatics Centre

- **Forest administration database creation:** One of the major projects undertaken by the Geomatics Centre is preparation of digital database based on data received from Divisions on 1:50,000 scale Survey of India topographic maps.
- **Annual forest fire burnt area assessment:** Forest fire monitoring using satellite remote sensing and GIS is being carried out at the Geomatics Centre and forest fire burnt area is assessed annually from 2001 onwards.

SFS Trainees CASFOS, Coimbatore

Multi-spectral satellite images of IRS LISSIII are used to assess forest fire damage and its spatial spread.

- **Daily fire alert using MODIS data:** Active fire spots are detected using Moderate Resolution Imaging Spectro-radiometer sensors. MODIS fire data provides geo-coordinates (latitude and longitude), date, time of overpass satellite, satellite name, etc., for the fire spots. Geomatics Centre downloads this near real-time data, overlay with Forest Administrative Map to identify the Reserved Forest/Division/Range/Beat. Once the Beat is identified, the information is communicated to the concerned District Forest Officer for necessary action on the field.

- **Vegetation change analysis:** Vegetation change analysis study has been undertaken by the Geomatics Centre. The analysis involves choice of satellite sensor, images, date of pass, selection and procurement of images for time T1 and time T2, geometric correction of images, normalisation of images, change assessment, etc. Vegetation change analysis study has been undertaken to find the impact of afforestation projects, like Tamil Nadu Afforestation Project, over a period of time.

- **Identifying wildlife movement:** Geomatics Centre is also using GPS to identify the elephant movement to overcome the man animal conflict issues.

Management Information System

The Tamil Nadu Forest Department is making efforts to develop five modules in the near future, such as store inventory system, natural forest management system, working plan management system, condition of plantation management system and FMIS, personal vigilance wing. The Forest Management Information System (FMIS) is envisaged as an integrated system which will be used to support the planning, implementation and monitoring of multi-objective forest management activities. The FMIS can be used for strategic, tactical and operational planning and implementation and operational control in and across administrative units and levels of the organisational hierarchy, besides the databases and models required to support decision-making in the many programmes of the department.

Proposed Geomatics Centre activities

Geomatics Centre is making efforts to use this technology in various fields in the near future as innovation, such as preparation of latest District/ Division forest cover atlases, fire monitoring for developing fire zonation and fire prone areas, change analysis in select afforestation areas and degrading forests, coastal zone vegetation mapping for disaster management, digitisation of boundary stones and pillars of forest areas, watershed marking/ delineation with model treatment map, undertaking of species specific habitat studies (elephant and corridor), distribution pattern of RET species and to develop monitoring protocols and disaster management studies.

Real-time tracking of resources

Several applications have been developed to enable comprehensive and scientific natural resource management

Rajesh Kumar Sharma & Chandra Mohan Gupta

With the overall objective of improving transparency and efficiency in the core processes of the Karnataka Forest Department, Information Technology (IT) and its products play a major role. They enable the department with tools to support decision-making and to improve citizen services rendered with the help of Information and Communication Technology (ICT). This is done by strengthening the basic IT infrastructure in all administrative units of the Forest Department.

The E-Governance Working Group, headed by APCCF (HQ), consists of officers with experience / inclination in e-Governance. The ICT Centre in Karnataka was established in 2011 with the staff hired through NIC (National Informatics Centre) and KEONICS (Karnataka State Electronics Development Corporation Limited).

The Karnataka Forest Department ICT wing has deployed 5 RFOs (ICT), 1 RFO (Remote Sensing), 1 RFO (GIS), 1 Deputy RFO, 1 Forest Guard and 1 Forest Surveyor. The Development Team consists of 1 Database Manager, 1 Senior Programmer, 8 Programmers, 2 GIS specialists from Karnataka State Remote Sensing Application Center and 2 Data entry operators.

The KFD ICT wing has developed several applications for natural resource management. The initiatives aim to enable comprehensive and scientific natural resource management by enabling real-time tracking of what is being extracted, from where, by whom and for what purpose, so that policy decisions are based on data, not assumptions. The applications include:

Forest Produce Tracking System (FPTS): Transparent, accountable and efficient movement of forest produce from source to sink.

E-timber: Tracks timber movement from source to sink

Huli: Carries out digital census of tigers using PDAs

Bhuvan: Acts as a geo-spatial natural resource database; developed in collaboration with ISRO

Forest Produce Tracking System

It is a web-based system for managing transportation of minerals from the mine heads to destination. The weight of mineral is measured automatically

by integrated weighbridges, along with scanning and verification of transit passes at checkpoints with barcode scanners. The entire project, from initiation in June 2011 to state-wide rollout in January 2012, took seven months, with three months spent on application development.

India's first end-to-end online system for tracking forest produce, FPTS represents a radical shift in the approach toward transit management as user departments have access to all the data on a single, simplified dashboard which generates reports on transit passes (TPs), rejected applications, check post registers and tracks delayed arrivals too. The FPTS automatically tracks a voluminous number of transactions, handling approximately 4,000–5,000 TPs issued daily.

e-Timber

e-Timber is the web-based system for the entire process of timber management and accounting. The e-Timber application is specifically designed for the users handling Timber sales at Government Timber Depots of Forest areas. It keeps a track of the forest produce, which is put up for sale at the Depots and also provides information on revenue generated from application is designed for the Karnataka Forest Department.

It consists of registration of forest coupes, marking of trees and extraction, transportation to depot after conversion and depot stock entry and its management. It also handles notification of auction sales, creation of lots and auction of timber along with live and downloadable reports on sales and revenue.

HULI: Wildlife, habitat and conflict management system

Huli is a web-based and android-based patrolling, monitoring, reporting and management system. The Huli application records patrolling by forest staff, wildlife sightings as well as direct and indirect evidence. It includes simple and pictorial user interface to allow the user to capture and update data. It facilitates registration and management of wildlife conflicts in the systems along with provides a repository of illicit activities. The reports in the run provide insights on the reasons and the suitable methodologies to tackle them. The project became operational in March 2012.

Bhuvan

"Bhuvan-Karnataka Forest" has been released in collaboration with ISRO on October 12, 2012 having the features of 'Know Your Forest, Active Fire Mapper, Asset Management, Change Monitoring, Greening India, Wild Life, User Data Upload'.

Under this, data from the Forest Department has been with the Indian Space Research Organization's geoportal- Bhuvan. Using spatial data from earth observation satellites shown on Bhuvan and data from the Forest Department, forests of Karnataka can be observed. Forest fires, assets, changes in forest cover, etc., can be viewed through the portal.

e-Nursery and Krishi Aranya Protsaha Yojana

The stock of seedlings raised in all nurseries across the State with details, including species, size, etc., is maintained in the system and has been made accessible to public. It enables stock creation and stock disposal by concerned Range Forest Officers who update the information and to facilitate the public in knowing the availability of stock at any place at any point of time and to apply online for procuring seedlings. It also encourages farmers to go for agro-forestry.

Aranyavahini

It enables online tracking of letter/ file movement in the Karnataka Forest Department so as to improve transparency and monitoring of pendencies. A query can be made based on subject, section and office along with date-wise reports on letters and files. Automated alerts facility is there for backlog files. Online case register is there regarding any file or letter, providing complete information of letter/ file movement.

Advantages of using IT

For State/Park/ Circle administrators: IT tools enable monitoring and visualising camp-wise patrols across the State in near real time and assess the type of wildlife present in the forests of the State. This, in the long run, helps in chalking out appropriate wildlife management plans. They also help in formulating appropriate measures for a better herbivore-carnivore balance to maintain the pyramid of hierarchy in the forests.

For Field Staff: The IT tools enable the field staff to view the distance traversed by them during each patrol and they can identify themselves on the map if they find themselves lost during patrol. The tools also allow them to record sightings of rare and indigenous species in their forests as also mortality, illegal activities, evidences and direct sightings. The pictorial interface makes their understanding easier and better. The easy-to-use apps keeps them motivated and focused on their key role in conserving and providing information in the protection, conservation of forests, habitat and the ecosystem as a whole.

Challenges

- There is inadequate IT infrastructure, particularly at the Range Offices.
- Technical manpower is not easily available at Range level
- Uninterrupted power supply is a critical requirmenet for efficient functioning.
- Connectivity is needed in remote locations in Range offices, Mine heads, Timber Depots, Forest Check posts and Anti-poaching camps, etc.
- e-Governance has to be continuous learning and evolving process with fast technological developments.

Way Forward

The Department is not resting on its laurels. It has come up with new software named 'Aane' (elephant). 'Aane' will pinpoint locations on forest boundary

where elephants are straying and alert the forest staff on a real time basis. This is expected to help the foresters control human and crop damage caused by elephants. The software is enabled with infrared sensors, which will beep the location of straying elephant and other wild animals to the monitor systems. The data will be relayed to frontline staff engaged in stopping animals from straying to human habitats.

Similarly, the Bandipur Tiger Reserve will soon launch 'Hejje' (pug marks) software to enhance monitoring on frontline staff, who man and patrol the forest beats and are stationed at Anti Poaching Camps (APCs). The Hejje software is an improved version Huli, which is already in place at BRT Tiger Reserve. After success of Huli,

wherein the forest officials sitting in Bangalore can view what the frontline staff at tiger reserve is doing, is in great demand. Six states in the country, which has a tiger population, have sought for this software. Unlike Huli, where the foresters use handheld GPS equipment, the Hejje software will be enabled on Android phones, which will be provided to frontline staff at Bandipur.

Some suggestions to improve the efficiency and impact of IT-based applications include the need to establish connectivity with the Field Level, enable the Department with hardware support, integrate GIS and MIS Services for better decision support tools and exhaustive training and handheld support to all the staff in the Department.

# Streamlining field and administrative operations

The Goa Forest Department has put in place successfully a file management system and 'HULI' a web based application to monitor wildlife and habitat health.

Pradeep Kumar and Sumit Bansal

The forests of Goa form the part of Western Ghats, the region which has been internationally recognised as a Biodiversity Hotspot of the world owing to its rich flora and fauna.

Goa is leading in the IT sector in India, but in the Forest Department there is not much use of IT. There is no separate IT cell in the Goa Forest Department. The Information and Communication Technology (ICT) products in the department are used with the help of Info Tech Corporation of Goa Limited (ITG).However keeping the future demands in perspective the Goa Forest Department has taken a number of initiatives. One of the first initiatives included a File Management System(FMS) used to track movement of official files. The File Management System (FMS) was developed with a view to improve transparency in the movement of files and documents within a government set-up. The FMS has been designed, developed and implemented by the National Informatics Centre, Goa State

Centre, and has been functional since September, 2009. The FMS was initially implemented in the state Secretariat. After successfully implementing the FMS in the Secretariat, it has been made mandatory for every department to come on board and use FMS in their offices. The FMS is a web-based system, installed in the NIC data centre based at the state Secretariat in Porvorim, Goa. For the connectivity to internet, LAN (Local Area Network) and WAN (Wide Area Network) is used in Goa Forest Department. All personal computers, laptops and other systems are connected through LAN with in office, wi-fi is also used for communication within the office. Goa Forest Department is connected through GBBN (Goa Broad Band Network) that is a state wide area network. The State Wide Area Network - Goa Broadband Network - connects all the 12 talukas, 189 Village Panchayats, 225 office buildings/termination points, around 1200 Government offices/ sub-offices/corporations/autonomous bodies/municipalities, around 500+ schools/colleges/educational institutes through fiber network. This is a unique initiative and Goa is the only state in

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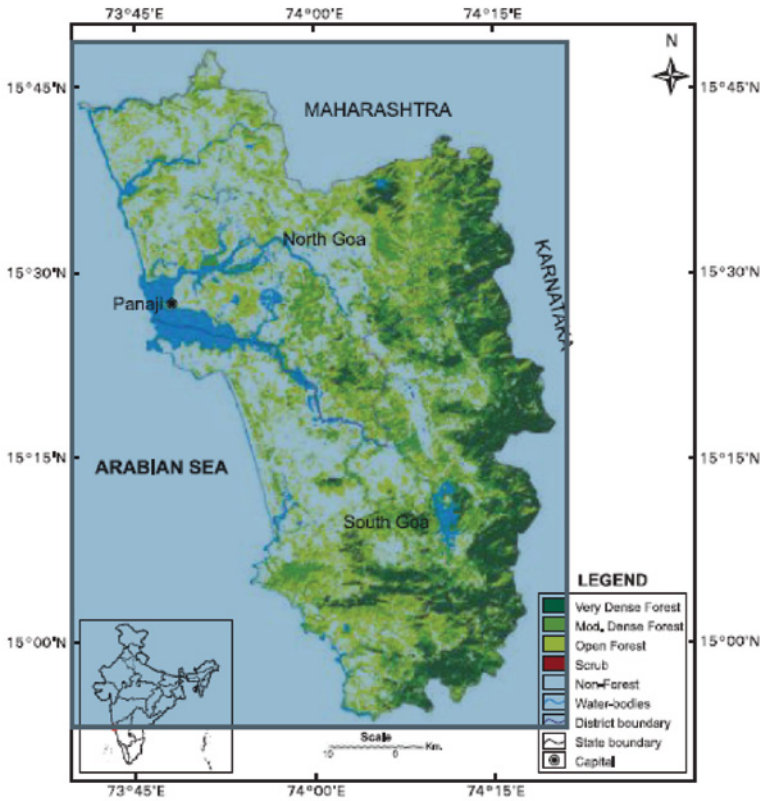
Fig 9.7 Forest cover map of Goa

India to have such a rigid fibre based network. The network will be used for communicating between the G2G, G2C, and other government departments.

The website of Goa Forest Department - www.forest.goa.gov.in – is maintained by Infotech Corporation Goa Limited. The cost of operation is approx Rs. 80,000 which includes 2 years of maintenance. Cyber security is provided by a certified empanelled agency. Protection from viruses is provided by Infotech Tech Corporation. Firewalls are also used as safeguards in all personal computers and laptops. Another application called "HULI" acquired from the Karnataka Forest Department is undergoing trial. HULI is a web and android based application for monitoring wildlife and conflict management. The application allows daily patrols of the forest staff and events to be captured with geocoordinates. HULI ensures that each member of the camp is actively patrolling every part of the forest and helps guide the staff based on the patrol logs to distribute their

patrol paths. It also generates reports as per National Tiger Conservation Authority (NTCA) guidelines. The Conflict Management System caters to online registration of grievances and inspections in this regard. The reports provide insights on the reasons and the suitable methodologies to tackle them. To use this application a smart phone is given to each user. Using this application Goa Forest Department will be able to monitor, and visualize camp-wise patrols across the state in near real time and assess the type of wildlife present in the forests of the state. This will help in the long run to devise appropriate wildlife management plans.

Another IT initiative undertaken by the Goa Forest Department is making online transactions through E-cheque. Login and password are provided by State Bank of India to authorized personnel of the forest department. The person preparing the cheques will generate an E-cheque using his login and password that will be authorized by the other authorized person.

Another important ongoing initiative is "Online permission application for Tree Felling". Permission to fell trees is regulated under provisions of Goa, Daman and Diu Preservation of Trees Act, 1984. Under this initiative, the applicants can apply online for taking tree felling permission and one id will be generated that will be sent to applicant and one message will be sent to forest officer to start process for that application. The applicant has to upload seven documents that are necessary for further processing .The forest officer will check the documents and if all documents are correct a date will be given for inspection.. Infotech Corporation of Goa Limited is developing this project. Another project "Online booking for Dudhsagar" is in the pipeline. Under this project an online taxi booking system will be developed to allow tourists to do online taxi booking system from Collem to Dudhsagar and vice versa. The tourist will make payment online for the booking through the payment gateway. The amount collected will be shared between the taxi owners, Forest Department and the application developer. At the initial stage, the forest department is planning for only limited tickets to be booked online. Once operational it will be a great step taken by the Goa Forest Department to boost eco-tourism in the state.

The IT initiatives taken by the Goa Forest Department can be strengthened by creating a separate IT cell and providing training for the staff. IT projects can be expanded to include some other activities like e-auction, online transit pass, nursery stock information and cloud computing for application and data sharing.

Highway for natural resource management

The Telangana Forest Department is utilizing the technical outputs generated by its Geomatics Centre and well-trained personnel for intensive forest management

Omprakash Jangid & Sandeep Kumar Chhalani

With 26,904 sq. km of notified forests covering 24 per cent of the geographical area, the state of Telangana is ranked at the 12th position in terms of the extent of forest area in the country. The department has been entrusted with the enormous responsibility of protecting, conserving, developing and efficiently managing the natural resources in the form of forests and wildlife under its administrative control. The State has a strong protected area network with 9 Wildlife Sanctuaries and 3 National Parks covering 5,856 sq. km of the forest area with unique ecosystems and biodiversity. It is vital to assess the location wise change in the forest cover to analyse the impact of biotic pressure and various developmental programs and to formulate appropriate strategies for better protection and management of forest resources. These resources are critical for human existence and survival of other living beings and are national assets to be protected and conserved for future generations. The 'Ku Haritha

Haaram' is a flagship programme of the Telangana Government and envisages to increase forest cover from the present 24 per cent to 33 per cent of the total geographical area of the state. The thrust areas to achieve the above are two-fold; one, initiatives in notified forest areas, and the other, initiatives in areas outside the notified forest areas.

Keeping in view recent trends, the department has laid special emphasis on Forest Research to conduct experiments, improve nursery and plantation techniques, vegetative propagation, seed production and various silvicultural practices. Monitoring of vegetation (forest) canopy cover density, forest fire risk zone mapping, mapping all forest areas with site suitability, relocating and demarcating forest boundaries and inventory of forest resources are some of the major and important activities taken up by the department using latest information technology includes GIS. Almost all programmes/schemes of the forest department are being implemented through participation of local people, *vanasamrakshnasamithis* (VSS) and Eco-Development Committees (EDCs)

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in Protected Areas and Watershed Development Committees in the Watershed areas.

The department has a well-established Geomatics Centre and well trained GIS personnel. The forest department is utilizing the technical outputs generated by Geomatics Centre in protection and intensive management of natural forests by way of identification of suitable sites for plantations, water harvesting structures, habitat management and control of forests fire, etc.

IT wing of Forest Department

The core IT activities are handled by the IT Centre at Aranya Bhawan, Hyderabad. The IT wing has three laboratories – Geomatics Centre, the MIS lab and the GIS lab. The IT Center at Aranya Bhawan is headed by a Special PCCF(Dev) & CWLW assisted by APCCF (IT & WP), Dy.CF(FCA) and DCF(IT) who are assisted by 17 Project Scientists hired on contractual basis to carry out day-to-day activities. Every range office is equipped with a computer system and every range officer is provided a data entry operator to ensure smoothly functioning of the MIS modules and GIS techniques. Forest beat officers, section officers, computer operators and range officers are trained through refresher training courses on IT, by IT experts under the directions of DCF IT at Telangana Forest Academy at Dullapally.

Geomatics Information System (GIS)

GIS is an organized collection of computer hardware, software, geographical data and personnel designed to efficiently capture, store, update, manipulate, analyse and display all forms of geographically referenced information. The forest department has created a core team from its own cadre, trained them and started the work. Excellent infrastructure has been created at the PCCF's office in Hyderabad and at the Regional Centres. All the divisions are equipped with hardware and software for end user applications.

Management Information System (MIS)

The forest department has also deployed a number of web-based Forests Management Information System (FMIS) including various modules for monitoring activities like offences, Trees outside Forests (ToF), *beedi* leaves, sawmills, vegetation cover monitoring, Vana Mahotsava, Compensatory Fund Management and Planning (CAMPA), nurseries and plantations of the department and been a pioneer in use of IT among the forest departments of the country. There are currently three modules under development and these include WPMIS- Working Plan, Tree Felling Permissions and HRMS-Human Resource.

Use of ICT technology in decision making

As all records are now online in form of different modules, decision making at all levels has become very easy and transparent. It also encourages execution of work in a time bound

manner. Real time data provided by ground level staff helps a lot in decision making like financial requirements for particular head, labour requirement, requirement of godowns for procurement of timber and Non Timber Forest Produce (NTFP). It also helps to meet the requirement of different stake holders. Decision makers need not to depend upon clerical staff or heavy files.

GIS is helpful in finding out tree cover change, land use, plantations, water bodies and conservation structures, forest boundaries, location of forest pillars or land marks, encroachments, fire occurrence and fire lines, topology and landscape, etc. All these help to plan how encroachment can be removed and stopped, planning of plantations, control of forest fires and in construction of water harvesting structures.

IT initiatives by Telangana Forest Department

The forest department has adopted Information Technology in a bigway as DSS for the Management of natural resources in Planning and Implementation of different projects. Modern technologies like Remote Sensing (RS), Geographical Information System (GIS) and Global Positioning System (GPS) and Digital GPS have been deployed in the day-to-day administration and management of forests and monitoring various activities, which has led to an improvement in efficiency, transparency and ease of monitoring. The department has executed GIS and

Remote Sensing based projects in the past like Vegetation Cover Monitoring, Fire Risk Zone mapping, Site Suitability of Water Harvesting Structures and Site suitability of Plantations. It has also carried out a State wide Inventory of Forest Resources using modern tools and carried out survey of assets under Recognition of Forest Rights (RoFR), Forest Blocks and Forest Conservation Act areas using DGPS. With gaining expertise in the technology and using sophisticated RS Data; latest hardware and software has been procured gradually to keep pace with the advancements in technology. It has completed many Projects within the department and also rendered services to other Departments of state as well as to other states. Telangana State Forest Department is the first Forest Department in India to use the Cartosat stereo-pair data for estimation of Trees outside Forests, ascertaining genuineness of RoFR claims, and preparation of Working Plan inputs.

Other IT related activities

Some of the other IT based activities include development and maintenance of websites of the forest department across the state for providing online information on various activities, maintenance of e-mail service, biometric attendance system for monitoring attendance, procurement of IT Equipment and software, cell phones, personal digital assistants, computers and printers, etc.

Forest department websites

The important websites created and

maintained by the forest department include

- Forests.TELANGANA.gov.in
- tgfdgis.com, tgfmis.com
- harithaharam.gov.in
- tgfmis.gov.in

Use of social media in the department

- Ratnam computing services have been hired to send 1 lakhs SMS'es per year throughout the forest department(official messages to all officers and employees)
- Whatsapp groups and Facebook links are also provided to public domain by the department for sharing information.
- A mobile app is also being developed for field staff so that they can feed latitude, longitude, photos and other information related to any incident

Projects within the Department – Ongoing

Some of the important ongoing projects within the department include Near Real Time Vegetation Cover Mapping – using IRS P6 LISS III Data 2011 and 2012, Generation of State of Forest Report for Telangana 2014; DGPS Survey of FCA Areas for entire state, bundle adjustment and Ortho-rectification of Cartosat Steoreo-pair; generation of Digital Elevation Modeling (DEM) and contours at 5 m interval, verification of areas claimed under RoFR Act 2006 using Cartosat 1 Data, WebGIS and Customization of ArcGIS Server, development of FMIS modules on Forest Fire, Nursery, Plantation, Wildlife, Watershed, WP,

Offence, CAMPA, etc., implementation of PDA based Wildlife monitoring and inventory of Trees outside Forests.

Achievement of IT wing of Forest Department

Forest Fire Risk Zonation Mapping was carried out only in united Andhra Pradesh in the entire country using the latest technology. For which'Silver Icon'was awarded by Govt. of India, in2004 under the category "Trail Blazing Application". This work is being refined using MODIS and other ancillary data.

It was awarded the 'Golden Icon' under the category "**Innovative Operations and Best Practices**" in 2005 for Site Suitability Analysis for construction of Water Harvesting Structures for all the forest areas using various spatial and non-spatial data. The department had been awarded with "**Award of Appreciation**" by **CSI-Nihilent** during 2011 under Departmental category for the IC&T initiative in the department. The 'Core' officers were awarded the 'Uttam Samrakshana Pathakam' by the with Hon'ble Chief Minister and other incentives to sustain the interest.

Possible Activities in Future

Some of the activities planned for the future include:

- Vehicle Tracking System for better protection.
- Plantation Monitoring by High Resolution Remote Sensing data
- Survey of All Notified Forest Blocks for remaining divisions using DGPS.

- Preparation of RoFR Act 2006 Layer and verification of areas claimed under ROFR
- Act 2006 using Cartosat 1 Data.
- Inventory of NTFP & Timber Resources and Solid Carbon once in 5 – 10 years
- Development of mobile application for online collection and

dissemination of data
- Monitoring of Forest Fires and Groundwater levels.
- Generation of new vegetation indices for State
- Archiving training sets of different years data for change detection studies

Note: Articles may be sent at the following email ID:
fieldforester@gmail.com

Contributions Invited

The Field Forester invites articles from serving as well as retired forest officers and others working in the forestry sector. The Field Forester offers a unique platform for forestry professionals to share their work and experiences. The article should be interesting and entertaining to read and should be written in a lively and concise style.

Evaluation and Review System

There will be two layers of review of the contributions; Faculty and the Directorate review. Evaluation and review at the faculty level in the training institutes/academies will be undertaken under the guidance of Director/Principal/Head of the institutions. Even very specialized and technical topics shall be presented in simplified format so that frontline staff and forest community are able to appreciate and understand the topics. Articles shall be written in a popular style, easily understandable and in simple English.

However depending on the response to this programme, arrangements can be made for translation of the magazine into the vernacular. A short note about the contributor and the reviewer shall accompany the article. The note shall contain name, age, postal and e-mail address, course, academic accomplishments, and important assignments held. The evaluation would be done on following criteria:

a. **Style**: The article should be interesting and informative. The introduction should draw the reader in and convince them that the remainder is worth reading. The remaining should be written in a lively and concise style, and should leave the reader convinced of the importance of the topic.

b. **Structure**: The article should be within 1000 words, and formatted in 1.5 line spacing in Times New Roman 12 point font.

c. **Organization**:
    • Instead of an abstract the article will give information on the location, the period when the field work was carried out
    • Integration - the article organized in a coherent form and all ideas are clearly leading to a single main argument.

The review at the Directorate level will be done through an editorial board constituted by the DFE, which will be responsible for the content, design and review of the journal articles. The editorial board shall consist of expert/experts constituted by DFE and reconstituted every year, which would screen contributions and recommend their publication. Articles previously published elsewhere, or simultaneously sent for publication elsewhere, may be accepted with modifications. Article submitted shall carry a declaration that the article is original. The Editor would reserve the right to reject articles without assigning any reason and articles not found suitable will be sent back.

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जहाँ है हरियाली।
वहाँ है खुशहाली।।