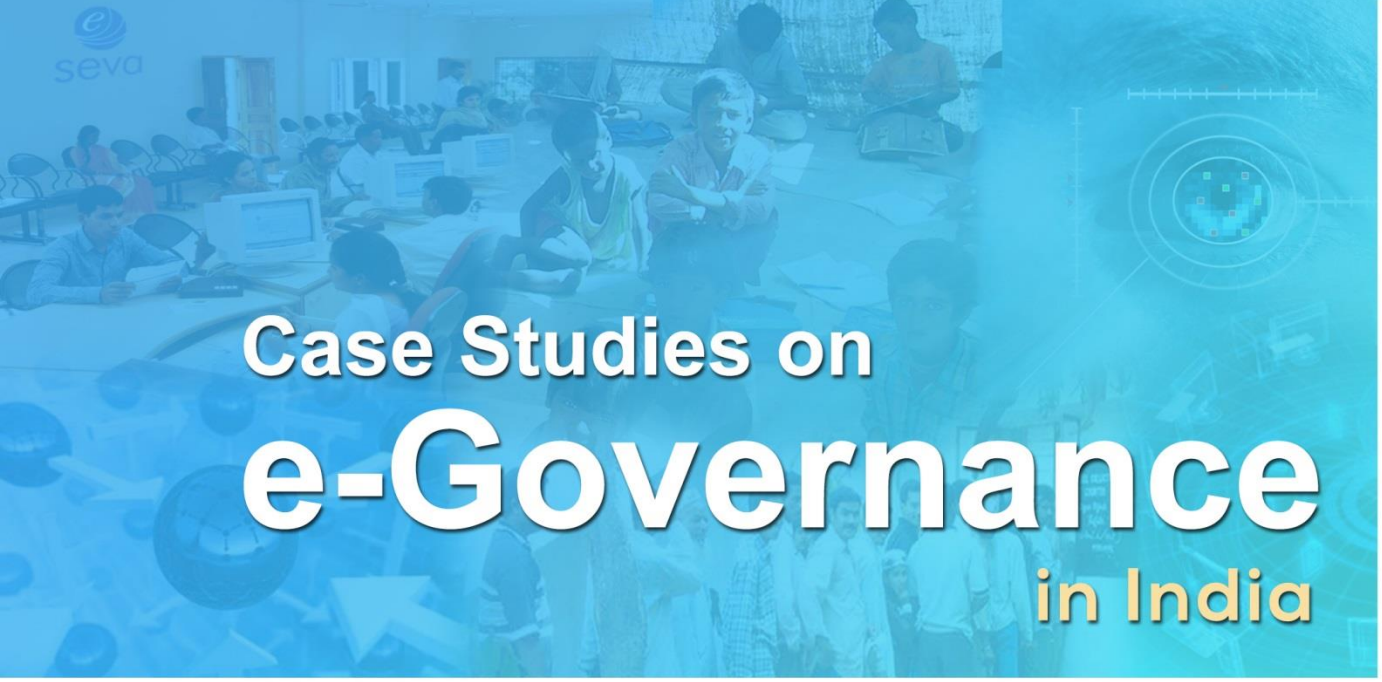

Case Studies on e-Governance in India

Nurturing the Nature: A Case Study of Forest Cover Change Monitoring Information System in Andhra Pradesh

Shri Paresh Kumar Sharma

Dr. A. Sridhar Raj

Architecting e-Government

राष्ट्रीय इ-गवर्नेंस योजना
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About the Initiative

This publication is a part of the Capacity Building initiative under the National e-Governance Plan (NeGP) by NeGD with an aim to draw out learnings from various projects implemented in various States/ UTs and sharing this knowledge, in the form of case studies, with the decision makers and implementers to benefit them, by way of knowledge creation and skill building, from these experiences during planning and implementation of various projects under NeGP.

Conceptualised and overseen by the National e-Governance Division (NeGD) of Media lab Asia/DeitY these case studies are submitted by e-Governance Practitioners from Government and Industry/Research Institutions. The cases submitted by the authors are vetted by experts from outside and within the Government for learning and reference value, relevance to future project implementers, planners and to those involved in e-governance capacity Building programs before they are recommended for publication. National Institute for Smart Government (NISG), working on behalf of this NeGD provided program management support and interacted with the authors and subject matter experts in bringing out these published case studies. It is hoped that these case studies drawn from successful and failed e-Governance projects would help practitioners to understand the real-time issues involved, typical dilemmas faced by e-Governance project implementers, and possible solutions to resolve them.

Acknowledgment

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Abstract

The case study, "Nurturing the Nature: A Case Study of Forest Cover Change Monitoring Information System in Andhra Pradesh" provides insights into the integration and application of IT tools in the Forest Department of Government of Andhra Pradesh to document the forest cover changes to nearest accurate level. This is done using the latest Information and Communication Technologies (ICTs) which provide faster data sharing between the ground staff and the officers by recording the increase or decrease of the forest cover. This in turn has helped the Forest Department in taking remedial and faster actions in protection of forest resources and safeguarding nature for human race.

Key words

Forest cover, environment, change management, ICT.

Note to Practitioners and Instructors

The case study "Nurturing the Nature: A Case Study of Forest Cover Change Monitoring Information System in Andhra Pradesh" is a good example of how integration of technology with the existing processes has led to better communication and increased flow of information for faster decision making for the protection of forest cover. The integration of various technologies - Information Technology (IT), Management Information System (MIS), Geographic Information System (GIS) and Remote Sensing (RS) - has led to better flow of information among the employees for better accountability and the protection of the forest reserves. The benefits for the Forest Department include recording, precise detection and documentation of the forest cover changes at the grassroots level by interpretation of the satellite imagery, location of the change points (polygons with locations and extents), faster exchange of communication regarding the change in the forest cover and fixation of accountability of the employees.

The case study can be used to dwell upon issues like deployment of technology, change management, capacity building, fixation of accountability, increased transparency levels within the department, better coordination and faster decision making. The case study can be a good reference point for the officers intending to deploy technology for accurate documentation of activities pertaining to forest cover changes and also increase transparency within the department. The teaching objectives of the case study may include the following:

a. Deployment of Information Technology (IT)
b. Integration of IT and the existing processes
c. Training of personnel to meet the technology upgradation

d. Encouraging the employees to adopt process change

e. Increase of efficiency in terms of time and resources

As a part of the case study some of the key issues that can be discussed include *the integration of IT with the existing organizational processes, capacity building among the employees, better monitoring of the field level employees, fixation of accountability, increase in efficiency levels of the employees at all the levels, better coordination within the department, near accurate documentation of data and faster decision making.*

The case study enables the readers in understanding various dimensions of the FCCMIS, particularly the cost and benefits issues, which can be discussed during the capacity building programmes. Some of the issues that can be discussed include the following:

a. Should it be a pilot project?

b. How should the project be financed?

c. Should the Forest Department have a separate IT wing?

d. What should be role of the external experts – GIS, MIS, RS?

e. Should changes be made to the existing ground truthing practice after adopting technology in tracking and documenting forest cover changes?

f. Is ground truthing necessary after the deployment of technology?

g. What should be periodicity of tracking and documenting the forest cover changes?

h. Are there any benefits for the society at large with this project?

i. Is it useful for the government in policy formulation?

j. With faster exchange of information between the field offices and the head office under this project, can the forest cover change become positive in the days to come?

k. To what extent this project will help in arrest the declining the forest cover?

l. Who can be the major beneficiaries of the project?

m. Will it increase awareness among people about environment?

Project context

The pace at which forest reserves of the world are depleting is a cause of concern as the depletion is not only impacting the fragile eco-system but is also impacting the livelihood of the people dependent on the forests. The State of Forests Report 2011 states that the overall forest cover declined by 367 square kilometres (sq km) compared to the situation in 2009. What is also disquieting is that the country is left with only 2.54 per cent of its geographical area under dense forests and another 9.76 per cent under moderately dense foliage. The rest of the forests have varying degrees of density, including some that are only

sparsely vegetated. (Business Standard, 3rd March 2014) The Conference of Parties (CoP-11) on Bio-diversity is a step in the direction of conserving natural habitats across the world. The importance of forests in sustaining livelihood for a large number of people and also balancing the environment cannot be overlooked given the focus on sustainable development by the governments all over the world. In line with such thinking, the Forest Department of the Government of Andhra Pradesh has been endeavoring towards enhancing the protection of forest cover using technology. With personnel located far and wide across remote and inaccessible parts of the state, the department has found a better way of managing the forest cover changes by deploying Information and Communication Technologies (ICTs).

The ICTs have helped the Forest Department in developing various modules for better organization, collection and documentation of data and thereby creating a better decision making support system. Some of the modules include Forest Protection Management Information System (FPMIS), Wildlife Management Information System (WMIS), Plantation Management Information System (PMIS), Nursery Management Information System (NMIS) and BeediLeaf Management Information System (BLMIS). In line with development of such modules, the Forest Cover Change Monitoring Information System (FCCMIS) has been developed with the integration of Management Information System (MIS), Geographic Information System (GIS) and Remote Sensing (RS) with a view to 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.

The Forest Cover Change Monitoring System (FCCMIS) initiative has helped the Forest Department in **tracking positive and negative changes** in forest cover at an interval of one year. FCCMIS is an e-governance initiative which helps the personnel of the Forest Department in detecting, measuring and documenting the **positive and negative changes** in the forest cover. Earlier, the only source of forest cover changes was the Forest Survey of India (FSI) which brought its biennial India State of Forest Reports since 1987. But these reports provided a macro view of the forest/tree cover changes and did not provide the statistical information on forest cover changes at the micro level, like a Beat or Compartment.

The FSI Reports provided information up to the district level only and no information was available below the district level which is critical for the field level functionaries, both in terms of evolving strategies for the better protection and identifying suitable areas for taking up plantations or regeneration activities. Therefore, a necessity arose to collect and document the data at the lowest level of the administrative and management hierarchy of the Forest Department utilizing satellite images, Hardware, Software, and other ICTs (Remote Sensing, Global Positioning systems and Geographical Information System). This has led to recording, precise detection and documentation of the forest cover changes at

the grassroots level through interpretation of satellite imagery by the expert team of Forest Officers and Scientists in the Geo-Informatics Cell of the Department. Earlier, 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.

This necessitated the development of an IT module Forest Cover Change Monitoring Information System (FCCMIS) which could address the above mentioned issues within the department and also lead to better accountability and higher transparency of the activities. The change required adoption of ICTs along with other technologies which facilitate the Forest Department in tracking forest cove changes more effectively than the existing ones which was time consuming and also suffered with certain flaws – delays in information exchange, regular monitoring of the changes, delayed decision making, etc. However, shifting to extensive use of technology required awareness about the use of technology at all levels, proper deployment of the module, changes in existing processes, training the stakeholders, ensuring that the stakeholders use the same without any glitches and finally the shift towards technology adoption necessitates financial resources.

The *decision dilemma* was resolved by adhering to the tenets the Information and Technology Vision Document of the Forest Department which focused on technology initiatives for better governance. The vision document states, “It is proposed to execute the technology initiatives in an integrated manner where in all the key functions are carried out through we based workflows, which will facilitate each role player to log on to the departmental web portal and enter his/her work data/information and will also facilitate every employee to remain in constant touch with the latest happenings in the department. This working methodology will not only bring transparency, responsibility and accountability but will also enhance efficiency and move towards a paperless office.” Given the enormous benefits that would follow the deployment of technology in tracking and documenting the forest cover changes at regular intervals; the Forest Department went ahead in the deployment of technology. The case study provides the readers 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. The case study also provides a reference point for the readers while making decisions pertaining to shift towards technology driven processes.

The *uniqueness* of the case study lies in the fact that for the first time the data pertaining to forest cover changes is put before the citizens in a transparent manner. This helps the stakeholders in accessing the forest cover changes and discussing the issues pertaining to the larger environmental issues. This has not been done in any other state in India and the

Forest Department of Andhra Pradesh has taken a lead in showcasing forest cover change in a transparent manner. The possibility of other forest departments taking a cue from the FCCMIS is very high as it has led to better tracking of forest cover using various technologies. That apart, the case study is unique as FCCMIS is handy in deploying financial and human resources based on the actual requirements of the field, which was not possible under the earlier system. Besides, the case study provides unique insights how various technologies can be put into place with the help of a dedicated team of forest officials and technical officers to document data to the near accurate level and also take reactive and proactive measures to save environment for the larger benefit of the society. All these benefits help the Forest Department in prudent deployment of resources – human and financial, for better tracking and documenting of the forest cover changes. Although the cost of images and other inputs are needed which is expenditure for the Forest Department, the benefits far outweigh the costs incurred as a part of implementing the FCCMIS.

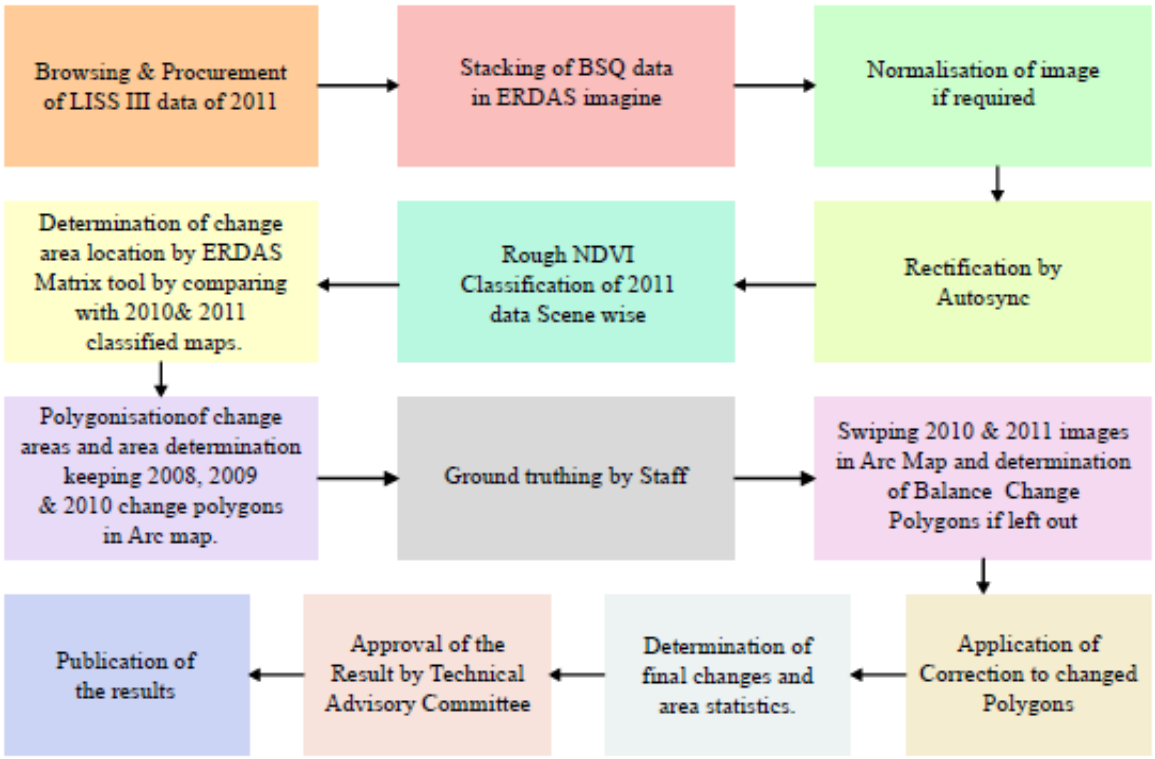
Project Overview

The Forest Cover Change Monitoring Information System (FCCMIS) is the result of various technologies - IT, MIS, GIS, RS and the existing processes so as to streamline the detection and documentation of forest cover changes in the state of Andhra Pradesh. The FCCMIS provides data pertaining to the Beat or Compartment level which was not the case earlier. The system helps the Forest Department in tracking the changes to the forest cover in terms of harvesting of matured plantations, clearance of forest growth for raising plantations, encroachment, harvest of agricultural crop in old Podu area, clearance of forest growth under forest conversation, growth in raised plantations, improvement in encroached area after eviction, and improvement in natural forest due to protection due to soil and moisture works.

All these changes are documented in the form of annual Andhra Pradesh State of Forest Report which depicts the actual state of forest cover changes on a yearly basis. The latest State of Forest Report is available at http://202.53.72.34/ALL/SFR/SFR2013.pdf which shows the detailed changes in the forest cover in Andhra Pradesh. The Figure 1 provides the details of the Process Flow for Development of the State of Forest Report.

(Figure 1)

Process Flow for Development of the State of Forest Report



Source: Forest Department, Government of Andhra Pradesh

The preparation of the State of Forest Report (SFR) helps the Forest Department in comprehending the increase or decrease of forest cover and also reasons for such a change during the last one year. The SFRs are prepared annually and can be accessed by the citizens as well. This helps the department in conducting its activities in a transparent manner. The SFR is an outcome of the FCCMIS and the benefits of this e-governance project is not limited to the publication of the SFR but goes beyond as the information provides better understanding of the change in the forest cover during the last one year. This helps the officers to probe for the reasons of such increase or decrease and take appropriate action. The Figure 2 provides a glimpse of the details provided by FCCMIS pertaining to the forest cover changes, which is available in the public domain as well.

(Table 1)

Forest Cover Change Matrix

Forest Cover Change Matrix						*Area in Sq.Km*	
2010 (Data of Sep 2010-Jan 2011)	**2011 (Data of Sep 2011- Mar 2012)**						**Total of 2010**
	VDF	**MDF**	**OF**	**Scrub**	**NF**	**WB**	
Very Dense Forest	931.73	0.00	0.00	0.00	0.00	0.00	931.73
Moderately Dense Forest	0.00	18400.61	0.01	0.31	7.55	0.00	18408.48
Open Forest	0.00	0.00	22587.85	1.13	62.30	0.00	2265.28
Scrub	0.00	0.00	5.48	13510.64	34.19	0.00	13550.31
Non-Forest	0.00	0.00	1.58	5.76	7615.15	0.00	7622.49
Water	0.00	0.00	0.00	0.00	0.00	649.86	649.86
Total of 2011	931.73	18400.61	22594.92	13517.84	7719.19	649.86	63814.15
Net Change	0.00	-7.87	-56.36	-32.47	96.70	0.00	

Source: Forest Department, Government of Andhra Pradesh

Table 1 provides the details of the state of forests in Andhra Pradesh from 2010 to March 2012. According to the Andhra Pradesh State of Forest Report 2013, the forest cover change matrix reveals that there has been a decrease of 7.87 (Sq.Km) of Moderately Dense Forest and 56.36 (Sq.Km) of Open Forest. This data is captured by the Forest Department and ground truthing is done - physical verification of the forest cover changes - by the officials. On the basis of ground truthing conducted by the officers of the Geomatics Center and the field officers for the aforementioned data, the main reasons for decrease in the forest cover

were identified to be management interventions like harvesting (clear felling) of matured plantations, clearance of bush growth and preparation of land for raising of plantations and fresh attempts on encroachments triggered by recognition of rights of occupation. The data input from the field staff in finding out the reasons for the increase or decrease of forest cover and the forest reports input to the officers complement each other in strengthening the overall forest management. *The input from the field staff provides the reasons for the forest cover change and the input from the Geomatics Center highlights the forest cover change in various areas with longitudinal and latitudinal specifications to the beat level. Both these inputs form the crux of the FCCMIS around which decisions are taken for better monitoring of the forest cover changes.* The salient features of the project are given in the following text box:

Salient Features of the Project
• Integration of ICT with MIS, GIS and RS • Documentation of forest cover change detailing the latitude and longitude • Faster exchange of information between the senior officers and the field staff • Analysis of forest cover changes • Increased transparency awareness about forest cover change • Better fixation of responsibility and accountability • Immediate remedial measures to check forest degradation/encroachment

When such data are available on a regular basis, there is scope for understanding the rate of increase or decrease of the forest cover change, the reasons for such change and also deploying human resources according to the exigency from time to time.

Objectives of the Case Study

With the increasing integration of ICTs and the processes in all government organizations as part of the National e-Governance Plan, it is difficult for any government agency to remain aloof from such developments. ICTs are not only beneficial in fine tuning the existing processes for improving efficiency but also enable these agencies in delivering better services to the stakeholders. Although there are no specific set of clientele to the Forest Department, integration of ICTs and processes can lead to efficiency in conducting its own affairs – monitoring, decision making, accountability, and transparency, leading to better

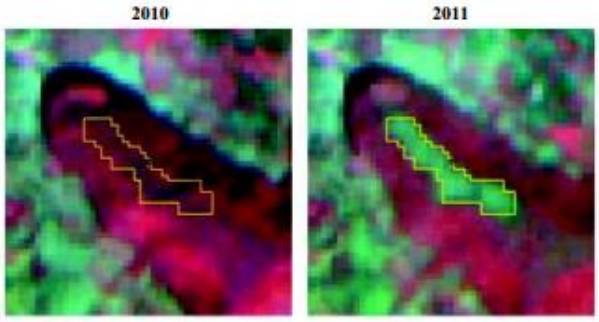
delivery of results. In sync with such an ethos, the Forest Department joined the bandwagon of e-governance and one offshoot is the FCCMIS. The objectives of the FCCMIS include the following:

- **Transparency:** Increasing transparency by making the SFR accessible to citizens through its website.
- **Accountability:** To enhance accountability in terms of activities, particularly, ground truthing in case of forest cover changes.
- **Data exchange:** To improve communication of the interpretation on of forest cover changes on account of sending and receiving online feedback from different ranges across the state.
- **Planning:** Assist the planners and field officers in managing the natural resources more effectively.
- **Avoiding delays:** Avoiding delays in the exchange of data from the field office and the head office.
- **Decision support system:** Provide a decision support system for the officers for the proper allocation of resources.

The FCCMIS helps in quicker and better way of dissemination of the information about the positive and negative changes in the forest cover getting feedback from the field officers and analysis of the data received for a robust Decision Support System for better protection and monitoring of forests in the state of Andhra Pradesh. The FCCMIS helps the department in expediting the communication of the outcomes of the interpretation of Satellite data (Figure 3**)** to the field and getting the feedback after ground verification (Ground Truthing) thereby saving precious time in taking further necessary action. The Figure 3 provides the manner in which data are captured and provides evidence to the forest cover changes that have occurred over one year 2010 to 2011. The Figure 3 also provides the latitude and longitude details of the forest cover change in Adilabad Division of Andhra Pradesh.

(Figure 3)

Satellite Data of the Forest Cover Change



Longitude	78.50777° E
Latitude	19.22364° N
Area in Ha	7.23
Change	OF TO NF
Comp No.	38
Beat	Pisra
Range	Boath
Division	Adilabad

Source: Forest Department, Government of Andhra Pradesh

The information sent after interpretation through FCCMIS is accurate in extent, location and shape which provides the officers an opportunity to estimate the negative change (i.e. degradation) and positive change (i.e. increase in forest cover) across the forest divisions. On the receipt of feedback from the Field Officers on the causes of changes, through the FCCMIS, it is critically analyzed by a team of senior officers of the Forest Department. The information analyzed by the officers includes various changes to the forest cover and the FCCMIS provides data pertaining to type of change, change in the extent of area, latitude, longitude, type of forest lost or plantation raised, saplings planted, scheme under which plantation has been taken up, the name of the persons involved in ground trotting, booking details of offences, case booked in case of felling/encroachment, period of felling, test checking, date/period of felling, etc. In the case of negative change pertaining to encroachment of forest area, the following details are provided through FCCMIS:

a. Range, where the encroachment has taken place;
b. Compartment,
c. Polygon ID, the ID given to the encroached land;
d. Change in Class, which means the change in the vegetation cover;
e. Latitude;
f. Longitude;
g. Extent of area encroached;

h. POR number and date, indicating the offence

i. Name of the offender;

j. Period of encroachment;

k. Name, designation of the person who did ground truthing and also the date on which ground truthing is done;

l. Name, designation of the person who certifies that ground truthing had been done correctly;

Similarly, in the case of clearance of forest growth for raising plantations, the data that are keyed into FCCMIS also includes the following, apart from the regular data:

a. Name of the plantation raised;

b. Year of raising;

c. Species, etc.

In case of positive forest cover change pertaining to growth in raised plantations, the data that are keyed into FCCMIS include the following, apart from the regular data:

a. Name of the plantation to be raised;

b. Scheme under which plantation to be raised;

c. Extent of raising the plantation;

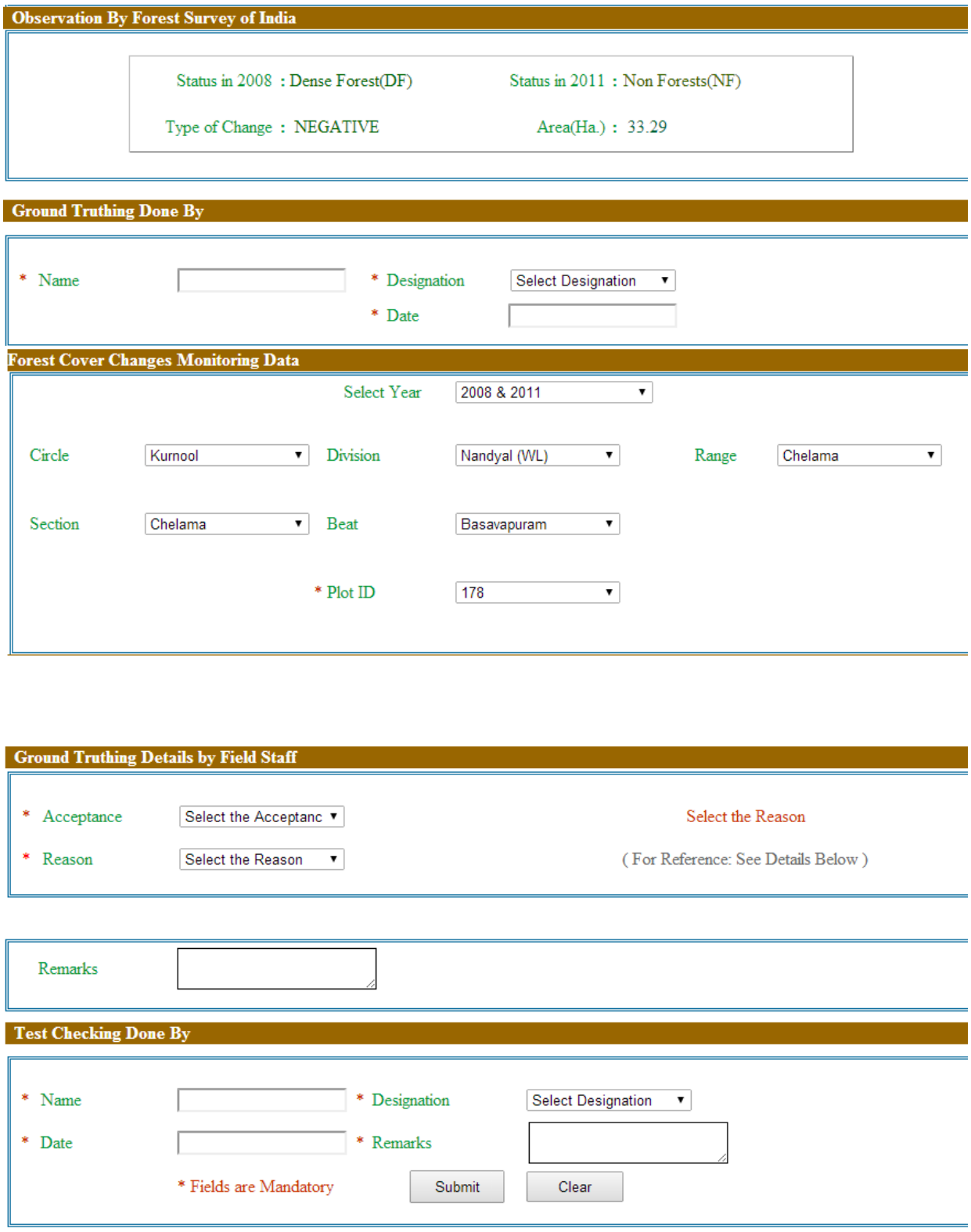
d. Species raised or proposed to be raised;

e. Year of raising; etc.

The following diagram (Figure 4) shows the details of how the information is captured using FCCMIS and stored in the data base which is accessible to all the stakeholders of the Forest Department.

(Figure 4)

Data Capturing through FCCMIS



Source: Forest Department, Government of Andhra Pradesh

Ready availability of such information has strengthened the hands of the decision makers of the Forest Department.

Key stakeholders

The Forest Department as an entity exists to preserve and protect the environment in its existing form towards which the FCCMIS is a handy tool. Towards the fulfillment of such an objective, the FCCMIS helps in capturing and documentation of the data on which decisions of the Forest Department regarding the deployment of resources are based. Therefore, the key stakeholders of the project include the officers involved in decision making at the higher levels of the department and also the field officers who are involved in ground truthing of the changes in forest cover. That apart, the citizens who normally do not have access to data pertaining to forest cover changes are also stakeholders as the FCCMIS data is accessible to the citizens in case they intend to know about the changes in the forest cover.

Issues and challenges faced

The implementation of the FCCMIS has shown that the project has been successful in documenting the forest cover changes to a near accurate level which was not the case earlier. However, the initiative did not go well as people expressed their doubt about its efficacy in documenting the forest cover changes to the near accurate level. Before embarking upon the e-governance initiatives, the people within the Forest Department were to be convinced to opt for ICTs. Individuals were not that amenable for change for the adoption of technology as a tool for monitoring forest cover change. This apart, initially, there were hiccups as the inputting of data from the field was a problem due to lack of knowledge and training of the field staff. The field staff was not willing to shift to the new system as it necessitated changing from physical form to electronic form. There were delays in inputting of data pertaining to ground truthing which led to delayed action on the part of the officers. In certain instances, the follow up for the inputting of data was delayed that prevented prompt action, particularly in cases pertaining to encroachments.

Overcoming challenges

The challenges did not deter the officers of the Forest Department in pushing forward the agenda of FCCMIS and most of the issues and challenges have been addressed. As the benefits outweigh costs of the FCCMIS, the individuals within the department were of the opinion that such an initiative would bring the data at the finger tips for better monitoring and decision making. The problems pertaining to data inputting was overcome by regularly sending instructions to key in data so that the same may be taken as the basis for decision making. These apart, training programmes were conducted to make the field staff ready for utilization of the FCCMIS. Increasing emphasis on the use of technology coupled with the training programmes made employees to reorient themselves towards changed processes. The officers followed up with the field staff in case records were not updated or data not

keyed in correctly and all such endeavors led to successful shift to the FCCMIS within the Forest Department.

Capacity Building Programme

Capacity building programme is vital for successfully taking forward any e-governance project as such project involves a shift in the nature of work. The FCCMIS highlights the importance of e-governance initiatives in the Forest Department where the individuals entrusted with the responsibility of protecting the forest cover are ill trained and are not exposed to training programmes. This specific e-Governance initiative will help in understanding how to bring in changes in a department where most of the lower rung employees are not well educated and are not tech-savvy. Further the case study helps in sensitizing the participants about how to initiate *change management* at all levels and make the employees to accept technology for reaping the benefits of better documentation and communication of information.

The Forest Department too initiated a plethora of programmes for training the officers at various levels. The Heads of Department were sensitized about the FCCMIS and its usage at the senior level and similar exercises were undertaken for the field officers. The field officers were sensitized about the process involved in data capturing and data documentation. They were also informed about the benefits of the module. The capacity building initiatives have started yielding rich dividends in the form of accurate data reporting, better coordination among the officers, timely corrective measures, etc.

Benefits realized

The benefits were immense for the Forest Department as the data were at the finger tips of all the officers and they could easily find various details pertaining to the forest cover changes, both positive and negative. They have data pertaining to forest cover change, reasons for such change, people who have done ground truthing, the types of offences, the cases booked, the types of species raised, the extent of change in forest cover in the form of clear pictures, and the exact location of the forest cover change. On the basis of such data, the officers are in a better position to monitor the activities of the field staff with regard to the actions taken by the latter in different types of forest cover changes. This was not possible earlier as the data moved slowly from one level to the next level, thereby leading to delays in the exchange of information which in turn slowed down the decision making process. With the data in hand and easily accessible for the officers, they are in a position to evaluate and identify the forest cover change from a macro perspective and also deploy suitable measures to combat forest cover change more easily. The deployment of resources is now easy for the officers as they are in a better position to evaluate the trends of forest cover change in a proactive manner. Some of the benefits realized are discussed in detail below.

- **Forest cover change:** The forest cover change is found to be negative from 2010 to 2011 as reported the SFR 2013. The total negative change is 41.35Ha in Adilabad Division in which 3.35Ha is on account of clearance of jungle growth for raising of plantations and 38.00 Ha is on account of encroachments. As clearance of jungle growth for raising of plantations are forest management interventions, the same are not considered as loss of forest cover. Thus, only the negative change due to encroachments is taken as loss of forest cover. Therefore, the net loss of forest cover is 38.00Ha in the Division. On finding the reasons for such depletion through ground truthing, the matter is reported to the officers and the issues pertaining to encroachment are addressed promptly. This is how forest cover change is documented and acted upon by the Forest Department in monitoring the forest cover change.
- **Extent and location of forest cover change:** The FCCMIS helps in estimating the nearly accurate changes in forest cover, which was not the case earlier. This apart, the location was also a big problem given the inaccessibility of forest areas due to thick coverage in Very Dense Forest Areas. The FCCMIS enables officers to gauge the extent of change in the forest cover and also the exact location of such change in terms of longitude and latitude as shown in Figure 3. This helps the Forest Department to estimate the change and take necessary action.
- **Better Monitoring:** FCCMIs helps the officers of the Forest Department to monitor the field staff as the project provides details in terms of ground truthing, persons involved in ground truthing, the timing of ground truthing, delay in ground truthing, and such like, all of which enable the Forest Department to monitor the activities of the field staff in case of forest cover change. Better monitoring from the higher echelons deters the field staff from entering incorrect facts about forest cover during ground truthing.
- **Exchange of Information:** The FCCMIS helps in faster exchange of information between the officers and the field staff. Earlier, the information pertaining to forest cover changes was sent in manual and physical forms and there was delay in such information reaching from the field to the head office. The delay prevented the officers in taking suitable and prompt action in case of forest cover change; leading to delays and inaction. The FCCMIS helps the officers in accessing information in real time and the field staff is equipped with necessary tools to pass on information from the field. The latitude and longitude of the change in forest cover area in the shape of polygons and the nature of such changes are communicated to the field officers for ground truthing to be done by the latter.

- **Decision support system:** FCCMIS provides the officers a decision support system in the allocation of resources – required number of saplings for regeneration and growth of forest cover and suitable number of human resources/personnel for focused monitoring of certain deforestation prone areas. Based on the data if it is found that forest cover change is due to intervention of the Forest Department for regeneration of the forests through planting of new saplings, the FCCMIS provides the extent and location of the forest land to be recovered with the new saplings. The decision regarding the type of sampling and number can be easily determined based on the data and financial allocation can be made accordingly. Similarly, if the data shows that the forest cover change is due to Podu cultivation or other encroachment, more human resources can be deployed to prevent such instances.
- **Cutting down delays:** The FCCMIS has led to recording, precise detection and documentation of the forest cover changes at the grassroots level by interpretation of satellite imagery by the expert team of Forest Officers and Scientists in the Geo-Informatics Cell of the Department.

Key lessons

The FCCMIS offers certain key lessons for the individuals engaged in change management by adopting technology as a tool for better governance in terms of accountability, transparency, data sharing, etc. The FCCMIS shows how technology can be integrated for better decisions. For example, the integration of data capturing and data documentation (with the help of ICTs, GIS, MIS and RS) with actual field activity (ground truthing by the officers of the Forest Department) is a pointer in the direction of aligning technology and process for better management of forests. Another key lesson is that the people working in remote and inaccessible areas in the forests are ready to adopt technology given its utility in increasing their work efficiency. The FCCMIS demonstrates that the technology is making its way into all the departments of public governance and no public agency can be aloof from such developments. That apart, the case study shows how even forest management too can be done effectively using ICTs (integrating with GIS, MIS and RS) wherein the officers can take correct stock of the situation and take informed decisions.

Beneficiaries of the project

A change management programme leads to change in the existing processes resulting in more outputs and outcomes. This happened in the case of FCCMIS as well wherein the change to e-governance form of forest cover change management has been beneficial to many stakeholders. The officers at the middle and senior level have easy access to data pertaining to forest cover change and such data provides all the inputs needed for better decision making. The speedy exchange of data between field staff and the officers has led to better coordination in taking immediate and prompt action in addressing the issues of forest

cover change, both positive and negative. The FCCMIS has also provided right tools for the officers to monitor the happenings in the field and by a click of the mouse; they access data which was not the case earlier. With such ready and easy access to data, the officers are in a position to take informed decisions.

Methodology of writing the case study

The case study has been written on the basis of first hand information and insights provided by the officers of the Forest Department of Andhra Pradesh Government. The author interacted with the senior officers of the department involved in initiating and taking the FCCMIs forward. The senior officers are those who are directly involved in the policy decisions and execution of the FCCMIS who have given a broader vision of the departmental activities. The author also interacted with the members of the Technical Team which designed and activated the FCCMIS module. This has helped the author to come out with a proper framework for writing the case study. Most of the inputs were taken through one-to-one meetings with the officers of the department and an open ended questionnaire was used to elicit data pertaining to the project. The following personnel have provided first hand information for writing the case study:

1. Sri PK Sharma, IFS, Special PCCF (Dev), AP Forest Department.
2. Dr. HC Mishra, IFS, Addl. PCCF (IT), AP Forest Department.
3. Sri. P. Sreenivasa Rao, Deputy Conservator of Forests (GIS), AP Forest Department.
4. Dr. A. Rama Murthy, Assistant Conservator of Forests (RS), AP Forest Department.

Case Study Fact Sheet

Demographic Information: The FCCMIS is used by the employees of the Forest Department tracking forest cover changes. They are located across the length and breadth of the state of Andhra Pradesh. The personnel who use the FCCMIS include the following:

- Divisional Forest Officer: 47
- Sub- Divisional Forest Officer: 73
- Forest Range Officer: 204
- Forest Section Officer: 970
- Forest Beat Officer: 2500
- Assistant Beat Officer: 1100

The case study belongs to the Environment Management Sector.

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 is the general public at large, who can access the forest cover changes from time to time.

- Employees at range level
- Policy executioners of the Forest Department
- Policy makers of the government
- Educational institutions
- NGOs
- General public

Calendar of the major events

- Phase 1 (2010): Decision taken to formalize the online project
- Phase 2 (2011): Providing a strong decision support system for forest protection
- Phase 3 (2012): Implementation and formal launch

Major services being provided

- Tracking forest cover changes
- Providing a strong decision support system for forest protection
- Prioritizing the resources for improving forest protection by redeployment of Base Station Parties and Strike Forces on a dynamic basis
- Prioritization of the depleted areas for treatment, particularly by way of re-afforestation thereby better management of forest resources
- Providing the information about forest cover on an annual basis to the general public

Project team (PMU)

The Department formed an in-house Core Group to take up the project and a few Project Scientists are hired (outsourcing) through from external agencies (NIIT GIS). The Project Management Unit consists of a team headed by Additional PCCF (IT). The other team members are Deputy Chief Conservator (GIS), Assistant Conservator of Forest (GIS), four Forest Range Officers (GIS) and six Project Scientists.

Implementers of the project

The project is basically developed, deployed and implemented by Andhra Pradesh Forest Department. The Principal Chief Conservator of Forests, Forest Department is the implementer through the IT Wing (PMU). Following Principal Chief Conservator of Forests were involved in the implantation of the project:

Name of the PCCF	Term in Office
Sri. C Madhukar Raj	22.12.2009 – 30.11.2011
Sri. H Malhotra	01.10.2011 – 30.08.2012
Sri. S V Kumar	30.08.2012 – 30.04.2013
Sri. B S S Reddy	30.04.2013 – till date

The IT Wing was headed by Sri. P K Sharma, the then Additional Principal Chief Conservator of Forests from 26.04.2006 to 06.02.2012 and since then it is headed by Dr. H C Mishra, till date.

Technology used for FCCMIS

Software

- .Net
- SQL Server
- MSQL Server
- Erdas Imagine
- Arc GIS (Version 10) – 6 in Head Office and 10 in field offices.
- Skyline Globe - One
- Arc GIS Server

Hardware

- GIS Work Stations – 8
- Differential Global Positioning Systems (DGPS) – 2 in Head Office and 10 in field offices.
- Personal Digital Assistants (PDAs) - 227
- Hand Held GPS – 1000
- A0 Size Plotters and Printers

- Servers – 6
- Storage Devices (UDO Archive)

LISS III data of the entire state is available since 1996 to 2012

Cost of the project

The detailed breakup of the expenditure is given in the following table to undertake the exercise of tracking and documenting the forest cover changes in Andhra Pradesh.

S.No.	Item of works	Cost (Rs,)
1.	Cost of 27 scenes of LISS III data @ 7000/- per scene	1,89,000.00
2.	Proportionate cost of Software in average ERDAS packages and 1 autosync is used only 20 % Cost is projected.	3,00,000.00
3.	Cost of Hardware – 25% of 6 Computers Cost	1,25,000.00
4.	Cost of 6 Scientists doing lab and field work per 1 year.	12,00,000.00
5.	Cost of field trips	50,000.00
6.	Cost of Printing of SFR (700 Copies)	1,26,700.00
7.	Ground truthing expenditure by FBO's (@ 2 locations per day)	3,50,000.00
8.	Miscellaneous	22,000.00
	Total	23,60,700.00

Source: Forest Department, Government of Andhra Pradesh

Agenda of the Discussion

The agenda of the discussion with the officials of the department revolved around the issues pertaining to change management by adopting technology. The manner in which the forest cover changes were monitored was extensively discussed and the discussions threw light on the issues like delay in exchange of information, inaccurate ground truthing, incorrect analysis of the forest cover changes due to insufficient or incorrect information, difficulty in fixation of accountability with regard to forest cover changes, difficulty in knowing the exact areas of change in forest cover by senior officers, etc. The agenda also included the benefits that have accrued to the Forest Department after implementing the FCCMIS which include speedy transfer of information, easy accessibility of data, better decision support system, increased transparency levels within the department and fixation of accountability of ground truthing officials.

Questions

1. What is FCCMIS?
2. What are the major objectives of FCCMIS?
3. How is it financed?
4. What prompted the Forest Department to opt FCCMIS?
5. What were the challenges faced by the Department while implementing the project?
6. How were the challenges overcome?
7. What benefits did accrue to the Department?
8. How was the field staff trained in using the FCCMIS?
9. How did it help the senior officers in tracking forest cover changes?
10. Has accountability and transparency increased within the department? If so in what way?
11. Are the officers in the head office and the field offices comfortable in using this module? If so, what measures were taken to make them comfortable in terms of capacity building?
12. How were change management programs – capacity building – taken forward?

References:

1. Andhra Pradesh State of Forest Report 2011
2. Andhra Pradesh State of Forest Report 2012
3. Andhra Pradesh State of Forest Report 2013
4. Challenges of Forest Protection and Management, Unpublished note prepared by S.D.Mukherji, IFS(Retd.), 2011
5. Forgetting forests, Business Standard, 3rd March 2014

Brief profile of author/s

FIRST AUTHOR: Shri Paresh Kumar Sharma is the Special PCCF (Development) in the Forest Department of Andhra Pradesh. Earlier, he worked as a Divisional Forest Officer of Karim Nagar East, Kothagudem, Kagaz Nagar andMahboob Nagar Forest Divisions between 1983 and 1993 and was promoted as Conservator of Forests in August 1993. He worked as Conservator of Forests, Research & Training Circle, Hyderabad, Conservator of Forests, Warangal Circle (1994 to 1995), Conservator of Forests, Vigilance, Hyderabad (June 1995 to August 1998), Addl. Director, A.C.B., Hyderabad (August 1998 to December 1998), Conservator of Forests, Project Formulation Circle, Hyderabad (December 1998 to July 1999), Conservator of Forests, Wildlife Management Circle, Tirupati (July 1999 to Nov 2002) &Conservator of Forests, Planning & Extension, Kadapaup to May 2003. He was promoted as Chief-Conservator of Forests in May 2003 & posted as CCF Production. He worked as CCF Development from 2005 to 2006. He was Additional PCCF (IT) from 2006 till 2013. He was made in charge and nodal officer FCA for FC cases and worked in the capacity from February 2013 to September 2013. He was promoted as Special PCCF (Development) in 2013 and is in the same capacity till date. He can be reached at pareshvyas2@rediffmail.com.

CONTACT AUTHOR: Dr. A. Sridhar Raj is an Assistant Professor in the Institute of Public Enterprise, Hyderabad and is involved in teaching, research, consultancy and training activities. His activity areas include organizational behavior, training and development, organization development, etc. His areas of interest include public affairs, governance, public policy, e-Governance, etc, and as part of such interest, he organized a National Conference on e-Governance sponsored by AICTE in the year 2012. He has attended a number of national and international conferences and published a number of papers. Currently, he is working in the areas of performance management in government organizations. He can be reached at sridharraj@ipeindia.org.

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