Case Study

Fire Alert Messaging System in Madhya Pradesh

December 2010

Governance Knowledge Centre

Promoted by Department of Administrative Reforms and Public Grievances
Ministry of Personnel, Public Grievances and Pensions
Government of India

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EXECUTIVE SUMMARY

Forest hazards are a major threat to natural ecosystems. Ninety percent of the tribal population Madhya Pradesh relies on forest produce for survival. Fire disasters hurt tribal sources of income, burn fuel and fodder, threaten biodiversity and pollute the air. In order to ensure effective fire management, the IT section of the Madhya Pradesh Forest Department (MPFD) developed a system to protect fire sensitive forest locations and dependent communities.

Fire Alert Messaging System (FAMS) combines Geographical Information System (GIS) and Management Information System (MIS) technologies. It uses processed remote sensing data of active fire locations and sends alerts to concerned field staff via SMS on registered mobile phones and through email. This information allows the patrol camps to execute fire combating operations in a timely manner, saving forested areas from being destroyed. The system also maintains a database of fire locations which can be used to identify fire sensitive zones and plan fire control operations. The system monitors Beat officers (frontline staff forest guards) and field officers, hence ensuring their accountability.

In just one year, FAMS has achieved in decreasing the average land destroyed PER FIRE FROM 5.6 TO 3.35 HECTAres. Under the Additional Chief Conservator of Forest, Government of Madhya Pradesh, the state forest department has achieved in conceiving, developing and implementing a cutting-edge and unique forest information and management system that has become an exemplary model for others to follow in management of forest resources.

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BACKGROUND

Prior to the Fire Alert Messaging System (FAMS), forest fires were monitored and recorded manually at the locality in which they occurred. At times, information was inaccurate and authorities lacked a means for verification due to poor communication and difficulty in accessing widespread areas. The forest department also lacked the necessary resources to

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compile fire incidences. At the time, reporting forest fires began at the bottom tier of management and went up the chain from field to division headquarters in Bhopal. However, past records were not kept in order and as a result, the management was ill-equipped to make informed decisions about the future. The introduction of FAMS changed the entire process. The Madhya Pradesh Forest Department (MPFD) signed a MoU with the University of Maryland, USA in order to leverage their Fire Information Resource Management System (FIRMS).

Today, the geographical information system (GIS) allows for precise detection of forest fires through satellite from which fire location information is sent in the form of SMS on registered mobile phones to front line field staff, also known as Beat officers. Range officers travel to the fire location and take appropriate action. The digital procedure ensures an effective response to fire incidences at the time that they occur. After the fire is extinguished, feedback is uploaded onto the website for future reference.

OBJECTIVE

The project aims to organise, plan, implement and monitor forestry and other related operations by systematic collection, storage and retrieval of geo-spatial data using satellite and a MIS. The objectives are:

• Identification and delineation of fire prone forest areas.
• Detection and sending of instant messaging about fire locations to front line field officers.
• Creation of spatial and temporal database of fire locations.
• Monitoring of the extent of burnt forest area, loss of life and other property.
• Bringing accountability to the fire detection system for effective delivery of public services.

WORKING DESIGN

Fire Information Resource Management System (FIRMS) was developed and is maintained by the University of Maryland and NASA to provide various services regarding fire information and resource management. Through the system, active fire data is updated every six hours. The system downloads this data and further processes it using spatial queries of a digital forest map to identify active fire locations and appropriate corresponding administrative units. In other words, a location that catches fire is captured by the FIRMS satellite sensors in the University of Maryland on a real time basis and the information is filtered, uploaded to the Madhya Pradesh Forest Department server, and displayed on digitised maps.

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The information is sent out to the registered mobile phones of Beat officers (Frontline field staff), Field officers (fire combating staff) and monitoring management, including sub-divisional officers, the Division Forest Officer and the department head. All mobile phones have their own international mobile equipment (IME) identity number, which allows for easy tracking of users and distributing of messages.

Forest area	95221 km
Population	60.3 million
Villages	51,806
Villages in forests	22,000
ST population	22 percent
Below poverty line	44 percent
Cattle population	33 million
Forest dependent	15.4 million
Forest based employment	48.6 m person days

Table 1: Forest fact file of Madhya Pradesh

The range officer of the concerned forested area takes charge of operations by identifying the location of the fire through Google Maps and making the decision to extinguish the fire as quickly as possible to avoid damage of the forested area. There are around 5000 patrol camps with trained personnel to carry out fire strategy plans.

After taking measures to control the fire, a status report is uploaded by field staff on the range officer's computer. They input detailed information about the location and the action taken online. The outcome has not only been a reduction in fire duration, but intensity as well. All regions within the state have been registered, and over 4000 maps have been digitised by the department. The public website www.mpforest.org stores fire incidents, feedback reports and names of fire sensitive areas.

Prior to the digitised system, it took an average of 11 to 12 hours to extinguish any one fire. Today, it merely takes two to four hours. From November 2008 through June 2009, the total number of fires was 3613, burning 20364 hectacres of land and bringing the average land destroyed per fire to 5.6. Due to the new system, from November 2009 through June 2010, the

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number of total fires fell to 2662, burning 8892 hectacres in total, decreasing the average hectacres destroyed per fire to 3.35.

FAMS has inspired the forest officials in states like Jammu and Kashmir, Jharkhand, Uttar Pradesh, Bihar, Karnataka, Haryana and Rajasthan among to visit Madhya Pradesh for further understanding and replication of this programme.

The major ICT tools used by the department are Microsoft Visual Basic, ESRI Mapobject, ASP.NET, Google Maps API and Microsoft SQL Server. Mobile services are provided by BSNL at a minimum cost to the department.
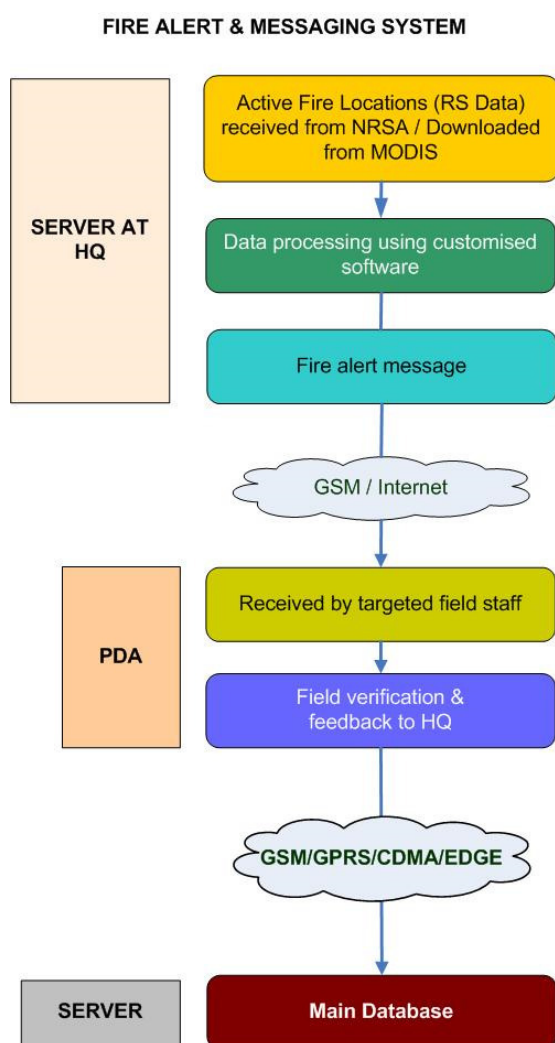

Figure 1: Fire Alert & Messaging System (FAMS) process flow

METHODOLOGY

The OneWorld Foundation India (OWFI), New Delhi, Governance Knowledge Centre (GKC) research team identified Fire Alert Messaging System as a best practice on the basis of its proven ability to be an effective disaster management tool. Secondary research was carried out through online resources. For further queries, the team conducted a phone interview with the Additional Chief Conservator of Forest.

LESSONS LEARNED

The Forest Department of Madhya Pradesh has designed and successfully implemented FAMS, creating a paradigm shift in forest fire management. It has benefited the forest dependent communities of 22,000 villages in the state and has enhanced the accountability of management in delivery of a crucial public service.

The following are the key lessons learned from the project:

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- **Low-cost model:** The FAMS application (satellite imagery) was developed by the University of Maryland and is utilised by the Government of Mahdya Pradesh free of cost. The remaining components of the system were developed in-house. External software and technologies used include Microsoft Visual Basic, Microsoft SQL server, ESRI Map Object, Asp.NET, Google Maps API, Satellite based remote sensing, Global Positioning System and GSM based Wireless Telecom Network are low-cost or free. The price per mobile phone is 500 rupees and BSNL provides the mobile service to the department at a minimal cost. As a result of low initial and subsequent costs, the model is financially sustainable.

Hardwares (computers, mobiles)	Rs 5 lakhs
Software/Tools (FAMS application)	Rs 5 lakhs
Digitisation of forest maps	Rs 100 lakhs
Connectivity services	Rs 50 lakhs

Table 2: Financial break-up of funds for FAMS

- **Reliable and immediate response to fire incidences:** The application is apt to track fire locations and to direct management to take immediate action. There are 8000 beat guards in every forested area. All field units and staff are organised into a network which has resulted in the effective usage of resources. Through this process, absenteeism of frontline staff is mitigated and effective monitoring has resulted in accurate reporting of fire incidences. The entire process has increased the managements' sensitivity towards protecting forests. All fire incident reports and feedback are available online for future reference.

- **Reliable geo-spatial and temporal database:** The geographical information system (GIS) helps to classify, store and analyse spatial data like forest cover and boundaries, population, and poverty levels. The satellite takes images of fire locations and the information is automatically sent to the Forest Department in MP. The GIS is connected to the management information system (MIS) and hence, any forested area that is threatened can be easily tracked and protected. The system gives accurate results in terms of intensity of fire and location on a real time basis.

- **Real Impact - reduction in fire damage:** The maximum number of fires occur during the lean period (May - August) due to very high temperatures. Most fires are human induced; it has been reported that often fires result from people smoking inside the forested area. With the GIS and MIS technologies, information is tracked by satellite censors, images are captured on Google Maps and instant data of the location and intensity of fire is sent out to all registered mobile phones of the front line field staff. Hence, accountability is reinforced

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through effective monitoring of field officers and regular updates of fire incidents. As shown through the following data, the system has helped in the preservation of forest resources to a significant extent.

Parameter	2006-07	2007-08
Fire Incidences	381	1876
Less than 2 hectares	29%	74%
Area burnt per fire (hectares) 8.37		5.29

Table 3: Comparison of fire occurrences statistics

- **Empowering management to take informed decisions:** Earlier, the department was not in a position to take collective decisions or coordinate fire extinguishing operations; however, with GIS-MIS support, GSM connectivity, and digital map usage, the forest department is now equipped with accurate information and sufficient tools to prevent damage caused by forest fires. It has enabled management at all levels to make informed decisions by examining the history of fire in the area. Therefore, the project has greatly enhanced the accountability of management in provision of services to the people.

- **Paradigm shift in attitude:** The beat officers and the frontline field officers have changed their attitude towards work performance as they are monitored by the management and can no longer ignore their responsibilities. They are motivated to carry out their duties on a regular basis. This has improved their productivity a great deal. Implementing this system came with its fair share of challenges. The following are the areas to closely consider when attempting to replicate this model.

1. *Location:* Since many forested areas are in difficult-to-reach locations, capturing, collating and preserving forestry data was impossible without using ICT.

2. *Mobile phones*: Although mobile provision was inexpensive, the administrative approval to provide phones was difficult to achieve due to the large number necessary to make the programme operational.

3. *Digital maps and internet connectivity:* Digital mapping of administrative boundaries of each field unit is necessary in the early stages of development. Extending connectivity to the interior forest areas is a difficult but important task. As such, in this case, management approached the board of BSNL to erect a number of new towers in forested areas in a short time span, which managed to extend coverage well beyond 80 percent.

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4. *Training:* Around 27,000 forest officers and staff were trained through videoconferencing, sessions at the ICT Lab, at circle and divisional levels, and in remote areas of forests.

The rural life of Madhya Pradesh revolves around forests. The tribal communities depend on forest resources for their daily fuel and food. Hence, the dependent communities are the most affected by the prevention of forest fires. The fire alert messaging system has helped in the preservation of wildlife and biodiversity, as well as reduction in occurrence of accidents and saving of lives and valuable resources. Moreover, it has been effective in reducing carbon emissions. Owing to its success, the programme was awarded the 12th National (Silver) Award for e-Governance in 2009 by the Government of India.

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ANNEXURE I: INTERVIEW QUESTIONNAIRE

1. How does the Fire Alert Messaging System operate?

2. What is the process of locating fire prone areas?

3. In what ways has it improved forest management? (Data)

4. List of stakeholders involved in the project?

5. Cost of the project?

6. How has it achieved the following:

   • Assured response to fire incidences?

   • Reliable geo-spatial and temporal database?

   • Reduced damage?

   • Optimum utilization of resources?

   • Empowering management to take informed decisions?

   • Advance and intensive planning?

   • Paradigm shift in attitude?

   • Introduced reliability, transparency and accountability?