



Best Practices Report

E-Governance Implementation

Department of Forests and Wildlife Preservation

Government of Punjab

DOCUMENT CONTROL SHEET

Version	Date Submitted	Changes
Best Practices Report Version 1.0	14 th December, 2009	Best Practices Report after incorporating feedback from department in prior meetings
Best Practices Report Version 1.1	30 th December, 2009	Incorporation of feedback received from department and PICTC. Following changes have been made in the document: <ul style="list-style-type: none"> • Executive Summary: Updated • Chapter-3: Newly added • Chapter-4: Newly added • Chapter-5: Newly added
Best Practices Report Version 1.2	1 st April, 2010	Incorporation of feedback received from department and PICTC.
Best Practices Report Version 1.3	16 th April, 2010	Incorporation of comments received from department.
Best Practices Report Version 1.4	26 th April, 2010	Incorporation of feedback received during meeting with Financial Commissioner on 19 th April, 2010.

Report Approved By:

List of Abbreviations

ADI	Atmospheric Dispersion Index
AFORNET	African Forest Research Network
BP	Best Practice
BPR	Business Process Re-engineering
CCF	Chief Conservator of Forest
CFFDRS	Canadian Forest Fire Danger Rating System
CWFIS	Canadian Wildlife Fire Information System
DFWP / PFD	Department of Forest and Wildlife Preservation, Govt. of Punjab
DPR	Detailed Project Report
FAO	Food & Agriculture Organization
FFI	Fauna Flora International
FBP	Forest Fire Behaviour Prediction
Fire M3	Fire Monitoring, Mapping and Modeling
FORZA	Forest Development Project (Swiss-Ukrainian)
FOMFIS	Forest Fire Management and Fire Prevention System
FWI	Forest Weather Index
GIS	Geographical Information System
ICT	Information and Communication Technology
IFER	Institute of Forest Ecosystem Research, Czech Republic
IUFRO	International Union of Forest Research Organizations
ISRO	Indian Space Research Organization
MIS	Management Information System
NGO	Non Government Organization
PCCF	Principal Chief Conservator of Forest
PIRSA	Primary Industries and Resources South Africa
PM	Program Management
PoC	Push to talk on Cellular (Mobile)
WDP	Watershed Development Plan
SADC	South African Development Committee
SFI	Statistical Forest Inventory
SASSI	Southern African Sustainable Seafood Initiative

Executive Summary

Earlier driven mainly by economical considerations, management practices for forests, an important renewable resource, must now take into cognisance the interconnectedness of, and the need to balance, the environmental and economic benefits that forest ecosystems can potentially generate.

Forestry in India distinguishes itself from that in other countries in that there is a tremendous influence of anthropogenic factors on forests in this country owing to a high population pressure. This implies that any decision-making in the sector is necessarily a multi-dimensional exercise that has to respond to the requirements of not just ecology, but also of socio-economic challenges. In India, forests, in the most part continue to be not just degraded, but also fragmented. These twin factors of population pressure and fragmentation distinguish forests in India from most other areas of the world.

In Punjab, with about 6% of the geographical area classified as forests, large tracts continue to have ownership outside the department, though the latter still has a decisive say in how these areas are managed. Fragmentation of forests in the state is severe with substantial forest areas existing as "strips". Naturally, therefore, practices that may be appropriate for the State may be quite different from what would be proper in other places.

Innovation and efficient management being the key, this puts a premium on the adoption and usage of Information and Communication Technologies (ICT) towards better management and conservation of the forest and wildlife resources of the state, besides bringing about better levels of internal efficiencies and effectiveness in the working of the Punjab Forest Department.

ICT must be constructively used in the preparation of long-term plans for the department, keeping a record of plantations and their development, Joint and Community Forest Management initiatives, forest inventorying and estimating the growing stock in the state, tracking forest offences in the state, facilitating production and sale/disposal of forest produce (including Non-Timber Forest Produce) and generally help in the planning, execution, monitoring and evaluation of projects and programmes being taken up in the state.

Best practices can be defined as the most efficient (least amount of effort) and effective (best results) way of accomplishing a task, based on repeated procedures that have proven themselves over time for large numbers of people. Sharing of best practices gives us many advantages including avoidance of mistakes that have earlier been committed, pre-empting of threats even before they arise and the like. Best practices covered in the document span three important areas- (a) Best Practices in the usage of ICT for Forestry and Wildlife, (b) Best Practices in the usage of ICT as a tool for Community Engagement, and (c) Best Practices generally relevant for automation in the department.

Best Practices in the usage of ICT for Forestry and Wildlife

In line with the division of activities in the DFWP, while studying the best practices, the same have been categorised into three broad areas: Sector Management (or a more efficient management of the existing set of activities of the sector), Sector Development (or the taking up of activities to grow and expand the sector, and Sectoral Collaboration (or the collaboration among the stakeholders in the sector and beyond it). The best practices thus compiled and studied have each been examined on grounds of their desirability and feasibility for their appropriateness to the forests and wildlife in the state of Punjab. These best practices have been taken not only from different parts of the country but also from several other areas of the world.

A couple of prominent case studies from within the country have also been taken to consider challenges commonly encountered when the department embarks upon computerisation.

Best Practices in the usage of ICT as a tool for Community Engagement

Best Practices have been brought out in this area that will lead to greater transparency and accountability, greater trust in government and stronger government-citizen relationships.

Best Practices for Automation

Automation best practices are those that could be considered for project management, application design and development, database design and development, hardware, communication among stakeholders, invoking appropriate levels for information security, building the right ICT networks and generally in the area of process automation.

Further, best practices covered in the document have been appropriately summarised by the above sections in which they have been covered; the summary could be kept handy by the department during the course of computerisation.

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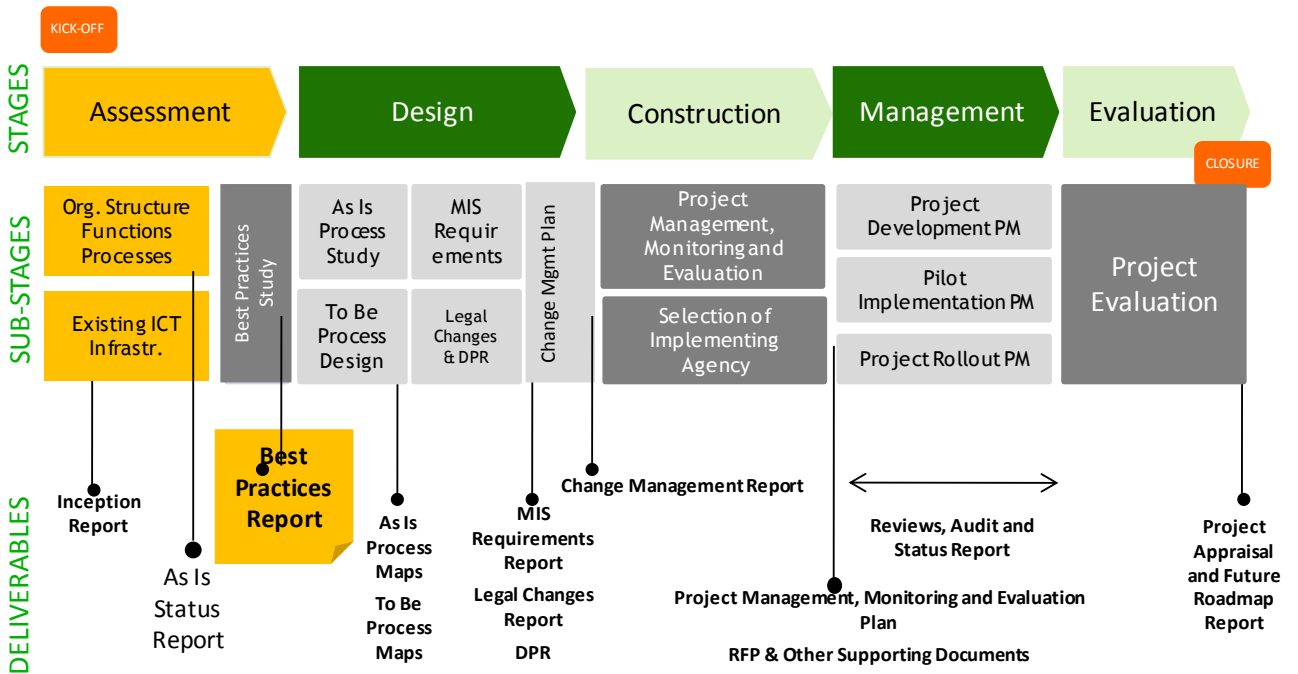
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THIS REPORT IN THE ASSIGNMENT



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1. Context of the Assignment

Forests are important renewable natural resources and have a significant role in preserving an environment suitable for human life. Earlier driven mainly by economical considerations, forest management practices must now take into cognisance the interconnectivity of, and the need to balance, the environmental and economic benefits that forest ecosystems provide.

1.1 FOREST MANAGEMENT IMPERATIVES- THE CASE OF PUNJAB

Forests as a Renewable Resource of Prime Importance in the State

Forests are a renewable resource and perform productive as well as protective functions. Apart from providing various products, forests reduce soil erosion, regulate the flow of water, control floods, moderate climate, increase rainfall and enrich genetic reserve of flora and fauna. Forests play an important role in improving the quality of environment.

Forest Sensitivities in India

In India, particularly, forestry distinguishes itself from that in the other countries in the following main ways:

- There is a tremendous influence of anthropogenic factors on forest management in this country owing to an inordinately high population pressure that forests face;
- Despite of the rich biodiversity heritage of this country, the enormous population pressure means any decision-making in the sector is necessarily a multi-dimensional exercise that has to answer to the requirements of not just ecology, but also of socio-economic pressures; and
- Despite the vast areas the country is endowed with and the significantly high percentage of forest areas themselves (nearly 19%), forests, in the most part continue to be

not just degraded, but also fragmented. To that extent, therefore, it is hard to get forest areas that are relatively undisturbed.

Forests in Punjab

With over 6% of the state's geographical area as forests, substantial tracts of areas outside forests where tree planting is taken up, and the larger need to balance the requirements of conservation and development in Punjab, the importance of forests in the socio-economic development of Punjab cannot be overemphasized. Forests in the state span many forest types including the Tropical Dry Deciduous, Tropical Thorn and Sub-tropical Pine Forests, in addition to other specialized forest types. Additionally, wildlife areas taken together with the forests, present a mosaic of habitat types in the state.

Threats to the forests in Punjab

The forest areas in Punjab are however, under serious threat due to a number of factors. Whereas prior to the 19th century forests were protected by local rulers, vegetation cover started declining due to unrestricted felling and over grazing when these areas were transferred to villages. Subsequent enactment of the Punjab Land Preservation Act, 1900 provided power to the government to temporarily regulate, restrict or prohibit certain activities in forest areas and take up reforestation and soil conservation programmes. However, poor enforcement of the Act has led to deterioration of forests in Punjab.

Further, large displacement of population and its re-settlement in the wake of partition of Punjab also lead to diversion of large tracts of forest areas for habitation and agriculture and causing land degradation in general. Forests in the state are distinguished not just by their "patchy" nature, but also by the extent of anthropogenic pressures being faced owing to

the dependence of large sections of the population on the forests.

Steps to Reduce People's Dependence on Forests

To reduce this dependence, there is therefore an urgent need to take various measures like afforestation, check on overgrazing, better water management, rotation of crops, keeping the land under vegetation cover, adoption of dry farming, construction of wind brakes, extension of irrigation facilities, etc by the government and people of the state to overcome the problem of land degradation.

Sustainability of the Forest Ecosystem

Sustainability of forest ecosystem is an essential component of the environmental conservation efforts and any degradation of forests will have an adverse impact on various systems such as water resources, agriculture, biodiversity, environment, climate and human health, besides, the subsistence living of tribal and other communities living in and around forest areas. Therefore, the functions with respect to conservation of soil, water and biodiversity are vital for the welfare of present and future generations.

Balancing the Requirements of Conservation and Development

Today, balancing the requirements of conservation and development is an enormous challenge facing the state of Punjab. In particular, it is felt that the forestry sector, impacted by the course of events in other sectors and the pressures of development and high economic growth, cannot continue to do forest management in traditional ways anymore.

The National Forest Policy and the need for Innovative Ways

The National Forest Policy, 1988, farsightedly talked of creating a massive people's movement towards better managing our forest resources,

and of new and innovative ways to manage forests. Forest managers, therefore, must be in a position to undertake quick but comprehensive assessment of the current state of resources, the extent of impact being faced owing to pressures from multiple sources, anticipate likely emerging trends, and empower themselves with multi-dimensional data to chalk out informed ways of making wholesome progress in the conservation and management of forests and wildlife in the state.

The Need for Information and Communication Technologies

Among other things, this puts a premium on the adoption and usage of Information and Communication Technologies (ICT) towards better management and conservation of the forest wildlife resources of the state, besides bringing about better levels of internal efficiencies and effectiveness in the working of the Punjab Forest Department.

ICT must be constructively used in the preparation of long-term plans for the department (for both forestry and wildlife areas), keeping a record of plantations and their development, Joint and Community Forest Management initiatives, forest inventorying and estimating the growing stock in the state, tracking forest offences in the state, facilitating production and sale/disposal of forest produce (including Non-Timber Forest Produce) and generally help in the planning, execution, monitoring and evaluation of projects and programmes being taken up in the state.

In addition to the above, ICT must also be decisively used to bring about better levels of internal efficiencies and effectiveness through process re-engineering and ICT-enablement of all internal processes of the department.

The eGovernance Initiative of the Punjab Forest Department

In deference to the above considerations, the Punjab Forest Department has embarked on an ambitious initiative that is aimed at (a) bringing about better levels of internal efficiencies and effectiveness in the working of the department, including the ability to take decisions in a multi-dimensional environment, (b) extending better citizen-centric services to the customer, (c) making an appropriate and effective use of ICT to take well-informed forest management decisions, and (d) use the modern-day channels of communication to bring about better levels of awareness, in particular, and sensitisation to conservation issues in general.

1.2 BEST PRACTICES AND THEIR IMPORTANCE

Wikipedia defines a Best practice as a technique, method, process, activity, incentive or reward that is believed to be more effective at delivering a particular outcome than any other technique, method, process, etc. The idea is that with proper processes, checks, and testing, a desired outcome can be delivered with fewer problems and unforeseen complications. Best practices can also be defined as the most efficient (least amount of effort) and effective (best results) way of accomplishing a task, based on repeatable procedures that have proven themselves over time for large numbers of people.

Sharing of best practices or at least having them before oneself particularly accords us the following advantages

- Sharing best practices often helps sharing information, experiences, resources and expertise that were once used successfully and which can be done successfully again;
- Such sharing often helps in avoiding the repetition of mistakes that have earlier arisen thus saving us precious resources the next time; learning from someone else's

mistake is better than learning from your own;

- Sharing best practices also gives people the extra doze of confidence required before they begin any piece of work particularly if the practice has been tried successfully before; and
- Conversely such sharing also gives us the opportunity to counter any threats to following a particular practice from other quarters and helps build credibility.

2 Best Practices in ICT for Conservation

This section is split into two parts: the first part presents categories into which best practices could be put, and the second one lists the practices in the different categories presented in the first part.

2.1 CATEGORISATION OF BEST PRACTICES

For purposes of categorization we classify the different activities that could be taken up by the department into the following broad classes, as explained below

- Sector Management;
- Sector Development; and
- Sectoral Collaboration.

SECTOR MANAGEMENT

Sector Management includes within its ambit all activities that are geared towards the management of natural resources in a better way. In other words, this would imply conducting the existing set of activities of the department more effectively and efficiently.

As such, sector management would therefore include all interventions that are geared towards the performance of the department's existing set of activities more efficiently and effectively, bringing about higher levels of customer service, promoting higher levels of transparency and accountability in the department's operations.

SECTOR DEVELOPMENT

Sector development would include in its scope all interventions that are aimed at promoting the cause of conservation through taking up more activities than is actually the case, bringing about higher levels of awareness among the people for the environment, taking up research and educational interventions among the people and the like.

SECTORAL COLLABORATION

Forestry and wildlife as a subject can no longer be seen in isolation particularly in India where conservation and development are so inextricably intertwined. There is obviously no gain saying the fact that collaboration among all stakeholders is the need of the hour, and ICT presents possibilities and opportunities that were hitherto not available.

Sectoral collaboration, therefore, would include all activities that promote the working together of stakeholder groups not only within the conservation sector but also between this sector and other sectors outside.

2.2 SELECTION OF BEST PRACTICES CONSIDERED

This section covers the best practices we have considered categorized into the different categories mentioned above.

2.2.1 Sector Management

Best Practices in Sector Management are as covered below.

2.2.1.1 Inventorying Forest Resources

Inventorying of forest resources is critical to forest management since it is only then that foresters can know exactly what prescriptions need to be made for planned interventions. Resources inventory not only reflect the species composition and density and their growth (or decay) with time but also highlight any biotic or abiotic impact the area could be suffering from. All these would not only project the forest wealth contained but would also inform foresters with interventions that would be required.

BEST PRACTICE NO. 1: FOREST RESOURCE INVENTORY IN VICTORIA, AUSTRALIA¹

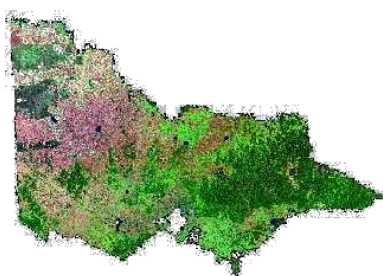
The Statewide Forest Resource Inventory (SFRI) in Victoria, Australia, is a systematic inventory of the

¹ Department of Sustainability and Environment, Government of Victoria, Australia, www.dse.vic.gov.au, accessed October 2009.

native forest on public land in Victoria. The mapped characteristics of the forest are:

- Species: Name and proportions in which they occurred;
- Crown cover: The ground area covered by tree crowns;
- Crown form: Four forms representing different stages of growth; and
- Height: Average height of the most abundant crown form.

State forests were generally mapped for all the above characteristics to derive growth stage as well as a basis for stratifying the forest for volume sampling. National Parks and other reserves were mapped for growth stage (crown cover and form) only. In addition, evidence of disturbance (harvesting or fire) was noted, and a code for damage due to biotic factors was also instituted.



All stand maps were transferred to a geographic information system (GIS) for storage and analysis. Detailed field measurements

(Ground Truthing) were then made in sample plots established in productive stand classes. Sample plots were established to collect tree numbers and species, and the innovative TREEMAP stem profiling technique was used to record tree dimensions, stem features and information about tree hollows.

Using these and historical data, models were developed to estimate growth and yield. Tree ring analysis was used to collect age and growth information for stands of unknown age, providing data for yield curves in the mixed species forests. From these data, timber volume and sustainable yield were calculated.

BEST PRACTICE NO. 2: FOREST RESOURCE INVENTORY FOR PROMOTING LIVELIHOODS IN UKRAINE²

Transcarpathia, the southwest region of the Ukraine, has the majority of its population living in narrow lowlands in the south of the region along the Tisa

River. This includes the Nizhniy Bystriy municipality and watershed, about 60 kilometers north of the regional centre of Khust. Despite the fact that the mountains to the north of this region contain enormous amounts of natural resources, which can potentially be used to raise the living conditions of local inhabitants, many people from Nizhniy Bystriy travel annually to western European countries or to Russia for seasonal work. This is because local businesses and infrastructure are not sufficiently developed to tackle the area's high unemployment rate.

To address this concern, the Swiss-Ukrainian Forest Development Project (FORZA) helped establish principles for well-functioning rural communities by designing the Watershed Development Plan (WDP). Part of WDP is the Statistical Forest Inventory (SFI) that assesses the potential of natural resources in a watershed. In July 2005, to determine whether the mountains contained enough quality timber to help grow the area's economy, an inventory was carried out by the Institute of Forest Ecosystem Research, Ltd. (IFER), in the 5,685 ha Nizhniy Bystriy watershed. IFER is an independent forest research institute located in Jilove u Prahy, the Czech Republic. As a first step toward designing the network of SFI plots, IFER used global Internet GIS data sources to obtain data needed to define the watershed and estimate the forest cover. IFER used ArcInfo and IFER's FieldMap, a forestry application based on Map Objects, to create the SFI in Nizhniy Bystriy. The Khust forest enterprise, which is responsible for the Nizhniy Bystriy watershed, is equipped with an ArcGIS workstation, allowing data gathered before or during SFI fieldwork to be used later by forest managers for further analysis and database building.

The forest area was derived from Landsat satellite imagery. They classified the imagery by combining supervised and unsupervised classification methods with ArcInfo. Using these methods, it was possible to get basic information about the study area even before coming to the Ukraine. IFER performed the SFI measurements on a large number of relatively small inventory plots. The network of SFI plots was designed to representatively cover the area, but at the same time, the plots needed to be accessed with minimal time loss. Plots were grouped in clusters of five, and these clusters, which covered local altitude gradient, were equally distributed in the forested area of the watershed. IFER visited 200 plots during the field campaign, subjecting 2,249 trees to

² ESRI GIS Best Practices

detailed biometrical measurements. Using field map technology, they stored the field team data in shape files directly in the field.

2.2.1.2 MULTI-LAYERED FOREST MAPPING FOR MULTI-DIMENSIONAL PLANNING

Remote sensing and GIS could be adopted for resource mapping, database generation, analysis and information extraction. MIS could be used for physical and financial progress monitoring and decision making. These technologies, in an integrated form, could be a very valuable tool for effective and efficient project planning, implementation and management.

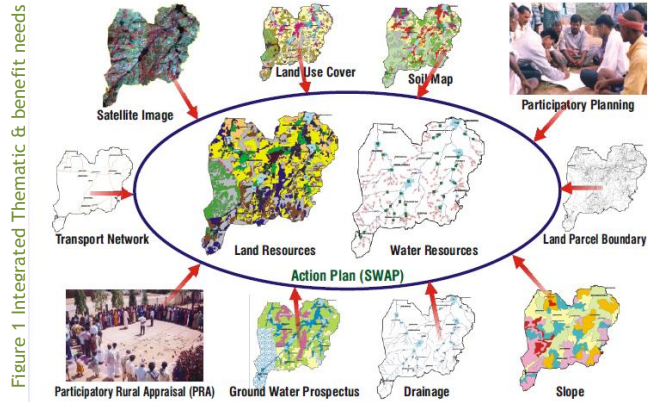
BEST PRACTICE NO. 3: INTEGRATION OF REMOTE SENSING, GIS, SATELLITE COMMUNICATION AND MIS FOR SUJALA WATERSHED PROJECT IN KARNATAKA³

Sujala Watershed is a Government of Karnataka initiative to develop a community driven participatory watershed development program. The Govt. of Karnataka used the remote sensing technology, satellite communication, GIS and MIS applications in an integrated manner to successfully implement the project.

- **Application of Remote Sensing and GIS:** The high-resolution satellite data was used to generate resource maps. These maps were then integrated with other non-spatial data like demography, rainfall, literacy etc. in GIS domain. Both RS and GIS were effectively utilized to derive critical information such as Watershed characterization, prioritization, inventory & assessment of natural resources, wasteland mapping, potential zones, run off estimation, action plans, site selection, monitoring and evaluation. These technologies were then used to generate maps:
 - Resources maps
 - Soil map
 - Ground water prospect maps
 - Drainage maps
 - Slope maps
 - Transport network and settlement map
 - Cadastral map
 - Land use/ Land cover map

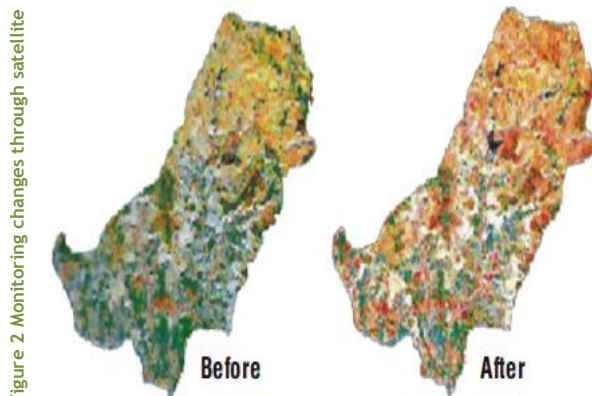
³ Use of IT in Sujala Watershed Project - N. C. Muniyappa (IAS), Project Director, Sujala Watershed Project.

- **Integration of Thematic and Beneficiary needs for Watershed Action plan:** Locale specific action plans for sustainable development of land and water resources were generated by integrating thematic information (soil, slope, land use, ground water prospects etc.) generated using Satellite data along with collateral information and socio-



economic inputs such as community needs, survey numbers etc.

- **Repetitive coverage of satellite data to monitor changes:** repetitive coverage provided an opportunity to monitor the changes that occurred over a period of time due to various interventions and



its impact on environment. Satellite data acquired before, during and after the implementation were observed for changes.

- **Satellite communication for capacity building of rural masses:** training programmes were imparted to rural people using satellite communication. Two ways audio and one way video broadcast was made through satellite media to five districts simultaneously from Mysore. Additionally, audio conferencing is conducted fortnightly to monitor the progress.
- **SuKriya Nakshe:** This GIS enabled solution depicts information related to where, what, when on

cadastral map in a user friendly manner. It allows about 150 different types of activities to be depicted at ground level for help in preparation of action plans.

2.2.1.3 Forest Fire Management

Keeping track of fire control resources, dispatching them to priority areas, and maximizing communication with staff are essential for effective and efficient wildfire containment. A Fire Management System is required to address the increasing need to improve coordination among during fire control operations. Staff in each of the fire centres activates the resources for fire control. Information can also be collected from other sources to confirm their position and status.

BEST PRACTICE NO. 4: FIRE ALERT AND MESSAGING SYSTEM IN MADHYA PRADESH, INDIA⁴

Modernisation of forest management using Information Technology by the state of Madhya Pradesh has been lauded at national level. The forest department of Madhya Pradesh has been selected for silver medal for innovative use of technology in e-governance for Fire Alert and Messaging System.

The forest department of Madhya Pradesh has all territorial and wildlife branches linked to 460 ranges through Internet at the Data Centre. As many as 52 centres have been set up in remote areas with the help of Edusat system of ISRO for providing training in I.T. to the officers of the department. Entire forests, one third of state’s area, are digitized.

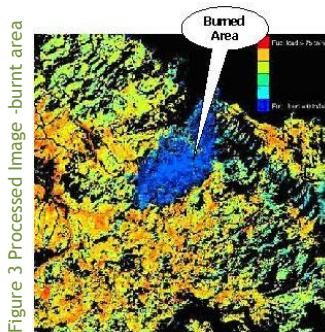
Fire alert and messaging system is a small but very useful computer program which combines GIS & MIS technologies. It uses processed remote sensing data of active fire locations obtained from MODIS satellite and sends alerts to concerned field staff from Beat Guard to CF through Short Message Service (SMS) and e-mail. It also builds the 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

⁴ Department of Public Relations, Madhya Pradesh, India, www.mpinfo.org, accessed October 2009

about correctness of alert locations, extent of fires and also the gap time to attend the fire for control⁵.

BEST PRACTICE NO. 5: FOREST FIRE MANAGEMENT AND FIRE PREVENTION SYSTEM (FOMFIS)⁶

The FOMFIS is an integrated computerized system based on semi-automated satellite image processing, socio-economic risk modeling and probabilistic models and serves as a tool for forest fire prevention and management.



FOMFIS has been devised at three of the most challenging regions of Mediterranean basin for forest fire planning and management viz. Galicia (Spain), Evia Island (Greece) and Aquitaine (France).

The system embraces several operational modules according to the most frequent user needs in the forest fire services:

- **Internal risk estimation:** It generates internal risk maps from forest fuel distribution, weather, wind patterns and territory information. This could help to estimate the destruction potential of forest fires in advance, thus allowing managers to take preventive actions.
- **Forest fuel mapping:** Satellite images are used to obtain fuel maps as these images are accurate, valid, timely and cost-effective. With the help of a relationship table between vegetation classes and parameterized fuel models, geographical distribution of fuel is obtained.
- **Efficiency-oriented Fire defense service planning:** Forest defense efficiency, in simplified terms, is the minimization of time involved in the operations such as fire detection, communication, resource preparation, transport, resource deployment and fire extinction & control.



⁵ ICT Initiatives in the Madhya Pradesh Forest Department, Anil Oberoi, APCCF, 2009

⁶ D.KALLIDROMITOU, MARC BONAZOUNTAS, PETROS PAPACHRISTOU, DAVID CABALLERO: Forest Fire Management & Fire Prevention System ; www.epsilon.gr accessed October 2009

This system uses spatial analysis (using raster maps vs. vector coverage) to calculate access time of ground vehicles. With this ground 'impedance map' and iterative automata (following minimum-time path) it is possible to derive accumulated time access map. The resulting map stores the time invested in travelling from a given point to every cell. Aerial coverage is estimated by directly considering distances to airbases and average speed of aircrafts. The resulting map is combined with ground access to estimate real coverage of fire fighting resources. Together with estimation of access time to fire area, these maps are used to calculate efficiency of fire vehicles in their water re-charging cycles to the nearest water point.

- **Probabilistic fire scenario generation:** The fire scenarios evolution, fire defense resources and infrastructures planning are used to simulate their interaction over time and to estimate costs of operations and losses due to wildfire destruction.

BEST PRACTICE NO. 6: WILDLIFE FIRE INFORMATION SYSTEM⁷

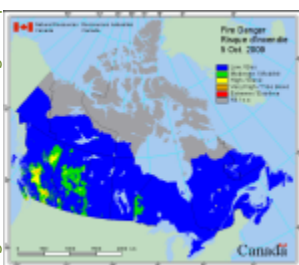
The Canadian Wildlife Fire Information System (CWFIS) is a computer-based fire management information system that monitors fire danger conditions across Canada. It collects daily weather conditions across Canada and produce fire weather, fire behaviour maps and hot-spot maps.

A hotspot is a satellite image pixel with infrared intensities typical of burning vegetation. A hotspot may represent one fire or be one of several hotspots representing a larger fire. Satellites are used to detect fires.

The CWFIS employs the following systems:

- **Canadian Forest Fire Danger Rating System (CFFDRS):** Risk, weather, fuels, and topography provide the necessary inputs to predict fire weather, fire occurrence, and fire behavior. Fuel moisture models are currently being developed for a range of Canadian forest types. Together, these systems predict the potential fire danger within the forest.
- **Canadian Forest Fire Weather Index (FWI)**

Figure 5 CWFIS Fire Danger Map



⁷ Canadian Forest Services - Natural Resources Canada, Govt. of Canada; <http://cwfis.cfs.nrcan.gc.ca> accessed October 2009

System: It consists of six components that account for the effects of fuel moisture and wind on fire behavior. Calculation of the components is based on consecutive daily observations of temperature, relative humidity, wind speed, and 24-hour rainfall. The six components provide numeric ratings of relative potential for wild-land fire.

- **Canadian Forest Fire Behavior Prediction (FBP) System:** provides quantitative estimates of potential head fire spread rate, fuel consumption, and fire intensity, as well as fire descriptions. With the aid of an elliptical fire growth model, it gives estimates of fire area, perimeter, perimeter growth rate, and flank and back fire behavior.
- **Fire Monitoring, Mapping and Modeling (Fire M3):** Fire M3 uses low-resolution satellite imagery to identify and locate actively burning fires on a daily basis, to estimate annual area burned and to model fire behavior, biomass consumption & carbon emissions from fires.
- **Atmospheric Dispersion Index (ADI):** ADI is a numeric rating of the atmosphere's capability of transporting pollutants away from their sources. Surface and rawinsonde (weather balloon) observations are used to collect information about atmospheric stability, the mixing height and the mean wind within the mixing layer (transport wind vector). Upper air conditions are observed every 12 hours at stations much farther apart than surface stations.

BEST PRACTICE NO. 7: FIREHAWK⁸: DETECTING FOREST FIRES IN SOUTH AFRICA

The Firehawk system consists of a network of eleven digital video cameras mounted on masts up to 72 metres high. The cameras record live video images of their surrounding area, completing a full 360° scan in less than four minutes. Each camera covers a radius of 6 to 8 kilometres but, visibility permitting, can detect a fire up to 20 kilometres away.

The live video images are transmitted via microwave antennae to Operations Centre at Kwambonambi, which can be up to 65 kilometres away. There, the images are analyzed by sophisticated Firehawk software that can distinguish between fire, smoke and glow, and automatically raises an alarm.

What makes the Firehawk system so valuable is its highly interactive nature - ZFPS operators are not

⁸ ICT Update, issue 19, July 2004, Forest Management

required to wait passively for incoming information. Each Firehawk camera is equipped with a radio receiver that allows the operator to manipulate it remotely without affecting other cameras in the system. Thus, using the video control panel, the operator can pan and tilt each camera in any direction and zoom in on any area of concern.

Moreover, the Firehawk software is linked to a geographic information system (GIS) database that provides operators with additional information about the area under surveillance. For example, at the touch of a button,



Figure 6 Camera mounted on masts

any fire can be cross-referenced from different cameras to determine its exact coordinates. The GIS maps are also used to identify the fastest or safest road to access the fire.

2.2.1.4 Support Function Automation

Apart from core forestry functions, there are support functions within Forest department which are critical for facilitating sector management. These functions are employee management, budget and finance management of the agencies, scheme management, file movement etc. These form the bedrock of internal efficiency and effectiveness in the department.

BEST PRACTICE NO. 8: FOREST FINANCIAL MANAGEMENT SYSTEM, MADHYA PRADESH⁹

The project involved design and development of an application for automating various routine processes, activities and functions related to budget receipt, allocation and financial transactions related to receipts and expenditure being carried out by various wings/units of the forest department. The project is being implemented at various wings of the Forest Headquarter, 16 Forest Circles, 62 Divisions, 129 Subdivisions, 450 Sub-DDO Offices, and 362

⁹http://www.nic.in/nicportal/Madhyapradash_Project.html
accessed November 2009

ranges. The application has been modeled as a workflow system and is simulates real life functioning of the department and is fully compliant with MP Forest Financial Rules.

The modules include Expenditure Management, Online examination/passing/pre-passing of vouchers by competent authorities, Revenue Management, etc. It may be considered as a flexible solution for the implementation of real life processes and procedures for the preparation of Cash-book and various monthly abstracts.

2.2.2 Sector Development

With production forestry receding into the background, forests in the state are increasingly managed for conservation. In this endeavor, activities can no longer be carried out in the same fashion as earlier. Not only are new activities required to be taken up through innovative approaches and research, stakeholders too have to be sensitized to the importance of conservation through educational and extension activities. Sector development has been defined for the purposes of this report to constitute this set of interventions as described above.

2.2.2.1 Alerting Citizens to Conservation Breaches

Popular perspective towards democracy calls for the direct participation of citizens and stresses its importance in strengthening the Government policies and programs. Today, conservation imperatives are getting increasingly compromised for development. Since law enforcers cannot possibly be exactly at the places where instances of breach are taking place, it is important that citizens themselves are aware of what conservation requirements are at the ground level at which they operate. This would not only enhance adherence to laws and rules laid down for the purpose, but would also free staff from such routine engagements.

BEST PRACTICE NO. 9: ALERTING CITIZENS (CONSUMERS) TO ENDANGERED SPECIES¹⁰

The Southern African Sustainable Seafood Initiative (SASSI), a project of the World Wildlife Fund South Africa, condensed available research on local fish stocks into wallet-sized cards and organized species into three color-coded categories:

- Green for species that were not over-fished;
- Orange for fish that were legal to sell, but where stocks are jeopardized; and
- Red indicating fish those are illegal to buy and sell in South Africa.

With the collaboration of information Technology Company, SASSI moved this system to a mobile platform called FishMS, enabling a wider group of consumers to access more regularly updated data. The FishMS is a text messaging-based service that provides point-of-sale information about the impact of fishing on fish stocks, enabling consumers to make informed choices about the seafood they purchase.

With this system a citizen standing at a fish counter in his local supermarket texts the name of a fish to a phone number. Within seconds, he would receive back information via a short text message informing him whether the fish is legally and sustainably harvested, and advise him whether “to tuck in, think twice or avoid completely.”

This system helps the Government to curb the illegal selling through the participation of buyers.

BEST PRACTICE NO. 10: MOBILIZING THE PUBLIC FOR ENVIRONMENTAL PROTECTION¹¹

The Forest Law, Argentina’s first federal forest protection act, was passed in 2007. It includes a one-year moratorium on clearing native forests, giving the forest service time to develop appropriate forest management regulations. The law, funded in part by an export tax on genetically engineered soy, also establishes public hearings and environmental impact studies.

Greenpeace was able to effectively advocate for the Ley de Bosques by building a large database of supporters. Through a form on the organization’s website, individuals were asked to sign a petition supporting the Forest Law, and submit both email

¹⁰ Wireless Technology for Social Change: Trends in Mobile Use by NGOs, United Nations Foundation & Vodafone Group Foundation, 2008

¹¹ Ibid

addresses and mobile phone numbers. About 300,000 phone numbers were collected from this web form, and an additional 50,000 were collected via other means, such as email or through volunteers stationed on busy streets. This 350,000-number mobile phone list is one of the larger active mobile phone lists used in advocacy today. By the end of the campaign, over 1.5 million people had signed the petition supporting the Forest Law.

Greenpeace used their mobile phone network in several ways. The organization collected about 3,000 signatures for the petition via text messaging. Greenpeace also sent out text messages asking people to call specific legislators to lobby for the law. Text messages were sent out to specific target audiences, so that people would be directed to their legislator. Finally, Greenpeace used the mobile network to send urgent alerts about other actions or news. Using text messaging for advocacy requires an active list of mobile subscribers who have agreed to receive communications from a campaign. Hernan Pablo Nadal, Greenpeace Argentina’s online organizer, describes how Greenpeace expanded its mobile list: “Two years ago, we had 10,000 mobile numbers. By October 2007 with a lot of outreach, we had 45,000 numbers. With the campaign for the Forest Law we gave signers of the petition the option of giving us their mobile number. As a result, we now have 350,000 mobile activists and 1.5 million people on our list—and a law on the books that protects Argentinean forests.”

BEST PRACTICE NO. 11: COLLEGE STUDENT ATTACHMENT¹²

Three students from the Sandakan Industry Training Institute were attached to the ICT Division of Malaysia for three months for on-the-job training from October to December 2007. They were assigned to the following tasks; basic regular maintenance of computer hardware and peripherals, computer viruses screening, managing the stocks of printer cartridge and stationery, etc.

2.2.2.2 Agro-Forestry

Agroforestry is an integrated approach of using the interactive benefits from combining trees and shrubs with crops and/or livestock. It

¹² Malaysia

combines agricultural and forestry technologies to create more diverse, productive, profitable, healthy and sustainable land-use systems. In agroforestry systems, trees or shrubs are intentionally used within agricultural systems, or non-timber forest products are cultured in forest settings. Knowledge, careful selection of species and good management of trees and crops are needed to optimize the production and positive effects within the system and to minimize negative competitive effects.

Land-use options that increase resilience and reduce vulnerability of contemporary societies are fundamental to livelihood improvement and adaptation to environmental change.

Agroforestry as a traditional land-use adaptation may potentially support livelihood improvement through simultaneous production of food, fodder and firewood as well as mitigation of the impact of climate change. Agroforestry systems in India are one way to address: (i) biodiversity conservation; (ii) yield of goods and services to society; (iii) augmentation of the carbon storage in agro ecosystems; (iv) enhancing the fertility of the soils, and (v) providing social and economic well-being to people. Agroforestry systems in India contribute variously to ecological, social and economic functions, but they are only complementary - and not as an alternative - to natural ecosystems. To promote well-being of the society, management of multifunctional agroforestry needs to be strengthened by innovations in domestication of useful species and crafting market regimes for the products derived from agroforestry and ethnoforestry systems.

A wider definition of agroforestry encompasses a variety of practices, including trees on farm boundaries, trees grown in close association with village rainwater collection ponds, crop-fallow rotations, and a variety of agroforests, silvopastoral systems, and trees within settlements. These systems have been

presented as a solution to rising fuelwood prices in India resulting from increase in demand and decrease in supply of fuelwood due to forest degradation.

BEST PRACTICE NO. 12: REJUVENATING TRADITIONAL TREE SPECIES THROUGH CONVENIENT INFORMATION DISSEMINATION¹³.

Pacific island tree species have, regrettably, been ignored and underutilized for decades. Pacific islanders were among the most self-sufficient and well-nourished peoples in the world, and had built up their agricultural systems around a diverse base of native tree species. Since colonial times, however, traditional agroforestry systems have been cut down and replaced with plantation and cash crops, so that knowledge of local tree species and their many applications has all but disappeared.

Most of the professional literature neglects traditional agroforestry trees, focusing instead on a narrow range of exotic species, many of which are untested in the region, and are difficult to acquire. They could also pose serious threats to island ecosystems in that they are potentially invasive. Nonetheless, farmers have turned away from reliable, 'time-tested' native species in favour of exotics, perhaps because information about them is more widely available.

Agroforestry.net, a nonprofit educational organization, has launched its Traditional Tree Initiative, with the support of the US Department of Agriculture's Western Region Sustainable Agriculture Research and Education (WSARE) programme and the SPC/GTZ Pacific-German Regional Forestry Project. The series of 50 fact sheets will cover the most important tree species indigenous to the South Pacific. Each sheet will provide detailed, practical information on tree products and their uses, intercropping applications, growing requirements and propagation methods.

The fact sheets will be freely available on the Internet and on searchable CDROM, with hyperlinks to 200 agricultural offices, libraries and schools in the region. They will therefore serve two overlapping goals: to record, in a single collection, the nearly forgotten knowledge about the region's native tree species, and to promote the re-adoption

¹³ ICT Update, issue 19, July 2004, Forest Management

of traditional agroforestry systems throughout the South Pacific.

While being aware of the existence of traditional trees is one thing, knowing how to use them is quite another. Even farmers who are aware of the economic benefits of integrating native trees into their farming systems may fail to recognize the ecological advantages. The Traditional Tree Initiative fact sheets aim to address all of these issues.

After surveying agricultural professionals throughout the region, Agroforestry.net decided that fact sheets would be the most appropriate format. The organization asked a group of regional experts to identify the 50 most important underutilized tree species through an email voting process. Leading authorities on traditional and native Pacific island species are currently compiling the species profiles. A panel of 35 academics, producers and other professionals will review their work in the coming months. At the start when a prerelease version of one species profile (*Morinda citrifolia*) was posted on the Agroforestry.net website in October 2003. It was downloaded by more than 14,000 visitors in just six months. Together the fact sheets will create a valuable reference work that may help to restore traditional agro forestry systems that will stand the test of time.

2.2.2.3 Research and Development

Research and development provide the basis for biological and timber inventory, forest management, the silviculture of harvested forests and the development of methods for assessing sustainable forest management.

BEST PRACTICE NO. 13: THE WARRA LONG-TERM ECOLOGICAL RESEARCH SITE

Forestry Tasmania's Division of Forest Research and Development and the state's Parks and Wildlife Service manage the Warra Long-term Ecological Research Site in southern Tasmania. The site provides a focal area for collaborative research in wet eucalypt forests by nine site partner agencies. Over 100 research projects have been conducted at Warra, many of them ongoing; they are progressively documenting the climate, geomorphology, hydrology and aquatic and terrestrial biodiversity of the site, as well as testing the development of sustainable

forest management indicators. The long-term flagship projects at Warra are a silvicultural systems trial, a log decay study, baseline altitudinal monitoring plots, a hydrological program and a set of wildfire time-sequence plots. The findings of these and other, shorter term, projects are directed into forest management. For example, the silvicultural systems trial provided data on variable-retention silviculture that enabled the Tasmanian Government to commit to phasing out clear felling in old-growth forests. Projects on coarse woody debris and its associated biodiversity, along with the wildfire time-sequence plots, inform the management of key structural attributes in production forests at a range of spatial and temporal scales.

Forestry Education and Awareness

In these times of heightened environmental consciousness, it is important that the seeds of and sensitivity to conservation matters are sown early during the formative years of development.

Different agencies are reaching out to their target customer bases using variety of media and methods like publications, treks and tours, and the like. Of particular significance in India is the concept of Wildlife Interpretation Centres which helps visitors to wildlife areas to sensitise themselves to conservation issues.

BEST PRACTICE NO. 14: SENSITIZING SCHOOL GOING CHILDREN TO CONSERVATION IN SOUTHERN AUSTRALIA

The South Australian Government supports programs to develop and deliver forestry education and awareness, principally through the Department of Primary Industries and Resources SA (PIRSA) Forestry and Forestry SA. About 8,000 schoolchildren visit South Australian public forest reserves each year for outdoor and forestry education purposes, mostly by arrangement with forestry staff. Rangers are available to host tours and to work with teachers in giving talks and assisting with other forest education activities.

A dedicated forest education centre has been developed to support some visits. PIRSA Forestry produces Forestry Matters!, a periodically updated, forest education resource about the plantation-based timber industries in South Australia. Forestry Matters is used by teachers preparing for forestry education activities, students researching forestry topics, and others wanting to know more about forestry. Originally developed in 2000, Forestry

Matters has been circulated to all schools in the state and is also available on the PIRSA website.

Visitors to forest reserves can obtain pamphlets from forest information centres or read interpretive signs while in the forest. Forest education and awareness programs are linked to other environmental education programs and are used by government agencies, the forest industry, educational institutions and especially by Forestry SA's Friends of the Forest volunteer program.

2.2.2.4 Community Forestry

Till the 1970s in India the management of forests had a narrow scientific focus accented more towards production and there was indifferent concern for the social development potential for forests and forestry. However, since the National Forest Policy, 1980, there has been a shift in focus, inter alia, in that (a) forest conservation as a theme has assumed predominance, and (b) local communities, for whom forests were traditional sources of income and livelihood, are now required to be involved to address the twin goals of conservation and poverty alleviation.

BEST PRACTICE No. 15: PARTICIPATORY FOREST MANAGEMENT IN SOUTH AFRICA¹⁴.

The Chief Directorate Forestry within the Department of Water Affairs and Forestry has undergone a re-orientation and transformation process in line with the current South African democratic principles, policies and evolving international trends.

The Chief Directorate has been considering local people's forestry based needs, their role in forest management and is empowering them through sharing decision-making over forest resource utilisation.

As a first measure in addressing the newly adopted departmental approach of PFM, workshops were held throughout the region to introduce the local communities to this aspect of service delivery. Contributing to the success of the workshops was the involvement of the South Cape Business Centre, a

non-governmental organisation (NGO) specialising in empowerment of previously disadvantaged communities. The local communities expressed interest in getting involved in the management of forests in their localities and to derive any possible benefits from such management.

ADVANTAGES OF THE WEB OVER TRADITIONAL' METHODS OF COMMUNICATION

- **PERMANENCE:** web-based services are available 24 hours per day end
- **IMMEDIACY:** information may be discovered when needed, without significant delay
- **CONTENT:** text, images, databases, video and sound can all be integrated into a web site—the chief barrier to the design of web-based services is the human imagination
- **ACCESSIBILITY:** anyone with a web browser can access web-based services with little or no training;
- **OWNERSHIP:** decentralised approaches can ensure that agencies maintain full rights and ownership of the information they provide to a web site, modifying it as desired, and
- **VALUE FOR MONEY:** considering the features listed above, the development of a web site is an extremely low-cost solution

As a means to promote more community participation in indigenous forest management, PFM Forums, comprising the local communities and DWAF staff were set up on all forest estates. Procedures for approval of PFM projects, and criteria for project selection/approval and formulation of standard project proposals/business plans were also agreed upon.

Forums have been established on all three estate (Farleigh; Diepwalle; Tsitsikamma) with communities deriving tangible benefits in the form of skills development, training in business skills, as temporal and permanent employment in the tourism industry. However, it is also felt that DWAF must play a more pro-active role in identifying and initiating forest based enterprises.

¹⁴ Department of Water Affairs and Forestry, Government of the Republic of South Africa, 2008

2.2.2.5 ICT IN FORESTRY EDUCATION

Educational institutions today are confronted with the challenge of finding innovative ways to attract and retain students and to improve course quality and flexibility. They are also required to improve efficiency, increase graduates' success in the labour market and create new streams of revenue. In addition, with changing roles of forests worldwide, a newly graduated forester needs a variety of non-traditional skills. Internet-based or online learning, integrating communication tools, can open new avenues to provide for and facilitate existing forestry and natural resource management education worldwide.

BEST PRACTICE NO. 16: INTERNET-BASED LEARNING IN FORESTRY- EXAMPLES FROM GERMANY AND SOUTH AFRICA¹⁵

Internet-based or online learning, integrating communication tools, can open new avenues to provide for and facilitate existing forestry and natural resource management education and awareness.

Forest Ecology Online is one of the few Internet-based learning in forestry, online courses initially developed at the Institute of Soil Science and Forest Nutrition, Faculty of Forest and Environmental Sciences, University of Freiburg, Germany. To respond to changing career paths of graduates, a major curriculum revision was carried out in 1994, including a reduction in the number of hours allocated to the basic sciences in the initial years of study.

However, it became evident that first-year students had different levels of basic knowledge. To solve this dilemma, Internet-based learning modules for independent study have been under development since 2000 to complement traditional courses. Courses within Forest Ecology Online range from soil science and forest botany to biometrics. Forest Ecology Online uses the open-source content management system ILIAS. Course units are based on

¹⁵ Internet-based learning in higher forestry education: Opportunities and limitations of online learning in forestry and natural resource management, with examples from Germany and South Africa, D.W. Längin, P.A. Ackerman and S. Lewark, Food and Agriculture Organisation (Forestry Department), 2009

HTML, using graphics, complex animations and interactive exercises.

Forest Ergonomics Online is a blended-learning course developed within a joint research and development project of the University of Stellenbosch, South Africa and the University of Freiburg. This two-week course was offered in July 2003 to forestry students at Freiburg and from Eastern European faculties. The Web-based course material was combined with a half-day face-to-face introduction and a field trip at Freiburg; a “virtual” field trip enabled the Eastern European students to do time study measurements without actually visiting the forest.

Discussion groups and regular chat sessions contributed to a strong interactive component, facilitating communication between resident students and those accessing the course from Eastern European countries. This remained the principal strength of the course. Students were required to work independently through eight core modules and recommended additional reading. They were encouraged to use a self-test function to control and monitor their progress. Students were also required to complete assignments based on their self-study, and these assignments were discussed and analysed during subsequent chat sessions.

2.2.2.6 ICT IN HUMAN RESOURCE MANAGEMENT

The human resources of the department are spread over multiple locations and hierarchies across the State. They are geographically dispersed into even the remotest places of the state. Delivering services to them and updating their information in records thus becomes quite challenging and time consuming. ICT tools can ease the process to a significant extent both for the Department as well as its employees.

BEST PRACTICE NO. 17: TRANSFORMATION OF HUMAN RESOURCE MANAGEMENT BY SCOTTISH GOVERNMENT¹⁶

The Scottish Government wanted to transform the way it handled management of its employees who

¹⁶ <http://whitepapers.zdnet.com> accessed on November 2009.

were providing key services such as healthcare, education, justice and transport to over five million people. It had an employee base of 8000 core employees and 1700 contractors and staff seconded from government-related agencies. Its aim was to

- Standardize processes while giving employees greater control over day-to-day HR issues and longer-term career development;
- Streamline all processes throughout the hire-to-retire lifecycle; and
- Reduce administration, improve efficiency, and cut costs.

The Government brought in the transformation with the help of ICT tool in the form of well established software package and process standardization as well as empowerment of employees to perform self-service. Briefly, it included:

- Implementation of HR software package for intuitive self-service interface, greater user configurability, and workflow-enabled process flows by linking HR actions to life events;
- Consolidated data of each employee in a single record to gain an accurate, up-to-date view of human capital assets;
- Relocated staff from multiple HR teams used by the Scottish Government and agencies to a shared-service HR center of excellence operating a single, consistent set of procedures;
- Empowering employees and devolving responsibility to them for leave and sickness management;
- Giving government the ability to track staff training and tool to ensure that skills are in place to meet organizational objectives; and
- Interfaced specialist third-party payroll, staff directory, and flexi-time applications with new system to ensure seamless, end-to-end HR processes.
- Overall the implementation of this software package resulted in automation of various HR processes including the following:
 - **Employee Self Service:** Using the system, employee could update their personal details into the system enabling HR personnel to have access to the upto date information of employees.
 - **Payroll:** Using the self- service interface, employees were able to update their investments for tax exemptions and access their payslips. The system enabled HR personnel to carryout the calculations for generation of pay-slip online and do the onlie fund transfer to employee’s account.
 - **Leave Management:** The self-service

Interface enabled employees to apply for leave online and check the leave balance online. With the work flow system, the approver could approve or decline the leave request online.

- **Induction and Training:** Induction and training module automated the activities like applying for a particular training, nomination of employees for training, training notifications, training feedback, training calendar etc. This system also provided the details of training an employee is supposed to go through after joining a new position. e.g. if an employee is joining the administrative position after working in field, he is supposed to undergo training on administrative functions such as Finance & accounts, budgeting, HR etc.

2.2.2.7 URBAN FORESTRY

Urban forestry is the careful care and management of urban forests, i.e., tree populations in urban settings for the purpose of improving the urban environment. It requires understanding of public attitudes, perceptions, and knowledge, a review of the agents in change, and the expressed needs and concerns of the community. By extension it also encompasses arousing conservational awareness and sensitivity among urban masses.

BEST PRACTICE NO. 18: WILLINGNESS TO PAY MODEL TO ESTIMATE RECREATIONAL VALUE OF URBAN FORESTRY SITE¹⁷

Recreational value of an urban forestry site that is used for tourism/ recreational purpose, Travel Cost Method (TCM) is the most commonly used method by environmental economists. The basic premise of this method is that the time and travel cost expenses which citizen incur to visit a site represent the “price” of access to that particular site. Thus, people’s willingness to pay (WTP) to visit the site can be found out based on the number of trips that they make at different travel costs.

Typically, a questionnaire is administered to citizens, to record details about place of residence, mode of transport used, cost of travel, time spent on travel etc. Information about socio-economic status

¹⁷ e-Review of Tourism Research, Pradeep Chaudhry (IFS) and Vindhya Tiwari, 2008

like occupation, education and household income is also sought. Some pertinent questions on urban greenery, city's parks/ gardens and environmental conservation are specifically asked from respondents and in this way citizens' perception and interest in these fields are obtained.

Using the above data average travel cost per citizen is calculated for different locations of origin. The model is used for estimating number of tourists at different hypothetical entrance fees. This is a measure of average willingness to pay for the recreational benefits provided by the urban parks and gardens of the city based on results derived from sample data.

BEST PRACTICE NO. 19: PROMOTION OF RECREATION POSSIBILITIES PROVIDED BY URBAN FORESTRY IN ESTONIA¹⁸

The Ministry of Environment, Estonia wanted to promote recreational and vacation possibilities provided by forests and other ways in which they can be used by Estonians.

The Ministry used a combination of initiatives for promotion including-

- Wide range of events for various target groups, comprising,
 - Seminars and training sessions organized for forest owners,
 - Events showcasing varied uses of timber,
 - The 'Spring Cup' wood chopping competition,
 - Presentations of forestry-themed books,
 - Excursions, and
 - Entertainment events with an educational bent for children (such as forest quizzes, orienteering games etc);
- Forest week events are organised across the country - including annual spring agriculture and forestry trade fair, new tree planting as part of county events and regional private forest days;
- Estonian parliament hosted a two week exhibition titled 'Get into the Forest' in order to promote economic and cultural heritage role forests play in Estonian society; and
- Wherever possible the forestry-based information event, is connected to other events that are important to the country.

¹⁸ Best practices in Forest Communication, UNECE - FAO Forest Communication Network, June 2008.

2.2.3 Sector Collaboration

It is well-known that better access to forest information would assist policymakers, researchers, forest managers, conservationists, and others in their efforts to address society's needs regarding sustainability of the forest resources. To re-emphasise this, "Improving Access to Forest Information" was formally recognized as a priority by the United Nations Conference on Environment and Development in 1992 when it stated in Agenda 21, Chapter 40 that "existing national and international mechanisms of information processing and exchange, and of related technical assistance, should be strengthened to ensure effective and equitable availability of information generated at the local, provincial, national and international levels."

Organizations should exploit various initiatives for electronic links to support information sharing, to provide access to databases and other information sources, to facilitate communication for meeting broader objectives, to facilitate intergovernmental negotiations, to monitor conventions and efforts for sustainable development, to transmit environmental alerts, and to transfer technical data".

The Internet and, in particular, the World Wide Web ('web' for short) provides a highly effective mechanism for sharing information among a community of agencies and individuals, and is ideal for implementation of electronically-enabled collaboration provided users have appropriate access.

BEST PRACTICE NO. 20: AFRICAN FOREST RESEARCH NETWORK (AFORNET)

The African Forest Research Network (AFORNET) is a network of African forest research scientists. One of AFORNET's main activities is to operate a research grants scheme with the aim of promoting and strengthening individual scientists' research capacity in order to retain outstanding scholars for generating and disseminating knowledge that is relevant to development. The appraisal of the applications by peer reviewers and the Technical Committee are

stringent and competition among applicants is stiff. Grantees submit progress reports and their findings are presented at a final workshop.

Over 140 research grants have been awarded to individuals and groups of scientists of which 51 grants were distributed during the program period 1998-2001. The subjects include forest management, timber and fuel production, forest genetics, agroforestry, biodiversity and socioeconomic studies of utilization of forest resources. Some of the grantees now hold positions of high responsibility in forestry research in their countries and a number of them are presently involved in the AFORNET.

AFORNET has a Board, a Technical Committee, and three regional “nodes.” The nodes have a regional steering committee, a nodal coordinator and national contact persons. These are research officers or university lecturers who engage in the AFORNET network as an integral part of their regular duties.

BEST PRACTICE No. 21: FORESTRY RESEARCH NETWORK IN SUB-SAHARAN AFRICA¹⁹

In reply to the expressed needs and to the requests received from countries, the Forestry Department of FAO and IUFRO-SADC undertook to formulate a regional project framework involving interested countries and sub-regions of Sub-Saharan Africa. The project aims at capacity building, development of collaborative research activities and networking; the ultimate result of the project would be the creation of an association of forestry research institutions in Sub-Saharan Africa, a federating mechanism across language boundaries, which will strengthen and build on sub-regional networks already active such as CORAF in Central and West Africa and SADC-FSTCU in Southern Africa.

BEST PRACTICE No. 22: COLLABORATIVE FOREST MANAGEMENT COMMUNITY-BASED RESOURCE MANAGEMENT IN NAMIBIA

Collective management of resources is happening with the help of ICT in Kasika, in the eastern part of the plain of the Chobe River in the northeast of Namibia. The project aids local people to use GIS to produce detailed colour maps indicating the location of wildlife and subsistence resources. Before the GIS system mapping land use, these communities used hand-drawn maps which posed serious problems to

¹⁹ IUFRO Occasional Paper No. 12, Papers presented at the Global Forest Information Service Side Event-The Third Session of the United Nations Intergovernmental Forum on Forests (IFF 3) Geneva, Switzerland, 3-14 May 1999

the development of tourism, but also that of new subsistence activities, as outsiders had difficulties understanding the maps.

The novelty in the Namibia project is the use of this participatory approach to improve the maps drawn by hand, and matching information from handwritten data cards. Village mapping workshops and meticulous recording allows the integration of local knowledge relating to place names, the localisation of natural resources such as pastures, cropping areas and useful plant species, and locations where wildlife and their movements can be seen. The final GIS maps use as much colour as possible and icons to make them accessible to people with low literacy.

BEST PRACTICE No. 23: COMMUNITY ACCESS TO COMPUTERS²⁰

In Cambodia, new information and communication technologies (ICTs) are almost non-existent outside the major cities. The country’s national ICT policy framework is in its formative stage and is receptive to policy research findings on how to connect poor rural areas. This project is supporting collaboration between the Ministry of Posts and Telecommunications and the Ministry of Commerce, and involving researchers, NGOs, and business in the design of a new approach to achieve universal access to ICTs.

Two pilot projects will introduce innovative wireless technologies, participatory ICT service development, alternative energy use, and local institutional development. Research teams are also supporting the evolution of locally driven cooperative enterprises to manage ICT services for all sectors of the community. A small grants fund is also being established to finance relevant studies by Cambodian researchers.

The lessons learned and recommendations from the two pilot projects along with small grants will contribute to the development of a national universal access policy and action plan, capacity building among Cambodian researchers, and the sharing of experiences with neighbouring Laos, Myanmar, and Vietnam.

BEST PRACTICE No. 24: COMMUNITY ACCESS TO COMPUTERS²¹

²⁰ IDRC in Cambodia, August 2006

²¹ Cambodia Forum ICT Platform Report, Mark Surman, May 2006

The Cambodia Development Research Forum included the prioritisation of joint ICT activities that might be undertaken by the Forum. In addition to a basic online platform that would be a simple, modern, dynamic website and e-newsletter for the Cambodia Development Research Forum that would provide a window into the work of each individual partner and an overview of the Forum as a whole, the top ideas included

- **SIMPLE ONLINE COMMUNICATION AMONGST PARTNERS**, allowing for a simple way for forum members to communicate with each other online including a basic e-mail list with a searchable web archive
- **SINGLE ACCESS POINT FOR CAMBODIAN RESEARCH** as the Cambodia Development Research Online Library that houses locally produced research, especially from forum members; the library would make it easy for researchers and students to find useful research by Cambodians about Cambodia.
- **CHEAPER, FASTER INTERNET ACCESS FOR RESEARCHERS** in the form of (a) forum partners securing a cheaper, better quality Internet access by negotiating with ISPs as a consortium/buying club, and (b) working with ISPs to create a Cambodia Research and education Network (C-REN) that leverages existing infrastructure to create a high speed network for researchers and educators within Cambodia.
- **SHARING ADVANCED, HIGH-END INFRASTRUCTURE** (for example, GIS) as the next system to be in place once the C-REN has been set up.
- **IMPROVED ICT SKILLS AMONGST ALL PARTNERS** or improving the capacity of all forum members through shared training and access to technical support. At the simplest level this capacity building should include training on how to use the Forum website and how increase the impact of research using online communications

2.2.3.1 HUMAN-ANIMAL CONFLICT

Human-wildlife conflict is a growing phenomenon around the world as human populations place mounting pressure on ecosystems, wildlife habitat is reduced, and animal migration routes are made inaccessible. As a result, humans are susceptible to injury, and even death, and animals suffer attacks by humans.

BEST PRACTICE No. 25: EARLY WARNING SYSTEM TO PREVENT CONFLICTS²²

The Laikipia District of north central Kenya is among the worst hit in the world by human-animal (elephant) conflicts, with more than 3000 incidents occurring annually. GSMA Development Fund along with mobile companies and local community groups tested an innovative solution of preventing such conflicts - "Push to Talk on Cellular" (PoC).

PoC technology combines the functionality of walkie-talkie or two-way radio with a mobile phone.

Local scouts assigned by a community association to patrol the area used the PoC enabled phones to alert Kenyan Wildlife Service officials of the location of elephants to reduce incidents of human-elephant conflict. With the phones, they were also able to report illegal logging and animal theft in the area.

All PoC users engaged in the trial found the service to be helpful in managing human-elephant conflict, with 72 percent of users reporting that PoC helped provide an early warning system to reduce crop raiding, and 41 percent claiming that PoC was most useful in improving communication among all stakeholders.

In much the same vein as the PoC project, a text message-based 'early warning' system has also been established in South Africa, enabling Kruger National Park authorities to contact local communities outside of the park's borders in an effort to reduce human- elephant conflict there.

2.2.3.2 USING MOBILE TECHNOLOGY FOR COMMUNITY COLLABORATION

With the increase in reach and penetration of mobile technology, it is also being employed to collaborate with citizens for preservation of forest & wildlife.

BEST PRACTICE No. 26: WILDLIVE - RAISING AWARENESS AND FUNDS THROUGH MOBILE²³

Fauna Flora International (FFI), a UK-based global conservation charity, launched Wildlive, with support from Vodafone UK and The Vodafone Group Foundation. It uses Mobile technology to raise

²² Wireless Technology for Social Change: Trends in Mobile Use by NGOs Environment

²³ Ibid

awareness about endangered species. Through the initiative, subscribers are able to track the progress of FFI conservation projects, access conservation news, and enter competitions. Customers pay a fee to download animal screensavers and animal sounds as ringtones, with 100 percent of profits going to FFI.

CASE STUDY- eTimBER IN KARNATAKA FOREST DEPARTMENT

In 2003-2004 the Karnataka Forest Department embarked on an ambitious initiative of computerisation of its timber extraction and sale operations through an Electronic Timber Extraction and Recording System (eTimBER) with the initiative being looked after in the department by a person of seniority no less than the APCCF. The system was developed on 2-tier client-server architecture and subjected to field testing at a prominent and busy depot of the state.

During the assignment the APCCF himself spearheaded visits to different locations of the state and ensured that all relevant officials of the state were invited and inputs taken from them for the system. Capacity building sessions were also held for the staff within the project duration.

However, after the completion of the project and movement of the APCCF to a different post, the system fell into disuse till eventually it was abandoned.

Reasons for this decline in usage could be attributed to the following:

- (a) There were no dedicated system maintenance personnel available with the department dedicated to eTimBER who would take care of the day-to-day operations, trouble-shooting, enhancement and general maintenance of the system;
- (b) The initial capacity building undertaken did not last beyond the currency of the project;
- (c) There was inadequate ownership among the subordinate staff towards usage of the system; and
- (d) In parts the system itself was a bit too complicated for the staff to handle.

LESSONS LEARNT

The following could be said to be the lessons that could be drawn from the exercise

ONE MAN DOES NOT AN ARMY MAKE

For any effort to be successful in the long-run it is imperative there be a combined ownership of any solution at multiple levels of the departmental hierarchy. The APCCF in this case was clearly a lone ranger.

CONTINUOUS AND CONSISTENT EFFORTS ARE BETTER THAN ONE-OFF ONES HOWEVER STUPENDOUS

It is important that the same zeal be maintained in implementation and operationalisation stages as during the design and development stage. A mix of incentives and disincentives could well be the answer to ensure that designed and developed systems are put to their rightful use.

PENNY-WISE IS NEVER THE ANSWER

It is often the case that to economise the department attempts to do things in-house rather than outsource the same to an external agency. While it is laudable that department feels the need to develop competencies in-house one needs to be realistic too. In this case, the department could have given a maintenance and operationalisation contract to the software vendor for a transition period during which the necessary competencies could have been passed on to the department officials till they became competent enough to take over.

THE PROOF OF THE PUDDING IS ALWAYS IN THE EATING

While it is tempting to go for systems that capture every nuance of the department's working, such efforts inevitably make systems unwieldy and undermine usability of the systems. Particularly for departments undertaking maiden efforts at computerisation, it is important that systems be designed to be simple even if they do not capture all requirements fully. Usability of any system must always be of paramount importance.

CAPACITY BUILDING IS THE KEY

There is no requirement perhaps as important as capacity building of the staff to ensure ownership and usage of the systems. Capacity building efforts must also be followed through to help the officials internalise the systems in the department's operations.

CASE STUDY- MADHYA PRADESH FOREST DEPARTMENT

Many state forest departments in India have had a first shot at ushering eGovernment in their operations with largely less than satisfactory results. Prominent among these states are Madhya Pradesh, Uttar Pradesh (then, both undivided), Kerala, Andhra Pradesh and Punjab. Most of these initiatives formed an integral part of a larger developmental assistance provided by agencies such as the World Bank, Japanese Bank of International Cooperation and the like. As such, the eGovernment component in the larger developmental package often amounted to no more than 5% of the overall assistance.

Discussed below is a brief case study of the "eGovernment 1.0" taken up by the Madhya Pradesh Forest Department (MPFD).

Back in mid 1990s the World Bank extended a major assistance to MPFD towards building up better sector management and development practices through far-reaching initiatives to be taken up by the department. Among other things, though integrally, this also included making the most appropriate use of Information Technology in the department's planning and operations. A budget close to INR 3 Crores was earmarked for this project and consulting-cum-implementation bids were invited globally by the department to computerise the following areas of the department's operations:

- Forest Plantation;
- Forest Production and Sale;
- Joint Forest Management (also called Microplan); and
- Working Plan.

Surprisingly, in a bid of these dimensions, the number of respondents was not too many from within the country. Eventually the bid was awarded to an multi-national consulting house that was based in India but had chosen to tie up with a Canadian company that specialised in forestry information systems in Canada and other similar temperate countries where mechanised logging dominated the operations with little left for considerations either of biodiversity or of human pressures, both of which uniquely distinguish the Indian forestry scenario. The consulting house did not involve anyone with local forestry exposure in the beginning.

Full three years of unsuccessful discussions later and despite the best efforts on part of both the consultants and the department officials, the latter arrived at a broad conclusion that the project was not getting anywhere. In particular, the Working Plan system was something whose solution eluded any structured understanding. Reasons for this could be said to be a combination of (a) the scope of computerisation was too big considering particularly that this was a maiden exercise, (b) there were no clear ownership structures identified to take up the solutions; moreover the project went so long that constancy of officials could never be ensured, (c) the IT solutions were far too complicated for the staff to take them up; the training imparted by the consultants did not endure, and (d) for a project of this scope the commercial value was too low and there were no support phases involving any extra remuneration; when the consultants left it was left entirely to the department to operationalise the solutions.

Three more years later, the project was completed, the consulting house got their payments, and the Canadian experts were denied anything beyond travel expenses. However, not more than a year later, none of the solutions was being used by the department and the CDs containing the solutions were stashed away as trophies inside the departmental shelves.

Later the department went for completely home-grown solutions developed by the department's resident software engineers that addressed specific objectives of the department, rather than take up the complete set of activities as had happened earlier. Although it took time, a couple of these solutions were very successful in the field and have since been cited by other departments as success stories.

LESSONS LEARNT

In retrospect, the following lessons could be drawn from the project:

THINK BIG. START SMALL AND SCALE FAST

It is important for the client to be realistic in terms of what it expects of a particular project, even if it is necessary for the client to be ambitious in the long run. It hardly makes sense to develop complicated IT

solutions with inordinately complex code that would not only be full of bugs but would also make for poor usability even if it were completely bug-free. It is better to develop something small and simple, let the department warm up to it and then gradually squeeze in more complexities.

INVOLVE SMALL GROUPS WITH ABILITY, AUTHORITY AND DRIVE

Different users have different perceptions of requirements from the same project. It is impossible, if not undesirable to satisfy all requirements of all stakeholders; in fact, at times, it may even be mutually untenable. In such cases it is important that we arrive at the Least Common Denominator of requirements that emanate from different stakeholders. An effective way out of this would be to have a small core group decide on what a piece of software would contain (and what it would not). This group must contain individuals who command a high level of authority, ability and drive. Generally, people lower down would tend to listen to their seniors they respect. A very big group often means that individuals often express their requirement more out of registering their participation than out of a need that is unmet.

COLLABORATION, NOT ONEUPMANSHIP

An assignment of this nature is something which is either Lose-Lose or Win-Win. Either both the parties gain out of it or both of them sink in the process. One-upmanship not only goes against the grain of such collaboration but is also severely detrimental to the project's outcome.

PERMANENCE OF PEOPLE FOR DISCUSSIONS AT THE GROUND LEVEL

It is important that the same set of people stay involved during a project even if it means making the involvement of individual, rather than a post. Regularly changing the team from the client's side often means that new team members not only start with a handicap but they are also likely to have a lower sense of ownership compared to the originals.

THE BEST IS OFTEN THE ENEMY OF THE GOOD

Efforts should be made to first develop a good product and operationalise, rather than develop the best product possible. The latter alternative would not only suffer from a very low marginal utility, operations covered in the "best solution" may not conform to operational practices which may severely dent the usability.

A CONSULTING HOUSE AND SOFTWARE DEVELOPERS OFTEN BRING COMPLETELY DIFFERENT SKILLSETS TO TABLE

One cannot diminish the importance of the "consulting" part of the project. Skills required to correctly and completely understand requirements of a solution and ability required to write computer programmes are vastly different with no implied hierarchy between the two. It is better to handover the consulting part to a team that is completely different from those who would write the computer programmes.

SOMEONE HAS TO BITE THE BULLET

It is important for the client to understand that at the end of it all someone has to "approve" the solutions advanced. Such "approvers" must be chosen with care and should be people who are effective decision-makers.

ADOPT STRUCTURE IN YOUR OPERATIONS

A piece of software can only translate real-life algorithms into computer programmes. If real-life situations that are sought to be computerised do not have any structure embedded in them effort must be made to lend them an algorithm that can be converted into programmes. There is a limit to which solutions can be "loosely coupled".

TRAINING GROUND

The fact that a government agency has thought it fit to outsource some work to an external agency adequately highlights the sense of importance that the agency accords to a work of this nature. Any consulting house chosen should deploy the best possible resource(s) it has for the job. Treating domestic projects as training grounds is not only an unethical practice but it also risks denting the image of the consultants, often irreparably.

INTERNAL FUNDING FOR FEELING THE PINCH

An IT project that is an integral part of a larger funded assignment often becomes a "necessary evil". Internally funded projects have a much higher sense of ownership particularly from the person who has sought the allocation and is more likely to succeed. The "owners" of the project must have a stake, either in the form of incentives or as disincentives in the event of a failure.

2.3 SELECTION OF BEST PRACTICES IN ICT FOR CONSERVATION

Selection of best practices to be adopted in the Department is a critical decision. The practices need to be analyzed according to the various factors such as their ability to address the problems and pain areas of the department, improve the service quality, convenience of stakeholders and so forth. A qualitative approach has been taken to select the best practices for the department.

Qualitative Approach

A typical best practice can be considered constituted by several elements. No best practice can be adopted or rejected in entirety as there may be elements in them that can be adopted even as there may be elements that are not appropriate for adoption by the department.

















Factors that have been considered to evaluate elements of best practices for Punjab Forest department include:

- Readiness of the department, especially the staff capability and IT infrastructure;
- Dependence on external sources on information;
- Marginal utility in terms of cost, time savings to the forest department; and
- General implementability - ease of the implementation and hence success of the system.












The best practices detailed out in this report have been subjected to rigorous analysis on the above mentioned factors and the synopsis of the outcome is presented below. It presents the elements of each best practice that should be directly adopted in the department, that should be put on hold for the time being and the elements that should be avoided by the department.

Table 1 Best practice adoptability matrix

BP	Adopt	Hold	Avoid
BP1	<ul style="list-style-type: none"> ➡ Drawing of sample plots and undertaking tree enumeration as a basis for estimating growing stock. ➡ Drawing stand maps and transferring them to GIS for storage and analysis. 	<ul style="list-style-type: none"> ➡ Drawing stand maps with parameters like species, crown form, crown height etc. it is better to draw stand maps on traditional attributes like stocking and site quality, which are readily available. 	<ul style="list-style-type: none"> ⬇ Calculation of yield - since forestry in the State is not production-oriented. ⬇ Tree ring analysis - since species in State not amenable to formation of rings. ⬇ Reading details like stem features, tree hollow etc.
BP2	<ul style="list-style-type: none"> ➡ Maintenance of Statistical Forest Inventory (SFI) based on the definition of strata and taking stratified samples. ➡ Data gathering using GIS before and after SFI fieldwork and this to be used later by DFOs for further analysis and database building. 	<ul style="list-style-type: none"> ➡ Storing data directly in the field using field map technology 	<ul style="list-style-type: none"> ⬇ Dependence of production forestry as livelihood. ⬇ Sample plots must represent the entire area while plots also need to be accessible with minimal time loss.









BP	Adopt	Hold	Avoid
BP3	<ul style="list-style-type: none">  Integration of remote sensing GIS satellite data with complete integration between spatial and a-spatial attributes.  Repetitive coverage through satellite imagery. 	<ul style="list-style-type: none">  Locale specific action plans for sustainable development of land and water resources instead division level plans must be used.  Capacity building of rural masses through satellite communication. 	<ul style="list-style-type: none">  Calculation of such parameters as run off estimation, transport network and settlement map except using manually captured data.
BP4	<ul style="list-style-type: none">  Linking all ranges, divisions, circles and all other offices in both Forest and Wildlife to a central data center through a dedicated / always available connectivity.  Complete digitization of the State forest area with all associated attributes particularly those related to forestry.  Building a database of fire location which can be used to identify fire locations and adopt fire control strategy  Capturing on GIS the network of fire control stations, so as to identify the nearest fire control station to a potential fire location.  SMS based fire alerts to officers manning the fire control station. 	<ul style="list-style-type: none">  Beyond the calculation of shortest distance from the fire spot to the fire control station, to find out the exact time taken for resources to reach a particular spot  Optimize this process of selection of fire control station based on parameters of distance and time  	
BP5		<ul style="list-style-type: none">  Using satellite images to obtain fuel maps with the help of relationship table between vegetation classes and parameterized fuel models. 	<ul style="list-style-type: none">  Evolution of probabilistic fire scenarios and generating estimates of operational costs and losses due to wild fire and destruction  Socio-economic risk modeling as a tool for

BP	Adopt	Hold	Avoid
		<ul style="list-style-type: none"> Efficiency oriented fire defense planning using spatial analysis to calculate access time of resources to the fire spot. 	<ul style="list-style-type: none"> forest fire prevention and management
BP6		<ul style="list-style-type: none"> Prediction of potential fire danger in forest using Fire danger rating system that uses risk, weather, fuels and topography as input to predict the weather, fire occurrence and behavior Using low resolution satellite imagery to identify and locate burning, estimate area burned and model fire behavior 	<ul style="list-style-type: none"> Collecting daily weather to produce fire weather, fire behavior maps and hot-spot maps. Using Atmospheric Dispersion index to capture atmosphere's capability to transport pollutant away from their sources Using Forest Fire Behavior Prediction (FBP) System to quantitatively estimate potential head fire spread rate, fuel consumption, and fire intensity, as well as fire descriptions.
BP7			<ul style="list-style-type: none"> Use of mounted video cameras to detect fire is not feasible in hilly areas such as Shivalik and has low marginal utility for the department
BP8	<ul style="list-style-type: none"> Use of financial information management system to automate routine processes and activities related to budget receipt, allocation and financial transactions related to receipts and expenditure being carried out by the forest department 		
BP9	<ul style="list-style-type: none"> Updated information about endangered species to interested citizens through SMS and related mobile applications 		<ul style="list-style-type: none"> Color coding of the species according to their legality for sale / purchase as its relevance in Punjab is quite low due to forest rules and acts in the state
BP10		<ul style="list-style-type: none"> ICT enabled activism 	

BP	Adopt	Hold	Avoid
BP11	<ul style="list-style-type: none">  Attaching college students (graduate level), interested in doing projects for the department by assigning job related to data entry and maintenance of GIS based software, surveys and research  Attaching post-graduate students with projects such as research and surveys, analysis of GIS output etc.  Attaching matriculate level students by assigning short-terms assignment such as data entry etc. 	<p>and advocacy has low marginal utility for the department</p>	
BP12	<ul style="list-style-type: none">  Spreading knowledge of local tradition species and their applications  Making a dedicated web representation of literature related to such species into which contribution is invited from multiple stakeholders including those outside of the department 	<ul style="list-style-type: none">  Preparation of fact sheet to cover the most important tree species with detailed practical information on tree products and their uses and prorogation methods  Distribution of searchable CDROM, free or otherwise containing such literature 	
BP13		<ul style="list-style-type: none">  Collating findings from all research projects on Punjab forests and document climate, geomorphology, hydrology and aquatic and territorial biodiversity of the site 	<ul style="list-style-type: none">  Conducting a log decay study, baseline altitude monitoring plots and channeling findings into forest management
BP14	<ul style="list-style-type: none">  Supporting program to develop and deliver forestry education 	<ul style="list-style-type: none">  Dedicated forest education centre to be used by teachers 	

BP	Adopt	Hold	Avoid
	<p>through the visits of school children in arrangement with department staff with the latter extending forest education activities</p> <p>↑ Dissemination of forest educational material through e-pamphlets</p>	<p>preparing for forestry education activities, students researching forest topics and others wanting to know more about forestry</p>	
BP15	<p>↑ Setting up online participatory forest management forums</p> <p>↑ Inviting online project proposals and business plans for livelihood generation to reduce pressure on forests</p> <p>↑ Undertaking skills development, training in business skills as temporal and permanent employment in department and related areas</p>		
BP16	<p>↑ Collaborating with other research and educational institutions in ecology to have a feed component as a integral part of their course curricula</p>	<p>→ Developing web based course material which students can go through before undertaking the field visits</p>	<p>↓ Making recommendations to state and national institutes providing education and research in ecology to effect any changes in their course curricula consequent on this best practice alone and without undertaking any other study to make this recommendation</p>
BP17	<p>↑ Implementation of HR software package for intuitive self service interface and workflow enabled processes</p> <p>↑ Consolidated data of each employee</p> <p>↑ Empowering employees in online updation of leaves and sickness related data</p>		<p>↓ Single, consistent set of procedure is already there. HR center of excellence at the level of Govt. of Punjab and across department is beyond the mandate of this exercise.</p>

BP	Adopt	Hold	Avoid
	<ul style="list-style-type: none"> Implementation of interfaced specialist payroll, staff directory, and flexi-time applications with new system to ensure seamless, end-to-end HR processes Implementation of Induction and Training, Payroll and Leave Management modules of the system. 		
BP18	<ul style="list-style-type: none"> Online polls can be conducted on the departmental portal to assess relative preference of an urban forestry location 		<ul style="list-style-type: none"> Avoid peoples' willingness to pay model particularly in a e-Governance effort under this department.
BP19	<ul style="list-style-type: none"> Undertake forestry and conservation promotion events like seminars, tours, tracks, competitions, educational events etc. within the department 	<ul style="list-style-type: none"> Undertake forestry and conservation promotion events outside the department e.g. in an urban forestry setting. 	
BP20	<ul style="list-style-type: none"> Building up an ICT enabled research network in the state 	<ul style="list-style-type: none"> Collaborating with research networks in other states to contribute to a national research network in forestry 	
BP21			<ul style="list-style-type: none"> Building up a research network in a supra-national level is beyond the mandate of this exercise
BP22	<ul style="list-style-type: none"> GIS enabled community based resource management to be used by forest officials and ICT operators entrusted by the department 	<ul style="list-style-type: none"> Customizing the same maps to make them accessible to people with low literacy and throwing them open for the use of common people including those with low literacy levels 	
BP23	<ul style="list-style-type: none"> Small grant funds to 		

BP	Adopt	Hold	Avoid
	<p>research teams embarking on innovative use of ICT for advancement of forestry</p> <p> Taking up a pilot project and rolling out the pilot based on its success</p>		
BP24	<p> Implementing a simple online communication amongst partners to communicate with each other online</p>	<p> Improving ICT skills amongst all players as this is not in immediate mandate of the exercise</p> <p> Access points for research in Punjab because it depends for others partners to collaborate</p>	<p> Cheaper, faster internet access for researchers because they are in other bodies and network facility should be provided to them by the respective bodies</p>
BP25			<p> Avoid Push to Talk Cellular introduction as it requires dedicated infrastructures and cellular sets to be deployed which may not be immediately feasible and may have low marginal utility for the department</p>
BP26	<p> Paid downloads of animal screensavers, animal sounds as ringtones from departmental website</p> <p> Making interested common people aware about endangered species and department's forest conservation projects and news through SMS which may be made paid or free service</p>		

The adoption approach and benefits from adopting appropriate and moderately appropriate best practices has been discussed in Table 2. It also indicates the reason for not adopting not-appropriate best practices in Punjab Forest department.

Table 2 Adoptability of Best Practices

BP No.	Best Practice Name	Adoption approach for Punjab Forest	Benefit to Punjab Forest	Recommendation
1.	FOREST RESOURCE INVENTORY IN VICTORIA, AUSTRALIA	<ul style="list-style-type: none"> • Mapping: State forests could be mapped for characteristics - Stocking, Site Quality, Species, Crown Cover, etc. • Transfer to GIS: Stand maps, thus prepared, could be transferred to GIS for storage and inventory. • Forest Inventory data could be calculated for particular combinations of the above parameters and growing stock/inventory could be projected based on total area calculated above and the sample data. 	<ul style="list-style-type: none"> • Using these models could be developed to estimate growth and yield. • From these and growth data, timber volume and sustainable yield could be calculated. 	Moderately appropriate and can be adopted with some modifications.
2.	FOREST RESOURCE INVENTORY FOR PROMOTING LIVELIHOODS IN UKRAINE	<p>Could not be appropriate as:</p> <ul style="list-style-type: none"> • It is not a management practice in Punjab Forest areas to let timber be used for commercial purposes such as for the growth of rural economy through timber and related forest inventory 	NA	Not appropriate for department
3.	INTEGRATION OF REMOTE SENSING, GIS, SATELLITE COMMUNICATION AND MIS FOR SUJALA WATERSHED PROJECT IN KARNATAKA	<ul style="list-style-type: none"> • Satellite maps Shivalik forest areas may be taken by taking help from Govt. Institutions such as NRSA. These maps could then be integrated with non-spatial data in GIS domain. • Satellite maps for the same areas could be taken up every few years (or months) to monitor changes • Satellite communication could be used to train and educate communities around forest areas in Punjab about forest conservation and its importance 	<ul style="list-style-type: none"> • Map generation: this technique could be used to generate multi-thematic maps for analysis and decision making. • Repetitive coverage through satellite could help in identifying changes in Shivalik area such as deforestation, results of afforestation etc. 	Appropriate for department for adoption

BP No.	Best Practice Name	Adoption approach for Punjab Forest	Benefit to Punjab Forest	Recommendation
			<ul style="list-style-type: none"> Education of communities for assisting government in conserving forest 	
4.	FIRE ALERT AND MESSAGING SYSTEM IN MADHYA PRADESH, INDIA	<ul style="list-style-type: none"> Punjab forest department could tie up for receiving satellite images. Remote sensing data of fire active locations could be then obtained from satellite A computer software can then be used to send SMS alert to concerned field staff Database of fire sensitive zones can then be gradually built up. Similarly, data related to each fire occurrence such as exact location, time taken to put it off, resources used etc. could be captured. 	<ul style="list-style-type: none"> Quick response to fire occurrences Database of historical events could help in better decision making during fire crisis situations particularly in Shivalik forest areas 	Appropriate for department for adoption
5.	FOREST FIRE MANAGEMENT AND FIRE PREVENTION SYSTEM (FOMFIS)	<ul style="list-style-type: none"> Could not be immediately appropriate as the effort and cost required for this system may not commensurate with the potential benefit to the department. However, for fire management, best practice number 4 can be adopted. 	<ul style="list-style-type: none"> It can help the department in conducting internal risk estimation, forest fuel mapping and fire defense planning. 	Not appropriate for the department
6.	WILDLIFE FIRE INFORMATION SYSTEM	<ul style="list-style-type: none"> The perceived benefit from the system may not justify the level of investment required for the system. Moreover, most of these benefits may also be obtained by implementing best practice no. 4. 	<ul style="list-style-type: none"> It can assist the department in producing fire behavior maps and hot-spots map. 	Not appropriate for the department
7.	FIREHAWK: DETECTING FOREST FIRES IN SOUTH AFRICA	<p>Could not be appropriate as:</p> <ul style="list-style-type: none"> This system uses video cameras mounted on masts 72 meter high to detect fires. This could not be practicable in forest areas of Punjab as major dense 	<ul style="list-style-type: none"> The system could make available real time videos of fire incidents to the department 	Not appropriate for the department

BP No.	Best Practice Name	Adoption approach for Punjab Forest	Benefit to Punjab Forest	Recommendation
		forest is in Shivalik which is a hilly region. Such mast mounted cameras may not be effective in detecting fire in hilly areas.		
8.	FOREST FINANCIAL MANAGEMENT SYSTEM, MADHYA PRADESH	<ul style="list-style-type: none"> An application for automating various routine processes, activities and functions related to budget receipt, allocation and financial transactions related to receipts and expenditure 	<ul style="list-style-type: none"> It could save significant time and cost for the department and can enable officers to focus more on their core competence instead of doing repetitive non-value adding activities It is a tried and tested product 	Appropriate for department for adoption
9.	ALERTING CITIZENS (CONSUMERS) TO ENDANGERED SPECIES	<ul style="list-style-type: none"> Punjab forest department can make a database of endangered species or other important species. Citizens could be given facility to access information about all species through SMS or website about their endangered status, importance, adulteration etc. As most of the citizens do not know the biological name or common names, so pictures of different varieties and important / endangered species could be made available on website for ready reference of citizens. 	<ul style="list-style-type: none"> Sensitising people towards conservation of endangered species Help in curbing illegal selling through buyers' participation 	Appropriate for department for adoption
10.	MOBILIZING THE PUBLIC FOR ENVIRONMENTAL PROTECTION	<p>Could not be appropriate as:</p> <ul style="list-style-type: none"> As the department is the policymaking and execution body of the Punjab Government, it cannot be a part of campaign to mobilize public for petition signing. 	<ul style="list-style-type: none"> Department may get public expectations and views on various decisions as well as get their endorsement on policy matters 	Not appropriate for the department

BP No.	Best Practice Name	Adoption approach for Punjab Forest	Benefit to Punjab Forest	Recommendation
11.	COLLEGE STUDENT ATTACHMENT	<ul style="list-style-type: none"> College students (graduate level), interested in doing projects for the department, could be assigned job such as data entry and maintenance of GIS based software, surveys and research. Post-graduate level students may be assigned projects such as research and surveys, analysis of GIS output etc. Matriculate level students may be assigned short-terms assignment such as data entry etc. Stipends or similar rewards may be given to such students 	<ul style="list-style-type: none"> It is a win-win situation for the Department as well as the students. The department may get assistance in conducting specific job for short term whereas students may get on-job-training, experience and some monetary benefit (in terms of stipend) 	Appropriate for department for adoption
12.	REJUVENATING TRADITIONAL TREE SPECIES THROUGH CONVENIENT INFORMATION DISSEMINATION	<ul style="list-style-type: none"> The department can identify a list of traditional trees that it wants to promote in the region Fact sheets on each one of them could be prepared with details on how to grow them etc. These details could then be put up on website for easy reference to citizens. The same can also be used to educate citizens during extension services. 	<ul style="list-style-type: none"> To record, in a single collection, the nearly forgotten knowledge about the region's native tree species Traditional trees would not be forgotten by the citizens To promote the re-adoption of traditional agroforestry systems 	Moderately appropriate and can be adopted with some modifications.
13.	THE WARRA LONG-TERM ECOLOGICAL RESEARCH SITE	<p>Could not be appropriate as:</p> <ul style="list-style-type: none"> The department would have to tie up with partner research agencies 	<ul style="list-style-type: none"> Networking with other research institutions and departments could be done. 	Not appropriate for the department
14.	SENSITIZING SCHOOL GOING CHILDREN TO	<ul style="list-style-type: none"> Department may conduct visits of school going children if approached by some school 	<ul style="list-style-type: none"> School children may be sensitized during visits to Zoo and conservation parks. 	Moderately appropriate and can be adopted with some

BP No.	Best Practice Name	Adoption approach for Punjab Forest	Benefit to Punjab Forest	Recommendation
	CONSERVATION IN SOUTHERN AUSTRALIA			modifications.
15.	PARTICIPATORY FOREST MANAGEMENT IN SOUTH AFRICA	<ul style="list-style-type: none"> • Workshops could be held in the region near to forest areas to introduce the local communities to the aspect of service delivery towards forest conservation and management • Participatory Forest Management team comprising of local communities and department officers. • Procedures for approval of PFM projects, and criteria for project selection/approval and formulation of standard project proposals/business plans could be agreed upon by PFM and the department in coordination. 	<ul style="list-style-type: none"> • Empowering local communities in sharing decision-making over forest resource utilisation 	Appropriate for department for adoption
16.	INTERNET-BASED LEARNING IN FORESTRY- EXAMPLES FROM GERMANY AND SOUTH AFRICA	<ul style="list-style-type: none"> • Web-based learning modules could be prepared for: <ul style="list-style-type: none"> ○ Employees - for policies, processes, forest related information, etc. ○ Local communities - residing near forest ○ General public - awareness creation about roles & responsibilities, services, procedures and specific rules 	<ul style="list-style-type: none"> • Anytime anywhere education to employees and citizens 	Moderately appropriate and can be adopted with some modifications.
17.	TRANSFORMATION OF HUMAN RESOURCE MANAGEMENT BY SCOTTISH GOVERNMENT	<ul style="list-style-type: none"> • Standardize HR processes across the department throughout an employee's hire-to-retire lifecycle • Implementation of HR software package for intuitive self-service interface • Empowering employees and devolving responsibility to them for services such as leave and sickness management. 	<ul style="list-style-type: none"> • Improved convenience for employees • Improved internal efficiency 	Appropriate for department for adoption

BP No.	Best Practice Name	Adoption approach for Punjab Forest	Benefit to Punjab Forest	Recommendation
18.	WILLINGNESS TO PAY TO ESTIMATE RECREATIONAL VALUE OF URBAN FORESTRY SITE	<ul style="list-style-type: none"> • Could be of little use to the Department till there is a need to design a business model for some urban forestry initiative. 	<ul style="list-style-type: none"> • Department may estimate the fees that citizens are willing to pay for entry in parks and zoos such as M.C.Zoo etc. 	Not appropriate for the department
19.	PROMOTION OF RECREATION POSSIBILITIES PROVIDED BY URBAN FORESTRY BY ESTONIAN GOVERNMENT	<ul style="list-style-type: none"> • The department could host various events for promotion of urban forestry such as <ul style="list-style-type: none"> ○ Seminars and training sessions ○ Social events ○ Tie- up with State or National events for wide spread promotion ○ Competitions etc. 	<ul style="list-style-type: none"> • Effective promotion of recreational and vacation possibilities of forests and other ways in which they can be used by citizens 	Not appropriate for the department
20.	AFRICAN FOREST RESEARCH NETWORK (AFORNET)	<ul style="list-style-type: none"> • Department can initiate a grant scheme for forest research in areas of importance and interest to the department • A technical committee and a steering committee could be formed for approval and sanction of grants • A network could then be formed to share and disseminate research findings with important institutes such as IIFM, universities, forest research institutions etc. 	<ul style="list-style-type: none"> • Promotion and strengthening of research capacity in order to generating and disseminating knowledge that is relevant to forest development in Punjab 	Not appropriate for the department
21.	FORESTRY RESEARCH NETWORK IN SUB-SAHARAN AFRICA	<p>Could not be appropriate as:</p> <ul style="list-style-type: none"> • It involves collaboration with relevant agencies from various regional countries. However, a similar network could be set-up with neighboring states. 	<ul style="list-style-type: none"> • Portal could be used for networking with research institutes, departments from other Indian States and countries. 	Not appropriate for the department
22.	COLLABORATIVE	<p>Could not be appropriate as:</p>	<ul style="list-style-type: none"> • Local communities may be 	Not appropriate for the

BP No.	Best Practice Name	Adoption approach for Punjab Forest	Benefit to Punjab Forest	Recommendation
	FOREST MANAGEMENT COMMUNITY-BASED RESOURCE MANAGEMENT IN NAMIBIA	<ul style="list-style-type: none"> Educating local communities in GIS based analysis and mapping could be difficult given the education level and awareness levels of citizens residing near forest areas in Punjab. Also the expenses of such education and providing access to them could be quite high 	leveraged for entry and maintenance of GIS data at ground level	department
23.	COMMUNITY ACCESS TO COMPUTERS	<ul style="list-style-type: none"> Grants to researchers and local communities to purchase ICT infrastructure for access and sharing information on forest 	<ul style="list-style-type: none"> Increased participation of researchers and local community 	Appropriate for department for adoption
24.	COMMUNITY ACCESS TO COMPUTERS (COMBODIA RESEARCH DEVELOPMENT FORUM)	<ul style="list-style-type: none"> Department could provide basic online platform - a simple, modern, dynamic website and e-newsletter for educating communities <ul style="list-style-type: none"> Online access to policy documents, circulars, notifications, research reports etc. Internet connection to communities residing near forest area for access to such services and knowledge 	<ul style="list-style-type: none"> Access could be provided to vulnerable sections of the societies. Common Service Centre (CSC) may be used to providing services easily to citizens. Increased awareness and knowledge of communities for better conservation of forests in Punjab 	Moderately appropriate and can be adopted with some modifications.
25.	EARLY WARNING SYSTEM TO PREVENT CONFLICTS	<p>Could not be appropriate as:</p> <ul style="list-style-type: none"> Cases of human-animal conflict are not high enough for the system to be feasible and practicable. However, a pilot may be done in highly sensitive area to test the results. 	<ul style="list-style-type: none"> Local communities may be enabled to timely alert concerned officials about human-animal conflict possibilities and actual incidences. 	Not appropriate for the department
26.	WILDLIVE - RAISING AWARENESS AND	<ul style="list-style-type: none"> Department can raise awareness of conservation of wildlife and forest, especially endangered species through a drive of innovative SMSs, screen-savers 	<ul style="list-style-type: none"> Increase awareness among public about forest and wildlife conservation and its 	Appropriate for department for adoption

BP No.	Best Practice Name	Adoption approach for Punjab Forest	Benefit to Punjab Forest	Recommendation
	FUNDS THROUGH MOBILE	(free or fee-based), wall-papers. These could be made available to the citizens through department website or through SMS based services.	benefits	

3 Best Practices in Using ICT as a Tool of Community Engagement

For any meaningful democratic participation, citizens must have access to decision-making mechanisms, the means to be informed and be able to exercise influence over the policy agenda. In other words governments and citizens must be able to "engage" each other. Involving communities in government decision-making is a necessary requirement for a strong and healthy democracy. Engagement provides a mechanism by which that participation can be enhanced benefiting not only government but the citizens engaged.

ICT for Community Engagement

The development of new information and communication technologies (ICT), in particular the Internet, brings new and exciting opportunities for government to engage with the wider community. Just as the Internet has fundamentally altered the way business is carried out, products our bought and communication established with friends and families, online environments have the potential to profoundly alter how communities and government agencies interact with each other.

Community Participation Benefits

Government agencies are beginning to use the Internet to consult with communities. Community engagement through ICT is a process through which information and communications technologies are utilised to enable communities to participate in decision-making. New developments in ICT enable a broad range of engagement possibilities through which citizens can actively converse with government.

For example, engaging with the community can lead to:

- discovery of issues of importance to the community;
- emergence of innovative and creative solutions;
- increased likelihood of policy and program acceptance and user satisfaction;
- financial savings for government agencies; and

- enhanced risk management.

This will, in turn, lead to:

- greater transparency and accountability;
- greater trust in government; and
- stronger government-citizen relationships.

Best Practice Guidelines

The best practices presented below provide a framework of considerations for online consultations in order to bring about accountability and transparency in the DFWP and to build trust and confidence of communities in the DFWP processes.

3.1 ICT MEANS OF COMMUNITY ENGAGEMENT

The following means could be used for online engagement with communities.

3.1.1 Email Alerts

Email alerts as a tool would let users subscribe to receive brief and timely email message alerts on a particular policy issue. Alerts would contain links to highly relevant updated information online.

The following best practice guidelines could be used.

- Large documents should not be electronically mailed.
- Clear information must be provided on how to unsubscribe to these alerts.
- Alerts must be strictly topical and concise
- Communities should be able to select particular issues about which they wish to be kept informed.

3.1.2 Electronically Mailed Newsletters and Online Reports

Newsletters would give the department the opportunity to send out mails to citizens who have opted in to the newsletter and wish to be kept informed about a particular topic.

The following best practice guidelines could be used

- Option should be provided to communities of receiving newsletters as attachments or in HTML or text format

- Headlines must be used at the start of the newsletters to highlight key points.
- Documents should be in a format that are accessible to the greatest number of stakeholders (for example in portable document format (pdf), html etc.)
- Ensure that documents sent are print friendly and are easily readable on screen.
- Break large documents into smaller pieces.

3.1.3 Online Forms

Online forms could be used for several methods of online engagement including polls, surveys, comments and submissions.

The following best practice guidelines could be used

- Maintain complete consistency between offline and online forms.
- Usability of the online form is of paramount importance; provide, for example, drop-down menus for entering information into pre-defined fields, instructions on how to complete and submit the forms, alerts whenever mandatory fields have been omitted, aids such as auto-fill up of forms for registered users and options for users to save and print the form.

3.1.4 Frequently Asked Questions (FAQ)

FAQ is typically a webpage containing questions from communities on a particular topic together with responses by an agency. An FAQ may comprise a list of questions that have been asked frequently or may simply be a method of disseminating information.

The following best practice guidelines could be used

- Include within the FAQ a provision for communities to submit questions that are not listed.
- Maintain a dedicated FAQ manager who would be maintaining an FAQ list
- Include also a rating mechanism to ascertain the quality of responses.

3.1.5 Online Discussion Forums

These demote online board or space where people can send messages, comments and opinions on either general or issue-specific matters and expect a response from the other person.

The following best practice guidelines could be used

- The DFWP must provide a skilled moderator for the discussion forum who must provide clear roles and terms of use.
- Have appropriate validation, verification and authentication for responsible use of this online space.

3.1.6 Short Messaging Services (SMS) over mobile phones

Short Messaging Services could be used for simple surveys and polls. transmit FAQ information and give update on the progress of consultations.

The following best practice guidelines could be used

- Information should be concise and no longer than the standard message.
- Provide citizens the ability to opt-in and opt-out of the process.
- Ensure that such communication is not considered spam.

3.1.7 Communities of Practice and Mailing Lists

Communities of Practice are rule-defined user groups on the Internet in such a way that specific policy issues are possible to be debated by the members of the group with particular interest in the issue being debated. Mailing lists are groups of people with some shared commonality among them designed to enable structured discussions with anyone on the mailing list being able to send a message to every person on the list. Similarly, any person can post a message to a newsgroup and any member of the group can read it.

The following best practice guidelines could be used

- Make possible a range of online tools including discussion forums, chat rooms, email lists and the like to facilitate discussion between members of the community

- Maintain a skilled moderator to monitor and input and regulate activity based on clear and set of rules.
- Use a Code of Ethics or Terms of Use in regard to offensive language, defamation, Spam etc.
- Allow authorised users to build, modify and dissolve user groups according to the content of message being shared.

3.1.8 Chat Rooms

The primary use of a chat room is to share information via text with a group of other users.

New technology has enabled the use of file sharing and webcams to be included in some programs and almost all Internet chat or messaging services allow

users to display or send to each other photos of themselves. Chat rooms enable geographically dispersed groups to interact at low cost.

The following best practice guidelines could be used

- Maintain a skilled moderator to monitor and input and regulate activity based on clear and set of rules.
- Use a Code of Ethics or Terms of Use in regard to offensive language, defamation, Spam etc.
- Scheduled Chat sessions are preferable to ongoing chat rooms.

4 Best Practices in Automation

Best Practices in Automation have been produced with an emphasis on automation in general. These have been produced in the following broad categories:

- Network Design;
- Application Design and Development;
- Hardware Procurement;
- Information Security;
- Process Automation;
- Database Design and Development;
- Communication; and
- Project Management.

4.1 NETWORK DESIGN

The Network Architecture specifies how information processing resources are interconnected, and documents the standards for protocols (for network access and communication), topology (design of how devices are connected together), and wiring (physical medium or wireless assignments). Network includes a unified, high-speed network, based on open systems standards.

4.2 APPLICATION DESIGN AND DEVELOPMENT

Application Architecture identifies criteria and techniques associated with the design of applications for DFWP's e-Government environment that can be easily modified to respond to changing business needs, as well as to the rapidly evolving information technologies available to support those needs.

4.3 HARDWARE PROCUREMENT

Platform Architecture identifies hardware platforms and associated operating systems. The Platform Architecture describes the platform requirements for building a client/ server infrastructure as well as the storage architecture associated in maintaining the data generated.

4.4 INFORMATION SECURITY

The purpose of security is to protect and secure the information resources in order to provide an environment in which DFWP's business can be safely transacted. Security services apply technologies to perform the functions needed to protect assets. As

DFWP performs business functions electronically, it must transition to security services designed to protect the electronic environment.

4.5 PROCESS AUTOMATION

Once DFWP puts business process automation into practice, the organization immediately identifies opportunities to automate other key processes. To set the best possible benchmarks for such initiatives, the trick is to automate and implement the first few processes, observe how they impact operations, measure their benefit, and then pursue additional opportunities using the standards established. Learning key factors that lead to successfully automating a process takes practice and experience.

4.6 DATABASE DESIGN AND DEVELOPMENT

Data Architecture is to establish and maintain an adaptable infrastructure designed to facilitate the access, definition, management, security, and integrity of data. Data architecture establishes an infrastructure for providing access to high quality, consistent data wherever and whenever it is needed.

4.7 COMMUNICATION

Application Communication facilitates and simplifies communication within and between heterogeneous, distributed application systems. There are two areas that require application communication- (a) Intra-application, within the tiers of an application system, and (b) Inter-application, between application system and external services, such as common shared services and other application systems.

4.8 PROJECT MANAGEMENT

Project management covers the gamut of functions required so that the above can take place in as smooth a manner as is possible. Primarily, this would relate to non-technical aspects and would serve as a support area for the above.

For the sake of brevity, the best practices in the different areas are not being reproduced here separately. These have been produced in Table 4 which summarises all best practices covered.

5 Summary of Best Practices

Table 3 summarises all best practices produced in this document and recommendations on adoption (↑), Hold (→) and Avoidance (↓)

ICT as a Tool for Forests and Wildlife Management			
Growing Stock Assessment	Capacity Building and Livelihood for Communities	Forest Fire Management	Endangered Species' Information
<ul style="list-style-type: none"> ↑ Use sample plots as the basic area of measurement and undertake tree enumeration as a basis for estimating growing stock in the sample. ↑ Associate sample plots with strata-related attributes which can then be used to project growing stock based on simple stratified sampling techniques. Adopt a standard combination of attributes for which data is readily available, is easily understood by staff and is most relevance to stock assessment. ↑ Use GIS-based techniques to store, visualise and query area-related features. → Storing of data directly in the field using field map technologies should be taken up in subsequent phases of automation in the department. ↓ Avoid taking strata attributes that are too complicated, irrelevant and/or offer little marginal utility based on the effort that would be required to forecast the growing stock. ↓ Avoid using tree-ring analysis as a technique for estimating stand growth since stands are mostly uneven-aged, heterogeneous and of tropical species. ↓ Avoid too complicated processes for the calculation of yield since forestry in the State is not production-oriented. 	<ul style="list-style-type: none"> ↑ GIS enabled community based resource management to be used by forest officials and ICT operators entrusted by the department ↑ Setting up online participatory forest management forums ↑ Invite online project proposals and business plans for livelihood generation to reduce pressure on forests. Have a mechanism for vetting these proposals before giving recommendations on them. ↑ Undertake skills development, training in business skills as temporal and permanent employment in development and related areas; this will facilitate a reduction in pressure on forests. → Customization of GIS maps to make them accessible to people with low literacy and throwing them open for the use of common people including those with low literacy levels initiative should not be taken immediately for implementation ↓ Avoid dedicating investment before a certain minimum level of service requests are received for the same in the DFWP. 	<ul style="list-style-type: none"> ↑ Capture on GIS the network of fire control stations, so as to identify the nearest fire control station to a potential fire location. ↑ Build a database of fire location which can be used to identify fire locations and adopt fire control strategy. ↑ Have SMS based fire alerts to officers operating the fire control station. → Optimization of the process of selection of fire control station based on parameters of distance and time should be taken in next phase. → The initiative of finding out the exact time taken for resources to reach a particular spot should be taken up in next phase. ↓ Avoid overdoing this effort by including more complications like producing fire weather, fire behaviour maps, evolution of probabilistic fire scenarios and generating estimates of operational costs and losses due to wild fire and destruction. 	<ul style="list-style-type: none"> ↑ Assort a group of species' names that are illegally traded or are otherwise thought to be vulnerable; develop a comprehensive database of FAQs on these species. ↑ Allow for expansion in the group by including more species as and when they become relevant for inclusion in the group. ↑ Make interested common people aware about endangered species and department's forest conservation projects and news through SMS which may be made paid or free service. ↑ Take up a pilot project and roll out the pilot based on its success. ↑ Update information about endangered species to interested citizens through SMS and related mobile applications.

Conservation Awareness	Forest Management using ICT	ICT-enabled Collaboration	Forest Research Networking
<ul style="list-style-type: none"> ↑ Conduct online polls on the departmental portal to assess relative preference of an urban forestry location. ↑ Undertake forestry and conservation promotion events like seminars, tours, tracks, competitions, educational events etc. within the department ↑ Have paid/free downloads of animal screensavers, animal sounds as ringtones from departmental website. ↑ Develop web based course material which students can go through before undertaking field visits. ↑ Disseminate forest educational material through e-pamphlets. ↑ Support programme to develop and deliver forestry education through the visits of school and college-going students in arrangement with department staff with the latter extending forest education activities. ↑ Allow attachment of college students (graduate level), interested in doing projects for the department by assigning job related to data entry and maintenance of GIS based software, surveys and research. ➔ The initiative of forestry and conservation promotion events outside the department e.g. in an urban forestry setting should be undertaken in next phase. ➔ Dedicated forest education centre to be used by teachers preparing for forestry education activities, students researching forest topics and others wanting to know more about forestry should be set up in later phases. ➔ Distribution of searchable CDROM, free or otherwise containing conservation literature 	<ul style="list-style-type: none"> ↑ Adopt a compartment as the most atomic unit of planning and management and standardise this as a unit of data capture as well. ↑ Forest planning and execution operations always follow a similar chain of events (for example, from the Working Plan-->APO-->Budgetary Allocation-->Preparation of Estimates-->Execution-->Inspection-->Payments-->Monitoring and Evaluation. Standardise this cycle and suitably replicate across all classes of activities to be performed rather than developing different applications for different types of work. ↑ Build an intelligent library of expenditure items that will help the forest manager/ planner easily complete every chain of this planning and management process based on the requirement at hand. ↑ Adopt the same rule as above for wildlife too. ↓ Desist from adopting any other land unit (for example, a particular locale within a compartment) as the management unit since this will increase data capture requirements without necessarily resulting in any significantly added benefits. ↓ Although the APOs would ideally need to derive themselves from the Working Plan of which the APO is an annual component, do not couple this linkage very tightly; allow 	<ul style="list-style-type: none"> ↑ Link all ranges, divisions, circles and all other offices in both Forest and Wildlife to a central data centre through a dedicated / always available connectivity. ↑ Implementing a simple online communication amongst partners to communicate with each other online. ↑ Adopt various forms of online communication and exchange of information ideas through emails, chat platforms, group messaging platforms, blogs and the like. ↑ Allow top level executives in the department to configure and form groups of people according to relevance and/or discretion so as to be able to communication departmental official information like circulars, Government Orders, standing instructions and the like. ↑ Avoid removing the traditional paper-based formats for all exchanges unless there are very strong indications that everyone in the department has been brought up to speed and prefers using the online options to the traditional means. ➔ Improving ICT skills amongst all partners is not immediate priority for the department. ↓ Avoid providing cheaper, faster internet access for researchers because they are in other bodies 	<ul style="list-style-type: none"> ↑ Build up an ICT enabled research network in the state; take it up as a pilot project and roll out the pilot based on its success. ↑ Extend small grant funds to research teams embarking on innovative use of ICT for advancement of forestry. ↑ Attach post-graduate students with projects such as research and surveys, analysis of GIS output etc. ↑ Spread knowledge of local tradition species and their applications through easy-to-use ICT platforms. ↑ Make a dedicated web representation of literature related to such species into which contribution is invited from multiple stakeholders including those outside of the department. ↑ Prepare fact sheets to cover most important tree species with detailed practical information on tree products and their uses and prorogation methods in an overall effort to increase the green cover. ➔ Hold collaborating with research networks in other states to contribute to a national research network in forestry

<p>should be taken up later.</p> <p>↓ Avoid including external support on such activities from private agencies or other departments unless such support has been promised in writing or has top-level political and/or executive commitment.</p>	<p>complete freedom for the development of the APO independently of the approved Working Plan while at the same time informing the planner of the larger planning agenda.</p>	<p>and network facility should be provided to them by the respective bodies</p>	<p>↓ Avoid building up a research network at a supra-national/state level that is beyond the mandate of this exercise.</p>
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ICT as a Tool of Community Engagement

Email Alerts	eNewsletters and Online Reports	Online Forms	Frequently Asked Questions (FAQ)
<ul style="list-style-type: none"> ↑ Disseminate clear information on how to unsubscribe to these alerts. ↑ Adopt alerts that are strictly topical and are concise. ↑ Allow communities the option to be able to select the topics of alerts. ↓ Avoid sending large documents not to be electronically mailed. ↓ Avoid alerts on topics that are no longer relevant ↓ Avoid excessive alerts. 	<ul style="list-style-type: none"> ↑ Include option to receive newsletters as attachments or in HTML or text format. ↑ Include headlines at the start of newsletters. ↑ Send documents that are print friendly and easily readable on screen. ↑ Break large documents into smaller pieces. ↓ Avoid sending documents in proprietary and/or uncommon formats. 	<ul style="list-style-type: none"> ↑ Maintain complete consistency between offline and online forms. ↑ Usability paramount; drop-down menus, how to complete and submit the forms, alerts for mandatory fields omitted, aids such as auto-fill up of forms for registered users and options to save and print form. ↓ Avoid seeking unnecessary data. 	<ul style="list-style-type: none"> ↑ Include within the FAQ a provision for communities to submit questions that are not listed. ↑ Maintain a dedicated FAQ manager who would be maintaining an FAQ list ↑ Include a rating mechanism to rate quality of responses. ↓ Avoid unanswered questions solicited or delay in answering
Online Discussion Forums	Short Messaging Services (SMS) over mobile phones	Communities of Practice and Mailing Lists	Chat Rooms
<ul style="list-style-type: none"> ↑ The DFWP must provide a skilled moderator for the discussion forum; the moderator must provide clear roles and terms of use. ↑ Have appropriate validation, verification and authentication for responsible use of this online space. ↓ Avoid anonymous or unregistered entries into forums. 	<ul style="list-style-type: none"> ↑ Information should be concise and no longer than the standard message. ↑ Provide citizens the ability to opt-in and opt-out of the process. ↑ Ensure that such communication is not considered spam. ↑ Do not send messages if the user does not want them. 	<ul style="list-style-type: none"> ↑ Use a range of online tools - discussion forums, chat rooms, email lists etc to facilitate discussion between members ↑ Have a skilled moderator to monitor, input and regulate activity. ↑ Use a Code of Ethics or Terms of Use in regard to offensive language, Spam, defamation etc ↑ Allow authorised users to build, modify, dissolve user groups by content of message shared. ↓ Do not continue with communities that are not active. 	<ul style="list-style-type: none"> ↑ Maintain a skilled moderator to monitor and input and regulate activity based on clear and set of rules. ↑ Use a Code of Ethics or Terms of Use in regard to offensive language, defamation, Spam etc. ↑ Scheduled Chat sessions are preferable to ongoing chat rooms. ↑ Have dedicated chat rooms for officials.

ICT for Automation and Service Delivery

Communication	Information Security	Application Development	Hardware
<ul style="list-style-type: none"> ↑ Avoid proprietary formats in document exchange with outside users/ applications. ↑ For non-editable documents, the standard file format is PDF. Typical application software using this file format includes word processing, imaging systems, web publishing. ↑ For monochrome documents or drawing, the standard file format is TIFF using CCITT/ITU Group IV compression; for colour documents, drawings, or photographs, the standard file formats are GIF and JPEG; for facsimile documents, the standard file format is TIFF using CCITT/ ITU Group III compression; for vector or geometric data, the standard file formats are DGN and DWG; for multimedia images, the standard file format is MPEG-1/2. ↑ Email servers should be administered and managed as a part of the strategic infrastructure; Email servers should support multiple email clients. The email client should include standard APIs for email-enabling other applications. ↑ Security features should be incorporated for email message transport and storage; use Simple Mail Transport Protocol ('SMTP'), Multi-purpose Internet Mail Extensions ('MIME'), Internet Message Access Protocol ('IMAP') and Lightweight Directory Access Protocol ('LDAP'). 	<ul style="list-style-type: none"> ↑ Authenticate users prior to accessing services; Use Public Key / Private Key technology for authentication when digital signatures are required. ↑ Use token-based or strong password authentication where public key certificates not feasible. ↑ Authorise users based on least privilege to minimise impact of security violations. ↑ Use appropriate security service levels for each part of the technical infrastructure according to enterprise-wide standards; use open standards-based security solutions. ↑ Protect data in transit to and from the enterprise in compliance with legal requirements for confidentiality and privacy; web-enabled applications must protect confidential or critical data from unauthorised access. ↑ Use secure server-to-server communication to protect confidential or critical data transmission; Avoid Virtual Private Network ('VPN') solutions for connecting trading partners outside DFWP. ↑ Use Secure Sockets Layer (SSL) protocol for communication between Web Server and browser; Web-enabled applications that require user authentication should use SSL with client authentication and client public key certificates where appropriate. ↑ Use encryption for stored data or email only when appropriate since encryption leads to huge management and performance overhead. ↑ Services provided through the Internet 	<ul style="list-style-type: none"> ↑ Design and develop applications in a modular and parametric way wherever possible to minimise duplication of code being written and bring about an overall reduction of effort. ↑ For user access sites with assured connectivity adopt a centralised architecture with applications being served on the web; this will eliminate local flavours of any application being developed and will facilitate centralised access to data from everywhere in the state. ↑ Design for N-tier service oriented architecture. ↑ Generalise application interfaces. ↑ Assign responsibility for business rules to business units. ↑ Make business rules platform neutral. ↑ Implement business rules as discrete components. ↑ Access data through business rules. ↑ Adopt coding standards. ↑ Design for end to end management. ↑ Instrument applications to report the information 	<ul style="list-style-type: none"> ↑ Run mid-range application and database servers on a 32-bit multi-tasking, multi-threaded operating system, at a minimum. For reliability and ease of support, place each major application on a uniformly configured server. ↑ Consider normal anticipated future application growth when determining capacity requirements for server platforms. ↑ Balance business adaptability and ease of systems management. However, when there is a conflict between business adaptability and ease of systems management, the business requirement for providing adaptability should have priority. ↑ Provide for change in business operations and its supporting applications. Therefore, even though it is easier to manage a large server rather than multiple smaller servers, the business need to provide flexibility should take precedence over any marginal increases in operational costs. ↑ Make server platform decisions after the business makes some basic determinations regarding growth, scalability, portability, and openness. ↑ Client platform choices should satisfy both end-user ease-of-use and ease of systems management. When there is a conflict between end-user ease-of-use and ease of systems

- ↑ Maintain transparent interoperability with other applications and computing platforms. The application should provide a mechanism for attaching supporting documentation, such as meeting materials, to the notification message.
 - ↑ Allow the user to create both public and private notification groups and contact lists.
 - ↑ Document management systems and components should conform to the Document Management Alliance specifications.
 - ↑ Workflow systems should conform to the interface specifications of the Workflow Management Coalition ('WfMC').
 - ↑ Ensure hardware/ software and image file compatibility using TWAIN, ISIS, and TIFF standards.
 - ↑ Use extensible Mark-up Language ('XML') when capturing or authoring document content that requires further automated processing by other information systems and Web based clients using standard XML enabled browsers.
- (Web-based applications, FTP, Mail, News, DNS, etc) must be placed on the DMZ or proxied from the DMZ.
- ↑ Use role-based administration and multiple security domains that are easier to administer and maintain than user-based privileges and single enterprise security domains.
 - ↑ Implement a fault tolerant solution to provide 24-hour, 7-day availability to the enterprise directory.
 - ↑ Use the Centralised Metadata Repository directory schema of attributes and object classes. Like other databases in the enterprise, directories and their elements must be centralised.
 - ↑ Use Lightweight Directory Access Protocol ('LDAP') for directory access; for Commercial off-the-shelf ('COTS') applications that often require their own directories, have a standards-based approach and require LDAP compatibility.
- necessary to manage them. (for e.g. applications should report status, performance statistics, errors, and conditions).
- ↑ Instrument applications to facilitate administration.
 - ↑ Design applications to be highly granular and loosely coupled.
 - ↑ Plan for extensibility and scalability.
 - ↑ Design application to reuse components.
 - ↑ For application integration the recommended priority of using components of application integration are interface engine first, middle ware systems second, and direct program to program interface as third and last alternative.
 - ↑ Clearly Define Application Interfaces.
 - ↑ The message structure must be documented; A message or transaction is the mechanism for extracting data from an application or sending data to an application.
 - ↑ The application must be able to transmit and receive messages using a client/ server model. The client is the process that sends or originates the message. The server is the process that receives the message.
- management, give priority to end-user needs.
- ↑ Choose client platforms that support personal productivity and connectivity. The client platform displays the interface to an application. In the design of applications, minimise dependency on a particular client platform as much as possible.
 - ↑ Consider financial viability of vendor, availability of packaged software, ability to meet department needs, adherence to state standards and direction, cost, availability of skill sets for development on the platform, support availability, and service terms and conditions.
 - ↑ Avoid proprietary smart cards reader-side APIs.
 - ↑ Use SAN based fibre channel technology for large scale storage deployments running mission-critical applications.

Network	Data	Process Automation	Project Management
<ul style="list-style-type: none"> ↑ Position networks for future growth in traffic and expansion of services such as voice and video. ↑ Configure all servers supporting mission critical applications, including desktop applications, to minimize service interruption; configure topology (physical wiring) in a Star pattern so as to provide capability to easily add and remove devices as necessary ↑ Develop one enterprise-wide network infrastructure that is centrally maintained and managed. ↑ Use the standard TCP/IP protocol technology which allows Internet access as well as allows creation of intranets and Virtual Private Networks ('VPNs'). Use standard Domain Name System (DNS) Internet access technology. ↑ Design network-neutral applications; Network-specific design (e.g., wireless or guaranteed high-bandwidth) should only be performed when business requirements dictate. ↑ Minimise data movement; When possible, schedule heavy network use for off-peak hours. ↑ When data has to be distributed to multiple points (e.g., software and content distribution), move it once and only once across each data link. ↑ Perform performance measurement and load testing on distributed applications before deployment. ↑ Deploy heavily used data sources 	<ul style="list-style-type: none"> ↑ Use and actively maintain the Centralised Metadata Repository ('CMR') to store centralised metadata definitions. When designing or modifying a database, review the Centralised Metadata Repository for existing standard and proposed data elements before implementing a new database. ↑ Authoritative business sources for centralised metadata must be identified, documented, and actively maintained in the repository. ↑ Custom systems and Commercial off-the-shelf ('COTS') systems must comply with CMR standard data element definitions. ↑ Use Centralised Metadata Exchange Standards when exchanging data across departments. ↑ Take the Entity-Relation (ER) model to the third normal form, and then denormalise where necessary for performance. ↑ Restrict free form data entry where possible. ↑ Limit the number of indexes on databases that will be experiencing significant insert and update activity. Increase the number of indexes on databases where importance lies in retrieval time. ↑ Design data models to accommodate any future changes, including growth and changes in business requirements or database technologies. ↑ Use a data-modelling tool to reverse engineer existing databases. ↑ Implement a server-based solution as opposed to a workstation based implementation. ↑ Use domain name system ('DNS') alias 	<ul style="list-style-type: none"> ↑ Utilize experienced consultants well-versed in facilitating discovery sessions, process automation, business process mapping and documentation will save you time and money ↑ when launching your automation program. ↑ Acquire knowledge, methodology, training and experience you need to perform future process automation projects. Once you learn the methodology and how to break apart a process into discrete steps, you'll be prepared to conduct process mapping on your own. ↑ Do not choose to reengineer your most important, mission-critical processes at the outset. Instead, start with easier processes you can tackle, especially since a great deal will be learnt throughout the first few automation exercises, and acquired insights can be leveraged thereafter for more complex areas business. ↑ Learn not only how process automation works, but also how automating processes 	<ul style="list-style-type: none"> ↑ Be realistic in terms of what you expect of a particular project, even if it is necessary to be ambitious in the long run. It hardly makes sense to develop complicated IT solutions with complex code that would also make for poor usability even if it were completely bug-free. It is better to develop something small and simple, let the department warm up to it and then gradually squeeze in more complexities. ↑ INVOLVE SMALL GROUPS WITH ABILITY, AUTHORITY AND DRIVE. It is impossible, if not undesirable to satisfy all requirements of all stakeholders; in fact, at times, it may even be mutually untenable. Arrive at the Least Common Denominator of requirements that emanate from different stakeholders. Have a small core group decide on what a piece of software would contain (and what it would not). This group must contain individuals who command a high level of authority, ability and drive. ↑ An assignment of this nature is something which is either Lose-Lose or Win-Win. Either both the client and the consultants gain out of it or both of them sink in the process. One-upmanship not only goes against the grain of such collaboration but is also severely detrimental to the project's outcome. ↑ Maintain PERMANENCE OF PEOPLE FOR DISCUSSIONS AT THE GROUND

“close” to the applications using them; “Close” does not imply physical proximity. It means deployed on platforms that have high bandwidth connections between them. Do not perform heavy data movement across the WAN during peak hours.

- ↑ For applications requiring very large amounts of data movement, try scheduling the execution of these queries to run during off peak hours to minimise the impact on network performance. Where business rules allow, use off-peak hours for scheduled data transfers.
- ↑ Use asynchronous rather than synchronous communications between application components (except in cases where business rules require synchronous communications).

names when accessing databases.

- ↑ Establish a data infrastructure that can accommodate rapid changes in data models based on changes in business requirements or changes in database technologies.
- ↑ High-volume transaction data that is shared across locations and that needs to be current for all locations must be centralized so all locations have access to the same data source.
- ↑ Design databases to be modular, business driven and aligned with application services.
- ↑ Design an N-tier architecture where all data access is managed through a middle tier.
- ↑ Design for data to be accessed only by the programs and business rules owning the data, never by direct access to the database.
- ↑ For data quality management, implement tools, methods, processes and policies to provide high-level data accuracy and consistency across distributed platforms.
- ↑ Use ANSI-Standard SQL programming language to access a database.
- ↑ Implement security to be a roadblock to unauthorised access, but not a hindrance to access by authorised users. Implement minimal sign-on or authentication processes if possible.
- ↑ Use transaction logging so recovery of original data is possible and protect the transaction log.
- ↑ When high impact, sensitive data is transported through the LAN, WAN, or Internet, ensure that the data is encrypted and protected from alterations.
- ↑ Protect source code in data access rules,

works in the organisation, with the staff.

- ↑ Prioritise automation of business processes, taking up first the ones that give the maximum purchase in terms of cost, time and convenience to stakeholders, both internal and external to the department.
- ↑ While mapping the “As Is” processes ensure that every stakeholder who is a part of the process is involved integrally in it so as to correctly capture the same. While recommending the “To Be” processes, ensure that the stakeholders who would be participating in it are involved and their buy-in is obtained before setting off the process of automation.
- ↑ While capturing the processes and their automation in process maps deploy uniform standards and conventions to represent key aspects of the process automation like exchange of documents, production of outputs, approval processes, usage of communication and information technology channels and devices.

LEVEL.

- ↑ THE BEST IS OFTEN THE ENEMY OF THE GOOD. Efforts should be made to first develop a good product and operationalise, rather than develop the best product possible.
- ↑ Have smooth approval processes. It is important for the client to understand that at the end of it all someone has to “approve” the solutions advanced. Such “approvers” must be chosen with care and should be people who are effective decision-makers.
- ↑ An IT project that is an integral part of a larger funded assignment often becomes a “necessary evil”. Internally funded projects have a much higher sense of ownership particularly from the person who has sought the allocation and is more likely to succeed. The “owners” of the project must have a stake.
- ↑ Have a combined ownership of any solution at multiple levels of the departmental hierarchy.
- ↑ Maintain the same zeal in implementation and operationalisation stages as during the design and development stage. A mix of incentives and disincentives could well be the answer to ensure that designed and developed systems are put to their rightful use.
- ↑ Consider giving a maintenance and operationalisation contract to a software vendor for a transition period during which the necessary competencies could have been passed on to the department

	<p>particularly if it contains password information.</p> <ul style="list-style-type: none"> ↓ Do not store credit card numbers in the database for non-recurring charges or infrequent recurring charges. ↑ Change all default database passwords as soon as a system is setup. 		<p>officials till they became competent enough to take over.</p> <ul style="list-style-type: none"> ↑ Have capacity building of the staff as a requirement to ensure ownership and usage of the systems. Capacity building efforts must also be followed through to help the officials internalise the systems in the department's operations.
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Table 3 Summary of Best Practices Relevant for the DFWP eGovernment Implementation

CONCLUSION

6 Conclusion

The best practices presented in this report offer alternative ways of approaching a problem. They typically have been successful in some part of the world. An analysis of such practices and their applicability on one's system could open a vista of ideas to address pain areas and to improve performance.

Like most Government departments in India, DFWP too has its share of issues and pain areas. It has initiated this e-Governance programme to address them with the help of technology and process re-engineering initiatives. Practices adopted in other countries or States in India can inform DFWP towards taking the right decisions.

The best practices present technologies that have been successful in addressing similar problems as well as the method that made them successful. It saves substantial effort, cost and time in testing ideas. It comes with experiences of other parties and is a good platform to correct course and proceed in the right direction.

However, replicating a model that has been successful elsewhere under different conditions may not always be desirable. Ground realities may be quite different, even when compared to Forest departments in other Indian states. Hence, the analysis to identify the applicability and appropriateness of a practice to the DFWP is a critical step.

This report has presented a set of best practices from across the world that has been successful in addressing problems similar to that in DFWP. It also presents the analysis of appropriateness of these practices in DFWP's scenario.

The next step would be to mould the current practices and systems in DFWP according to the

appropriate practices identified in this report and the conditions of the department.

This adaptation of best practices along with innovative ideas and improvement suggestions from BPR exercise would result in a solution for achieving the objectives identified by the Department for the e-Governance initiative.

Not only would the new system be a treasure in itself for the department but also the learning and experience gained from conceptualizing and implementing this initiative would continue to inspire further efforts in this direction. It would help the department leap several steps ahead and would make it a benchmark for many other States and countries.

