# Introduction

## Introduction

Forests provide renewable raw material; and energy, maintain biological diversity, mitigate climate change, protect land and water resources, provide recreation facilities, improve air quality and help alleviate poverty. At the same time forests are affected by fire, grazing, pest and invasive species and are also the primary targets for agricultural and urban expansion.

The forest wealth in our country is extremely diverse as a result of the huge variation in the topography of the country. Due to the impact of biotic pressure on our forests, many forest areas spread across the country has been depleted and degraded which is a serious concern.

The role of India's forests in the national economy and in ecology was further emphasized in the 1988 National Forest Policy, which focussed on ensuring environmental stability, restoring the ecological balance, and preserving the remaining forests. Other objectives of the policy were meeting the need for fuel wood, fodder and small timber for rural and tribal people while recognising the need to actively involve local people in the management of forest resources. A new target was to increase the forest cover to 33 percent of India's land area. While adequate protection and afforestation activities has contributed to the increase in the extent and quality of forest cover in some parts of the country, it is extremely important that the spatial distribution of the changes in forest cover and growing stock be monitored on a regular basis for effective planning. It is imperative for this purpose to conduct regular assessment of forest cover.

Forest Survey of India (FSI), is a premier national organization for forest resource assessment working under the Ministry of Environment and Forests, Government of India. Besides, carrying out forest and tree cover assessment, Forest Survey of India is also engaged in providing the services of training, research and extension. Established on June 1, 1981, the Forest Survey of India succeeded the "Preinvestment Survey of Forest Resources" (PISFR), a project initiated in 1965 by Government of India with the sponsorship of FAO and UNDP. The main objective of PISFR was to ascertain the availability of raw material for establishment of wood based industries in selected areas of the country.  In its report in 1976, the National Commission on Agriculture (NCA) recommended the creation of a National Forest Survey Organization for collection of data on scientific lines through countrywide comprehensive forest resources survey at regular intervals.  Consequently, PISFR was reorganized into FSI in June 1981.  After a critical review of activities undertaken by FSI, Government of India redefined the mandate of FSI in 1986 in order to make it more relevant to the rapidly changing needs and aspirations of the country.  The main objectives of FSI are as follows:

## Objectives of FSI

➢ To prepare State of Forest Report biennially, providing assessment of latest forest cover in the country and monitoring changes in these.

➢ To prepare thematic maps on 1:50,000 scale, using aerial photographs.

➢ To function as a nodal agency for collection, compilation, storage and dissemination of spatial database on forest resources.

➢ To conduct training of forestry personnel in application of technologies related to resources survey, remote sensing, GIS, etc.

➢ To strengthen research & development infrastructure in FSI and to conduct

research on applied forest survey techniques.

➤ To support State/UT Forest Departments (SFD) in forest resources survey, mapping and inventory.

➤ To undertake forestry related special studies/consultancies and custom made training courses for SFD's and other organisations on project basis.

**Major activities**

The major activities of FSI are:

a. Forest Cover Assessment
b. Inventory of Forest areas
c. Inventory of Trees Outside Forests (Rural & Urban categories)
d. Inventory data processing
e. Methodology Design
f. Training and Extension
g. Projects and Consultancies

**Organizational Set-up.**

The Forest Survey of India is headquartered at Dehradun and has four zonal offices located at Shimla, Kolkata, Nagpur and Bangalore. The Forest Survey of India is headed by a Director General who is assisted by two Joint Directors at headquarters who are looking after the National Forest Data Management Centre (NFDMC) and the Training & Forest Inventory (TFI) units. Each zonal office is headed by a Regional Director. The locations of the headquarters along with zonal offices is depicted in Fig.1.1.The Headquarters as well as the Zonal offices work in close coordination to carry out the various activities of FSI.

## Table 1- Jurisdiction of the Zonal Offices

| SI. No. | Name of the Zone | Jurisdiction | |
|---|---|---|---|
| | | States | Union Territories |
| 1. | Northern Zone, Shimla | Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Uttaranchal, Haryana, Punjab, Rajasthan & Delhi. | Chandigarh |
| 2. | Eastern Zone, Kolkata | Bihar, Jharkhand, West Bengal, Sikkim, Meghalaya, Tripura, Manipur, Nagaland, Assam, Mizoram, Arunachal Pradesh & Orissa. | Andaman & Nicobar Islands. |
| 3. | Central Zone, Nagpur | Madhya Pradesh, Chhattisgarh, Maharashtra, Gujarat & Goa. | Daman & Diu. Dadara and Nagar Haveli |
| 4. | Southern Zone, Bangalore | Andhra Pradesh, Karnataka Kerala and Tamil Nadu. | Lakshadweep, Pondicherry |

# Forest Cover Assessment

Forest Survey of India (FSI) assesses forest cover of the country by interpretation of remote sensing satellite data and publishes the results in a biennial report called 'State of Forest Report' (SFR). Beginning in 1987, nine SFRs have been brought out so far.  Starting with data of US Remote Sensing Satellite Landsat for SFR 1987, FSI shifted over to the use of data of the indigenous satellite Indian Remote Sensing (IRS) LISS III sensor since 1995 till 2003. In the current cycle (i.e. for SFR 2005) FSI is using satellite data for IRS P6 Resourcesat LISS III.  The technological advancement in scale of interpretation, resolution of sensor, mode of interpretation and data freshness is indicated in table no. 3.

The scale of interpretation has improved from 1:1 million (SFR 1987) to 1:50,000 bringing down the minimum mappable area to 1 ha. from 400 ha.  The spatial resolution of the sensor has come down from the course resolution of 80 m x 80 m to a fine resolution of  23.5 m x 23.5 m. This improvement of scale of interpretation and sensor resolution on one hand means increased capability of FSI in delineating smaller and smaller areas of forests (and blanks inside forests) and consequently on the other hand, a multiplication of work load for the technical personnel of FSI.  Starting with 363 Survey of India toposheets of 1:250,000 scale to nearly 5,200 SOI toposheets of 1:50,000 scale; the forest cover assessment exercise has become a huge task in terms of resources, man hours, and time. However, shift from visual interpretation of satellite imagery in hard copy to the digital interpretation of satellite data in soft copy has made this possible.

These days the satellite data for the forest cover assessment is obtained in digital form from the National Remote Sensing Agency (NRSA) – the sole authorized Govt. agency in India to download and disseminate the satellite data.  For the tenth forest cover assessment, in the year 2005-06, 68 scenes of  Resourcesat–1 (IRS-P6) LISS III data of resolution 23.5 m x 23.5 m were acquired.  Besides some scenes of LISS IV MX (multi spectral) of the same satellite were also acquired for selected areas which are to be used as proxy for ground verification in such areas which are inaccessible or extremist prone.

The satellite scenes are interpreted in FSI by a group of about 30 technical staff using Digital Image Processing (DIP) software. Digital data from satellite is downloaded from CDs onto the Workstation and radiometric and contrast corrections are applied for removing radiometric defects and for improving visual impact of the False Colour Composites (FCC). Geometric rectification of the data is carried out with the help of scanned SOI toposheets. Based on tone and texture the forest cover areas are delineated. Interpretation of forest cover for the whole country is done at 1:50,000 scale using polyconic projection. Normalized Difference Vegetation Index (NDVI) transformation is also used for density classification of forest cover. Areas of less than one hectare, whether classified as forest within non-forest areas or blanks within forested areas, are excluded by clustering pixels and merged with the surrounding class. The methodology has been shown schematically in the figure 3.

The details of satellite data procured from NRSA during 2005-06 is given below in table 2.

Table 2 - Details of Satellite data procured from NRSA

| 1. SFR-10th cycle Resourcesat-1 IRS-P6 LISS III, Resolution 23.5m. | | |
|---|---|---|
| **Date** | **No. of Scenes** | **Rate** |
| 25.04.05 | 45 | 20000 each |
| 25.05.06 | 01 | 20000 each |
| 09.08.05 | 21 | 20000 each |
| 17.11.05 | 01 | 20000 each |
| **Total Sheets** | **68** | **13,60,000** |
| 2. High Resolution Data for Delhi area Resourcesat-1 IRS-P6 LISS IV, MX, Multispectral. | | |
| **Date** | **No. of Scenes** | **Rate** |
| 24.04.06 | 4 | 42,750 |
| **Total Sheets** | **4** | **42,750** |

Table 3 : Satellite Data for Forest Cover Assessments from 1987 to 2003

| Assessment and Year | Data Period | Sensor | Data Form | Spatial Resolution | Spectral Resolution | Scale of Interpretation |
|---|---|---|---|---|---|---|
| I    1987 | 1981-83 | Landsat– MSS | Hard Copy FCC | 80 m | 4 Bands | 1:1million |
| II   1989 | 1985-87 | Landsat– TM | Hard Copy FCC | 30 m | 7 Bands | 1:250,000 |
| III  1991 | 1987-89 | Landsat– TM | Hard Copy FCC | 30 m | 7 Bands | 1:250,000 |
| IV   1993 | 1989-91 | Landsat– TM | Hard Copy FCC | 30 m | 7 Bands | 1:250,000 |
| V    1995 | 1991-93 | IRS-1B LISS II | Hard Copy FCC & Digital* | 36.25 m | 4 Bands | 1:250,000 |
| VI   1997 | 1993-95 | IRS-1B LISS II | Hard Copy FCC & Digital* | 36.25 m | 4 Bands | 1:250,000 |
| VII  1999 | 1996-98 | IRS-1C/1D LISS III | Hard Copy FCC & Digital** | 23.5 m | 4 Bands | 1:250,000 |
| VIII 2001 | 2000 | IRS-1C/1D LISS III | Digital | 23.5 m | 4 Bands | 1:50,000 |
| IX   2003 | 2002 | IRS-1D LISS III | Digital | 23.5 m | 4 Bands | 1:50,000 |

* Digital data used for two states
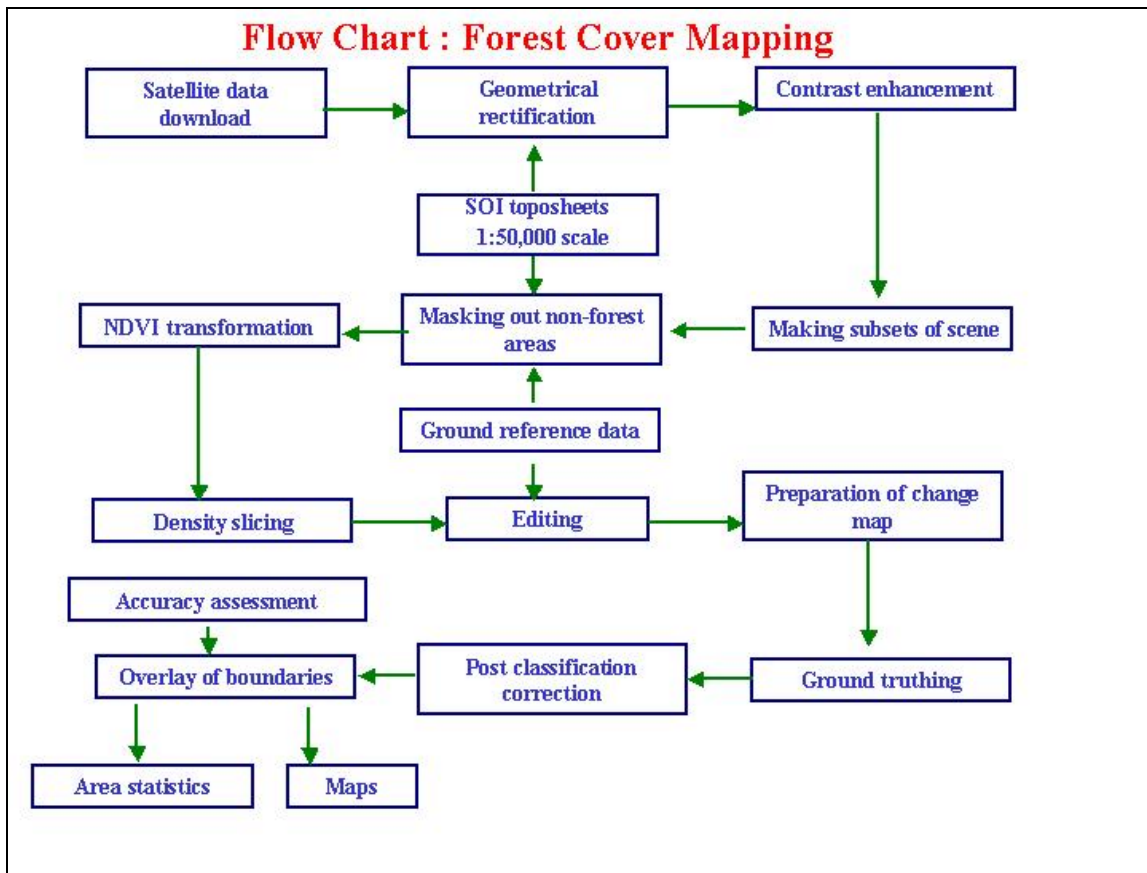** Digital data used for 14 states



Figure 3:  Flow Chart Showing Methodology of Forest Cover Mapping

The total forest cover of the country as per State of Forest Report 2003 is 678,333 km², which constitutes 20.64 percent of the geographic area of the country. Of this, 51,285 km² (1.56%) is very dense forest, 339,279 km² (10.32%) is moderately dense forest and 287,769 km² (8.76%) is open forest cover. The mangrove area in the country is 4461 km$^2$ **(0.14%) of the country's geographic area. The non-forest cover excludes scrub and is estimated to cover an area of 2,568,661 (78.13%) km²**. The status of forest cover in India as per State of Forest Report 2003 is indicated in Table 4 and depicted in pie chart in fig 4. The forest cover map of India is given in fig 5.

Table 4: Status of Forest Cover in India (As per SFR 2003)

| Class | Area (km²) | Percent of Geographic Area |
|---|---|---|
| Forest Cover | | |
| a) VDF | 51,285 | 1.56 |
| b) MDF | 339,279 | 10.32 |
| c) Open | 287,769 | 8.76 |
| Total Forest Cover* | **678,333** | **20.64** |
| Non-forest Cover | | |
| Scrub | 40,269 | 1.23 |
| Non-forest** | 2,568,661 | 78.13 |
| Total Geographic Area | 3,287,263 | 100.00 |

Fig 4 : Status of Forest Cover in India (As per SFR 2003)



* Including 4,461 km$^2$ under mangroves (0.14% of country's geographic area)
** Excludes scrubs and includes water bodies
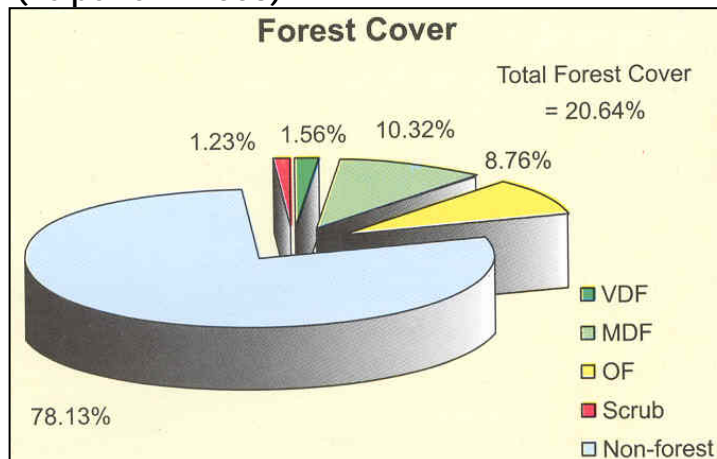
A comparison between the forest cover since 1987 onwards till 2003 is depicted in Table 5 below. Although it is improper to make a comparison in different assessments due to change in technology and scale of interpretation, however, it may still be observed that the forest cover of the country has remained between 19.5% to 20.5% in the last two decades.

Table 5 : Forest Cover in Different Assessments (1987 to 2003)                (Area in km2)

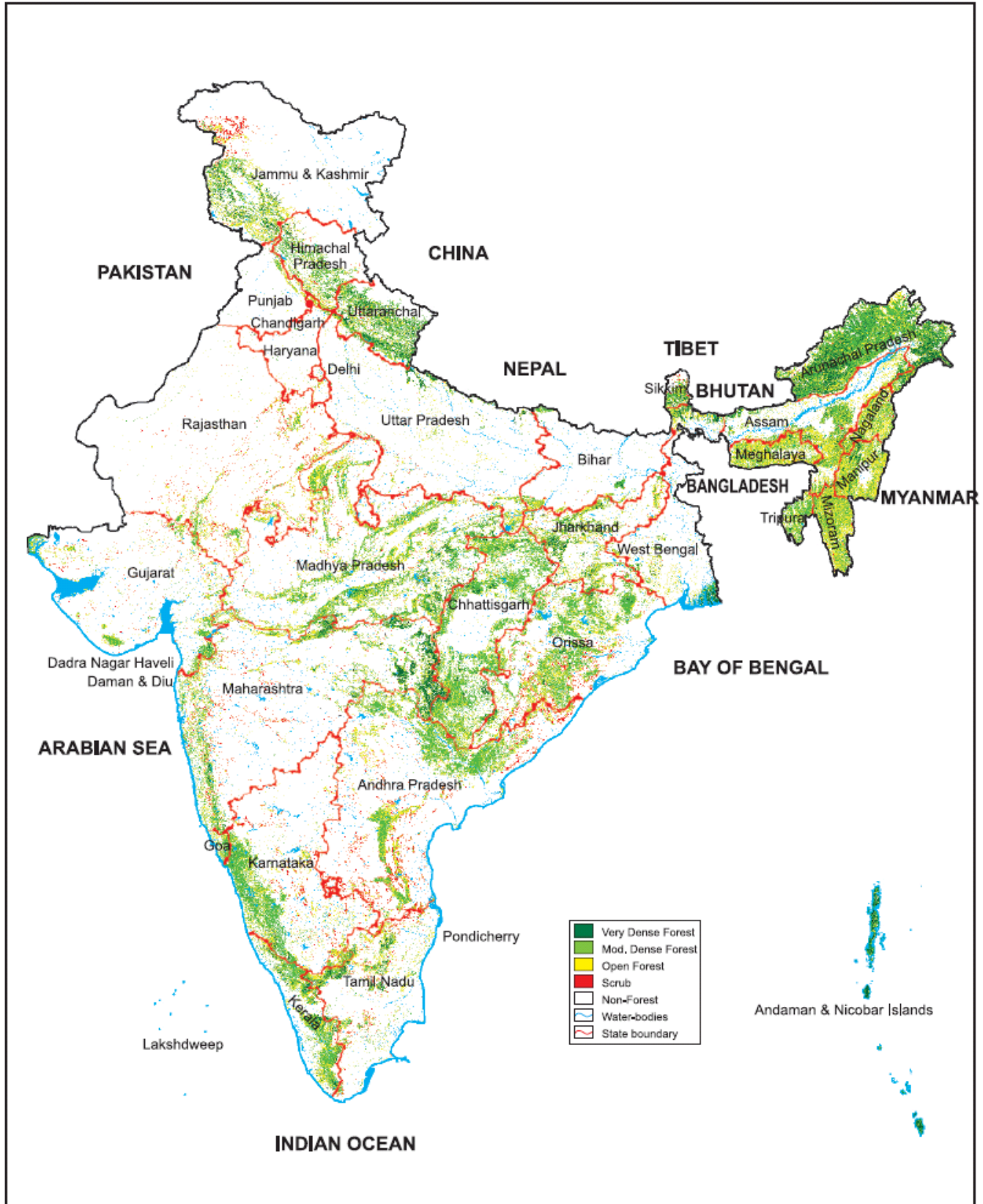| Year of Assessment | 1987 | 1989 | 1991 | 1993 | 1995 | 1997 | 1999 | 2001 | 2003 |
|---|---|---|---|---|---|---|---|---|---|
| Forest Cover in India | 640,819 | 638,804 | 639,364 | 639,386 | 638,879 | 633,397 | 637,293 | 675,538 | 678,333 |
| Percent | 19.49 | 19.43 | 19.45 | 19.45 | 19.43 | 19.27 | 19.39 | 20.55 | 20.64 |

Fig 5. Forest Cover Map of India

# Thematic Mapping

Another important mandate of FSI is to prepare thematic maps based on interpretation of aerial photographs acquired from Survey of India.

The forest types in 48 categories and 14 non-forest categories of land uses are depicted in these thematic maps, at 1:50,000 scale. A lot of information of the forest types, major species composition, crown density of forest cover and other land use classes is obtained with the help of thematic maps.

The aerial photographs are procured from Survey of India after following the routine procedure and are interpreted using stereoscope. Since there is considerable overlap in the successive photographs, therefore stereoscope viewing produces three dimensional images with the help of which various land use classes are identified and delineated. These maps are indented by State Forest Departments, Railways, Engineering Departments, Educational Institutes and other establishments for updating stock maps, working plan preparation, forest management, land use & other general planning.

The total geographic area of the country is covered by 5,200 Survey of India map sheets on 1:50,000 scale and of these about 3,400 sheets bear forest cover. Nearly 75% of the country's forested area, as depicted in figure 6, has been thematically mapped. FSI library holds around 50,000 such thematic maps. Of late, the task of thematic mapping has decelerated because of procurement difficulties and non-availability of the latest aerial photographs on time. Moreover, the demand of Thematic Maps from different SFD's and other organisation has declined over the years due to availability of high-resolution satellite imageries which are now in demand by the SFD's and other organisations for preparation of land use maps.
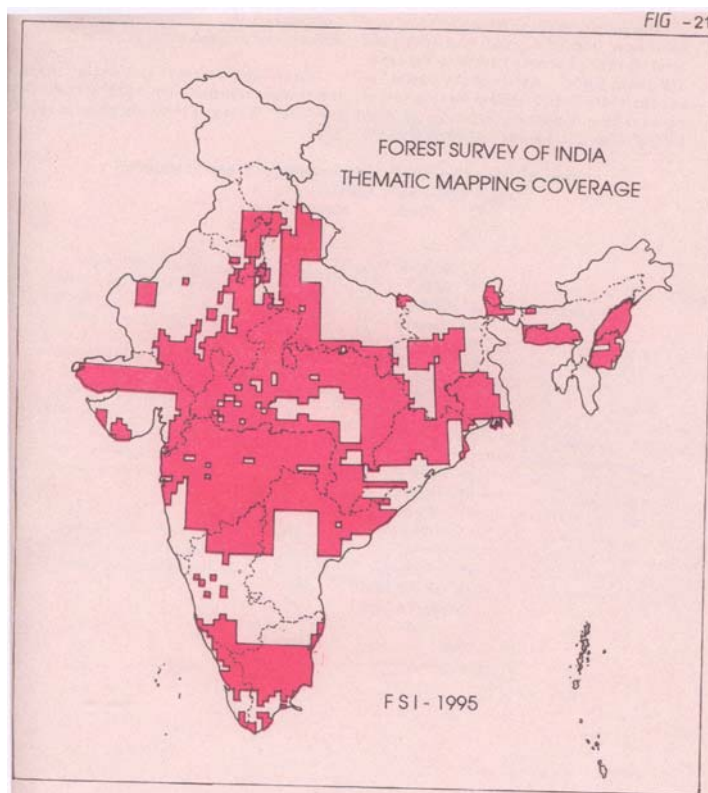
Fig. 6: Forest Area covered under Thematic Maps

Fig. 7: Thematic Map of BIhar

## Inventory of forest/tree resources

Forests have acquired increasing importance in the recent past not only for their role in meeting the material requirements but also for their ecological and environmental functions. To ensure sustainable development of our forestry resources, it is important to have accurate and up-to-date information/data on our forest resources. Some of the important parameters required by forest managers, planners and policy makers on forest resources are forest cover, growing stock, annual increment, species composition, biomass, regeneration status, biodiversity, non-timber forest products etc. The Forest Survey of India (FSI) and its precursor organization, Pre Investment Survey of Forest Resources (PISFR) has carried out forest inventories since 1965. So far about 80% of the country's forest areas have been inventoried including some areas more than once and about 140 reports have been published. Although, some of the parameters mentioned above are still to be measured at the national level, FSI has been able to give the distribution and volume of important tree species within and outside the recorded forest area. Moreover, other important parameters like regeneration survey, distribution and volume of important species of bamboo will be made available by FSI in the near future.
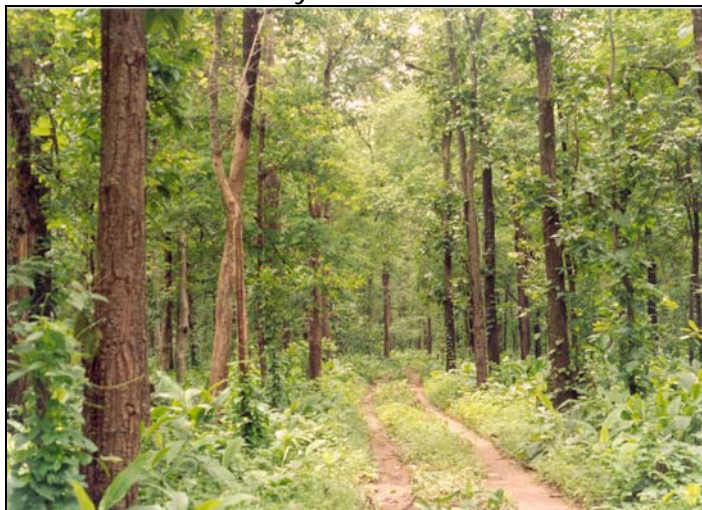


**Dense Sal Forest with Canopy Over 70%**

Besides forest resources, extensive tree wealth exists outside continuous forested areas. Termed as "Trees Outside Forests (TOF)," these are in the form of small woodlots and block plantations, trees along linear features, such as roads, canals bunds, etc. and scattered trees on farmlands, homesteads, community lands and urban areas. They serve a number of economic and ecological functions and therefore require to be managed in a planned and systematic manner. Inventory of trees outside forest together with forest inventory, provides a complete picture of tree/forest resources in the country. FSI has been carrying out TOF assessments since early 1990s till 2001, but an accurate estimate at the national level at a specific time frame was not available. It was only in SFR-2001 that a national level estimate of tree cover was given for the entire country, which has now become a regular feature of subsequent SFRs.



**TOF – Block Plantation**

At present, FSI is also supplementing the usual field inventory with measurement of several other parameters for a comprehensive assessment of forest resources inside and outside forest areas at the national level. During forest inventory, efforts are being made to collect additional data to assess regeneration status,

biodiversity indices and soil carbon in forest areas. Field data are being collected from sample plots based on stratification of the country into physiographic zones and a sample of 10 percent districts (or 60 districts) are taken in every cycle of 2 years for detailed inventory. The information, thus generated, will form a part of the biennial State of Forest Report in future. These estimates will be further improved in the subsequent reports as another set of districts are sampled and surveyed.

The methodology for inventory of forests & trees outside forests carried out by FSI since the inception of the Tenth Five Year Plan is given below.

## A.    Forest Inventory

The country is stratified into 14 physiographic zones according to tree species composition and other physiographic and ecological parameters. In strata, districts are considered first sampling units and grids of size 1 ¼´ X 1 ¼´ as secondary sampling units.   Ten percent of districts are being inventoried every cycle of 2 years.



**Measurement of Diameter using Callipers**

- 1:50,000 scale Survey of India toposheet is divided into 36 grids of 2 ½´ x 2 ½′, further each are divided into 4 sub-grids of 1 ¼´ x 1 ¼′ forming the basic sampling units.   Two of these sub-grids are randomly selected and corresponding sub-grids in all the 2 ½´ x 2 ½′ grids are

selected to form the sample.   The intersection of diagonals of such sub-grids are marked as center of plot on the map. At the center of selected subgrid a plot of 0.1 ha area is laid out in each such grid and data are collected from the plots falling in forest area only.

- For collecting data on soil, forest floor (humus & litter carbon), sub-plots of 1m x 1m are laid at each corner within the 0.1 ha plot.

- The data regarding herbs and shrubs (including regeneration) are collected from four square plots of 1m x 1m and 3m x 3m respectively.   These plots are laid out at 30 meters from the centre of 0.1 ha plot in all four directions along diagonals in non-hilly area and along trails in hilly areas.

The data collected in the field is checked and entered by the zonal offices and sent to head quarter for processing.  At the head quarter, the data received from the zones is again checked for inconsistencies and data is rectified before processing.  Processing is carried out by using a specially designed software for different parameters such as area estimation, volume estimation, stand and stock tables, standard error estimation etc.

## B.    TOF (Rural)

For assessment of rural TOF, a methodology based on remote sensing is used wherein LISS and PAN of IRS P6 (Resourcesat) scenes are used for identification and stratification of TOF resources in the selected districts. The LISS and   PAN scenes for the selected districts are procured from NRSA, Hyderabad.  Toposheets for the selected district are identified and geo-referenced.   These toposheets are then used to rectify panchromatic data.  After rectification, these PAN data are used to rectify the multi-spectral LISS data. The panchromatic and multi-spectral data are then

fused together (fig 8) and a classified image (fig 9) is prepared having three strata namely block, linear and scattered.

Stratified random sampling is being employed for the survey. The country is stratified into 14 physiographic zones and the physiographic zones are strata and the district is a first stage-sampling unit. The district is further stratified into three strata namely, block, linear and scattered. The number and size of sample plots under block, linear and scattered stratum has been decided on the basis of a pilot study and are given as follows:

a) 35 square plots of 0.1-hectare size in block stratum are randomly selected for each district.
b) 50 rectangular plot of 10m x 125m of sizes in linear stratum are selected for each district.
c) 50 square plots of 3.0-hectare sizes in scattered stratum in plains and 95 plots of 0.5 ha scattered stratum in hills are selected for each district.

**Note**: It has been concluded from the study conducted for determination of plot sizes and sample size for all the three strata that 35 plots in blocks and 50 and 50 plots for linear and scattered are to be surveyed in each district to generate estimates at 15% permissible error or 85% accuracy. However, some points may not be traceable on the ground or are inaccessible or status of points may not match with the stratum or fall in forest/ urban areas. To augment this, additional points needs to be surveyed. As such, field parties are given 50,60 and 60 plots for blocks, linear and scattered stratum respectively for surveying. Field parties collect information for these plots indicating status of plot in appropriate column of the form.

Desired number of sample points, as mentioned above, are randomly generated in each stratum, separately and the data on pre decided variables are collected on designed formats, following Manual for Assessment for Trees Outside Forests (FSI, 2003). Thereafter,

data processing is carried out following appropriate formulae corresponding to sampling design to obtain total stems in different category by species and dia class, number of stems per ha., volume per ha species and dia class-wise, total volume by species and dia class in different category and tree cover information.
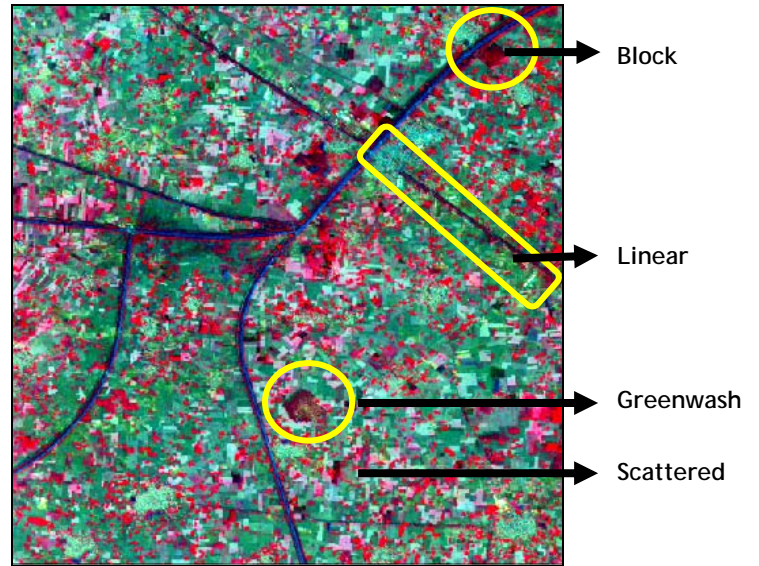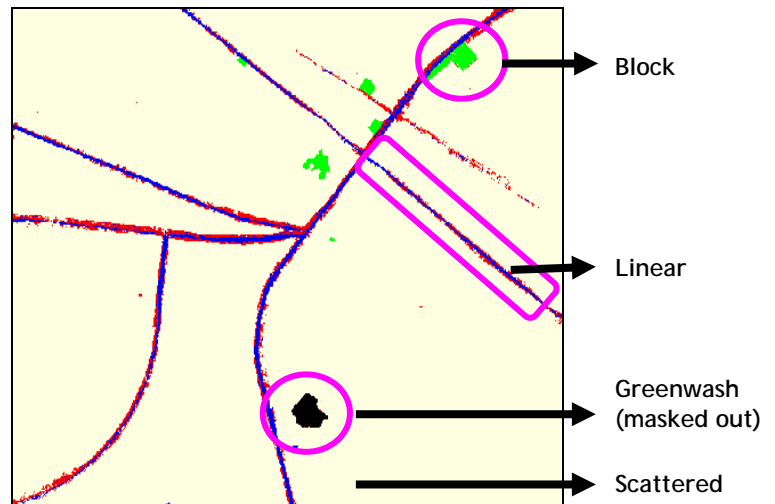


Fig 8 : Merged Image(IRS 1D PAN & IRS P6 LISS III)



Fig 9 : Classified TOF Map

## C. TOF (urban)

For assessment of urban TOF, the study area is considered as urban centers defined in district census book. Sampling frame for urban areas has

been prepared by an agency called National Sample Survey Organisation (NSSO) under the Ministry of Statistics and Programme Implementation, Government of India. This organization conducts surveys by the name of Urban Frame Survey (UFS). They divide the whole urban centers of a district in blocks called UFS blocks. These blocks are having clear-cut well defined natural boundaries (fig 10). These blocks are formed on the basis of 600-800 population or 120-160 households and cover the whole area within the geographical boundary of town including vacant lands.
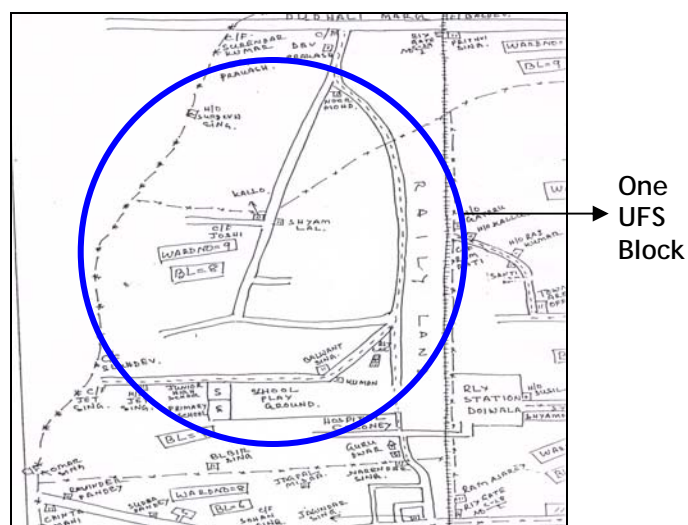


Fig 10 : A UFS Block Map used for TOF Urban

The sampling technique, which is being used, is stratified random sampling. The district is divided into five categories of town based on population, as strata. Urban Frame Survey Blocks (UFS Blocks) are the sampling units which are obtained from the National Sample Survey Organisation. The number of sample blocks to be surveyed in the district is to be decided by the following method.

(a) In the district 10 % of total blocks will be selected and proportionately distributed in five class of town when available UFS blocks in the districts are less than 500. Minimum number of blocks should not be less than twenty in a district.

(b) In the district 5 % of total blocks will be selected and proportionately distributed in five class of town when available UFS blocks in the districts are between 500 and 1000.

(c) In the district 2.5 % of total blocks will be selected and proportionately distributed in five class of town when available UFS blocks in the districts are more than 1000. Maximum number of blocks should not be more than 60.

After selecting the UFS blocks, data are collected, entered and processed in the same way as it was done in case of Forest Inventory/TOF Rural.

## Achievement during the year 2005-2006

A total of 28 districts (List enclosed as Annexure-II) were selected for complete inventory of forest & TOF areas during 2005-06 out of 60 districts for the period 2004-06. Zone wise details are given below:

### Central Zone

In Central Zone a total of eight districts namely Akola, Barwani, Beed, Chindwara, Dangs, Jabhua, Nasik and Ratnagiri were alloted for forest and TOF inventory. All the eight districts have been inventoried both for forest and TOF. The entered and checked data for all the eight districts has been received by Headquarter. The data checking and cleaning work is under progress.

### Eastern Zone

During 2005-06, six districts namely Bankura, Golpara, Gumla, Kodarma, Ribohi, and West Kameng were alloted to Eastern Zone for forest and TOF inventory. All the six districts have been inventoried both for forest and TOF. The entered and checked data has been received for all the districts.

### Northern Zone

A total of eight districts namly Churu, Gautambudhnagar, Nanital, Pali, Rampur, Rohtak, Solan and Una were alloted to Northern Zone for forest & TOF inventory. All the eight districts have been inventoried both for forest and TOF. The entered and checked data for all the eight districts has been received by Headquarter. The data checking and cleaning work is under progress.

## Southern Zone

In Southern Zone a total of six districts namely Banglore (Rural), Coimbatore, Prakasam,Raichur, Thiruvarur and Tumkur were alloted for forest and TOF inventory. The forest inventory and TOF work for all the seven districts has been completed and entered data has been received by head quarter for processing.

## Data Processing

The data processing work is carried out at head quarter. As per the revised methodology a **National Forest Inventory Database System** (NFIDS) based on database software (MS Access) using front end on Visual Basic has been prepared. The data entry module for forest and TOF inventory has been prepared and successfully installed in all the zonal offices. The entered data from the respective zones are sent to the headquarters at Dehradun for processing of data on forest and TOF. The data processing module for processing of forest and TOF parameters like, total estimated stems, volume and per hectare figures under different species and different diameter class has been developed. In addition, estimates of total number of stems, stem per hectare and total growing stock for entire district are also produced using the same module. The processing modules for additional parameters of forest resources such as bamboo, regeneration, soil carbon etc is under progress.

# Training

## Introduction

Training unit of FSI has been imparting training to forestry personnel since 1981 with the objective of disseminating knowledge and information on the modern techniques being employed in forest survey. Forestry personnel of various levels, working in the State Forest Departments are provided training in various disciplines like, Application of Remote Sensing (RS) and GIS in Forestry, Application of Geographical Information system (GIS) in preparation of working plans, and Application of Global Positioning Systems (GPS) in Forest Survey and Demarcation, during in-house training courses of varying duration, organized throughout the year having a judicious mix of theoretical and practical orientation. Till date, more than 2300 forestry personnel from different State Forest Departments have been trained. Forest Survey of India conducts 10 to 12 such courses on different themes every year. The Training Unit has imparted training to 2315 forestry personnel till March 2006. The annual target for training personnel during 2005-06 was 100 and against it till 31st March 2006, the target achieved was 189, which includes 51 forestry personnel trained in the outreach training courses conducted for forest departments of Punjab and Andaman & Nicobar Islands. In addition, the technical staff of FSI is also trained frequently for refurbishing and upgradation of their technical skills to enable them to keep pace with the rapid advancements in this technology.

During 2005-2006, FSI conducted three courses of 2 week duration on RS/GIS Application for CF/DCF/ACF level officers, one course of 3 weeks duration on "Application of RS, GIS and Inventory in Forestry" to Range Forest Officers, four courses on "GPS Application in Forest Survey and Demarcation" and 2 compulsory courses for IFS officers. The training calendar for the year 2005-2006 is depicted below in Table 6.

## Table 6 : Training Calendar for 2005-2006

| Theme | No. of Course | Level of Participants | Duration (Weeks) | May '05 | June '05 | July '05 | Aug. '05 | Sept. '05 | Oct. '05 | Nov. '05 | Dec. '05 | Jan. '06 | Feb. '06 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Application of Remote Sensing and GIS in Forestry | 2 | IFS | 1 | 9-13 | | | | 19-23 | | | | | |
| Application of GIS in Forest Resource Management | 3 | DCF/ACF | 2 | | | 4-15 | 16-26 | | | | | 9-20 | |
| Application of GIS and Inventory in Forestry | 1 | RFO | 3 | | | | | | | | 5-23 | | |
| GPS Application in Forest Survey and Demarcation | 1 | CF/DCF | 1 | | | | | | 3-7 | | | | |
| | 3 | ACF/RFO | 1 | | 6-10 | | | | | 21-25 | | | 6-10 |

## One-week compulsory training for IFS officers

Two compulsory courses of one week duration each on 'Application of Remote Sensing & GIS in Forestry' for IFS officers were conducted by Forest Survey of India from 9th to 13th May 2005 and 19th to 23rd September 2005 respectively. This short duration (one week) course is aimed at sensitization of IFS officers towards the application of Remote Sensing, GIS and GPS in forestry. Fourteen participants from 10 States participated in the first course and Twenty one participants from 12 States participated in the second course.

During the course basic concepts of Remote Sensing & GIS were dealt with in detail. Practical sessions on the interpretation of satellite imagery were conducted with the object to expose the participants to the procedural aspects. The

application of these technologies in forestry was demonstrated through suitable case studies related to habitat/biodiversity mapping, Working Plan preparation, fire risk zonation etc. In addition to the above, demonstration on use of hand held GPS was also given. A panel discussion on latest advancements in application of remote sensing, GIS & GPS in forestry was organized on the last day.


Participants of IFS Compulsory Training at FSI

## GIS training on ArcGIS software

ArcGIS desktop includes a suite of integrated applications: ArcMap, ArcCatalog and ArcToolbox, using which one can perform any GIS task, simple to advanced, including mapping, data management, geographic analysis, data editing and geoprocessing.

FSI has already developed a training model on ArcGIS 9.1 Software for imparting training to forestry personnel from various SFD's in GIS courses. This training was earlier imparted on Geomedia professional software, however, on requests from a number of States, the above module on ArcGIS Software was prepared and the first batch of officers were trained in GIS on ArcGIS Software from August, 2005. It is expected that this training module will be very useful for the DCFs/ACFs & ROs engaged in preparation of working plans.

## Outreach Training Programmes

Besides in-house training courses, FSI also conducts training courses designed to meet the specific demand of various State Forest Departments at their place of choice of location and duration. This year 27 personnel of the Punjab Forest Department were imparted training out of which 18 officers were trained in a four-day course organized at Hoshiarpur from 16-19th Nov 2005 on "GPS Application in Forest Survey and Demarcation", and 9 officers were imparted training on "Application of GIS in Forest Resource Management" organized at FSI, Dehradun from 13-24th Feb 2006. In addition, 24 officers from A & N Islands were imparted training on "GPS Application in Forest Survey and Demarcation" in a 3-day course organized at Port Blair from 6-8th Mar 2006.


**Training at A&N Island Forest Department**

## Training during 2006-07

During 2006-07 it is proposed to organize 12 in-house training courses for 100 forestry personnel including one compulsory training course on 'Application of Remote Sensing & GIS in Forestry' and one two-day workshop on 'Remote sensing, GIS and GPS in the preparation of Working Plan: Strategy for implementation' for IFS officers in addition to organizing training courses on the specific request of the SFD's at their choice of location and duration, catering specifically to their needs. Apart from increasing the number of training courses on GIS and GPS, an advanced course on Application of GIS in Forest Resource Assessment will also be introduced.

# Extension

## Introduction

Extension unit of Forest Survey of India is responsible for showcasing the activities of FSI to users, stake holders and others.  In Forest Survey of India, Extension Unit is engaged in printing and publication of State of Forest Reports, Inventory Reports, Reports of Several Projects, Quarterly News letters, Training Calendar, Annual Report and other informative material including Van Darpan in Hindi.  Publicity and Liason Work, conducting Workshops/ Conferences/ Seminars; organizing visits of officers, trainees and dignitaries from different organizations of national and international importance also form a part of the extension activities of Forest Survey of India.

## Library

The Library in Forest Survey of India consists of around 5500 books on diversified modern subjects ranging from the fields of Remote Sensing, G.I.S. (Geographic Information System), D.I.P (Digital Image Processing), Forestry and Computer applications in forestry.  During 2005-06, 79 books on subjects mentioned above and 47 books on Hindi were procured to enrich the library on modern digital Image Processing & GIS Techniques and to promote the use of Hindi in Forest Survey of India.

Apart from books on diversified subjects, the Photo Library of Forest Survey of India has around three lakhs aerial photographs on varying scales (1:10,000 to 1:50,000) of different kinds viz B&W (Black & White); B&W (Panchromatic); IR (Infra Red) & False colour.  The Map  Library is also stocked with thematic maps of a wide range of selected areas of the country on 1:50,000 scale prepared on the basis of interpretation of Black & white aerial photographs of multi seasons.

In addition, the Map Library is equipped with a wide range of collection of topo graphical sheets of Survey of India on 1:25,000, 1:50,000, 1:250,000 and 1:1 M scales of de-restricted and restricted areas of the country.  Map Library also includes a large series of vegetation maps on 1:250,000 and 1:50,000 scale prepared on the basis of Visual Interpretation of hard copies of MSS (Multi spectral Scanner); TM (Thematic Mapper), IRS-1 B LISS II (Indian Remote Sensing Satellite – 1B Linear Imaging and Self Scanning Sensor II) and IRS-IC /ID LISS III (Indian Remote Sensing Satellite – IC/1D  Linear Imaging and Self Scanning Sensor III) for the entire country.