PREPARING A FOREST WORKING PLAN IN INDIA

GIS in Forest Management

A Forest Working Plan regulates wood production, silviculture and tending activities for a predefined period of time by specifying targets, actions and control arrangements. The author shows how GIS was used to prepare a Working Plan for Velhe forest subdivision in India.

Systematic forest management requires division of the forest area into blocks and compartments. A block is usually bounded by natural features and divided for administrative purposes into several compartments. For silvicultural management Working Circles (WC) are defined. A WC is a forest area with particular characteristics and the same set of Working Plan prescriptions.

Box
Velhe Forest subdivision is situated in Pune district of Maharashtra State, India and covers 26,147ha of forest scattered over a geographic area of 132,783ha. The 323 villages have a population of 113,761 as per 2001 census. The average annual rainfall is 2,050mm.

The Aims of Forest Management are:

- conservation of forest steep slopes and lake catchment areas by checking soil erosion, and soil and water conservation
- tending immature growth to secure full growing vigour and size by carrying out proper silvicultural operations
- meeting requirements of local, rural people for fuel wood, fodder, minor forest products and small timber
- increasing forest cover through afforestation works on degraded, barren, denuded forest areas.

Creating GIS Layers
Topographical maps at scale 1:50,000 were geo-referenced and features such as the transportation network, water bodies, settlements, contour lines and archaeological structures were digitised. Forest, block, compartment and beat boundaries were digitised from forest topographic maps at scale 4 inch to 1 mile. Soil type polygons were digitised from soil maps and an MS Access database was created. This stores for each soil polygon attributes including code number, soil-depth class, particle-size class, mineralogy class, soil PH class, soil drainage class, surface texture, slope class and erosion class. Attributes were used to develop a soil GIS layer.

IRS, LISS III, PAN-sharpened satellite imagery from February 2004 was used to obtain forest type and density. A GPS handset was used to collect ground reference data to classify the satellite imagery into forest types, density classes and so on. Sample plots of 25m x 25m were laid in forest areas according to the stratified random sampling method. The data collected in each sample plot included number of trees, herbs and shrubs, species types, height, girth, crown diameter and natural regeneration. From these sample plots a forest inventory was prepared for each of the 156 forest compartments. From the compartment inventory a database was created in MS Access with many different attributes. Forest compartment boundaries were digitised from the forest territorial maps. To create a compartment GIS layer the values of the attributes as listed in Table 1 were assigned to the compartment polygons.

Village boundaries were digitised from sub-district maps and geo-referenced to create a village-census GIS. The attributes for all the 323 villages in the subdivision were collected from the 2001 census.
Using GIS software, a DEM was created from which slope maps, aspect maps and stream network were derived and stream watersheds delineated. The data was processed and analysed using Geomedia Professional 5.2, GRID 5.2 and Image Analyst.

Working Plan
Forestlands within a buffer zone of 500m created around settlements, roads and cart tracks were identified as areas where no water sources were to be allowed for wildlife because of the risk of disturbance. Instead, sites near habitat edges were identified. Degraded forest areas were identified by running attribute and spatial queries on compartment, soil and village-census layers. View-shed analysis was carried out to identify optimal locations for watchtowers for fire and forest protection. After carrying out the GIS analysis and based on their characteristics, forest areas were allotted to various Working Circles (WC):

- Protection WC (12,169ha)
- Thinning and Improvement Felling WC (1,454ha)
- Soil and Moisture Conservation cum Afforestation WC (5,650ha)
- Fodder WC (2,309ha)
- Bio-diversity Conservation (overlapping) WC (whole area)

- Survey & Demarcation works WC (1,001ha)
- Fuel wood WC (3,562ha).

Protection WC is allotted to forest areas with slopes above 200, 20m wide buffer areas along steams, watersheds of lakes supplying drinking water to towns or farms, and compartments with endangered flora and historical/cultural sites. Thinning and Improvement Felling WC is allotted to teak-tree bearing areas on slopes below 100, compartments with a large number of tree-trunks in girth-class 20cms to 45cms and areas with over 60% forest density. Soil and Moisture Conservation WCs consist of forest areas with a slope less than 300 and less than 40% density, and areas where soil erosion is severe. To meet the fodder requirements of cattle, forest areas within 2km from settlements and with soil depth up to 10cm were assigned as Fodder WC. Survey and Demarcation Work WC is allotted to forest areas newly acquired and boundaries not properly demarcated.

Fuel wood is the major requirement for local people. Forest compartments within 2km of settlements were identified and a buffer zone of 100m was created for planting only fuel-wood species. Wasteland along the river with soil type suited for black cotton, soil depth more than 30cm and within 100m of the riverbanks was identified for planting Accia nilotica, a tree with high calorific value. For each WC such prescriptions have been defined and included in the regional Forest Working Plan.

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Further Reading

- National Working Plan Code 2004, India, Ministry of Environment and Forests, Government of India.