

Social Forestry Information System (SOFIS):

A standalone software for holistic planning of Social Forestry activities

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Abstract— Social forestry aims at raising plantations for the common man so as to meet the growing demand for timber, fuel wood, fodder, etc., thereby reducing the pressure on the notified or protected forest areas. Through the social forestry scheme, the government has involved community participation, as part of a drive towards afforestation, and rehabilitating the degraded forest and common lands. One of the major lacunae in social forestry is the lack of information about the place or suitable sites where to implement the social forestry activities. Information about the length and type of roads, canals and railways line along with the population pressure in and around it and the proximity to protected areas are crucial for the implementation of social forestry activities. SOFIS is application software developed for Social Forestry Department, Maharashtra State with the objective to identify the suitable sites for road/rail/canal side and block plantation. This standalone software was developed with open source GIS component – MAPWINGIS ActiveX control and Microsoft Visual Basic. MAPWINGIS component has wide range of functionalities for GIS processing which fulfills the requirement of this application. It does not incur any cost for the end user. This software facilitates display, navigation, rendering of geospatial data with archival of proposed plantations, querying and site suitability analysis. Various thematic layers, administrative boundaries (with socio-economic data) and infrastructure layers along with Cartosat-1 satellite data pertaining to Nagpur social forestry circle were integrated to the software for modeling the desirable output.

This software has site-specific reporting module, which gives thematic, socio-economic, and infrastructure details of interested areas. Suitability analysis module provides suitable sites for proposed linear/block plantation based on criterion specified. Ultimately planning module delivers the holistic planning of social forestry activities at a specified period for the desired administrative level.

Keywords- Social forestry, MAPWINGIS, Suitability analysis, GIS

I. INTRODUCTION

Social forestry means the management of forests and afforestation on waste lands with the purpose of helping in the environmental, social and rural development [1, 2]. This will enable the rural people to meet the growing demand for timber, fuel wood, fodder, etc., thereby reducing the pressure on the traditional forest area. Forests play an important role in the economy at local, regional and national levels, by contributing to the basic needs of the poor forest dwellers including tribal, meeting requirements of forest-based industries and most importantly in maintaining the ecological balance. Through the social forestry scheme, the government has involved community participation, as part of a drive towards afforestation, and rehabilitating the degraded forest and common lands [3]. Social forestry activity promotes creation of wood lots, horticulture plantation, bamboo plantation etc in the village common lands, government wastelands, along the roads/rail/canal and Panchayat lands [4]. One of the major challenges in social forestry is the lack of information about the places or suitable sites where to implement the social forestry activities. Information about the length of roads, canals, railways and waste lands along with the population pressure in and around it and the proximity to protected areas are crucial for the implementation of social forestry. The conventional method of making inputs for social forestry in India using ground survey is tedious process and time consuming. With the advent of high-resolution satellite data of Cartosat-1A, it is possible to generate the requisite digital database for the requirement of social forestry applications. Derived geospatial datasets such as Land Use /Land Cover, Slope, Soil, Settlement, drainage etc will help in decision-making.

SOFIS is application software developed for Social Forestry Department, Maharashtra State with the objectives of identifying the suitable sites for road/rail/canal side and block

plantation to cater the management activities and decision-making.

II. STUDY AREA , MATERIAL AND METHOD

The study area selected for the present study is Umred tehsil of Nagpur social forestry division. Indian Remote Sensing Satellite Cartosat-1A dataset having spatial resolution of 2.5 meter was used for generating linear features such as rail, road and canal. Whereas soil, slope, land use/ land cover, settlement, forest density, forest boundary and socio-economic data available at Regional Remote Sensing Center-Central, Nagpur has been used for the integration to software. Social forestry department provided information about the existing linear and block plantation with attributes like year of plantation, type of plantation, status of plantation, species and number of plants.

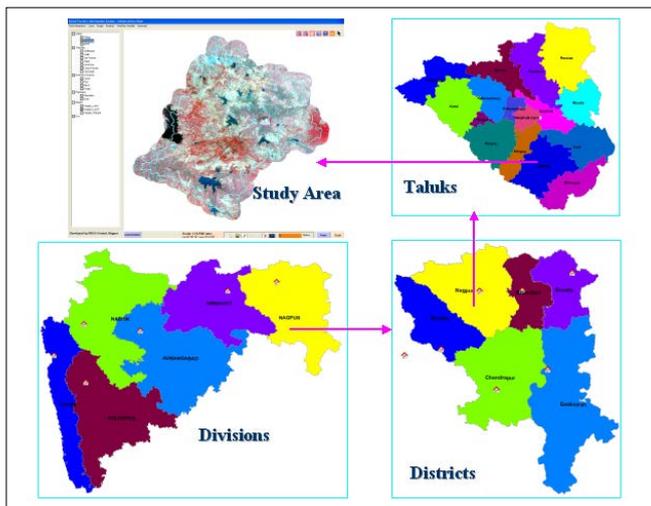


Figure 1. Study area

This software package is developed using open source GIS tool MapWinGIS and Microsoft Visual Basic. MapWinGIS is a free GIS ActiveX control portable to various programming languages such as Visual Basic, C#, Delphi and other languages that supports ActiveX technology [5]. MapWinGIS is quite powerful tool that supports necessary functionalities to visualize, render, create, edit and analyze geospatial data [6]. This tool supports shape file data structure for vector data and various raster data formats including GeoTiff. It includes standard GIS data visualization features as well as database functions such as attribute table editing, shape file editing and data converters. [6]. MAPWINGIS ActiveX control is free to download and use under MPL 1.1 license [7]. Visual Basic is more user friendly and quick at application development [8]. Hence is used for development of front end user interface. Application developed using VB is redistributable as installable setup [9, 10, 11]. As SOFIS is value added product, so it does not implicate any cost to be bear by end user.

SOFIS offers a user friendly GUI with user interactive dialogs and necessary GIS functionalities. Layer list is populated as a tree view for interactive selection and popup menu is provided regarding rendering and labeling tasks.

Navigation toolbar, drawing toolbar, modal dialogs made this application simpler and convenient. This has specific features mentioned as below:-

- Raster as well as vector data display
- Map navigation
- Feature identification
- User defined picture symbology for point data
- User defined rendering of layer with fill color, outline color, outline width, and color labeling
- Graphical display of weather variables
- Site report facility
- Site suitability analysis report
- Adding and attribute coding for proposed plantation site
- Grid generation for block plantations
- Plantation report module

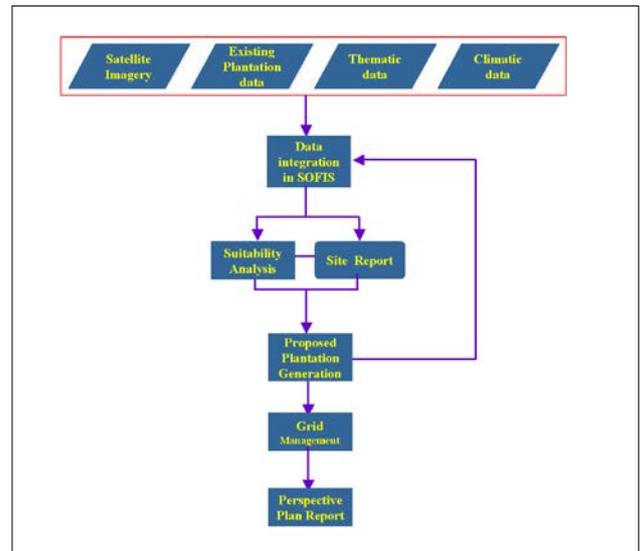


Figure 2. System Flow

III. RESULT AND DISCUSION

A holistic approach was adopted to fulfill the requirement of planning, monitoring and management of social forestry activities in Umred tehsil of Nagpur division. Remote sensing based inputs, thematic layers, ground data and other auxiliary information were integrated into the software. User can integrate the desired datasets in this system through data integration module where category, primary field, alias name of layer can be defined and LUT information can be generated. Display, rendering and map navigation helps user in visualization of integrated datasets. Spatial data is handled by MAPWINGIS tool whereas tabular data is handled using .dbf file structure.

A. Site report facility

Site report would help the user to identify the potentials & limitations about a particular site with respect to the proximity to settlement/ forest, socioeconomic status of village, adjacent

road/rail/canal details and soil /land use/slope parameters. This is quite helpful in site assessment and prioritization of proposed plantation activity through visual approach.

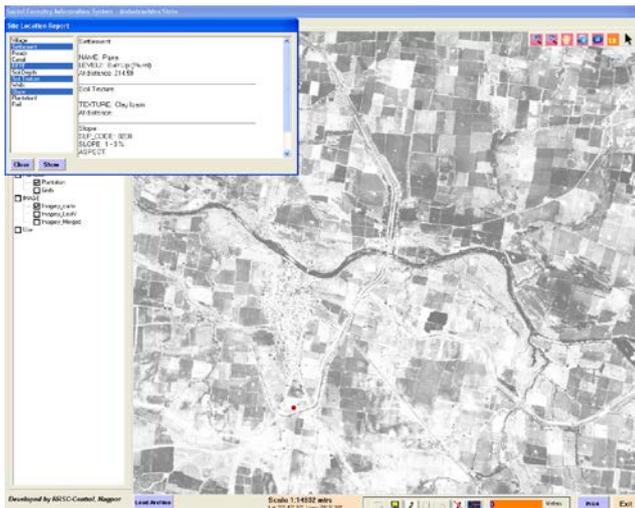


Figure 3. Site report facility

B. Auxiliary data visualization

Weather variables such as rainfall and temperature data also plays a major role in decision making for selection of plantation activity. Monthly average climatic data is made available in tabular form and shown in graphical mode.

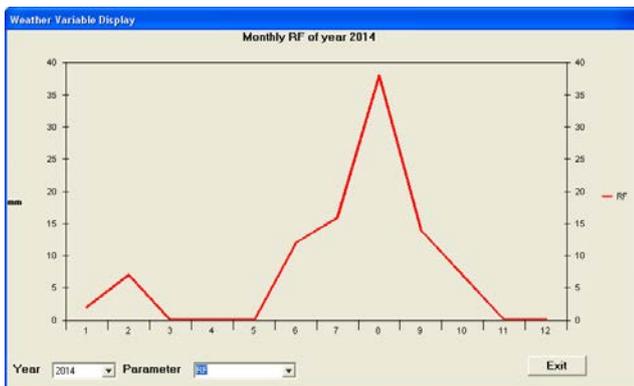


Figure 4. Weather variable display

C. Site suitability analysis

This is the significant module in this software system which suggests suitable areas for plantation as per the given criteria with respect to rail, road, canal and block. Here various thematic layers such as soil depth, soil texture, slope, land use / land cover etc can be used as input for analysis. User has choice of defining the criteria with flexibility of various mathematical and logical operations such as ">, <, =, >=, <=, and, or" etc. Analyzed output would be archived as .shp GIS file format in the defined path. A tabular report is populated with details of criterion values and length/area covered by each outcome. Such generated suitable sites can be overlaid on satellite imagery or other administrative layers for identification and interpretation purpose.

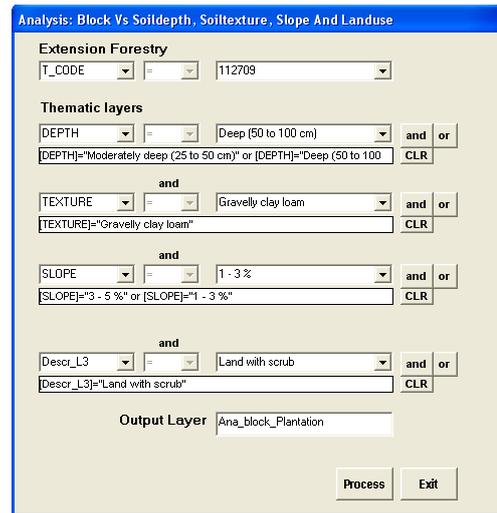


Figure 5. Query builder

LOCA	Village	DEPTH	TEXTURE	SLOPE	Descr_L3	BlockArea
1	Shapur	6562896.13867	Moderately deep (25 to 50 cm)	Gravelly clay loam	1 - 3 %; Land with scrub	30059.1
2	Shapur	6562896.13867	Moderately deep (25 to 50 cm)	Gravelly clay loam	3 - 5 %; Land with scrub	3764.94
3	Salasandha	1763376.35338	Moderately deep (25 to 50 cm)	Gravelly clay loam	3 - 5 %; Land with scrub	48904.76
4	Salasandha	1763376.35338	Moderately deep (25 to 50 cm)	Gravelly clay loam	1 - 3 %; Land with scrub	571.53
5	Nanda	6294576.18164	Moderately deep (25 to 50 cm)	Gravelly clay loam	3 - 5 %; Land with scrub	4543.87
6	Nanda	6294576.18164	Moderately deep (25 to 50 cm)	Gravelly clay loam	3 - 5 %; Land with scrub	144034.98
7	Angthal	2347796.98398	Moderately deep (25 to 50 cm)	Gravelly clay loam	3 - 5 %; Land with scrub	7230.95
8	Chahalkhadis	3228684.83009	Moderately deep (25 to 50 cm)	Gravelly clay loam	3 - 5 %; Land with scrub	9566.62
9	Basi Maana	4591338.51172	Moderately deep (25 to 50 cm)	Gravelly clay loam	3 - 5 %; Land with scrub	73890.38
10	Murapur	3562021.95684	Moderately deep (25 to 50 cm)	Gravelly clay loam	3 - 5 %; Land with scrub	2990.85

Figure 6. Suitable site listing

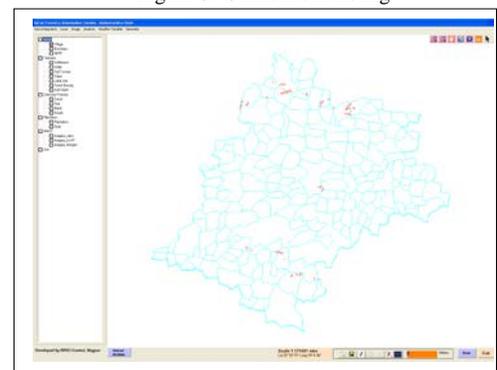


Figure 7. Overlay of analyzed sites

D. Proposed plantation generation

Proposed plantation toolbar has functions of drawing a line/block, attribute codification, and also delete option. After zoomin to the site of interest, user can draw a line or block for proposed plantation and save with proper attributes to be entered in proposed plantation category.



Figure 8. Plantation generation toolbar

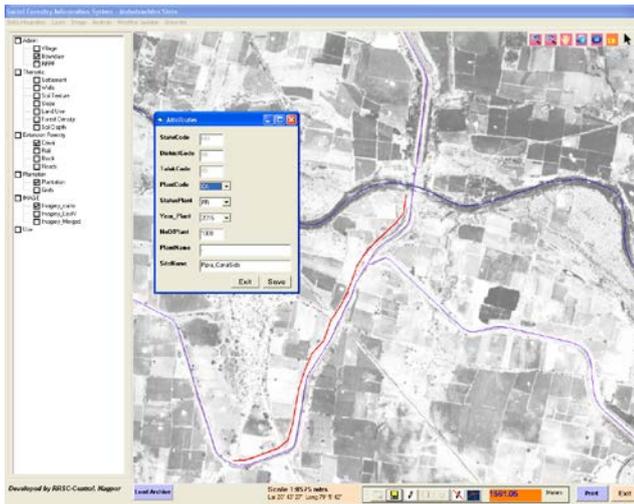


Figure 9. Proposed Plantation generation

E. Grid generation and management

Block plantation is managed at grid level. A given block is divided into 100 by 50 meter rectangular grids with consistent numbering mechanism. These grids are identified uniquely by software system and updated periodically with respect to various management operations undertaken. All the management activities carried under the grid can be used for monitoring purpose.

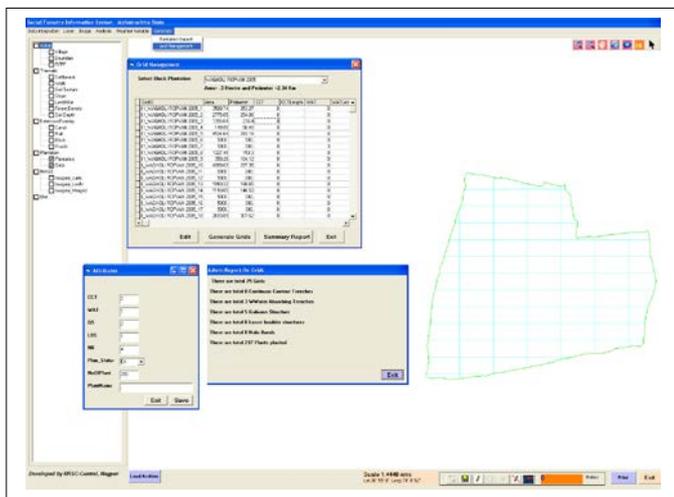


Figure 10. Grid generation and management

F. Plantation report

This is a tabular report related to all plantations for a particular administrative unit, which provides list of existing and proposed plantations. Simultaneously it gives the details of length /area of plantation site, type of plantation, plantation year, number of plants etc. User can zoom into a particular site with a selection and visualize on satellite imagery or administrative map.

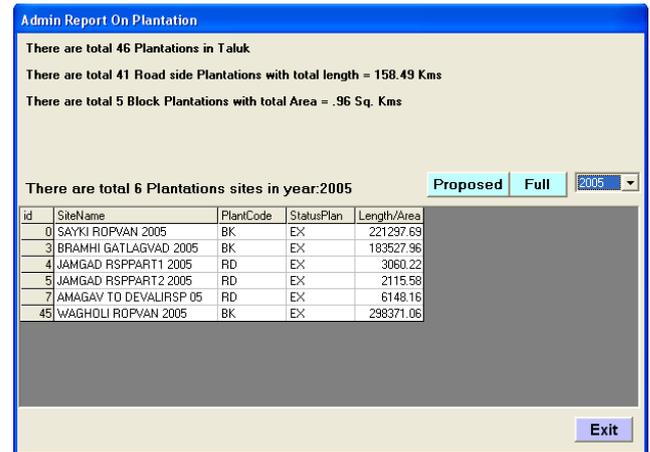


Figure 11. Plantation report window

IV. CONCLUSION

SOFIS is customized software developed for planning, monitoring and management of social forestry activities using integrated GIS datasets. This system can be effectively used for identification of suitable areas for linear plantations (under rail/road/canal) or block plantation (under waste land category). Integration of spatial and non-spatial layers in this software would help the managers to identify the potentials & limitations of different areas under their administrative unit, making innumerable queries to find answers to their day-to-day management questions. Ultimately the plantation report module would give the perspective report of all plantation activities taken up in the study area. Grid generation and management can be effectively used for monitoring the management activities undertaken for the study area. This software is realized by using open source GIS tool MapWinGIS ActiveX control.

ACKNOWLEDGMENT

We do acknowledge the staff of Social Forestry division, Nagpur for their cooperation and help rendered while executing this work.

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