Mapping of Crown Density in Barwala Block, Panchkula District using Geo-Informatics

Mohit Kumar[1], Vikas Sihag[2], Bhanu Pratap Singh[3] and Mona Yadav[4]
[1,2,3,4]Haryana Space Application Center

Abstract

The present studies cover the mapping an existing forest resources of Barwala block of Pachkula district. In analyzing the forest resources of the state, remote sensing approach was adopted. Remote sensing capabilities have evolved rapidly over the past quarter century with the development of new satellites and sensors, information management technologies, and image interpretation techniques. The present study demonstrates the scope, methodology and outcomes of forest resource mapping of Barwala block of Pachkula district. Cartosat-1 using approach for the mapping of various forest density mapping on 1:10,000 scale. As per National Remote Sensing Centre (NRSC), the forest area was classified into six categories based on crown density of trees 0-10, 10-20, 20-40, 40-60, 60-80 and above 80%. The maximum area was found under 40-60% density class which is about 21.50 sq.km and constituting 9.13% of total geographical area. The minimum area was under 60-80% density class which is 0.77 sq.km and constituting 0.33% of total geographical area. Most of The forest found in this block is moderate dense forest.

Keywords: Crown Density, Geoinformatics and Cartosat-1.

Introduction

According to FAO 'Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ is termed as forest. It does not include land that is predominantly under agricultural or urban use.'

Forest plant communities cover approximately 9.4% of the Earth's surface (or 30% of total land area), though they once covered much more 50% of total land area, in many different regions, forest function as habitats for organisms, hydrologic modulators, and soil conservers, constituting one of the most important aspects of the biosphere (Auclair D. 2000).

Forest Survey of India, Dehradun (FSI), an organization under the Ministry of Environment and Forests (Government of India), is mandated to carry out fresh assessment of forest cover in the country every two years. This is done using satellite based remote sensing data. Remote Sensing technology has provided users the means to create numerous maps quickly and efficiently. The present studies cover the mapping of existing forest resources of Panchkula district using remote sensing approach

Haryana is an agriculture-based state with a total geographical area of 44,212 sq. km (Statistical Abstract of Haryana 2011) out of which 1,586 sq. km is under permanent forest cover, which is only 3.59 % of total geographical area (FSI,2009) Forest resources, both major and minor cater to multiple basic needs to the community and contribute more to ecological stability. Thus, it is obvious that preservation and protection of this green gold is essential to the national interest.

Role of Geo-Informatics Technology

Interpretation of forest cover area is quite easier while using Geo-informatics technology. Remote sensing technology provides a synoptic view of forest cover area; depend upon the spectral reflectance and High resolution data, help in identification of particular species of the forest in study area.

Objective of Study

The main objectives of the present study were to mapping existing forest cover and to classify on the basis of crown density in Barwala Block, Panchkula district, Haryana.

Study Area

The total area of Barwala block is 235.37 sq.km. Barwala is located at 29° 23′ N to 75° 55′ E and 29° 38′ N to 75° 92′ E. It has an average elevation of 214 meters (702 feet). The Panchkula district comprises of four district physiographic units, which are roughly parallel to each other. The districts form a part of the Indo-Gangetic plane and the Himalayan ranges. These physiographic units are: Siwalik Hills, Kandi Belt, Intermontane Valley and Alluvial plain (Chaudhary.B.S,et.al, 2002).

The geological milieu in the district represents the litho logical formation belonging to the Indo-Genetic plain and Extra-Peninsular regions. The district can be divided in two different geological units as: Tertiary rocks of Laser Himalayas and Siwalik and Quaternary deposits of Indo-Genetic plains. The average rainfall of Panchkula district is about 1037.66 m. About 80% of its annual rainfall is received in months of June to September. The average rainfall of five years (2003-07) was taken due to the 2008 cartosat data, which was used for the study (Statistical Abstract of Haryana, 2011).
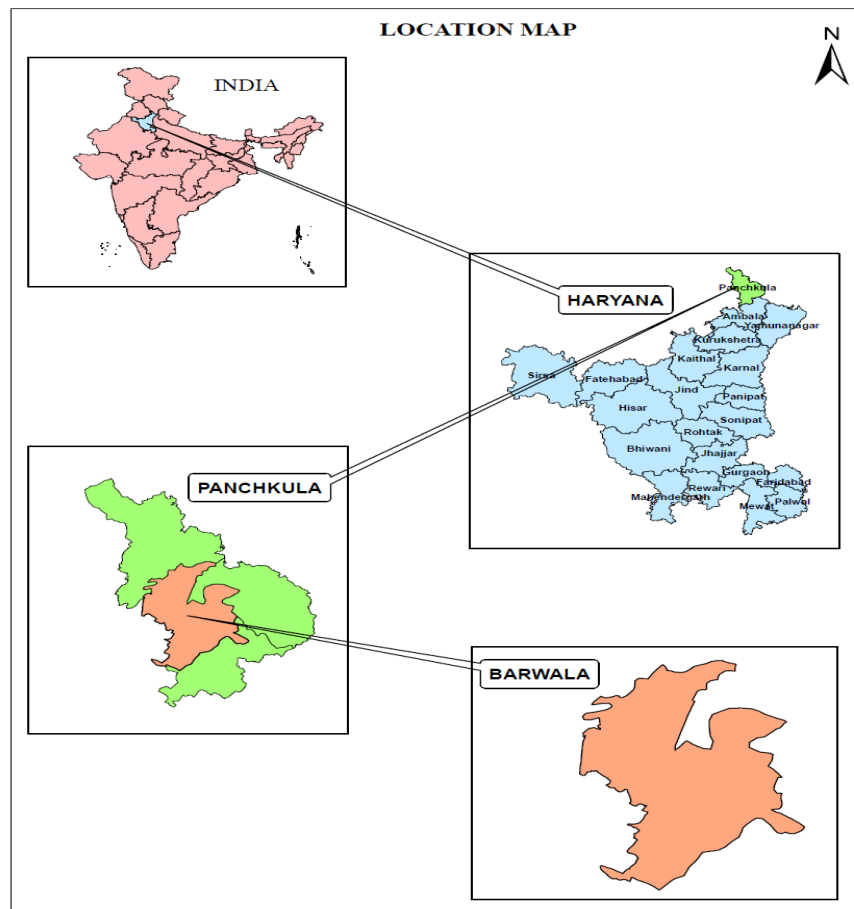

Figure 1: Location Map of the Study Area

Materials and Methodology

Cartosat-I (Panchromatic) digital data of October 2009 were used for the study. These were procured from National Remote Sensing Centre (NRSC), Department of Space (Table-1). The details of Satellite data used are given in. Primary and secondary data (Table-2) were also used for the study. Primary data include satellite image (Cartosat-1) and Toposheets 53B/13, 53F/01 and 53F/02 (Scale 1:50000) from Survey of India and Secondary data include district and block boundary maps from Haryana Space Applications Centre.

Table 1: Detail of Satellite Data used and its Characteristics

Satellite	Sensor	Spectral bands (microns)	Spatial Resolution (m)	Swath	Radiometry	Format	Date
Cartosat– 1	Panchromatic (B/W)	0.52-0.85	2.5m	Fore: 29.4Km. Aft. 26.2 Km.	10 bits	Geo-tiff	Oct. 2009

Primary and Secondary Data Details for the Study Area:

The following primary and secondary data were used for the study:-

Table: 2 Data type and Sources

Data	Data type	Source
Primary data	TOPOSHEETS No. 53B/13, 53F/01 and 53F/02	Survey of India, Scale 1:50000
	Satellite Imagery – CARTOSAT-1, Season OF October 2009 The Path and Rows of Our Study Area are 9406_12041	National Remote Sensing Centre (NRSC), Hyderabad
Secondary data	District & Block Boundry Maps	Haryana Space Application Centre

Methodology

Satellite data used for the study was geo-referenced using ARC/ MAP 9.3. . The methodology adopted in this project forms the basis for deriving statistics of Forest cover. Interpretation of Satellite Data Based on the standard image characteristics such as tone, texture, pattern, shape, size, location and association etc. on screen visual interpretation of remotely sensed data was carried out at 1:10,000. Different Forest categories were delineated by following a standard legend prepared by Department of Space. These maps were put in GIS format upload in the geo- database. The doubtful areas in the pre-field interpreted maps were checked during the ground truth and the pre-field maps were modified by incorporating field observations. After corrections, attributes were attached and final digital maps were prepared. As per National Remote Sensing Centre (NRSC), the forest area was classified into six categories based on crown density of trees as given in (Table: 4).

Table: 3 Different Forest Cover Categories

Sr. No.	Forest density
1.	>80%
2.	60-80%
3.	40-60%
4.	20-40%
5.	10-20%
6.	0-10%

Results and Discussion

Panchkula district having the dominance of forest cover in the state. Barwala block is the major part of the district. There are varieties of trees found in the block which have been mapped on 1:10,000 scales. The total area of the Barwala block is 235.37 sq.km. As per the result of the study, total forest cover in Barwala Block is 70.18 sq.km which is 29.82% of total geographical area.
There are five categories of the forest cover density identified in the area. (Table-4) show different categories of forest crown density in Barwala block. The maximum area was found under 40-60% density class which is about 21.50 sq.km and constituting 9.13% of total geographical area. The minimum area was under 60-80% density class which is 0.77 sq.km and constituting 0.33% of total geographical area. The total area covered by the forest is 70.18 sq.km.

All the forest area of this block exist in the northern part (Fig-3). As indicated in (Table: 4) although the area under forest cover is almost 30% but the condition of forest cover in the district is not very good. The highest density class of 60-80% crown density was observed on high ridges and in valleys but area found under this category was 0.77 sq.km. The forest found in this category is moderate dense forest. This category dominates in Ambwala and Didhgarh villages of Barwala block. The area under 0-10% crown density class is 15.60 sq.km. The area found in 10-20% crown density class is denser than the 0-10% category but still it is degraded forest area. The density range of 20-40% also represents the degraded forest. The maximum area was observed under 40-60% crown density class which is 21.50 sq.km. The forest found in this category is also moderate dense forest.

Table: 4 Forests Cover Density Categories in Barwala Block

Sr. No.	Description	Category	Area(Km^2)	%age of TGA*
1.	Forest Density	0-10%	15.60	6.63
2.	Forest Density	10-20%	14.38	6.11
3.	Forest Density	20-40%	17.93	7.62
4.	Forest Density	40-60%	21.50	9.13
5.	Forest Density	60-80%	0.77	0.33
6.	Forest Density	>80%	-	-
	Total Forest Density		70.18	29.82

*TGA (Total Geographical Area)
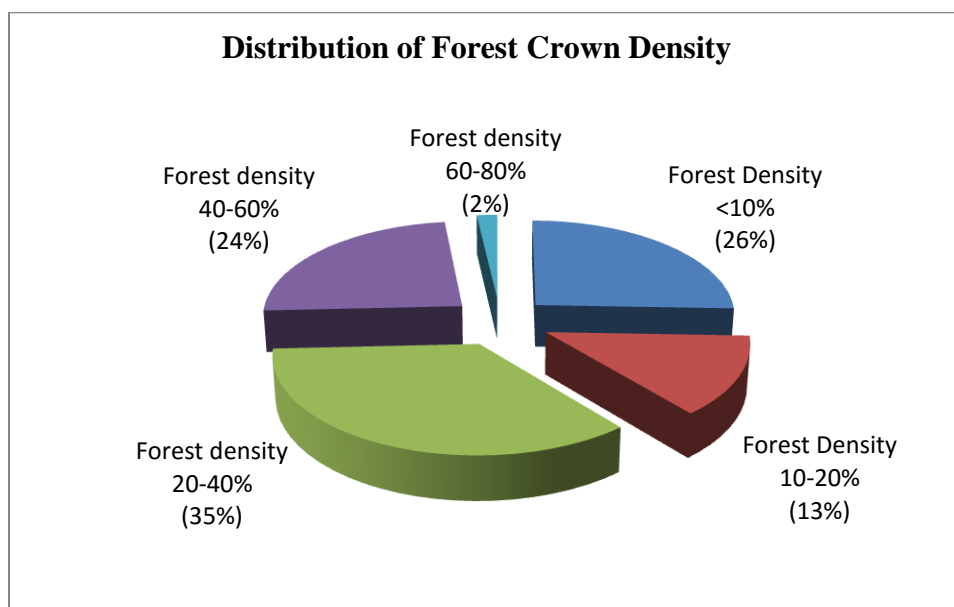
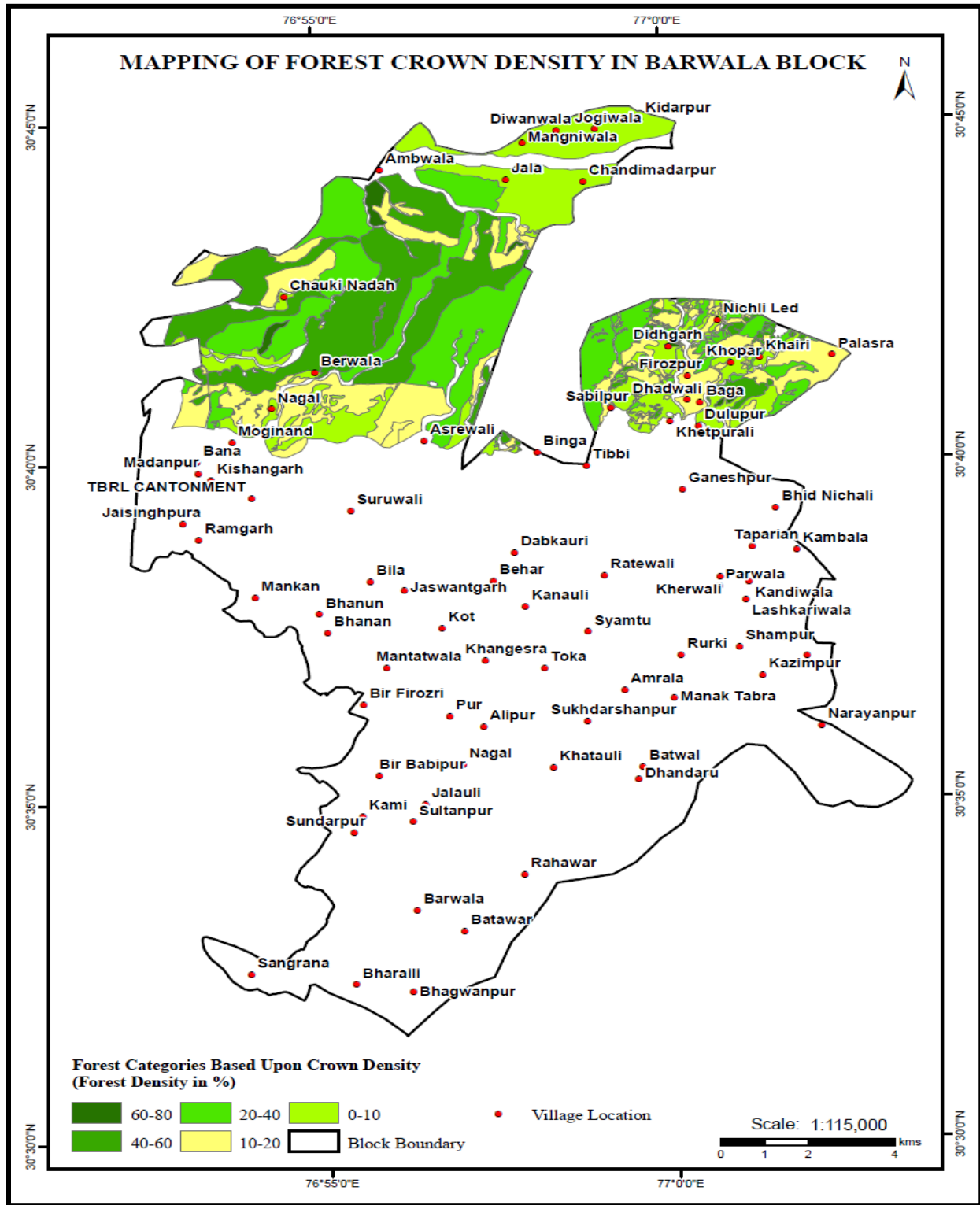**Figure: 2 Distribution of Forest Crown Density in Barwala Block (Panchkula)**

Figure 3: Mapping of Forest crown density in Barwala Block (Panchkula)

Conclusions

The study shows the utility of satellite remote sensing technique for preparation of more consistent and accurate information of different forest categories. Its provides a synoptic view of forest cover area; depend upon the spectral reflectance.Interpretation of Cartosat-1 (Panchromatic) data supported by ground truth information revealed that there are six types of forest categories in the study area. The total forest cover in the block was observed to be 70.18 sq.km which constituted 29.82% of the total geographical area. The maximum of 21.50 sq.km area in this block was observed under 40-60% density class. The area under the five categories of density 0-10, 10-20, 20-40, 40-60 and 60-80% were 15.60, 14.38, 17.93, 21.50 and 0.77 sq.km, respectively. The study helped in preparing latest crown density maps of the forest area in digital form which can be used for forest management. The spatial information generated on forests cover on 1:10,000 can be utilized for various reclamation measures and other uses for the district level planning.

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