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# Assessment and Classification of TOF (Tree outside Forest) using Space Technology in Morni Block, Haryana

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**Abstract**

The study of **"Assessment and Classification of TOF (Tree Outside Forest) Using Space Technology in Morni Block, Haryana"**. IRS Cartosat-I panchromatic data was used and based upon the standard image characteristics, the visual interpretation of satellite data was carried out. The study area lies between latitudes 30 $^{o}$21' to 30 $^{o}$56' north and 76 $^{o}$48' to 77 $^{0}$10' East longitudes. Total forest area of Morni block is 200.56 sq.km which covers 87.95% of total geographical area. The area under Tree outside Forest (TOF) is 10.75sq.km. In TOF three classes were identified viz. small trees, large trees and cluster of trees. TOF covers 4.71% of total geographical area of the districts. The district has a favorable climate for the growth of rich and abundant vegetation due to reasonably good rainfall and elevation. Shisham (Dalbergia Sissoo), Kikar (Acacia nilotica) Mango (Mangifera indica), and Safeda (Eucalyptus hybrid) are the important tree species grown in this region.

***Keywords:*** *Tree outside Forest (TOF), Panchromatic, Space Technology etc.*

## Introduction

Haryana located in north-west India is agriculture dominated state with a total geographical area of 44,212 sq.km out of which 1,553 sq.km is under permanent forest cover which is only 3.61 % of total geographical area (FSI, 2009; Statistical Abstract of Haryana, 2011). Trees outside the forest (TOF) are a highly heterogeneous natural resource and because of that, generally no coherent or regional planning is done to manage it. In India, most of the TOF resource is on agricultural lands. Apart from those planted under farm forestry, horticulture or under social forestry plantations, TOF are not major object of management. The term Trees outside forests, a neologism coined in 1995, is framed in the forest context, defining the concept by default with reference to forested areas. Therefore, Trees outside forests refers to trees on land not defined as forest and other wooded land. This may include agricultural land, including meadows and pasture, built-on land (including settlements and infrastructure), and barren land (including sand dunes and rocky outcroppings). Trees outside the forest are located on other lands mostly on farmlands and built-up areas, both in rural and urban areas. A large number of TOF consist of planted or domesticated trees. They may grow in meadows, pastoral areas and on farms, or along rivers, canals and roadsides, or in towns, gardens and parks (*Auclair et al.* 2000). In the tropics, farmers grow woody species for food security and subsistence. Trees outside the forest are a major source of food (*Belouard, 2002*). Livestock fodder produced by TOF can be a matter of life and death in semi-arid or mountainous areas. Trees outside forests (TOF) make critical contribution to sustainable agriculture, food security and diversification of household economies, they supply many products (including wood for fuel and construction, fruits, barks and food products) and services (e.g. biodiversity, habitat for wildlife, microclimate stabilisation) and they protect crops and the soil against water and wind erosion, thus combating drought and desertification and protecting water resources (*Glen, 2002*).

## 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. High resolution data, help in identification of particular species of the forest in study area.

## Trees outside Forests (TOF) and its Significance

Trees outside the forest are a highly heterogeneous natural resource and because of that generally no coherent or regional planning is done to manage it. In India, most of the TOF resource is on agricultural lands. Apart from those planted under farm forestry, horticulture or under social forestry plantations, TOF are not major object of management. They may grow in meadows, pastoral areas and on farms, or along rivers, canals and roadsides, or in towns, gardens and parks (Kleinn, 2000).

Trees on the land other than forest or other wooded land includes tree on the land that meets the definitions of forest and of other wooded land except that the area is less than 0.5 ha and width is less than 20 m, Scattered trees in permanent meadows, tree in parks and gardens, around buildings, in hedge rows and in lines along streets, roads, railway, rivers, streams and canals are included under this categories (FAO 1998). It may also include trees on land that fulfils the requirements of forest and other wooded land except that:

- The area is less than 0.5 ha.
- The trees are able to reach a height of at least 5 m at maturity *in situ* but where the stocking level is below 5 percent.
- Trees not able to reach a height of 5 m at maturity *in situ* where the stocking level is below 10 percent.

Trees outside forests – i.e. trees and tree systems found on agricultural land, on meadow and grazing lands, on unproductive lands and in cities and other human settlements, among other places- have numerous, often essential roles and functions (Glen, 2002).

## Study Area

The Panchkula (area extent 893 sq. km.) form the northern most districts of Haryana bounded by States of Punjab in the west, Himachal Pradesh in north and Uttar Pradesh in east. The district lies within latitudes 30 $^{o}$21’ to 30 $^{o}$56’ north and 76 $^{o}$48’ to 77 $^{0}$10’ East longitudes covering an area of about 4145sq. km. They are covered under topographical sheet No. 53/B, 53/F and 53 G of Survey of India (1:250,000). The total area of Morni blocks is 228sq.km. It lays between latitudes 30 $^{o}$21’ to 30 $^{o}$56’ north and 76 $^{o}$48’ to 77 $^{0}$10’ East longitudes. The Panchkula district comprises of four physiographic units, which are: Siwalik Hills, Kandi Belt, Intermontane Valley and Alluvial plain (Arya 2002). 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).

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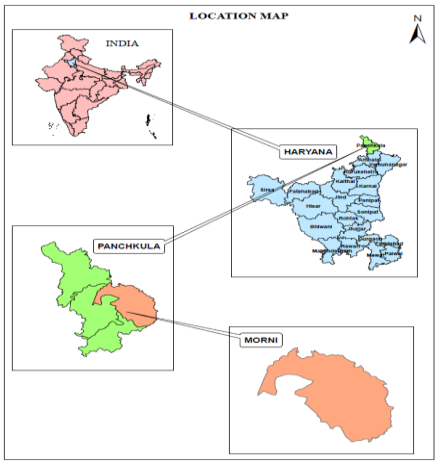


**Figure 1: Study Area Location Map**

## Materials and Methodology

**Materials:** Cartosat-I (Panchromatic) digital data of October 2009 were used for the present study. These were procured from National Remote Sensing Centre (NRSC), Department of Space shown in Table-1. The details of Satellite data used are given in. Primary and secondary data 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: Details of Satellite Data Used and its Characteristics**

| Satellite | Sensor | Spatial Resolution (m) | Swath | Format | Date |
|---|---|---|---|---|---|
| Cartosat– 1 | Panchromatic (B/W) | 2.5m | Fore: 29.4Km. Aft. 26.2 Km. | Geo-tiff | October 2009 |

**Methodology:** Ground truth data were collected in different areas and GPS points were collected and transferred on the map. These points provided the exact locations of the existing features in the study area. These maps were prepared in GIS format and uploaded in the geo- database. A standard legend prepared by Department of Space, Govt. of India was followed to identify tree outside forest (TOF) categories. Interpretation "keys" were developed for various TOF categories by correlating satellite data with ground data. Based on these interpretation keys, satellite data was classified into various TOF classes based on their occurrence in the concerned Block. 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.

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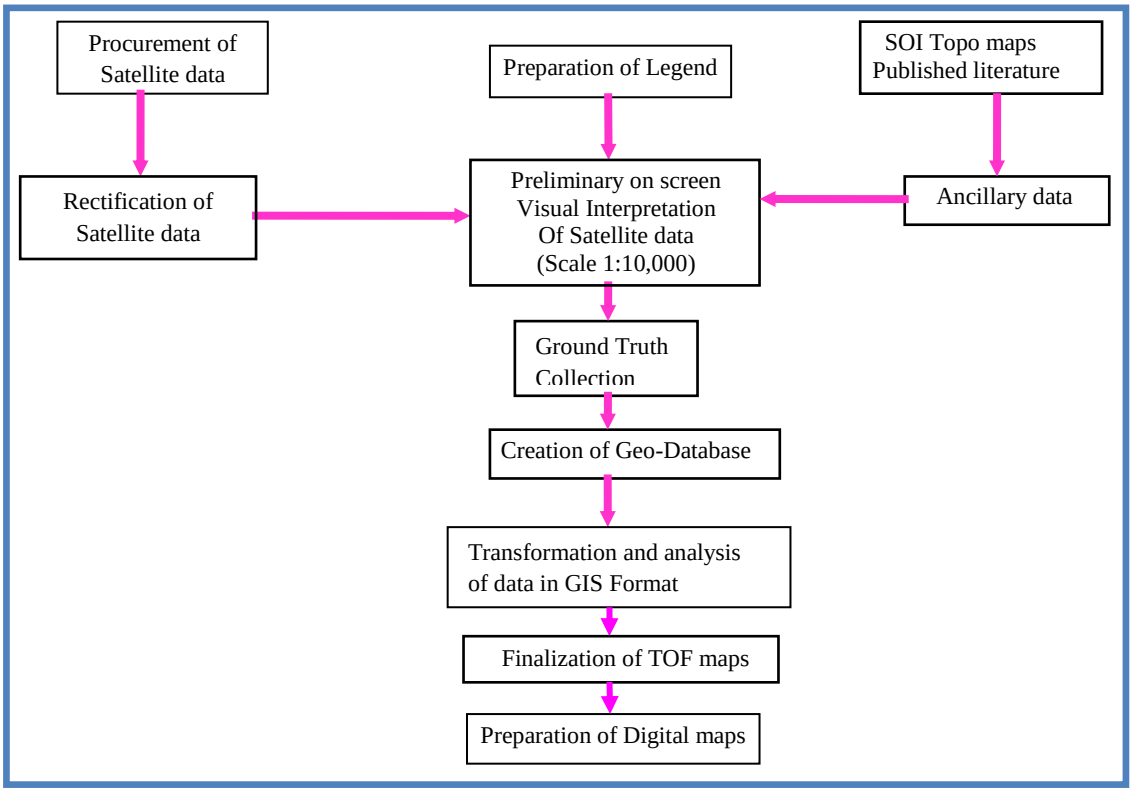


**Figure 2: Methodology Flow Chart**

## Results and Discussion

Tree outside Forest (TOF) are those areas wherever trees can be individually identified and their demarcation done on their identity. Such type of trees found in places like near to house, parks, public place, along the roads, canals, bunds, channels etc. Scattered trees are identified by their size and their appearance on the image. Scattered tree classes included small trees, large trees and clustered trees. Cluster of trees are the areas where trees are in compact form having less gap between them and not possible to identify separately.

**Table 2: Area under Tree outside Forest (TOF) Categories**

| Sr. No. | TOF Category | Area (sq. km) | % age of TGA* |
|---|---|---|---|
| 1. | Large Tree | 4.32 | 1.89 |
| 2. | Small Tree | 4.18 | 1.83 |
| 3. | Cluster of trees | 2.25 | 0.98 |
| | Total | 10.75 | 4.71 |

*Total Geographical Area

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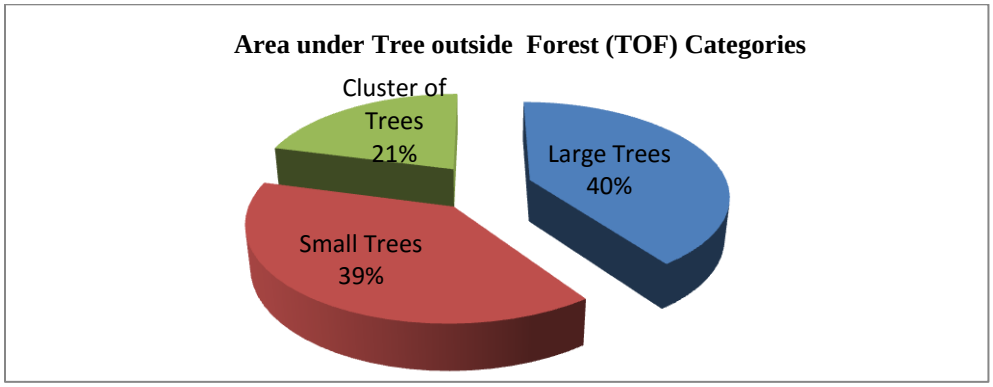


**Figure 3: Area under Tree outside Forest (TOF) categories**

Table -2 provides area under TOF in the Morni Block and (also describing the location etc.) the map of the same is provided in fig. 4, 5 and 6.

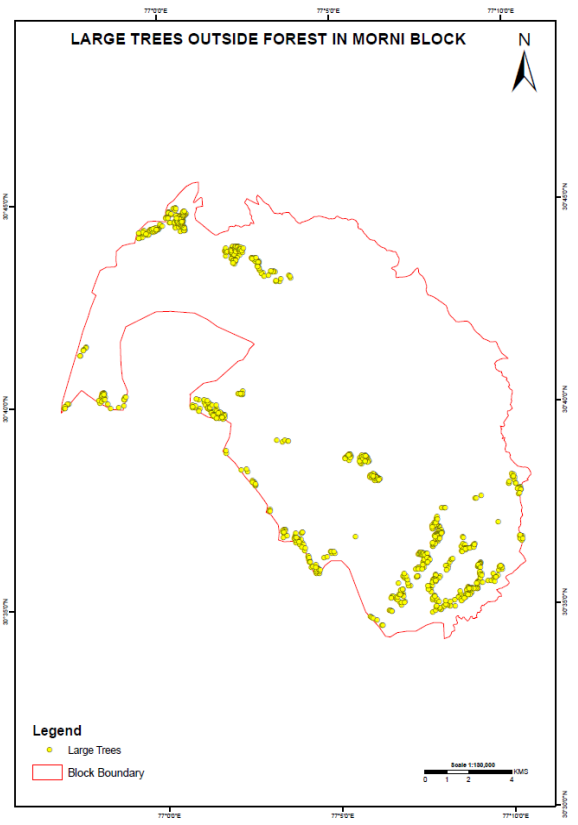


**Figure 4: Large Trees outside Forest**

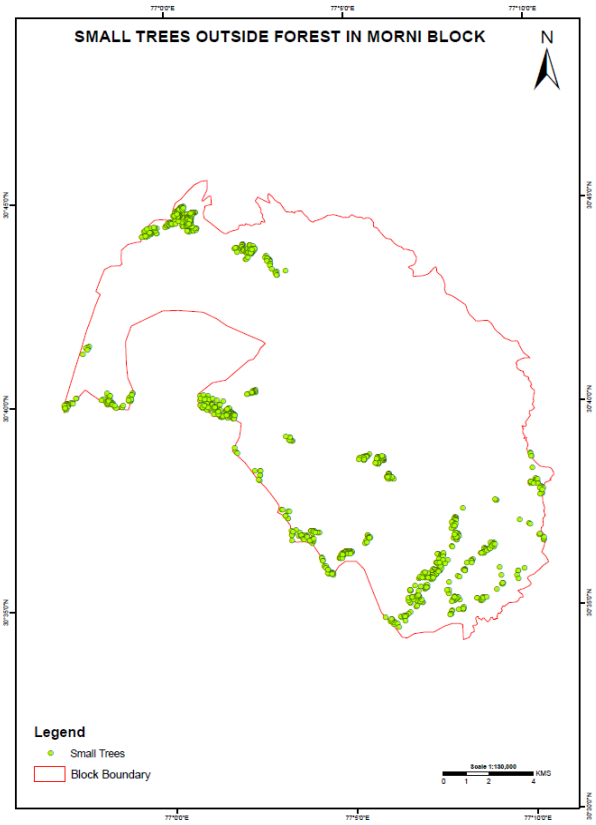


**Figure 5: Small Trees outside Forest**

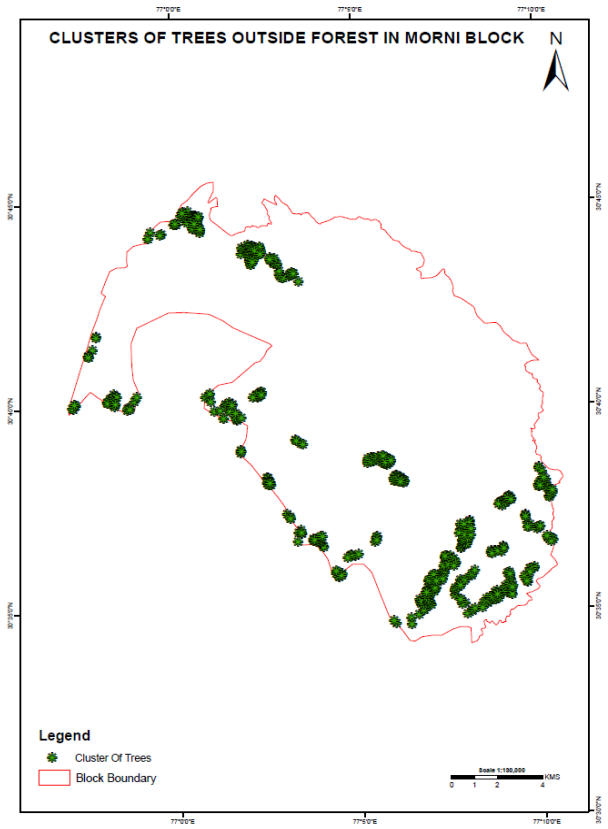


**Figure 6: Clusters of Trees Outside Forest**

## Conclusions

The study shows the utility of satellite remote sensing technique for preparation of more consistent and accurate information of different TOF categories. The visual interpretation technique is subjective and depends on the field knowledge and aptitude of the interpreter. Pine is the major species of trees in study area. In addition to forest cover mapping, remote sensing technology has been extensively used of late to prepare classified Tree outside Forest (TOF) maps. The spatial information generated on forests cover and TOF on 1:10,000 can be utilized for various reclamation measures and other uses for the district level planning. Total area under TOF was 10.75 sq.km which constitute 4.71% of the total geographical area. Maximum area of large trees was 4.32 sq.km constituting 1.89% of the total geographical area. Pine is the major species of trees in study area.

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