



# MONITORING OF ASSET MANAGEMENT AND FOREST DEGRADATION USING GIS AND REMOTE SENSING

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## Abstract

**Asset Management is a systematic process of maintaining, upgrading and operating physical asset. Forests are the terrestrial ecosystem of the earth and 30% of the land is covered by forest. Nowadays, most of the people cut down trees and export the wood to other countries for economic benefits. Tree stores huge amount of carbon, are essential for the cycling of nutrients, water and air quality and for other countless human services. The degradation and deforestation is one of the environmental disturbance caused by human beings. For that, this system is very useful in assisting the person during any emergencies as well as to save human lives. This work uses GIS (Geographical Information system) and Remote Sensing to produce the asset tracking and forest resource map.**

**Keywords: asset management, deforestation, GIS, Remote sensing**

forest lands into farm lands, urban use. In addition to that some precious trees such as sandal wood, teak and red wood are cut down illegally for commercial purposes. Almost 30% of the land area is covered by forest area. Assessment of deforestation is necessary in the world, because 46% of the forest trees have been cleared in the past 12000 years. The forest area around the world was cut down up to 2.3 million square kilometres between the years of 2000 to 2012. During this year the original forest area 16 million square kilometres were reduced to 6.2 million square kilometres. Forest is converted into the plain land for construction homes, industries, etc. Deforestation causes the environmental problems like landslides, extinction of animals, birds and it reduces vegetation. Many countries put for the law of conservation of forest to reduce deforestation, but people still disobey the law.

The removal of trees without sufficient reforestation causes a drastic change in climate, carbon releasing, global temperature [1]. The important effect due to absence of reforestation is damage to habitat, biodiversity. Geographical Information System is an information technology that has been used in public policy making for environmental, forest planning and decision making. GIS has integration of both hardware and software tools which are useful to monitoring, analysing and displaying all form of geographical related information [2]. Tree stores the huge amounts of carbon, are essential for the cycling of nutrients, water and air quality and for other countless human services. The degradation and deforestation is one of the environmental disturbance caused by human beings. Assessment of deforestation is necessary in the

## I.INTRODUCTION

The Asset management is a process for comprehending geography and making intelligent decisions in different locations on earth. It is usually associated with different environmental profiles of buildings, campuses and districts. These places are a mix of real property, associated physical assets and supporting infrastructure in schools and hospitals. For instance, this asset management help to manage infrastructure both outside and inside buildings, providing a comprehensive way to optimize space.

Deforestation is the removal or cutting down of trees. Deforestation includes conversion of

world, because 46% of the forest trees have been cleared in the past 12000 years. The forest areas around the world were cut down up to 2.3 million square kilometres between the year of 2000 to 2012 [3]. During this year the original forest area 16 million square kilometres were reduced to 6.2 million square kilometres. Salem district has more mineral deposits like Quartz, granite, bauxite, Iron ore, limestone, and magnetite [4]. To control and decrease the forest degradation the government should know where, when, why, and how such deforestation occurs and what measures government has been taken to solve the problem [5]. It seems that technological advancing Geographical Information System especially in the form of earth observing satellites, it make easier to analyse the impact of the deforestation. Deforestation also causes landslides.

Geographical Information System (GIS) is an important tool constitute a powerful technology that can address many of the information needs of decision maker in government and corporate. In addition to that, this tool is used for comprehending geography and making intelligent decisions through spatial visualization and its analysis. This spatial data base is a database that is optimized to store and query data that represents objects defined in a geo metric space. These tools are cost effective than other tools to study and analyze such global parameters. Recent improvements in satellite image quality made it possible to perform image analysis much better than past.

The main objective of this is to identify and manage asset, analyse and monitor forest area in and around Salem as a change detection of deforestation to save human lives and animals.

## II. STUDY AREA

The location of Dharmapuri, Tamil nadu, India according to Survey of India is between latitudes 11.47o N and 12.33o N and longitudes 77.02o E and 78.40o E. The total geographical area of Dharmapuri District is 4497.77km<sup>2</sup>, i.e. 3.46% of Tamil Nadu. There were a total of 26,943 workers, comprising 606 cultivators, 427 main agricultural labourers, 1,052 in house hold industries, 22,566 other workers, 2,292 marginal workers, 54 marginal cultivators, 77 marginal agricultural labourers, 213 marginal workers in household industries and 1,948 other marginal workers.

The location of Salem, Tamil nadu, India according to Survey of India is 11.669437° N and

78.140865° E at the elevation of 278m and area 5228 Km<sup>2</sup>. This is surrounded by hills on all the sides. The Nagaramalai to the north, the Jarugumalai to the south, the Kanjamalai to the west, and the Godumalai to the east.

## A. ARCGIS

GIS is a geographic information system (GIS) for working with maps and geographic information. It is used for: creating and using maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information; using maps and geographic information in a range of applications; and managing geographic information in a database. The system provides an infrastructure for making maps and geographic information available throughout an organization, across a community, and openly on the Web.

ArcGIS includes the following windows desktop software: Arc Reader, which allows one to view and query maps created with the other ArcGIS products; ArcGIS for Desktop, which is licensed under three functionality levels. Figure 1 shows Base map for Dharmapuri.

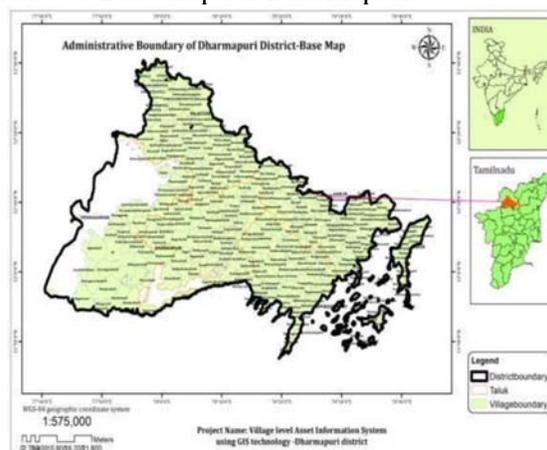


Fig 1: Base map for Dharmapuri

## B. ADD DATA THROUGH ARC CATALOG

There are two main ways to add data. Here begin with adding two data files – mid\_cities.shp and md\_interst.shp from Arc Catalog. Navigate to the data want to added. These are under Folder Connections. Mapping will add two layers. The colours of layers and their order may differ from the example on the instructor's screen, but should have all three datasets. Each of these layers contains geometric objects that represent some real world entity. Points are used in the mid cities layer to represent Maryland Cities. (At a larger scale cities could

be represented by polygons.) Lines are used in the mid-city layer to represent the interstate highways in Maryland, and polygons are used in the md counties layer to represent Maryland counties. On the left-hand side of the view the three selected layers are displayed in the view's table of contents. Each layer has a little check mark in the box to its left. This means they are "turned on" and being displayed. That layer is no longer visible, if it is unchecked.

**C.PUBLIC INFRASTRUCTURE**

The agricultural land, built-up land with and without vegetation, Dense and open forest, dense shrub, plantation and water bodies comprising mainly reservoir, lakes, river and its tributaries and numerous ponds The major land cover types that dominate the area are viz.. Figure 2 represents the public infrastructure of Dharmapuri.

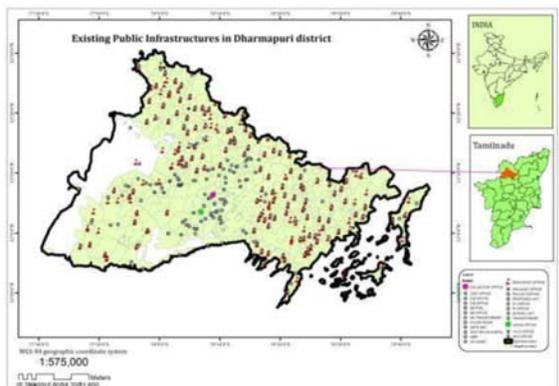


Fig 2: Public Infrastructure of Dharmapuri

The major land cover types that dominate the area are viz. agricultural land, built-up land with and without vegetation, Dense and open forest, dense shrub, plantation and water bodies comprising mainly reservoir, lakes, river and its tributaries and numerous ponds.

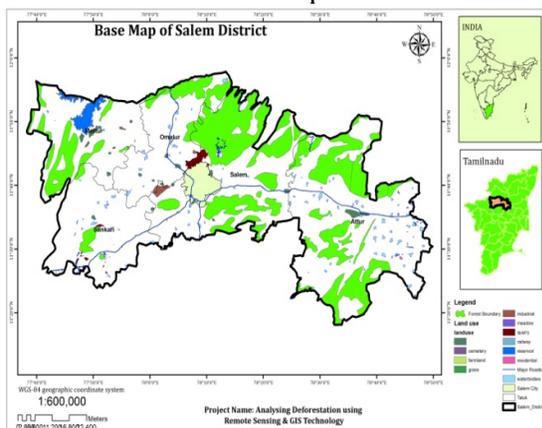


Fig 3: Base map of Salem

The Figure 3 represents the forest areas in Salem. The areas covered with green colour gives the detail about forest and high dense tree areas. Water bodies are marked in blue colour and mining industries are marked with brown colours.

**III. METHODOLOGY**

**A.ASSET MANAGEMENT**

A simple working definition of asset management would be: first, assess what have; then, assess what condition it is in; and lastly, assess the financial burden to maintain it at a targeted condition as in Figure 4. Essential processes and activities for infrastructure asset management include the following of maintaining a systematic record of individual assets (an inventory) e.g., acquisition cost, original service life, remaining useful life, physical condition, repair and maintenance consistency. Developing a defined program for sustaining the aggregate body of assets through planned maintenance, repair, and replacement.

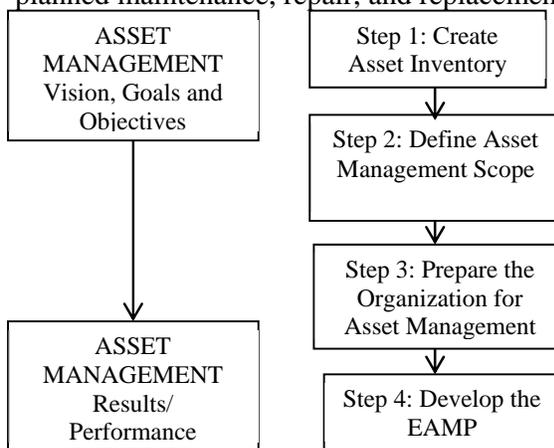


Fig 4: Flow Diagram for asset Management

**B. FOREST DEFOREST MONITORING**

Images: Landsat satellite images

Software: Arc GIS 10.3

Landsat MSS and Landsat ETM images are downloaded from UGCS earth resource observation systems data Centre and Landsat MSS images are provided by commercial data providers. In this study, the map of the years 1910 and 2016 was downloaded to analyse. These images are free sources and anyone can use it. Both primary and secondary data's are collected for this study. Primary data includes information from toposheets provided by Survey of India. Landsat MSS, Landsat ETM, Multi spectrum satellite images from Indian Remote Sensing Satellite. Secondary data comprises of population growth, the corporation map of this

region was obtained from Town and Country Planning, Salem, Tamilnadu, India. Figure 5 represents the block diagram of Forest Degradation Monitoring

The map or the satellite image that gives the detail about forest and other information such as agriculture land, water bodies, constructed areas, waste lands is given in Figure 6.

Geometric rectification of the data was carried out with the help of scanned Survey of India (SOI) toposheets for assigning geographical coordinates to keep pixel of the image. Supervised image classification is a method in which the analyst defines small areas, called training sites, on the image which are representative of each desired land cover Areas were calculated using ARC GIS 10.3 software and compared changes for both images.

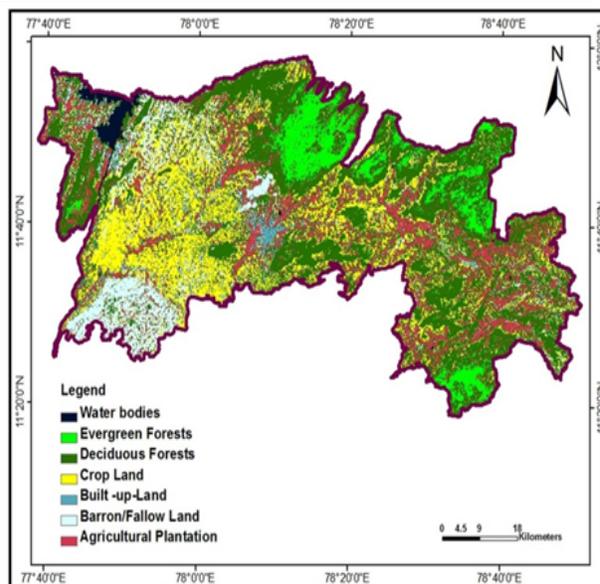


Fig 6: Map denotes forests in Salem

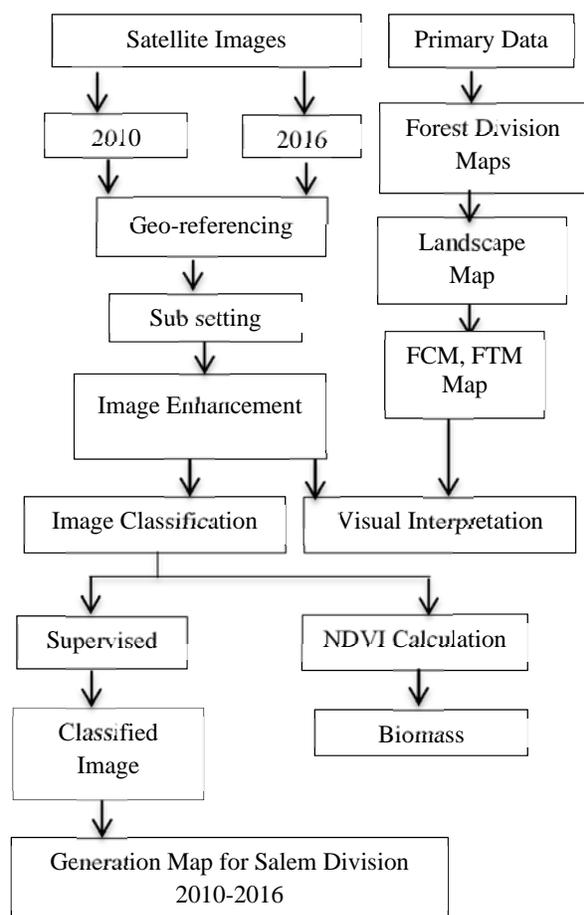


Fig 5: Block diagram for Forest Degradation Monitoring

The data was loaded onto the computer. Radiometric and correction was applied for removing radiometric defects and improving the visual impact of satellite data. The delineation of training areas representatives of a cover type is most effective when an image analyst has knowledge of the geography of a region and experience with the spectral properties of the cover classes. The image analyst then trains the software to recognize spectral values or signatures associated with the training sites.

Geo-Referencing is a process of locating an entity in real world coordinates. It aligns geographic data to a known coordinate system representing earth defined through projection systems so it can be viewed, queried, and analysed with other geographic data. Image classification refers to the task of extracting information classes from a multiband raster image. Depending on the interaction between the analyst and the computer during classification, there are two types of classification: supervised and unsupervised. Supervised classification uses the spectral signatures obtained from training samples to classify an image. Unsupervised classification, the signature file is created by running a clustering tool. Biomass is organic matter derived from living, or recently living organisms. Biomass can be used as a source of energy and it most often refers to plants or plant-based materials which are not used for food or feed, and are specifically called lingo cellulosic biomass.

**C.NDVI DIFFERENCING VEGETATION INDEX**

The Normalized Difference Vegetation Index (NDVI) is an index of plant “greenness” or photosynthetic activity, and is one of the most commonly used vegetation indices. Vegetation indices are based on the observation that different surfaces reflect different types of light differently.

$$NDVI = \frac{(NEAR\ I.R - RED)}{(NEAR\ I.R + RED)}$$

**IV. RESULTS AND DISCUSSION**

The study was carried out in Dharmapuri District using the techniques of GIS and Remote Sensing for the detection of asset resources. The schools and hospital cover is seen as one of the major threats to sustainable development. Here the results give the effective mapping and monitoring of asset schools and hospital areas in Dharmapuri. Figure 7 shows Village map Revenue. Figure 8 Hospitals map for Dharmapuri. Figure 9 shows Hospitals map for Dharmapuri.

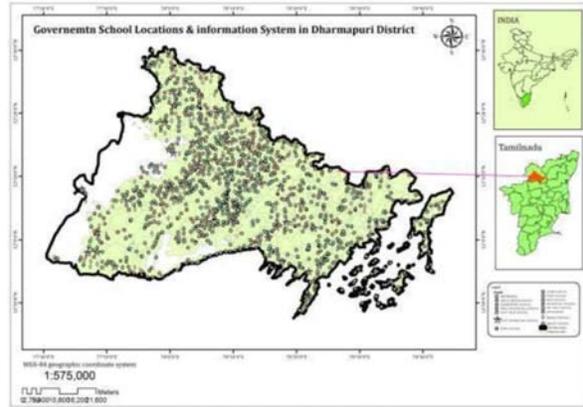


Fig 9: School information map for Dharmapuri

Figure 10 shows the hospital asset management using GIS for Dharmapuri district. The number of hospitals in Dharmapuri district is 160 including Government and private hospitals. Figure 11 shows the school asset management using GIS for Dharmapuri district. The number of schools in Dharmapuri district is 1858 including Government and private schools.



Fig 7: Village map Revenue

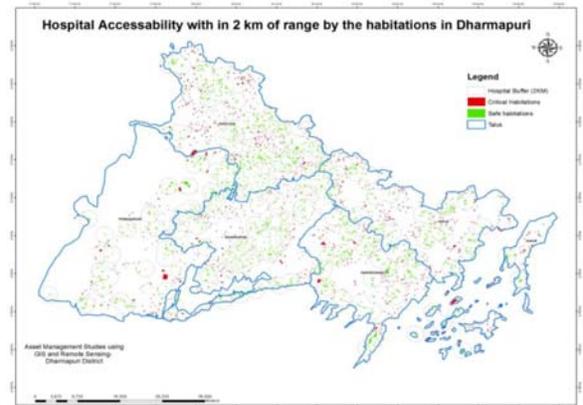


Fig. 10: Hospital asset management using GIS for Dharmapuri district

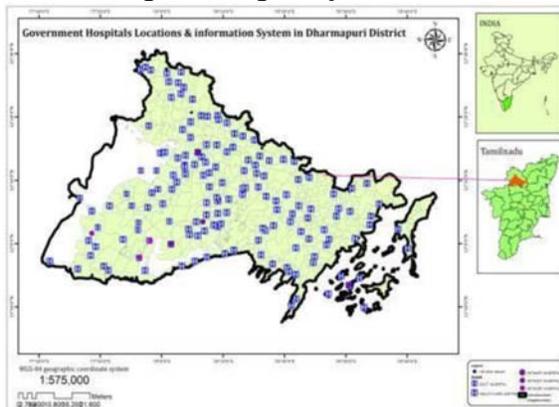


Fig 8: Hospitals map for Dharmapuri

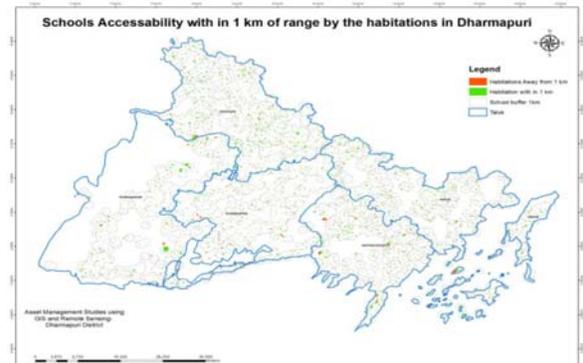


Fig. 11 : School asset management using GIS for Dharmapuri district.

Figure 12 shows the water management asset management using GIS for Dharmapuri district. The number of water sources in Dharmapuri district is 152. Figure 13 shows the water resources asset management using GIS for Dharmapuri district.

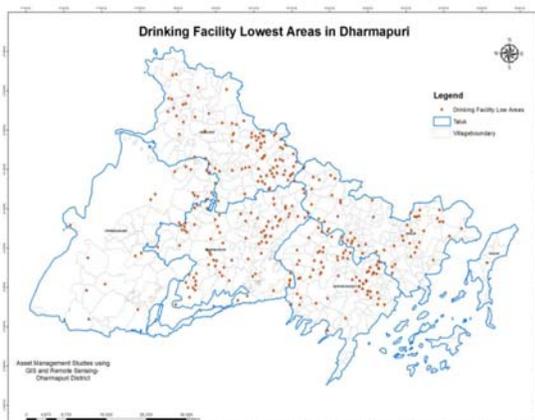


Fig. 12: Water management asset management using GIS for Dharmapuri district

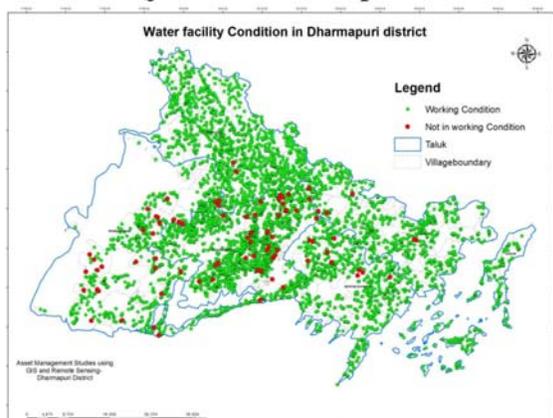


Fig. 13: Water resources asset management using GIS for Dharmapuri district.

Thus the Asset management using GIS for the total number of Schools, Hospitals and Water bodies are given in the table 1.

S.No	Asset	District	Total no of resources
1	Schools	Dharmapuri	1858
2	Water bodies	Dharmapuri	152
3	Hospitals	Dharmapuri	160
4	Transport	Dharmapuri	14879

Table 1: Asset management of Dharmapuri District using GIS

In the classified images dense forest cover is represented by dark green colour and degraded forest is represented by light green colour. ARC GIS 10.3 software was used to compute areas of the dense forest and degraded forest that resulted from the supervised classification approach.

In Figure 14, the green boundary region in the map denotes the forest. Places are mentioned by dots. The suitable colours are given by a process false colour composite (FCC). It is formed by the combination of primary colours red, green and blue. Other than the forest area the map shows constructed areas, water resources. Table 2 represents the particulates needed for processing the image.

Figure 15 represents the supervised classification image. Figure 16 represents the image of unsupervised classification. Figure 17 represents NDVI for Forest Cover Area in Salem division.

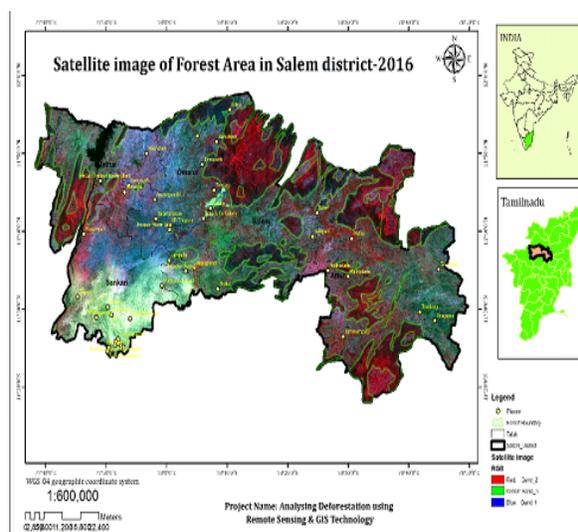


Fig 14: Processed image of Salem

Satellite	RIS IC
Sensor	LISS III
Scale	1:50000
Temporal Resolution	5 days
Spatial Resolution	5.8(PAN),23.5m,70.5m

Table 2: Particulates needed for processing the image

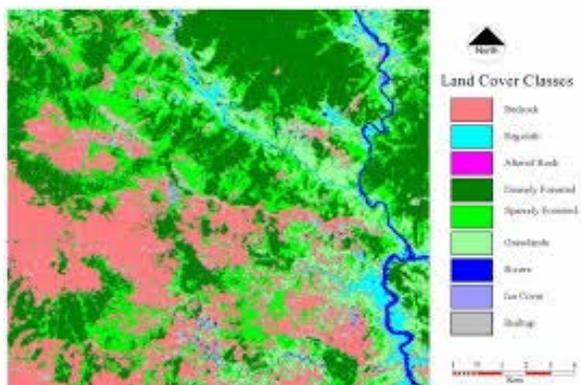


Fig 15: Image of supervised classification

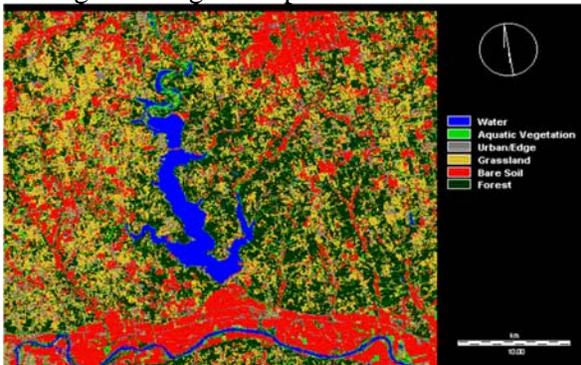


Fig 16: Image of Unsupervised classification

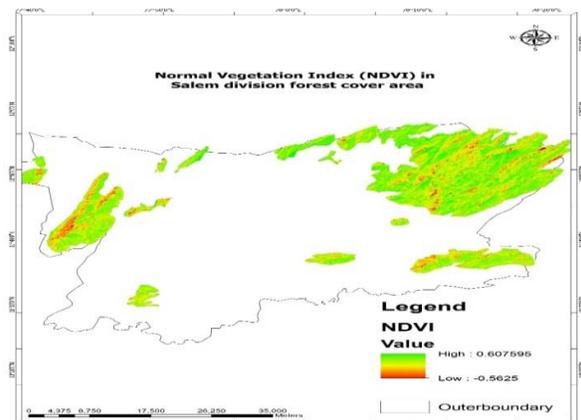


Fig 17: NDVI for Forest Cover Area in Salem division

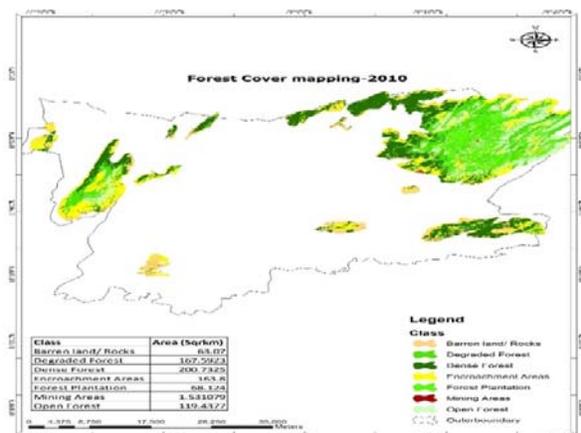


Fig 18: Forest Cover Mapping -2010

In the year 2010 Barren land/rocks areas are 3.07 sq.km, Degraded forest areas are 167.5923 sq.km, Dense forest areas are 200.732 sq.km, Human living in forest areas are 163.8 sq.km, Forest plantation areas are 68.124 sq.km, Mining areas are 1.531 sq.km and Open forest areas are 119.437 sq.km. Figure 18 shows the Forest Cover Mapping-2010.

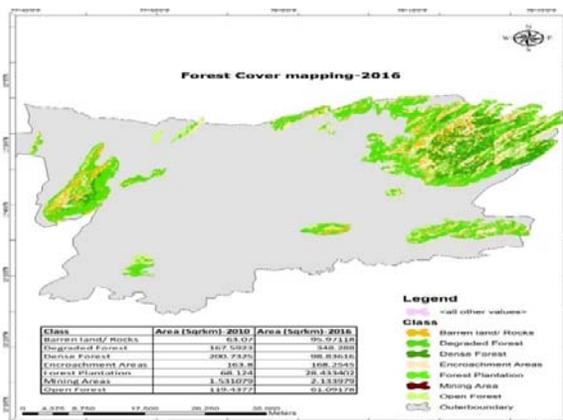


Fig 19: Forest Cover Mapping -2016

In the year 2016 Barren land/rocks areas are 95.971 sq.km, Degraded forest areas are 348.288 sq.km, Dense forest areas are 98.836 sq.km, Human living in forest areas are 168.254 sq.km, Forest plantation areas are 28.433 sq.km, Mining areas are 2.133 sq.km and Open forest areas are 61.091 sq.km. Figure 19 shows the Forest Cover Mapping-2016.

In the year of 2010, human living area in Salem forest division is 163.8 sq.km in 2016 human living area is increased into 168.254 sq.km. Within five years 4.454sq.km forest areas changed into a human living area. Figure 20 shows the human living area in Salem forest division in 2010 and 2016.

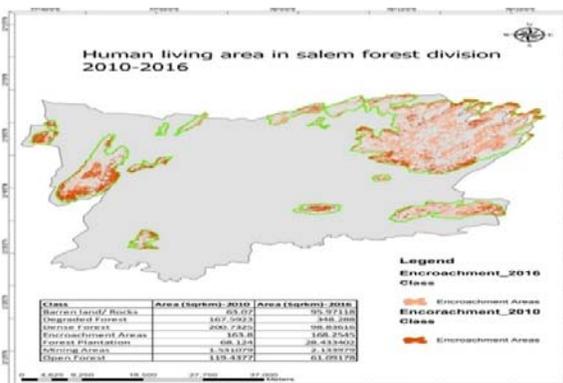


Fig 20: Human living area in Salem Forest Division in 2010 and 2016

Table 3 shows the comparison of Salem forest division in 2010 and 2016. Barren land/rocks, Degraded forest, Dense forest, Human living in areas, Forest plantation areas, Mining area and Open forest areas. Figure 21 shows the comparison of forest areas in 2010 and 2016.

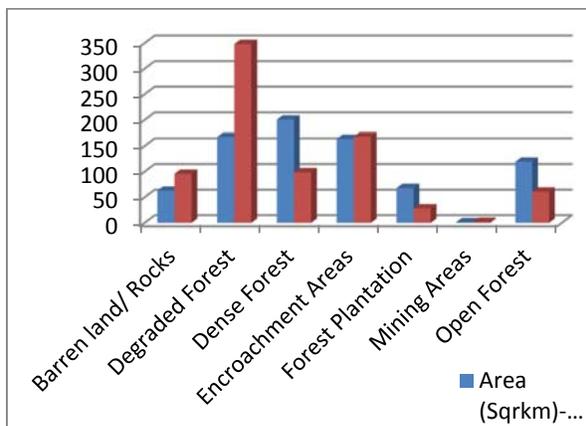


Fig 21: Comparison of Forest Areas in 2010 and 2016

Class	Area (Sq.km)-2010	Area (Sq.km)-2016
Barren land/ Rocks	63.07	95.97118
Degraded Forest	167.5923	348.288
Dense Forest	200.7325	98.83616
Human Living Areas	163.8	168.2545
Forest Plantation	68.124	28.433402
Mining Areas	1.531079	2.133979
Open Forest	119.4377	61.09178

Table no. 3. Comparison of salem forest division in 2010 and 2016

### V. CONCLUSION

Environmental asset management is widely understood and accepted among schools and hospital agencies. In early days new legislative and reporting requirements gave impetus in adaptation of asset management practices, today the widely demonstrated benefits of asset management in environmental decision making encourages its adoption. This environmental asset management is the key to finding the most effective and preserving, upgrading and replacing highway. The forest covered area is seen as one of the major threats to sustainable development. This implies a decline in vegetation. This confirms the change detected through post classification analysis.

Both the asset management and forest monitoring work was processed using the GIS technology. With this framework, the detection of possible land covered areas in Dharmapuri district and Salem division was analyzed. It is easy to map and monitor the land areas with the help of this study. It gives awareness about detection of assets and reducing deforestation.

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