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# Assessment of land use/land cover change detection of Mettupalayam Taluk, Coimbatore district, Tamil Nadu, India, using RS and GIS

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## Abstract

Understanding changes in land use land cover is essential managing and monitoring natural resources and development, particularly where urbanization is expanding. In present study, describes land use/land cover (LU/LC) mapping and change detection analysis of Mettupalayam taluk of Coimbatore district in Tamil Nadu. Estimation in ArcGIS for LU/LC classification from LANSAT images, is the best method for classifier for the different features were used to classify the satellite images are used to classify the land use/land cover change s for the given period. The results indicated that land cover changes have occurred in slight decrease in forests, vegetation and mountain and a corresponding tremendous increase in settlement. The comparison of LU/LC in 2000 and 2019 derived from topo-sheet and satellite imagery interpretation indicates that the settlement area shows variations. Settlement is an area of human habitation, which has a cover of buildings and a network of transport and other civic amenities, due to increasing population and the land is converted into habitation. The (Urbanization) settlement/ built-up areas have increased by 7.29% in 2000 while in 2019 it has increased to 16.43 %. It is found urban area increased due to population growth cum rapid economic progress.

**Keywords:** Land Use/ Land Covers; Mettupalayam Taluk; Changes detections

## 1. Introduction

The term land use usually refers to the changes on the surface of earth by way of increasing human activities. Land cover, defined as the assemblage of biotic and abiotic components of the earth surface is one of the most crucial properties of the earth system [1]. The term land cover and land use play different roles. Land cover can be taken as what cover the surface of the earth naturally and land use is how the land is used by human beings. Examples of land cover include water, forest, bare soil and hilly areas and land use examples built-up and agricultural land. The developing countries like India, the people from every part of the villages move towards the cities for better social life, education, business, and income. Changes in variation in the land cover tend to happen in a progressive manner, but from time to time such changes might be fast and unexpected, because of human activities [2].The study of LU/LC cover changes is very important to have proper planning and utilization of natural resources and their management [3]. LU/LC modification may threaten the ecosystem as an outcome of the devastation of areas nature and vegetation [4]. In an urban environment natural and human induces environmental changes are of concern today because of deterioration of environment and human health [5]. LU/L Care distinct terms but they represent interrelated concepts. Information about land cover and land use variation has a significant role in domestic, local, and general scheduling administration.LU/LC changes, apart from changing the physical dimension of the spatial extent of the land use and land cover classes, also influence many of the secondary processes which lead to the eventual degradation of the ecosystem of the earth [6]. The loss of a vegetation cover, in turn, leads to many other deleterious effects on the environment, namely, loss of biodiversity, climate changes, changes in radioactive forcing, pollution of other natural ecosystems with

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a reduction in their quality, changes in hydrological regimes, and the list of continues [7]. Changes to the variation in the land cover tend to happen in a progressive manner, but from time to time such changes might be fast and unexpected because of human activities [2, 4]. LU/LC use variations are among the major human activities changing hydrology [8,9]. Recent development in remote sensing technology and Geographic Information System allows us to use landscape ecology and spatial analysis approach to address the problem of deforestation and biodiversity conservation [10]. Remote sensing and GIS based change detection studies have predominantly focused on providing the knowledge of how much, where, what type of land use and landcover changes has occurred [11].

Several researchers have focused on LU/LC studies because of their adverse effects on ecology of the area and vegetation [12, 13,14]. Satellite images are regarded as a good method of interpreting changes in land use and land cover.

In this paper, the study area witnessed rapid development during past decades in terms of urbanization, industrialization and population increasing substantially. To prepare the land use/land cover map and change detection analysis over a period of 10 years using satellite images of 2000 and 2019, of Mettupalayam taluk in Coimbatore district of Tamil Nadu. The map of LU/LC map is prepared and identify the area changes occurred during a year span of 19 years.

## 2. Material and methods

### 2.1. Study Area

The study area is Mettupalayam taluk in Coimbatore district, Tamil Nadu located in the foothills of Nilgiri hills about 38 km from Coimbatore. Mettupalayam is the largest township in the district and one of the fast developing suburbs on the north side of Coimbatore. The area lies in the rain shadow region of western ghats and experiences a pleasant climate. In the taluk, the maximum temperature of $38^0$C and minimum temperature of $17^0$C and average annual rainfall is 830 gives the Mettupalayam location detail. The Nilgiri Mountain Railway which connects Mettupalayam railway station with Udagamandalam (Ooty) is a UNESCO World Heritage Site. Nilgiri Express connects Mettupalayam to capital Chennai via Coimbatore. Mettupalayam is situated at the base of Nilgiri Hills and hence is the starting point for the Ghat Roads. As of 2021 India census, Mettupalayam taluk had a total population is 3, 33,020. It has an average elevation of 314 meters (1033 feet).The latitude and longitude extension of the study area is 11º 07’ 13,65’’6 N to $11^0$ 24’ 27.36’’ N and $76^0$ 41’ 13.596’’ E to 76º 41’ 13.566’’ E respectively. Mettupalayam is situated on the bank of the Bhavani river at the foot of the Nilgiri mountains. Mettupalayam taluk consists of 19 revenue villages as shown in Fig.1 shows the digitized map o fMettupalayam.

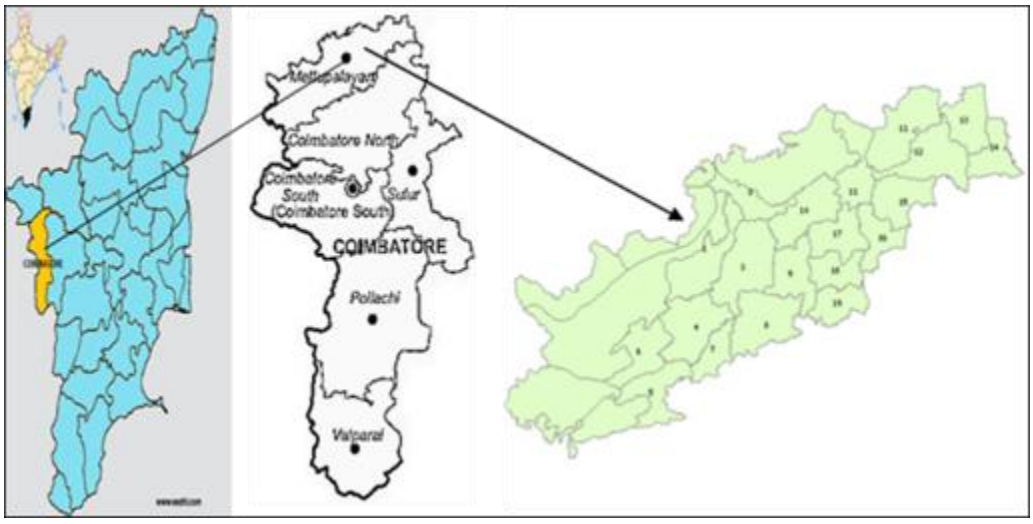


**Figure 1** Location of Mettupalayam taluk

### 2.2. Land Use/Land Cover

In the present study, landsat satellite imagery of different years (2000 and 2019) were classified and compared for the land use/land cover analysis.

The first step in undertaking a supervised classification is to define the areas that will be used as training sites for each land cover class. This is usually done by using the on-screen digitized features. The created features are called the Area of Interest (AOI). The selection of the training sites was based on those areas identified in all sources of images. Extraction of signatures: After the training site (AOI) being digitized, the next step was to create statistical characterizations of each information. These are called signatures editors in ERDAS Imagine 2015. In this step, the goal was to create a signal (SIG) file for every informational class. The SIG files contain a variety of information about the land cover classes described.

Classification process and analysis of the different LULC classes were done using two Landsat satellite images covering the Landsat 8 and Landsat 7 imagery. Land use analysis for the period 2000 & 2019 was carried out using supervised classification method. The satellite images were classified into five major types of land use classes; it includes settlements (urban, rural area, industrial area, and road), forest (evergreen, deciduous), vegetation (plantation, cropland), water body (river, lake, and reservoir) and barren land.

## 3. Results and discussion

Remote sensing can observe the variations, analyzing the modifications in data from satellite images. In this paper, the LULC maps of two different periods show that he Mettupalayam taluk has experienced a significant land cover change between 2000 and 2019 (Fig 2 and 3)The analysis also provides valuable insight into the extent and nature of changes that have taken place in the past. Were classified and compared for the land use/land cover analysis and corresponding distribution shown in Fig.4 and Fig.5. The images are obtained after processing and supervised classification which are showing the land use and land cover of the Mettupalayam taluk are shown following (Fig.6). These images provide the information about the land use pattern of the study area. Remote sensing and GIS technologies provide a powerful tool for mapping and detecting changes in land use/land cover. The general trend observed by the present study is a slight decrease in forests, vegetation and mountain and a corresponding tremendous increase in settlement. The supervised classification conducted on the 2000 and 2019 images, indicates that the settlement in the area specifically shows greater variations. Settlement is an area of human habitation, which has a cover of buildings and a network of transport and other civic amenities. Comparison of LU/LC in 2000 and 2019 derived from toposheet and satellite imagery interpretation gives statistical results (Table.1). There is significant expansion of built-up area noticed. It also indicates the impact of population and its development activities on LU/LC. The settlement is 7.29% in 2000 while in 2019 it has increased to 16.43 %. Due to which the barren land and vegetation have decreased. Barren land is 10.91% in 2000 and it has decreased to 8.50% in 2019. The vegetation has no significant decline, 28.56 % in 2000 and 24.58 % in 2019. The forest cover has reduced from 21.19 % to17.77 % in 2000 and 2019. The water body in the area is mainly the river present, it is 1.32% in 2000 and 1.07 % in 2019. This study proves that integration of GIS and remote sensing technologies is effective tools for urban planning and management.

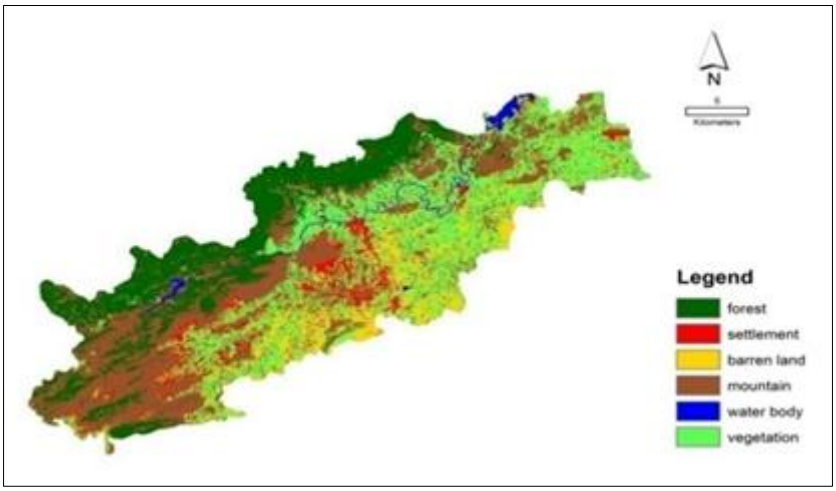


**Figure 2** Land use /land cover map of Mettupalayam taluk as on 2000

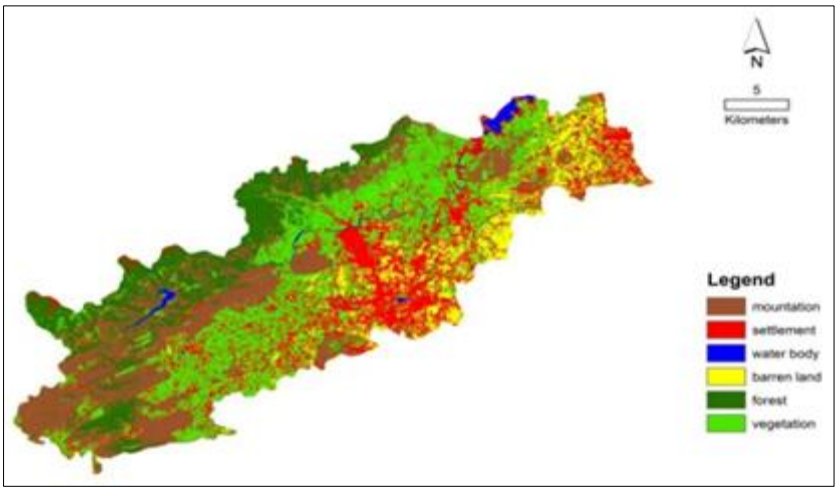


**Figure 3** Land use /land cover map of Mettupalayam taluk as on 2019

**Table 1** Land use/ Land cover changes in 2000 and 2019

| Features | 2000 | | 2019 | |
|---|---|---|---|---|
| | Area in km² | % Area | Area in km² | % Area |
| Forest | 140.65 | 21.19 | 123 | 17.77 |
| Settlement | 48.42 | 7.29 | 115.07 | 16.43 |
| Barren land | 72.45 | 10.91 | 60.4 | 8.5 |
| Mountain | 203.93 | 30.72 | 195.07 | 31.64 |
| Water body | 8.78 | 1.32 | 7.12 | 1.07 |
| Vegetation | 189.61 | 28.56 | 163.2 | 24.58 |
| Total | 663.84 | 100 | 663.86 | 100 |

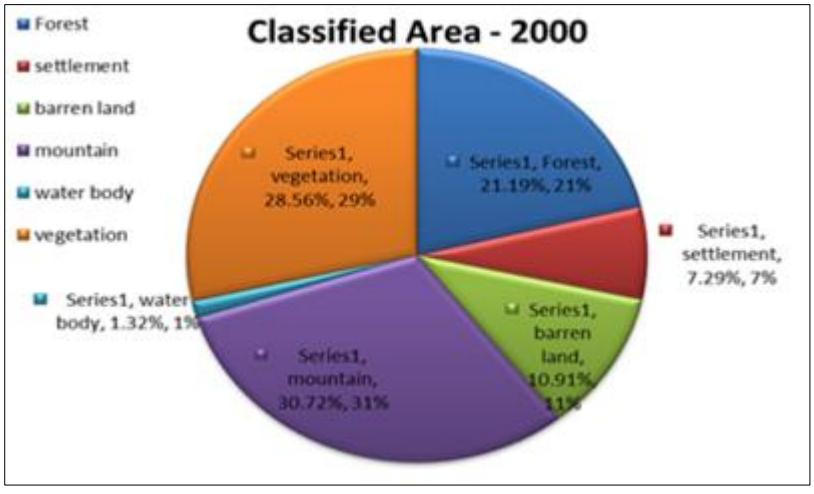


**Figure 4** Land use/land cover distribution as per 2000

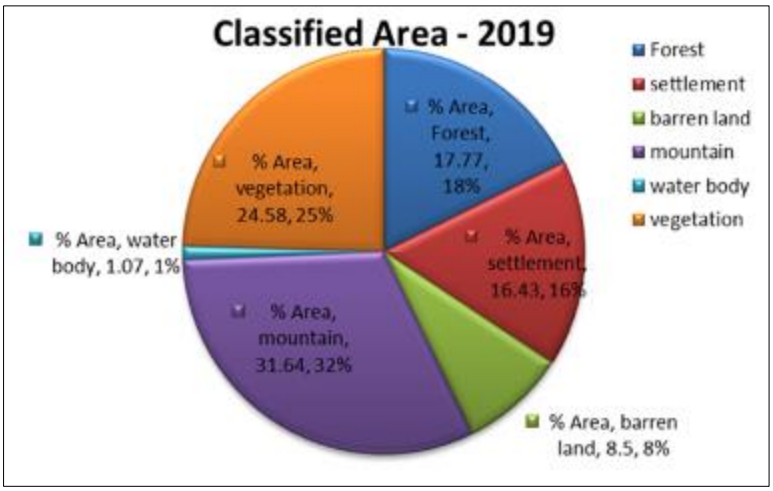


**Figure 5** Land use/land cover distribution as per 2019

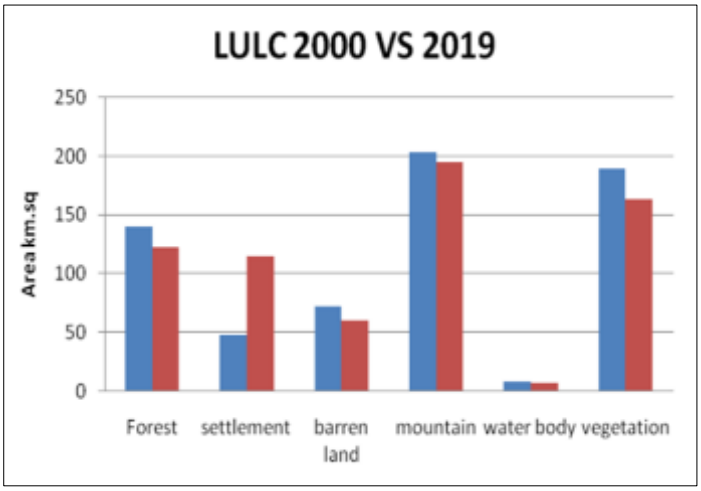


**Figure 6** Land use changes between 2000 and 2019

## 4. Conclusion

The paper focuses on LU/LC changes in the Mettupalayam taluk, Coimbatore district of Tamil Nadu using remote sensing data. The results clearly show that LU/LC pattern changes were significant during the period on 2000 and 2019.The general trend observed by the study slight decrease in forest area, vegetation area and mountain and a corresponding tremendous increase in settlement. There is significant expansion of settlement area noticed. This clearly indicates the impact of population and its development activities on LU/LC change. Settlement is an area of human habitation, which has a cover of buildings and a network of transport and other civic amenities. The settlement is 7.29% in 2000 while in 2019 it has increased to 16.43 % due to the expanding population and its settlement. In last decades, the construction of new settlement, such as individual houses and apartments, increased drastically. Due to which the barren land and vegetation have decreased. The water body in the area is mainly the river present; it is 1.32% in 2000 and 1.07 % in 2019.

## Compliance with ethical standards

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*Disclosure of conflict of interest*

The author declares there is no conflict of interest

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