*Eco. Env. & Cons. 28 (February Suppl. Issue) : 2022; pp. (S206-S209)*

*ISSN 0971–765X*

**DOI No.: http://doi.org/10.53550/EEC.2022.v28i02s.034**

# Assessing Land -use, Misuse and Abuse in Nilgiris District of Tamil Nadu Using Remote Sensing Data

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(Received 22 June, 2021; Accepted 22 July, 2021)

**ABSTRACT**

The Nilgiri mountain range in south India is an unique ecosystem and of considerable importance to anthropologists, geologists, climatologists, botanists as well as tourists. After the 19 th century the Nilgiris and its popular hill stations emerged as favourite places for rest and recuperation, game and for raising commercial plantations. Land cover refers to the natural vegetative cover types of particular region. Land use is the term that is used to describe human uses of the land or converting natural land cover for agriculture or settlement. The assessment of changes of land use pattern is necessary for estimating the land degradation rate and planning for sustainable land use. In this study the remote sensing data for land cover and land use of Nilgiris district is utilized for assessing the dynamics of land use and classification as use, misuse and abuse of land use pattern for the past decade and it was observed that there is aconsiderable increase in the built up area and decrease in forest cover in the recent years. The fallow land cover also increased concluding that the abuse (built up) and misuse of the land (fallow land) is in an increasing rate compared to proper usage of land (forest and agriculture).

***Key words:*** *Land use, Built-up, Barren, Fallow, Agriculture, Forest*

## Introduction

The land use pattern of a region is decided by the environmental factors and land utilization by man varies with time and space. Land is becoming a scarce resource due to increasing population and demand for cultivable land. Hence, information on the dynamics of land use / land cover and classification as land- use, misuse and abuse is essential for developing a sustainable land use pattern. Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes (Ademiluyi *et al.*, 2008). So this study examined the significance of land use and land cover changes for the past decade in Nilgiris district and helps in classification of land use pattern as use, misuse and abuse.

### Study area

The study area is the Nilgiris is situated at an elevation of 900 to 2636 meters above MSL. Its latitudinal and longitudinal dimensions being 130 kilometers (Latitude: 11°12 N to 11° 37 N) by 185 kilometers (Longitude: 76°30 E to76°55 E). The Nilgiris is bounded on North by Karnataka State on the East by Coimbatore District, Erode District, South by Coimbatore District and Kerala State and as the West by Kerala State. In Nilgiris District the topography is rolling and steep. The District has an area of 2459 sq.km.

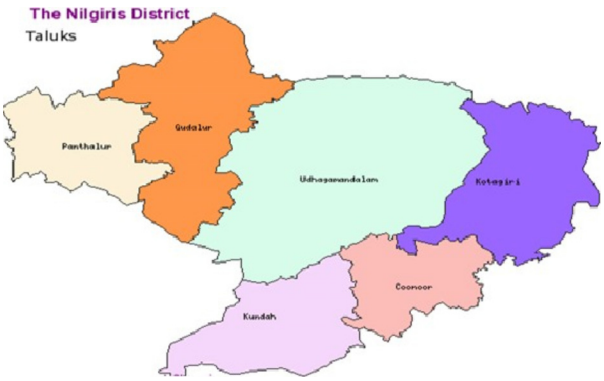


**Fig. 1.** Nilgiris District map

## Methodology

Cloud free Landsat-TM satellite imageries were used to assess the Landuse / Land cover changes for the years 2011 and 2015. The Data Product used was landsat-7-ETm+. The Resolution of the cell size was (x,y) = 30,30. The Path/row utilized waspath – 144 and row – 52 respectively. The Number of bands used were 6(b1,b2,b3,b4,b5,b7). The standard methods of visual interpretation techniques had been employed for the interpretation, classification and delineation of land use categories based on tone, texture, shape, size, pattern and differential erosion characteristics of the satellite imagery.

The detection of changes from initial status of 1973 to final situation of 2015 was also reported to get an exact idea about how much alteration has taken place in different landuse categories over the last 42 years.

In achieving this, the first task was to develop a table showing the area in km$^2$.In obtaining annual rate of change, the observed change (km$^2$) is divided by the number of study year 18 years (1973-1991), 14 years (1991-2005), 5 years (2005-2010) and again 5 years (2010-2015). Based on the remote sensing data for the years 2005, 2010 and 2015, classification of the landuse pattern in terms of use (agricultural purpose), misuse (fallow) and abuse (barren and built-up) area was done.

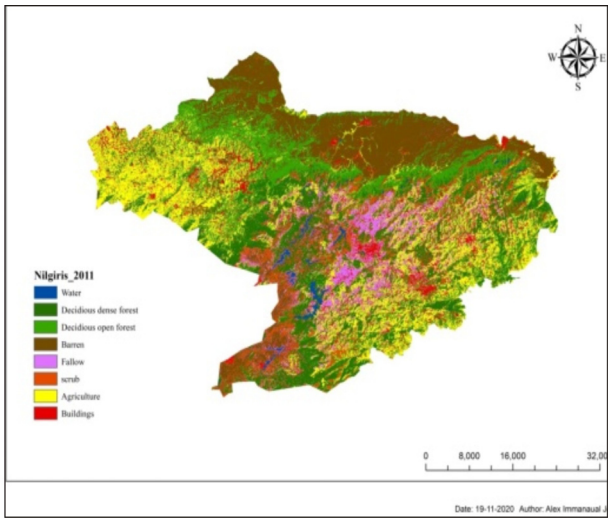


**Fig. 2.** Land use classification remote sensing image for the Nilgiris District (2011)

**Table 1.** Summary of decadal land use pattern between 1973 – 2015 in Nilgiris district

| Year | Forest (sq. km) | Agriculture (sq. km) | Fallow (sq. km) | Barren (sq. km) | Built –up (sq. km) |
|---|---|---|---|---|---|
| 1973 | 1441.75 | 884.14 | 65.51 | 34.31 | 8.41 |
| 1991 | 1453.97 | 948.74 | 34.67 | 29.02 | 35.82 |
| 2005 | 1435.94 | 886.23 | 42.67 | 95.7 | 39.65 |
| 2011 | 1234.08 | 922.63 | 242.26 | 56.93 | 48.34 |
| 2015 | 1234.15 | 919.19 | 245.45 | 58.38 | 48.58 |

**Total area :**2549 sq.km

**Table 2.** Annual rate of change of land use pattern

| Land use classification | 1973-1991 (sq km) | Annual rate of change (sq km) | 1991-2005 | Annual rate of change (sq km) | 2005-2011 | Annual rate of change (sq km) | 2011-2015 | Annual rate of change (sq km) |
|---|---|---|---|---|---|---|---|---|
| Forest | 12.22 | 1.52 | -18.03 | -1.05 | -201.86 | -40.37 | 0.07 | 0.01 |
| Agriculture | 64.6 | 3.58 | -62.51 | -4.47 | 36.4 | 7.28 | -3 | -0.6 |
| Fallow | -30.83 | -1.71 | 10.56 | 0.75 | 199.59 | 39.91 | 3.19 | 0.63 |
| Barren | -5.29 | -0.29 | 66.68 | 4.76 | 38.77 | 7.75 | 1.45 | 0.29 |
| Built up | 27.41 | 1.52 | 3.83 | 0.27 | 8.69 | 1.74 | 0.24 | 0.05 |

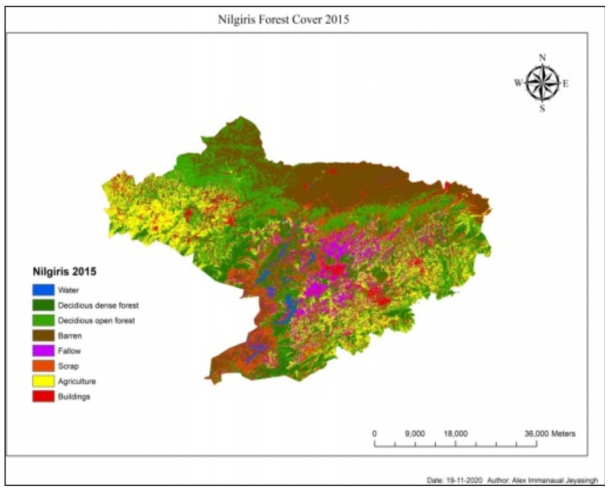


**Fig. 3.** Land use classification remote sensing image for the Nilgiris District (2015)

## Results and Discussion

The land use pattern of Nilgiris is very important because it has been identified as one of the biodiversity hot spot in the world. Hence, the identification and delineation of land use pattern of this area is more essential for monitoring the environmental alteration and stimulation of the existing condition. Here, the standard method of visual interpretation techniques were adopted to demarcate the different periods of various zones of natural and man- made patterns and classify them as use, misuse and abuse of land resources. The data for landuse pattern from 1973 to 1991, 1991 to 2005 collected from previous published works (Thirumalai *et al.*, 2015; Sathish *et al.*, 2014; Sudhaker Reddy *et al.*, 2016) and for the year 2011 and 2015 obtained from the remote sensing images.

### Use

Forest area decreased from 1441.75 km$^2$ (1973) to 1234.15km$^2$ (2015) as in Table 1. Nilgiris is a woody environment, and the dominant type of land was forest. Human population *growth* together with competitive *land use for increased food production is the reason for increase in agricultural land from* 884.14 km$^2$ (1991) to 919.19 km$^2$ (2011) as in Table 1 and the annual rate of change in agricultural land was high during 2005 to 2011 (Table 2).

### Misuse

The steady increase in fallow land from 65.51 km$^2$ (1991) to 245.45 km$^2$(2015) is due to uncertainty of monsoon, poor irrigation facilities, very costly irrigation through diesel pump sets, labour scarcity etc, reminding that *land management is not good* in the district. The area under fallow land could be categorized as misuse of land and found to be the highest during 2005 to 2010 (Fig 4).

### Abuse

Considerable increase was noted in settlement or Built-up area from 8.41 to 48.58 km$^2$ (Table 1) and the highest annual rate of change of Built up area was noted during 2005 to 2010 (Fig 5). The constant increase of urban growth by means of improvement of tourism associated with favorable climatic condition is the reason for the increase in the area covered by the buildings. Although the area of urban was much smaller than other districts, the change rate of urban was quite fast between the periods of 1973 to

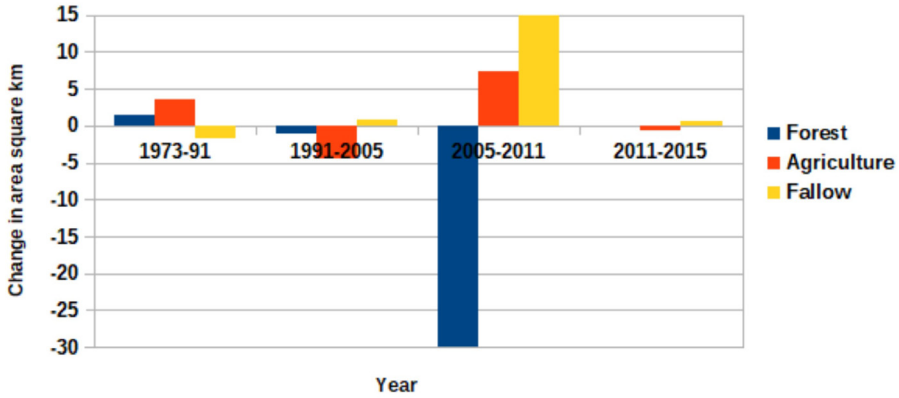


**Fig. 4.** Summary of land use change detection in com parison with forest area (Use- Agriculture and Misuse – Fallow)

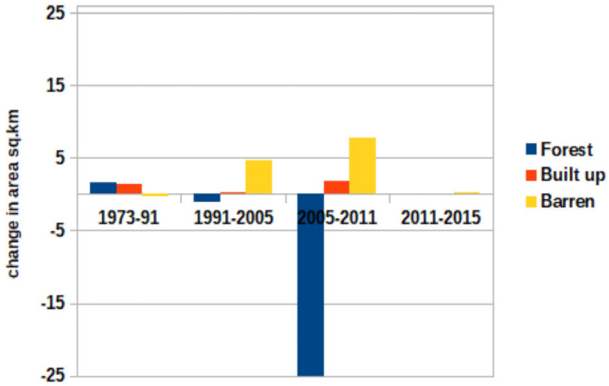


**Fig. 5.** Summary of land use change detection in com parison with forest area (Abuse-Built up and Barren)

1991 and 2005 to 2011 (Fig 5). The area under barren land was found to be highest during the period 1991- 2005 (Table 2).

## Conclusion

The landuse system is highly dynamic which undergoes significant changes according to the changing socio-economic factors and climatic conditions. The changes in any form of landuse are related either with the external forces and the pressure within the system. Transformation of forests into agriculture and built-up area is basically to fulfill ever-increasing demand of food, fuel wood, fodder and timber. The process of rapid land transformation has not only brought about an ecological crisis in the region but has also will lead to accelerated soil erosion, deforestation and reduction in ground water recharge (Janetos and Justice, 2000; Houghton, 1999). The present study of landuse and land cover changes in terms of land use, misuse and abuse shows the extent of changes in different landuse features. The land under agriculture and Built-up has increased significantly at the sum of reduction of forest area. Nilgiris has many exotic species , natural Montane grasslands and scrublands interspersed with sholas has been much disturbed or destroyed by extensive tea plantations, easy motor vehicle access and extensive commercial planting and establishing non-native eucalyptus and wattle plantations. Although, landscape conversion varies significantly throughout the world, its ultimate outcome is mostly the same: extraction of natural resources for immediate human needs, often accompanied by biophysical degradation (Foley *et al.*, 2005). Hence, assessing the conversion of a forested landscape may help us to understand the way the natural resources extraction occurs, and consequently the human influences on the forest ecosystem services. Further extensive study through remote sensing and GIS techniques about the crop diversity and agriculture practices on forest cover is needed to attain a sustainable land use pattern for the district.

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