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# A TEMPORAL LAND USE / LAND COVER CHANGE DETECTION IN MANJERI MUNICIPALITY, MALAPPURAM DISTRICT, KERALA

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## Abstract

*The land is one of the important natural resource next to water, for man to survive on earth. The land use / land cover studies help to understand about a natural vegetation cover over an earth surface and how and up to what extent man is utilizing a land cover for his economic benefit in an area. The present study deals with the land use / land cover change detection in Manjeri municipality, Malappuram district in Kerala. This not only study the existing land use / land cover pattern over the study area but also analyze the level of changes that happened within the span of 47 years. It also clarifies the causes for such changes and suggests remedial measures to overcome such problems. Hence this study will be very beneficial for the study related to natural resource management, regional planners and decision makers regarding sustainable development of Manjeri municipality in Malappuram district, Kerala.*

**Keywords:** Land use; Land cover; Manjeri; GIS & Remote sensing

## Introduction

Most of the time land use and land cover are used interchangeably. But in reality, both are having different meaning. Land use is influenced by economic, cultural, political, historical and land – tenure factors at multiple scales. Land cover, on the other hand, is one of the many biophysical attributes of the land that affect how ecosystems function (Turner et al., 1994). In simple sense Land cover can be defined as the vegetation cover spread over the surface of the earth but land use means how man is utilizing the earth. For example, land use includes wildlife management area, agricultural land, urban, recreation area etc. In another word we

can say that two land parcels may have similar land cover but with different land use.

The land cover data refers to how much of an area is covered by natural phenomena whereas land use data indicates how much area is utilized by man under which activity. These land use and land cover data are very important for land resource management, planners and decision makers (Ndukwe, 1997). However, by the advancement of technical field especially in the field of air and space borne remote sensing technique, it is now possible to acquire the land use and land cover data for any period of recent time. In another hand the advantage of GIS

made it easier to integrate multisource and multi-date data for the generation of land use and land cover data.

Since the land use / land cover information is the basic pre-requisite for land, water and vegetation resources utilization, it becomes necessary to use latest technologies and tools like Remote Sensing and GIS for effective planning and management of these resources in modern times. The temporal data provided by the remote sensing satellites helps to monitor the changes that occur from time in the land use / land cover. An attempt is made to study the land use / land cover patterns in the Manjeri municipality in Malappuram district of Kerala.

## Study Area

The study is focused on Manjeri municipality in Malappuram district in the state of Kerala, India. The Manjeri municipality is located in the central part of Malappuram district, Kerala, India at geographical coordinates  $11^{\circ} 7' 0''$  N and  $76^{\circ} 7' 0''$  E with a total area of 53.06 Km and is divided into 50 electoral wards. The Figure 1 shows the location of Manjeri municipality in Malappuram district, Kerala, India. The municipality has the total population of 97104 at the 2011 census, with a population density of 1878 per Sq Km making its one of the largest towns in Kerala. The male population in 2011 census was 48,195 and the female population is 49,009. Pulpetta, Thrikkalangode, Pandikkadu, Anakkayam and Pookattur panchayats are situated adjacent to Manjeri municipality. There is no railway access to Manjeri, but it is well connected by road to Kozhikode, Malappuram, Nilambur, Tirur, Thrissur, Mannarkkad, Palakkad and Perinthalmanna and is well accessible by bus. It is situated 12 Km from the Malappuram and 45 Km from Calicut railway station. The physiography of Manjeri municipality is characterized with peaked hills, slopes, and plain areas. It covers about 53.06 km. sq from which 24.3676 (48.87%) consists of sloppy region & (29.0766.4796) & consists of low land areas (it lies 38 meters from mean sea level.) & 19. 35% hilly region. The undulating region consists of hill tops covered with thick forest & coconut groves, cashew nut, rubber, etc. Manjeri municipality is bounded by more or less continues hill chain with an altitude between 130 meters to 185 meters above mean sea level. Drainage is an important factor determining the economic development of an area. Drainage system in this area is very well developed. Two important rivers of Kerala flow through Manjeri municipality. They are the Chaliyar and Kadalundi river, flowing towards the west into the Arabian Sea.

## Methodology

The base map was prepared from Survey of India toposheet pertain to the Manjeri municipality. The IRS data was visually and digitally interpreted by using the image interpretation elements in ArcGIS software. The derived map is verified

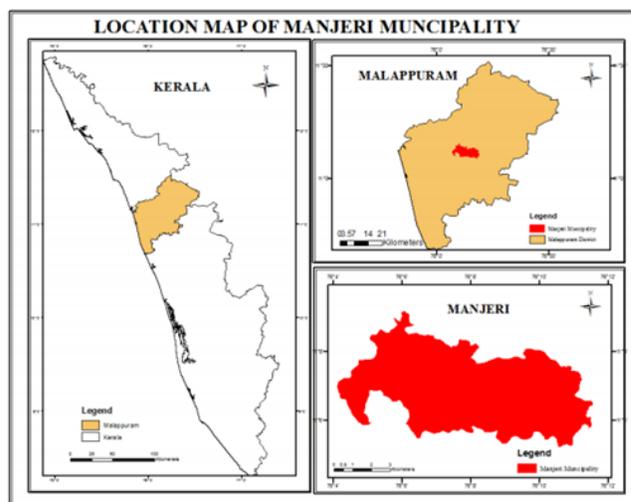


Fig. 1. Location Map of Manjeri Municipality

based on the field visit. The land use patterns are classified based on the key developed by the NRSA (India) for categorization of land use / land cover in 3 levels with certain modifications. The derived data was analyzed with the help of graph, pie charts and table using Microsoft Excel.

## Result and Discussion

The land use/land cover categories of the study area were mapped using the Survey of India (SOI) topographic sheets (58 A/4) for the year 1967 and satellite image (IRS-1C-LISS III) for the year 2014 of 1:50000 scale. The satellite data was visually interpreted and after making thorough field check, the map was finalized. The various land use/land cover classes in this study includes, built-up land, agricultural land (crop land, fallow land and agricultural plantation), waste lands, (land with scrub, land without scrub and barren rocky areas) and water bodies. The Table 1 gives a detailed account of land use/land cover changes for the period 1967 and 2014 and is discussed in the following section.

### Built-up Land

The built-up areas are the places of human inhabitation, developed due to non-agricultural activities like building, industries, commercial activities and transportation network. In the satellite image these features are identified with their dark bluish green tone in the center and bluish tone on the periphery. These features have a coarse texture. In the year 1967, the total built-up area was 0.319 % which increased to 10.504 % in the year 2014. In the study area build up land mainly include town and villages. These areas can be further classified into commercial, industrial, public or semi-public, recreational and mixed build up area. The town and villages

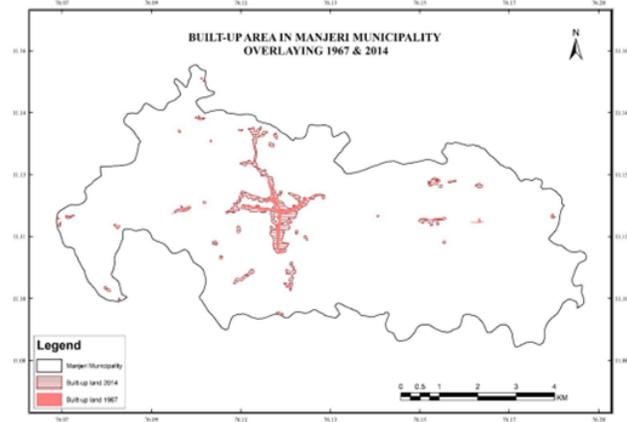
**Table 1.** Land use/Land cover Classification of Manjeri municipality

Name of land use classification	Area in Sq. Km (1967)	Area in Sq. Km (2014)	Difference in Sq. Km	Percentage 1967	Percentage 2014	Percentage difference
Plantation	2.183	25.970	23.787	4.115	48.945	44.830
built-up area	0.319	5.893	5.573	0.601	11.105	10.504
water body	0.191	0.092	-0.099	0.360	0.174	-0.186
Degraded land	0.004	1.260	1.255	0.008	2.374	2.366
Land without scrubs	0.940	0.653	-0.287	1.771	1.231	-0.541
Natural vegetation	21.302	0.072	-21.230	40.146	0.135	-40.011
Paddy	28.121	19.121	-9.000	52.998	30.036	-15.57362
Total	53.060	53.060		100	100	

are found scatter distributed with an increase of 5.573 sq. km. from the year 1967 to 2014. In town area the land is mainly utilized for commercial, industrial, public and semi-public purpose and recreational area like beaches and playground. In the village area, the mixed land utilization of agriculture and built up area is demarcated. The residential areas which are developed by converting the paddy fields are also found in the study area. The Figure 2 shows the distribution of built-up land use changes in the Manjeri municipality.

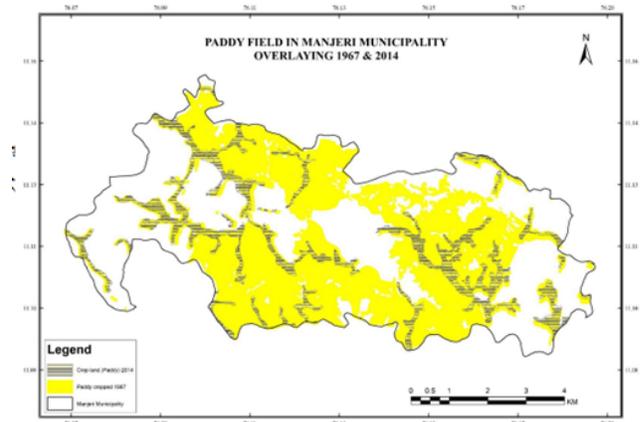
**Agriculture Land**

Agriculture land includes land raised for food crops, commercial crops, plantation crops and horticulture crops. With the help of satellite data, it is possible to identify the various agricultural lands up to Level II. The Figure 3 shows the agricultural land use in Manjeri municipality for the year 1967 and 2014. The agriculture lands are identified by their characteristics like red tone, square or rectangular shape of agricultural fields, association with water bodies and topography. The fallow lands are identified by their dark greenish tone, smaller size and medium texture. The total agricultural land in the year 1967 was 28.121 sq. km. which increased to 19.121 sq. km. in the year 2014. This shows an increase of -9.000 sq. km. area under agricultural activity. In the Manjeri munic-



**Fig. 2.** Build-up Land use changes in Manjeri municipality Overlaying 1967 & 2014

ipality the major agricultural activities are crop cultivation with special preference to paddy cultivation and plantation. But within the period of ten years, the area under paddy cultivation is reduced considerably and area under inter mixed cropping and plantation increased rapidly. There are many factors for this change especially the risk of paddy cultivation, high cost of labor etc.



**Fig. 3.** Paddy field Change in Manjeri municipality Overlaying 1967 & 2014

**Degraded Land**

Land which does not support any vegetation is known as waste lands. Barren rocky, degraded land under plantation, land with or without scrub, mining/industrial wastelands, sandy land, underutilized/ degraded forest land, water logged and marshy area. Such lands are formed due to chemical



and physical properties of soil, temperature, rainfall and local environmental conditions. The following Figure 4 shows the waste land use changes in the Manjeri municipality for the year 1967 to 2014. In the year 1967, the total waste land in the Manjeri municipality was 0.004 sq. km. which was reduced to 1.260 sq. km. in the year 2014. The increase in population, urbanization, commercial and industrial utilization resulted in utilization of waste land close to the build-up areas in the study area. There was a decrease of 2.366 sq. km. of waste land from the year 1967 to 2014.

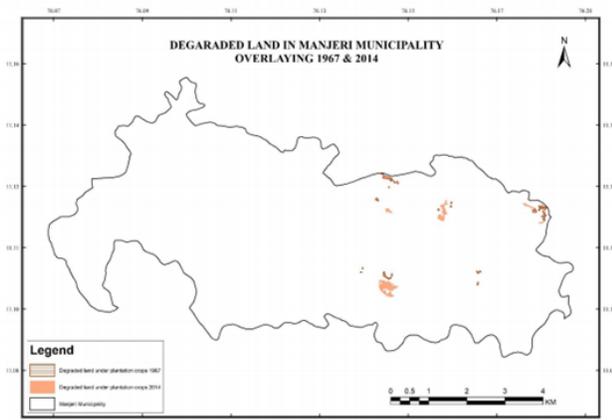


Fig. 4. Change of Degradedland in Manjeri municipality, Overlaying 1967 & 2014

### Water Bodies

The water bodies include both natural and man-made water features namely rivers/streams, lakes/tanks and reservoirs. The water features appear black in tone in the satellite image. The shallow water and deep-water features appear in light blue to dark blue in color. Tanks with plantation are identified by the square/rectangle shape and red color tone. Tanks without plantation are recognized by the shape and light blue to dark blue tone. The Figure 5 shows the water bodies and its spatial changes in Manjeri municipality In the year 1967 the total area under water bodies was 0.191 sq. km. which is now reduced to 0.092 sq. km. showing a decrease of 0.186 sq. km. of water bodies in Manjeri municipality This area is drained with good network of drainage but due to rugged topography and steep slope, the availability of water is less in this area. Apart from this there are several ponds, wells which are the major source of drainage in the Manjeri municipality. Dumping of urban waste in the water bodies, filling of dry ponds for build up areas, not only results in the reduction of water bodies but also disturbs the ecosystem.

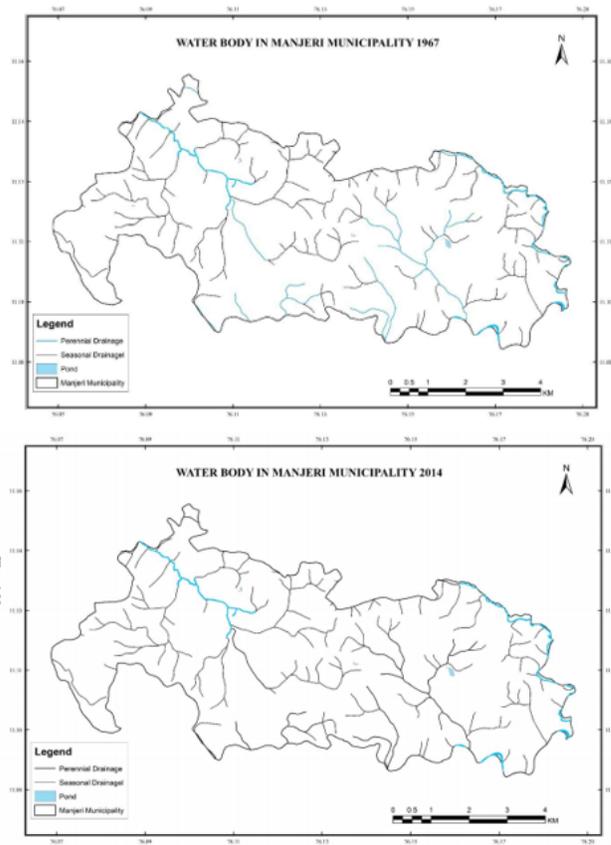


Fig. 5. Water body in Manjeri Municipality

### Plantation

Now days the most increased land use is plantation in the study area. in 1967 the plantation is very small area 2.183 Sq.km, and the plantation is increase in 2014 about 25.970 Sq.km, which is 48.945. The plantation is increased as 44.83% of total land area. The map Figure 6 shows the growth of Plantation Which include Mainly Rubber plantation, Coconut, arecanut plantation and other cash crops.

### Conclusion

This study shows that in 1967, fig. 7 most of the land cover is carried by Natural vegetation and it cover 21.302 Sq. km. But in 2014 the natural is depleted and now it is only 0.072 Sq.km. These changes occurred because of the increase in the plantation which is mainly mono culture. There is a 44.83% increase in the field of plantation. It shows that ecology is vulnerable. It's especially because of mono cropping technique. For example, the species like rubber plantation as mono culture. Other big change in the field of paddy cultivation. Paddy field of 1967 where converted in to barren land in 2014 it's because of mainly insufficiency and also



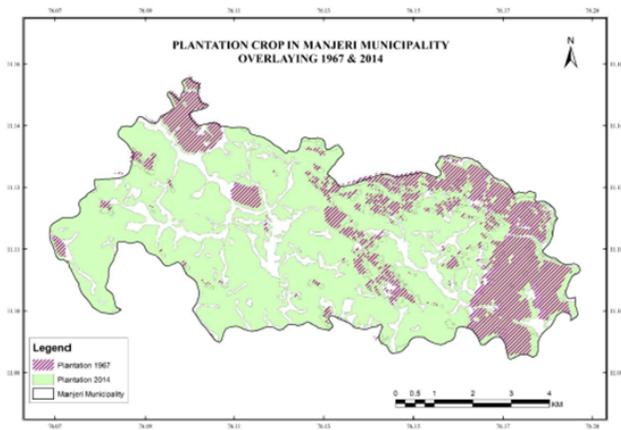


Fig. 6. Change of Plantation in Manjeri Municipality 1967 & 2014

lack of skilled labor. In 2014 fig. 8 major cropped paddy field situated in west of Manjeri municipality near Pullur and a small patch in south of Manjeri municipality near Thamerasserri village.

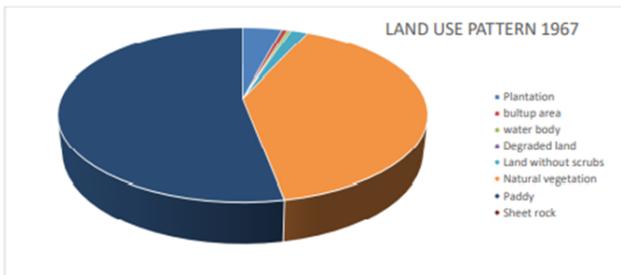


Fig. 7. Diagram showing Land use Pattern 1967

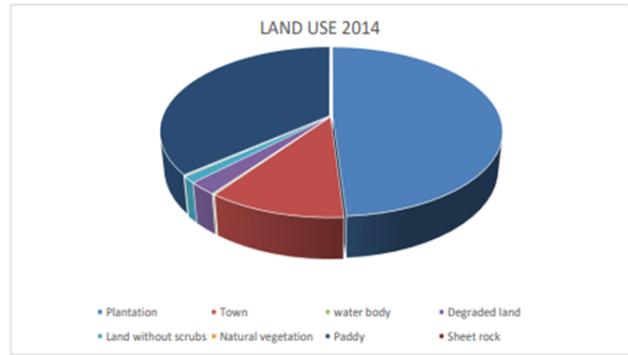


Fig. 8. Diagram showing Land use Pattern 2014

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