# Landuse/Landcover Change Detection in Umshing-Mawkynroh of East Khasi Hills District, Meghalaya Using Spatial Information Technology

**Pallabi Deka[*], Dr. P. K. Ryngnga[**] and Dr. S.J. Deka[***]**

[*] Research Scholar, Department of Geography, North-Eastern Hill University, Shillong-22.
[**] Assistant Professor, Department of Geography, North-Eastern Hill University, Shillong-22.
[***] Assistant Professor, Department of Botany, Goalpara College, Goalpara-01.

*Abstract-* Landuse / Landcover is result of combine activities of physical and human activities. Land use and Land cover change detection is essential for understanding of physical environment, ecological process, soil erosion, deforestation and also helpful in planning perposes. In this paper, an attempt is made to study the changes in land use and land cover in Umshing-Mawkynroh, East Khasi Hills District, Meghalaya. The study has been done through remote sensing and GIS approach using SOI toposheet (1966-1967), CARTOSAT P5 (2005) and LISS III (2011). GIS software is used to prepare the thematic maps. Ground truth observations (through field visits) were also performed to check the accuracy of the classification. The present study, as brought to light, that open forest area that occupied by about 64.76 per cent of the Unshing-Mawkynroh area in 1966-67 has decreased to 41.75 percent in 2011. Agricultural lands were also decreased from 10.93 percent to 6.94 percent during 1966-2011. However dense forests have shown considerable increase from 21.31 percent to 36.54 percent during 1966-2011. The reasons for this decrease and increase have been discussed. It is necessary to closely monitor the land use and land cover changes for proper planning and to maintaining a sustainable environment.

*Index Terms-* Land use, Land cover, Change detection, Remote Sensing, GIS and Umsing-Mawkynroh.

## I. INTRODUCTION

Major issue of global environment change is Land use/land cover (LULC) changes. The remote sensing spatio-temporal data provides quite useful in detecting land use/land cover patterns and changes with time. Quantification of such changes is possible through GIS techniques even if the resultant spatial datasets are of different scales/resolutions (Sarma *et al.,* 2001).To understanding the dynamics of human activities in space and time such studies are very helpful. Land use change is the modification in the purpose and usage of the land, which is not necessarily the only change in land cover. It also includes changes in intensity and management (Verburg, *et al*, 2000). Information about land use change is necessary to update land cover maps and for effective management and planning of the resources for sustainable development (Alphan 2003). Remote sensing has been used for land use/land cover mapping in different parts of world as well as in India over the years. Accurate and up-to-date land cover change information is necessary to understand and assess the environmental consequences of such changes (Giri et al, 2005). The present study has been undertaken to understand the changes of land use/ land cover in Mawlai Umshing-Mawkynorh.

## II. STUDY AREA

The area is located on 25°36'00" N to 25°39'36"N latitude and 91°55'12"E to 91°55'12"E longitude with an area of about 4.85 km². Geologically, the Umshing is a part of the rigid massif of the Shillong plateau, a detached part of peninsular Gondwanaland cratonic block.

MEGHALAYA

EAST KHASI HILLS
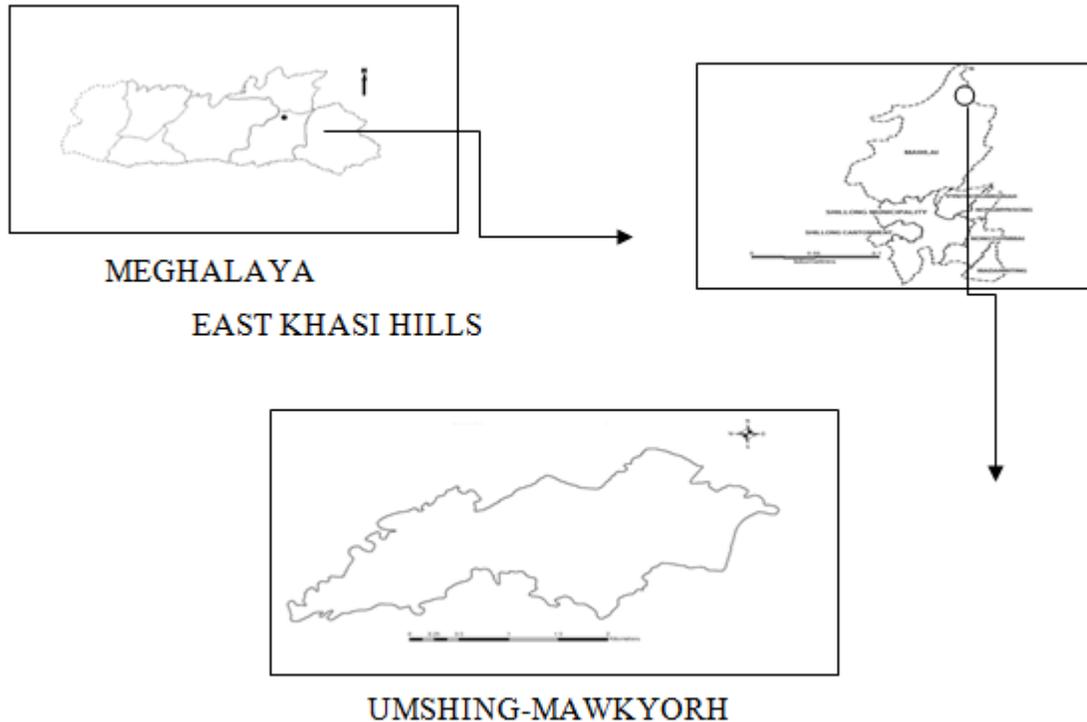
UMSHING-MAWKYORH

## III. OBJECTIVES

The aim of this study is to produce a land use/land cover map of Umshing-Mawkynorh to detect the changes that have taken place over a given period using change detection method.

**The objectives are:**
I.   To find out the factors responsible for LULC change.
II.  To prepare a LULC map and to detect the changes of the area.
III. To find out the rate of changes and extent LULC change in the study area.

## IV. DATA USED

For detecting the changes in LULC, CARTOSAT P5 2005 and 2011 have been used along with the Survey of India (SOI) topographical map with scale 1:50000.

## V. METHODOLOGY

Toposheet has been geo-referenced and base map is prepared from SOI toposheet with 1:50,000 scale using ArcGIS 9.3 software. Study area has been extracted from imageries of CARTOSAT P5 2005 and LISS III 2011. Landuse/landcover classes are digitized from topopsheet and imageries in ArcGIS. Change detection analysis has been done comparing the area occupied by different landuse classes from toposheet and imageries using simple comparative method.

## VI. RESULTS AND DISCUSSIONS

An important application of Remote Sensing technology is change detection. Change detection gives us information about temporal changes of LULC of an area. In this study detailed informations of LULC were obtained from two set of data for analysis of change detection to find out the changes that have occurred in 1996-97, 2005 and 2011.the changes between the three years of attribute informations were tabulated in details.
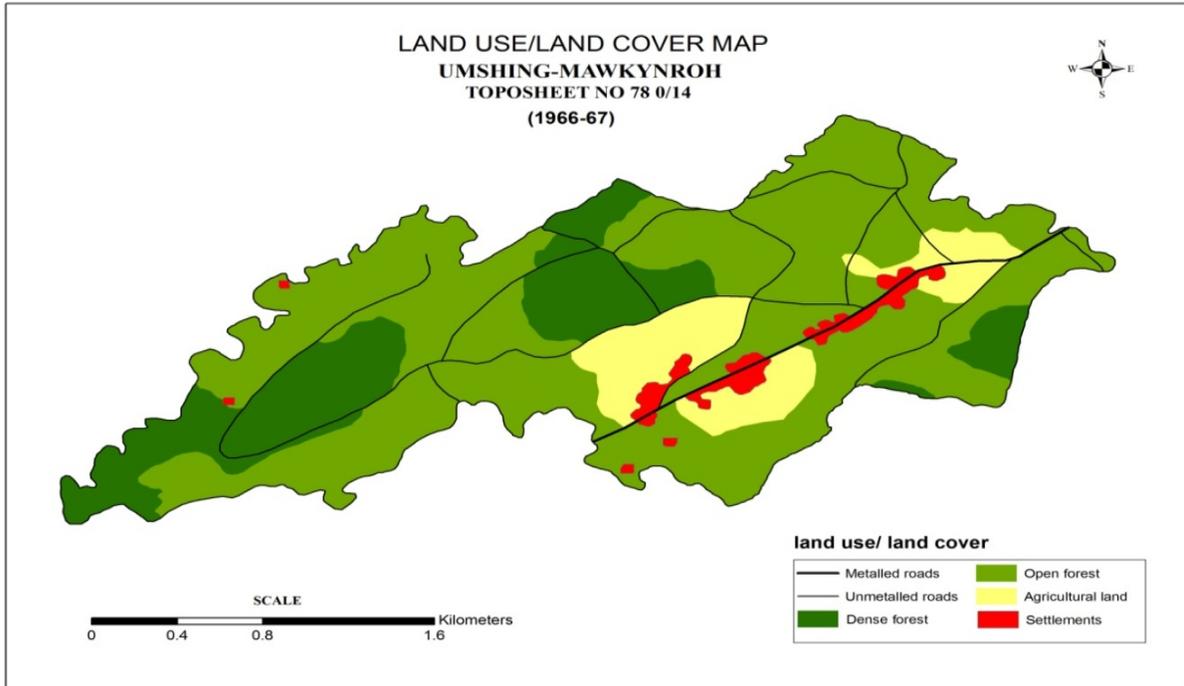
**Table 1: Landuse/landcover of 1966-76**

| Categories | Area in Sq.km | Area in % |
|---|---|---|
| Settlement | 0.080 | 1.647 |
| Agricultural area | 0.343 | 7.063 |
| Dense Forest | 2.551 | 52.512 |
| Open Forest | 1.663 | 34.251 |
| NEHU CAMPUS | | |
| Educational Building | 0.054 | 1.128 |
| Office Building | 0.041 | 0.856 |
| Hostel Building | 0.029 | 0.607 |
| Quarter Building | 0.072 | 1.499 |
| Recreational Area | 0.021 | 0.434 |
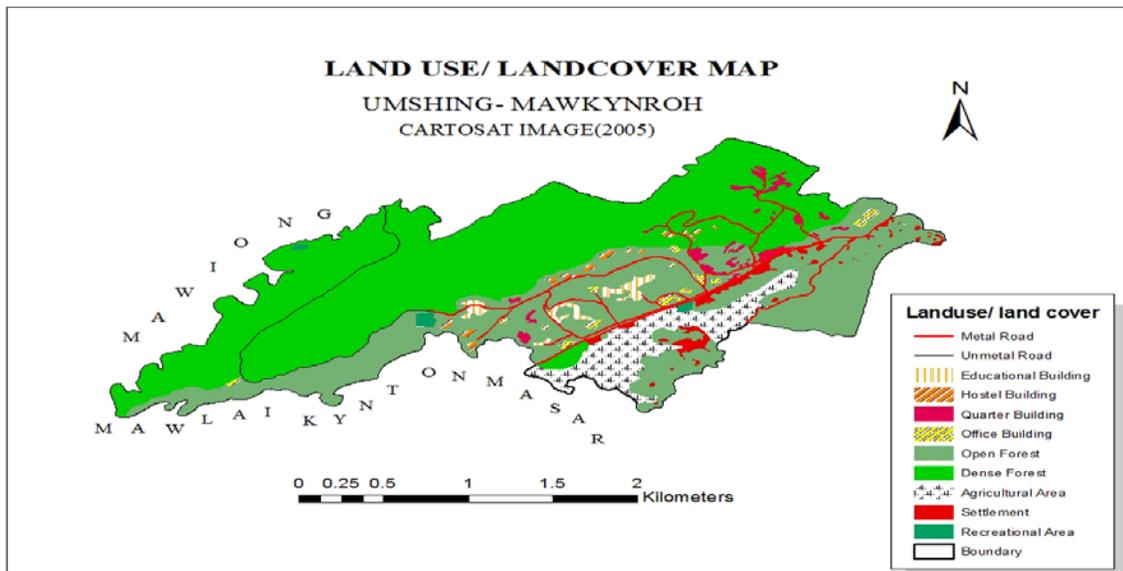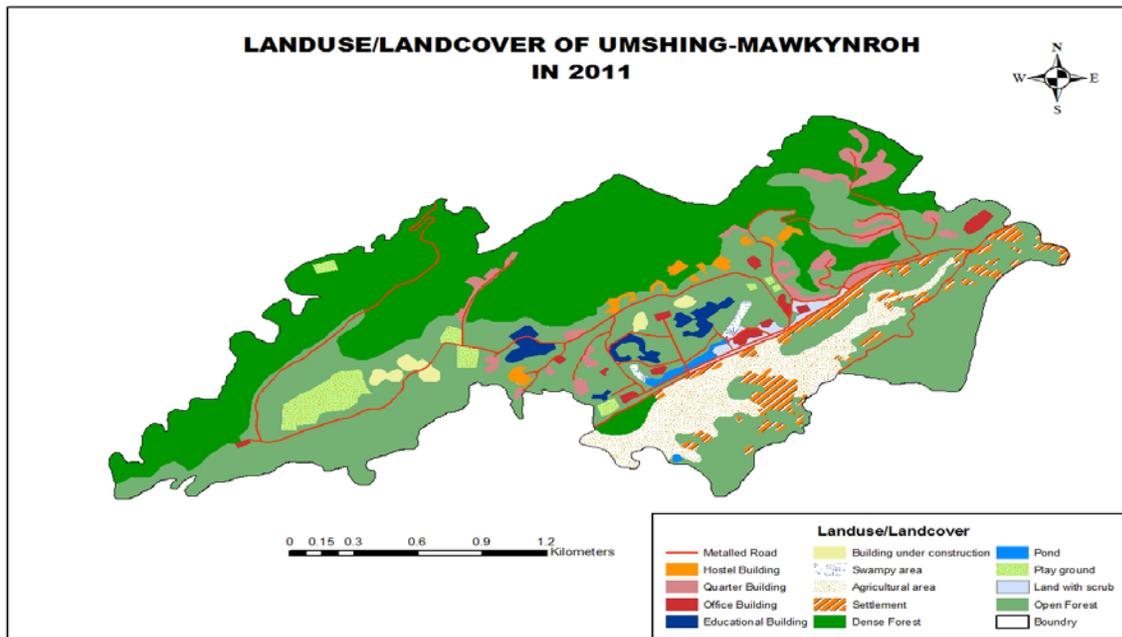
**Table 2: Landuse/landcover of 2005**

| Categories | Area in Sq.km | Area in % |
|---|---|---|
| Dense forest | 1.034 | 21.313 |
| Open forest | 3.144 | 64.769 |
| Settlements | 0.144 | 2.986 |
| Agricultural land | 0.530 | 10.930 |
| Total | 4.854 | 100 |

**Table 3: Landuse/landcover of 2011**

| Categories | Area in sq.km | Area in % |
|---|---|---|
| Agricultural area | 0.339 | 6.949 |
| Settlement | 0.168 | 3.451 |
| Open forest | 2.041 | 41.756 |
| Dense forest | 1.786 | 36.547 |
| NEHU CAMPUS | | |
| Hostel building | 0.041 | 0.843 |
| Quarter building | 0.166 | 3.395 |
| Office building | 0.045 | 0.938 |
| Educational building | 0.070 | 1.449 |
| Building under construction | 0.039 | 0.801 |
| Swampy area | 0.014 | 0.301 |
| Pond | 0.019 | 0.405 |
| Play ground | 0.113 | 2.313 |
| Land with scrub | 0.041 | 0.846 |
| Total Area | 4.889 | 100 |

LAND USE/ LAND COVER 1966-1967



LAND USE/ LAND COVER 2005



LAND USE/ LAND COVER 2011
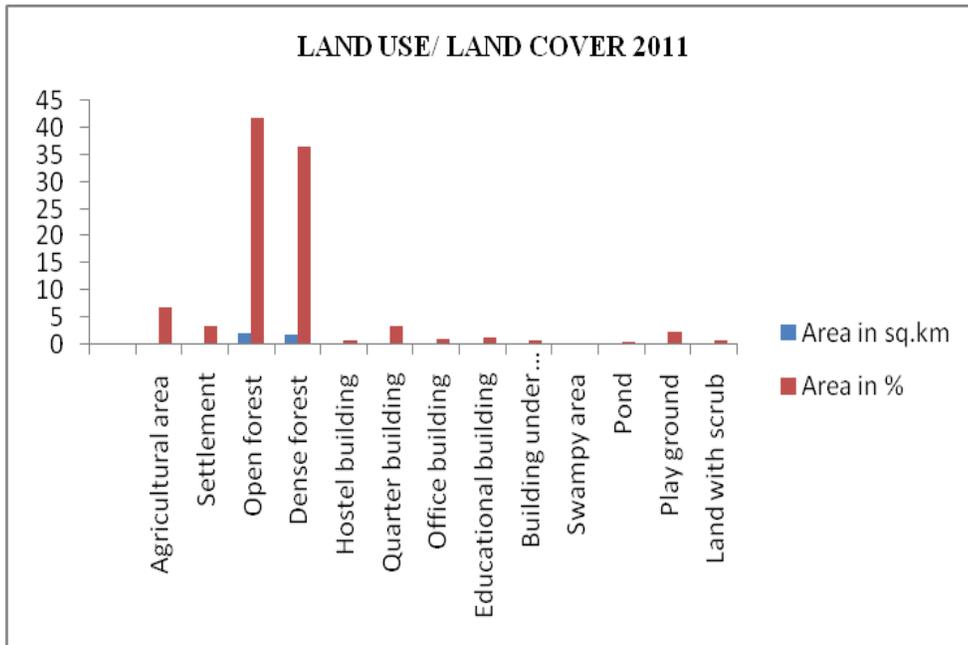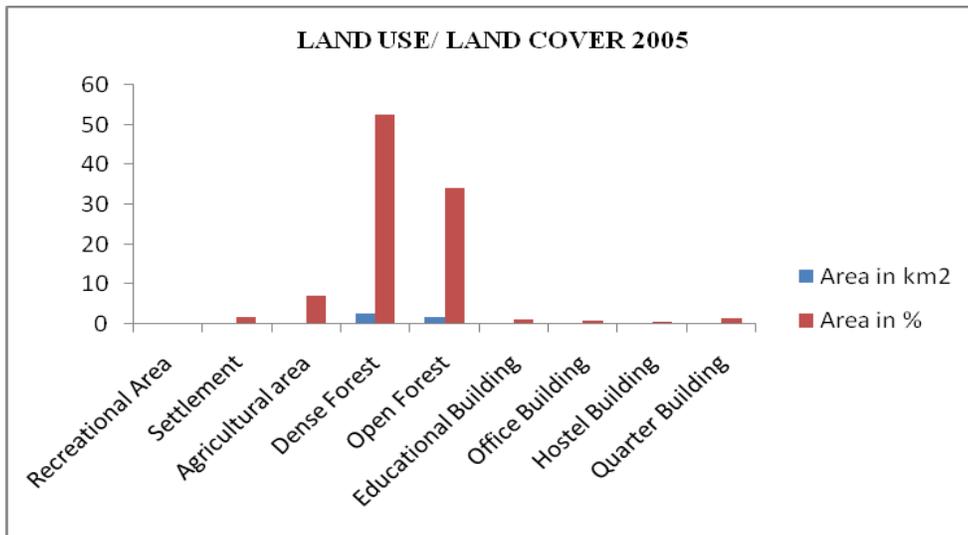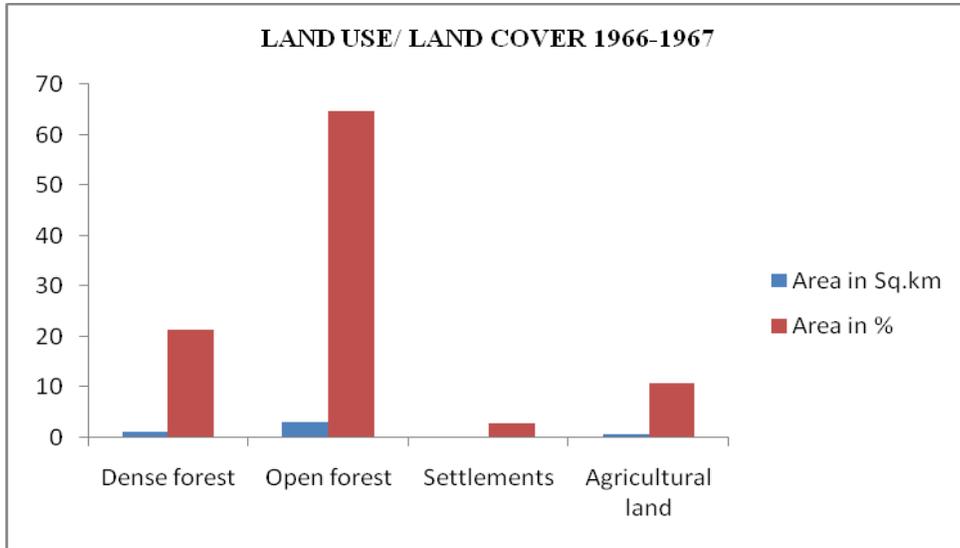
**Table No. 4: Land use/Land cover Change Detection**

| Categories | 1966-67 | 2005 | 2011 |
| --- | --- | --- | --- |
| | Area in % | Area in % | Area in % |
| Agricultural area | 10.930 | 7.063 | 6.949 |
| Settlement | 1.986 | 2.647 | 3.451 |
| Open forest | 64.769 | 34.251 | 41.756 |
| Dense forest | 21.313 | 52.512 | 36.547 |
| **NEHU** | | | |
| Hostel building | | 0.607 | 0.843 |
| Quarter building | | 1.499 | 3.395 |
| Office building | | 0.856 | 0.938 |
| Educational building | | 1.128 | 1.449 |
| Building under construction | | | 0.801 |
| Swampy area | | | 0.301 |
| Pond | | | 0.405 |
| Recreational Area | | 0.434 | 2.313 |
| Land with scrub | | | 0.846 |

The land use/ land cover categories like Agriculture, Open forest, dense forest, settlement and others have been identified and mapped from the SOI toposheet 1966-67, CARTOSAT P5 2005 and 2011. From the table no. 4 approximately 10.930% of the areas were occupied by agriculture during 1966-67 and it has been decreased to 6.949% in 2011. The area occupied by settlement was about 1.986% in 1966-67, 2.647% in 2005 and further increased to 3.451% in 2011. In 1966-67, 64.769% area was covered by open forest and it has been decreased 34.251% in 2005 and again it increased to 41.756% in 2011. About 21.313% of dense forest covers in 1966-67 and it has been increased to 52.512% in 2005, but in 2011 it was decreased to 36.547%. After 2005, the agricultural area has been showing decreasing trend and built-up area has been showing increasing trend. In contrast to open forest, dense forest areas showing decreasing trend after 2005. The main reason of changes of LULC in this area was the establishment of Noth-Eastern Hill University by central government and expanding of main city Shillong towards the Umshing-Mawkynroh.

## VII. CONCLUSION

From these three temporal data sets it has been observed that an area occupied by North-Eastern Hill University is experiencing great change. The settlement size in this area is increasing year after year due to overcrowding and expanding of urban sprawl. Most of the forest cover has been cleared due to constructional and residential purpose.

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AUTHORS

**First Author** – Pallabi Deka, Research Scholar, Department of Geography, North-Eastern Hill University, Shillong-22, E-mail-pallabi123deka@rediffmail.com
**Second Author** – Dr. P. K. Ryngnga, Assistant Professor, Department of Geography, North-Eastern Hill University, Shillong-22
**Third Author** – Dr. Sheemanta Jyoti Deka, Assistant Professor, Department of Botany, Goalpara College, Goalpara-01

**Correspondence Author** – Pallabi Deka, Research Scholar, Department of Geography, North-Eastern Hill University, Shillong-22, E-mail- pallabi123deka@rediffmail.com, Contact number: 09613622083