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LAND USE AND LAND COVER CHANGE DETECTION USING REMOTE SENSING and GIS TECHNIQUES (1985-2015)

(A Case Study of District Haripur, Khyber Pakhtoonkhwa)

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ABSTRACT:- *Geographic information system and remote sensing techniques are effective tools for the dynamic analysis of land use land cover transformations. This project examines the use of Remote Sensing in mapping Land Use Land Cover in District Haripur between 1985 and 2015 so as to detect the changes that has taken place in this status between these periods. Subsequently, an attempt was made at projecting the observed land use land cover in these years. The result of the work shows a rapid growth in built-up land between 1985 and 2015. To understand the spatio temporal dynamics of the city's growth, Satellite or Airborne images give urban planners comprehensive interpretations of large areas which allow them to lay plans for future urban development effectively.*

Keywords: *Land use, land cover, Change detection, Remote sensing, Image processing*

I. "Introduction"

Land use/cover change is a major factor for global change because it can affect ecosystem processes, hydrology, biodiversity, climate, biogeochemical cycles, energy balance, and human activities (Xiao *et al*., 2006; Pabi, 2007). Change detection in land use and land cover can be performed on a temporal scale such as a decade to assess landscape change caused due to anthropogenic activities on the land (Gibson and Power 2000) Recently cities all over the world have experienced rapid growth because of the rapid increase in world population and the irreversible flow of people from rural to urban areas. Specifically, in the larger towns and cities the rate of population increase has been constant and nowadays, many of them are facing unplanned and uncontrolled settlements at the densely populated sites or fringes (Amarsaikhan & Tsolmongerel 1997).

So to prevent from such circumstances, accurate and current urban landuse information is an essential data required by planners and policy makers for carrying out various activities in urban planning and management. For example, the landuse data is useful for urban planners and researchers in preparation of master plan, planning of smart cities and satellite towns, provision of basic amenities and urban infrastructure facilities, analyze the changes that have occurred in the landuse over the past years, prediction of future landuse, urban sprawl analysis, etc.

In recent decades, the use of satellite data has replaced the traditional field survey methods in preparing urban landuse maps due to advancements in remote sensing and geographic information systems (GIS) prepared (Sudhira *et al*., 2004; Jat *et al*., 2008; Guzelmansur & Kilic, 2010; Basawaraja *et al*., 2011; Feng and Li, 2012; Rahman *et al*., 2011; Moghadam and Helbich, 2013; Hegazy and Kaloop, 2015). The importance of remote sensing for studying land use/ cover patterns and their dynamics is well established. Many literatures have been carried out to analyze the importance of mapping land use classes and monitoring their changes using different spatial resolution satellite data, including Landsat Thematic Mapper (Dewan and Yamaguchi, 2008).

The aim of this study is to produce a land use and land cover map of District Haripur at different epochs in order to detect the changes that have taken place particularly in the built-up land by using different digital image processing techniques.

Objectives

The following specific objectives will be pursued in order to achieve the aim above.

- To prepare an existing land use/land cover map of study area.
- To determine the trend in land use/land cover change for the last four decades.

- To come up with the strategy and methodology that facilitates the future generation to acquire spatial information, which can be used for management.

Study Area

Haripur was founded in 1822 by Hari Singh Nalva, a Sikh General of Ranjit Singh's army. He was the Governor General of Kashmir in 1822-23 A.D. after whom it was named. Haripur district is situated at Latitude 33°44' to 34°22' N and Longitude 72°35' to 73°15' E and about 610 meters above the sea level. The total area of the district is 1725 square kilometres.

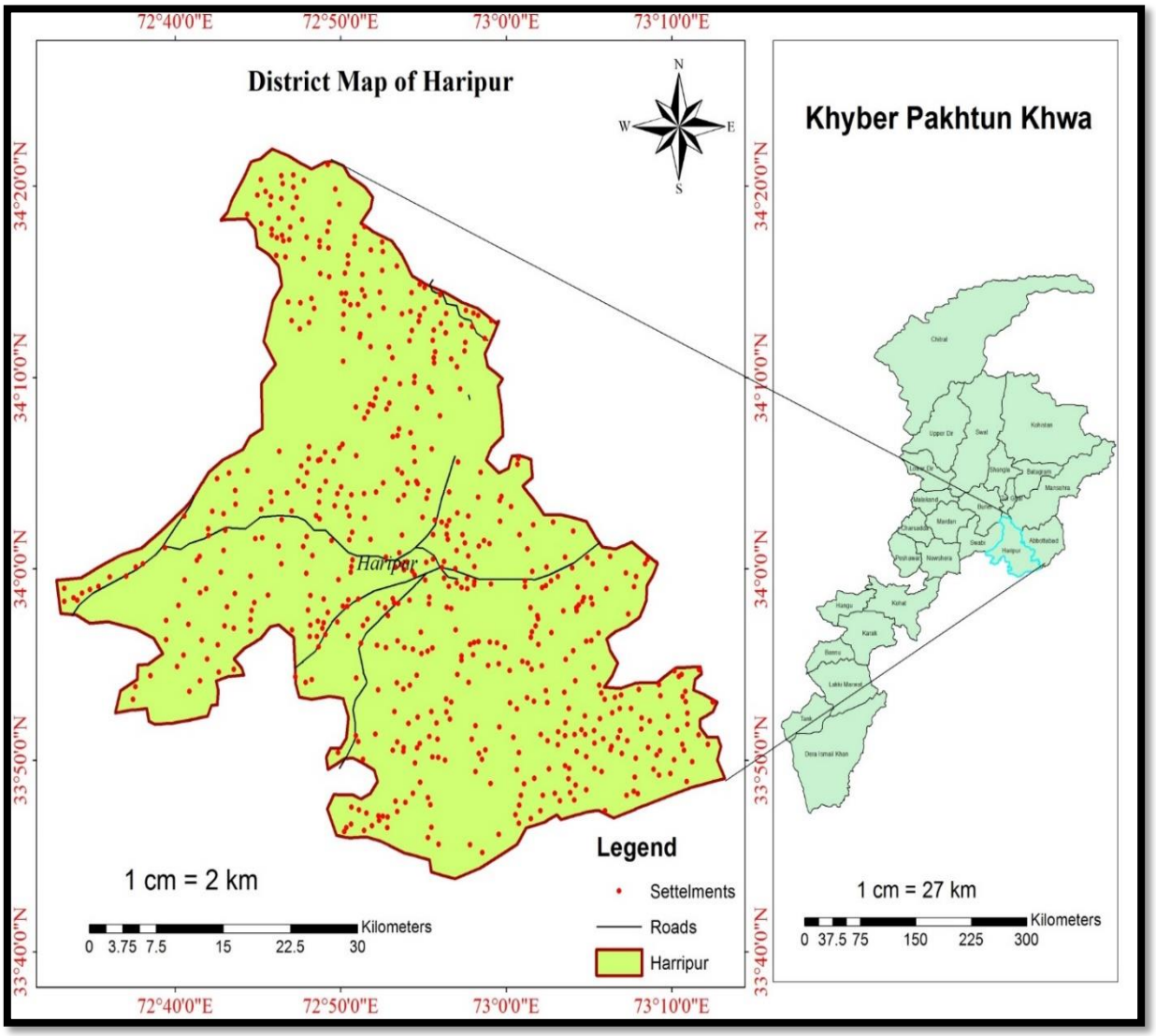
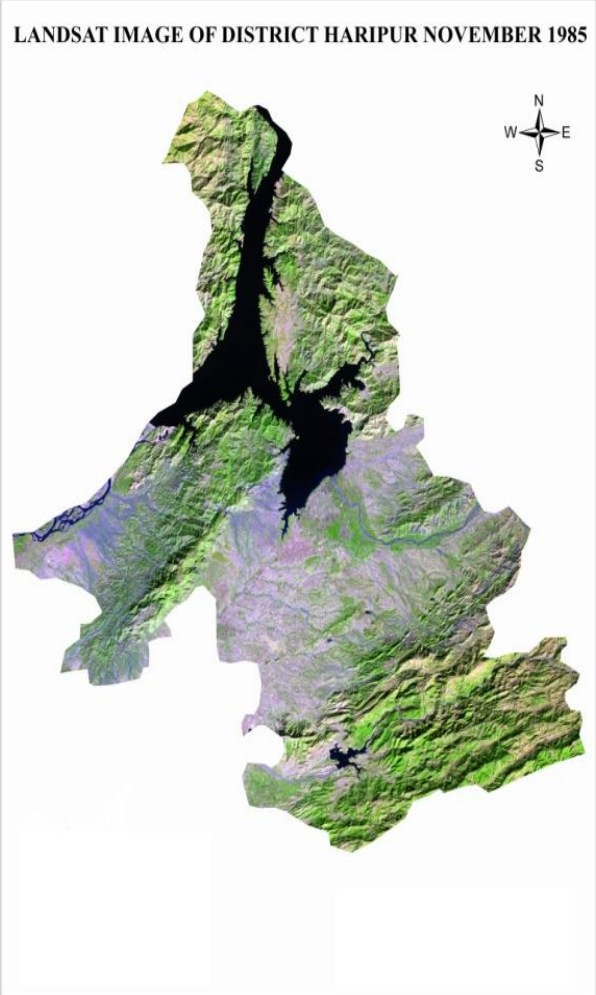


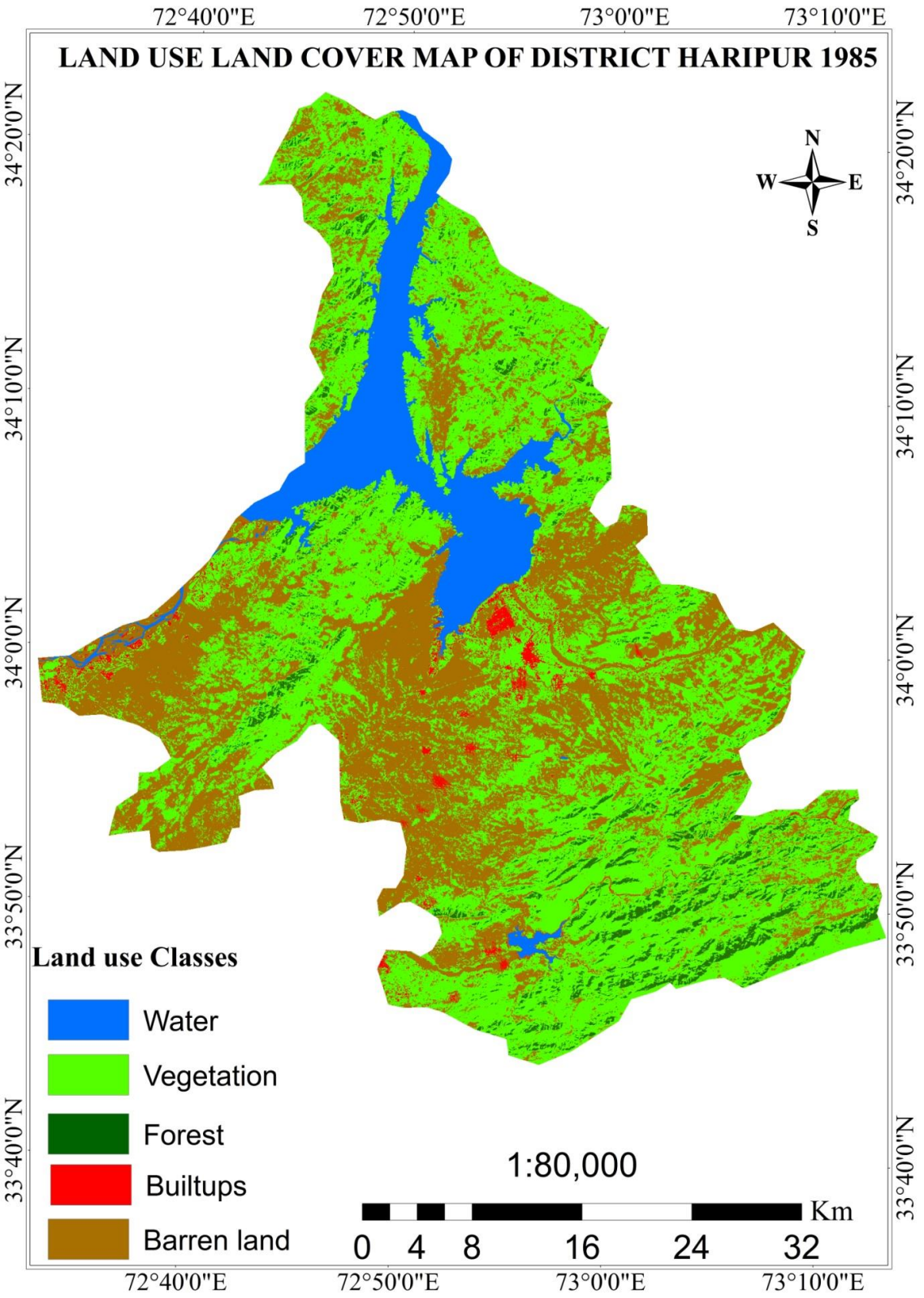
Figure1. Study Area Map

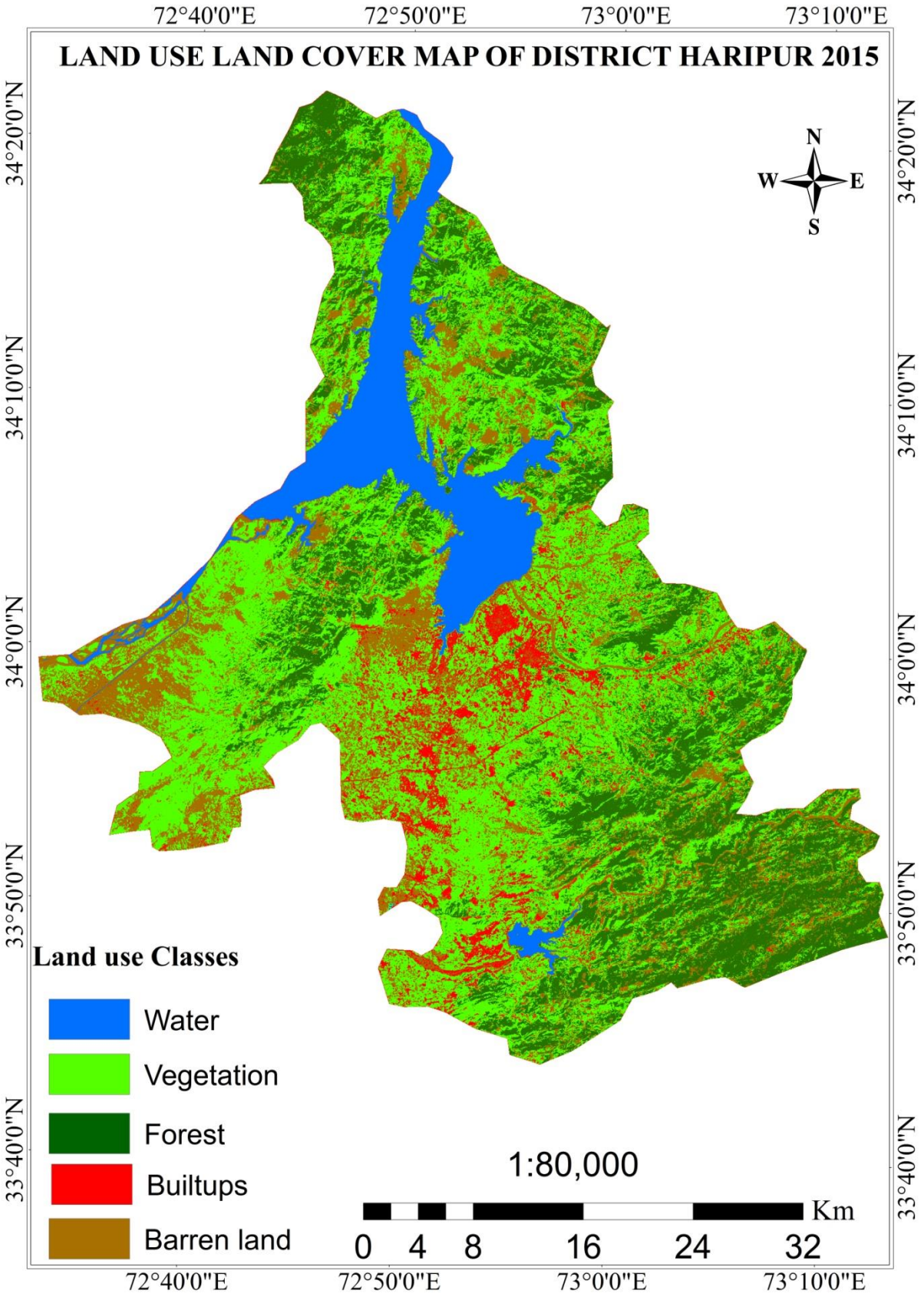
II. "Materials and Methods"

- LANDSAT satellite images of 1985 and 2015 of our study area for the month of September were downloaded from USGS website.
- The collected data were analyzed by using different software. ERDAS IMAGINE was mainly used for image enhancement but Arc GIS 10.2.2 was the major software used for analysis.
- All the images were mosaicked yearly wise and after that extract the area of study by using the shape file of the study area.
- Supervised classification is used for the image processing software is guided by the user to specify the land cover classes of interest. The user defines "training sites" area in the map that are known to be representative of a particular land cover type_ for each land cover type of interest.

- Supervised classification was performed on Landsat satellite images. supervised classification include three basic steps: (1) Select training samples which are representative and typical for that information class; (2) Perform classification after specifying the training samples set and classification algorithms; (3) Asses the accuracy of the classified image through analysis of a confusion matrix which is generated either through random sampling or using test areas as reference data.
- Accuracy assessment was done for the classified images find out the overall accuracy of the classified image.
- The classified raster were converted to polygon to find out the area of both the images which help in the change of land use pattern.
- Due to shortage of time and resource the present study was limited to the generalized land use pattern for whole of the year and not for a particular season or month. The remaining seasonal land use pattern changes may be taken into consideration in future study.







III. "RESULTS AND DISCUSSION"

Supervised maximum likelihood classification was performed using Landsat images to examine the land use changes in the study area. As well as the area summary report was prepared for the study area and area for each classes/ regions have been calculated carefully. By comparing these calculations it is found that in 1985 district Haripur the forest cover area was 7.00 % which is increased upto 14.00 % in 2015, Vegetation increased from 47.00% to 49.00%,amount of water remains constant, Builtups increased from 5.00 % to 12.00 %,While Barren land decreased from 31.00 % to 15.00 % which is shown in below comparison diagram and table.

Table 1. Calculate Average of Land use change in District Haripur 1985-2015

Classes	*1985*		*2015*		*Changes*	
	Area(Acre)	*Area %*	*Area (Acre)*	*Area %*	*Increase/Decrease Area in Acre*	*Increase/Decrease Area in Percent*
Forest	*33247.75536*	*7.00*	*66687.21477*	*14.00*	*33439.4*	*7*
Vegetation	*223235.3736*	*47.00*	*233405.6965*	*49.00*	*10170.3*	*2*
Water	*47496.79337*	*10.00*	*47633.78838*	*10.00*	*137*	*0*
Built-up	*23748.39668*	*5.00*	*57160.50157*	*12.00*	*33412.1*	*7*
Barren Land	*147240.2818*	*31.00*	*71450.68257*	*15.00*	*-75789.6*	*-16*

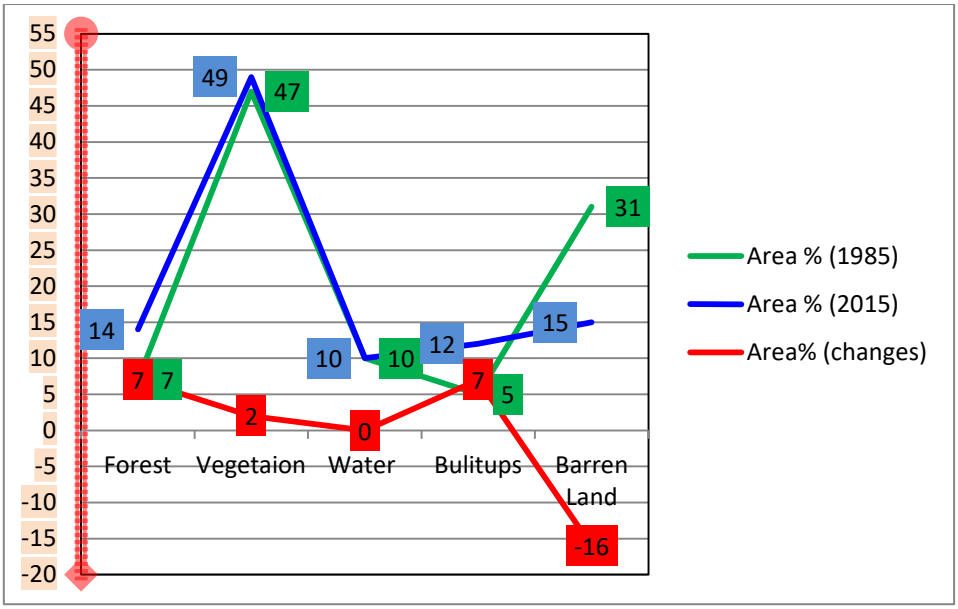


Figure 1. Average Change of District Haripur 1985-2015

An overall increase was found in the build-up area while the barren land has been decreased. The main reason for this cause is the shifting of people from rural areas to city area for their business and other jobs. Population and human needs along with migration are those factors which have direct effect on buit-ups, due to which built-ups increases. Urbanization plays important role in decreasing the barren land. Also the construction of factories, buildings and houses has direct affect in decreasing the barren land and vegetation land.

IV. "Conclusions"

Satellite remote sensing technique is more cost-effective and effective than conventional mapping surveys as it reduces field work to some extent. The study took the advantage of remote sensing and GIS techniques that are essential for dealing with the changing aspects of land use/cover in the study area. Therefore, use of remote sensing and GIS techniques are highly suggested for urban planners and decision makers to examine urbanization trends.

In this study landsat were classified. Supervised classification was carried out by using traning samples. For each class we take 40 traning samples. And then we applied maximum likelihood technique to detect the land use and land cover. Various thematic maps were developed main increase of built-up area and settlement.

This study shows that in district Haripur the major land-use class is vegetation area which comprised of about 47% of the total area of the district in 1985 and increased to 49% in 2015.Barren land was the second major land-use class in 1985 it is comprised of about 31% and decreased to 15% in 2015.Forest was comprised of 7% in 1985 and it increased up to 14%. Water was 10% in 1985 and it remain constant up to 10% in 2015.Built up was comprised of 5% and it increased up to 12% in 2015.

Due to shortage of time and resource the present study was limited to the generalized land use pattern for whole of the year and not for a particular season or month. The remaining seasonal land use pattern changes may be taken into consideration in future study

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