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SURFACE ANALYSIS AND LAND USE/LAND COVER CHANGES USING
GEOGRAPHICAL INFORMATION SYSTEM TECHNIQUES: A CASE
STUDY OF ENGLISH BAZAR MUNICIPALITY (MALDA), WEST BENGAL.



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ABSTRACT:

This work analyzes in a specific information about parts of the surface of English Bazar municipality and hence, an attempt has been made in this paper to determine and identify changes in land use and land cover, particularly in physical's aspect basically refer to the vegetation /wetted areas relative to the time in order to prevent and control deforestation and degradation of vegetation / wetted area in English Bazar municipality (Malda). To prepared Tin, relief, contour, slope, aspect maps have been used for surface analysis and an attempt has been made to prepare land use and land cover maps from Google earth data for the years 2006, 2015, applying ARC-GIS software and its techniques to determine the changes in different types of natural and manmade phenomena / aspects, of English Bazar municipality (Malda).

KEY WORDS: Surface analysis and Land use /Land cover changes in English Bazar municipality (Malda) during the period of 2006 to 2015.

I. INTRODUCTION:

This paper consists with two parts. One is surface analysis and another is land use and land cover pattern changes in English Bazar municipality (Malda.).

A. Surface Analysis: - Simply, surface is a three dimensional features of the terrain involve X, Y and Z values (Latitude, longitude and elevation). Surface can be well-represented by a raster digital elevation model, however, vector triangulated irregular networks can be represent surface very efficiently. Analysis of surface is very important in GIS modelling. Some important analysis are described as follows-

Contours/Isolines: - Contours/Isolines are lines that concept points of equal value (such as elevation, temperature, precipitation). The distribution of the lines shows how values change across a surface. Contour line can be useful for finding areas of the same value.

Deriving slope: - Slope identifies the maximum rate of change in value from each cell to its neighbours' or a measure of change in surface value over distance, expressed in degrees or as percentage. The lower the slope value means the flatter the terrain; the higher the slope value means the steeper the terrain.

Aspect: - In geography, aspect refers to the direction to which a slope faces, measured in degrees from North in clockwise direction. Aspect values are measured clockwise in degrees from 0 to 360.

Hill shade analysis: - The hill shade analysis obtains the hypothetical illumination of a surface by determining illumination values for each cell in a raster. We can create hill shade for both analytical and graphical purposes.

View shed analysis: - A view shed is an area of land, water, and other environmental elements that is visible from a fixed vantage (viewing) point. The term is widely in such areas as urban planning, archaeology, and military science.

Tin analysis: - Tin means triangulated irregular networks can be represent surface very efficiently. Adjacent data points are connected by arcs to form a network of irregular triangles using a particular method .The values inside the triangles are interpolated using linear algebra and trigonometry. An exact local method of interpolation .Most often used to generate digital terrain models. For high-precision modelling of smaller areas (Advantage -High accuracy and Limitation -Does not extrapolate outside the area covered by the data points).

B. Land use and land cover: - Land use refers to the use or management of land by humans. It describes how the land is being used. That may be residential, commercial or any away. But land cover means the physical coverage of the land. It describes how the land is covered by vegetation, water and other physical elements.

The land use/land cover pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. Land is becoming a scarce resource due to immense agricultural and demographic pressure. (V.S.S.KIRAN)

Difference between Land cover and land use:

1. Land cover which is related to the physical phenomena whereas land use is related the use or management of land by humans.
2. The components of Land cover are vegetation, river, and other natural aspects. But the components of Land use are build-up area, agricultural land, road, and other socio-economic aspects.
3. Land cover is the physical coverage of the land. But land use is made by manmade.

In the present time, Rapid population growth and anthropogenic activities on earth is changing the natural environment profoundly.

2. Objectives of the paper: - The main Objectives of this paper is as follows-

1. Surface analysis (3D analysis) in English Bazar municipality (Malda).
2. Land use /Land cover changes in English Bazar municipality (Malda) during the period of 2006 to 2015.

3. Location of the study area: - English Bazar municipality of Malda district in West Bengal state (India) has been taken as the area of present study. It is located in the central part of the West Bengal and it lies between 24°48'30" and 25°04'40" north latitudes and 87°56'30" and 88°07'30" east longitudes. It covers an area of 259.12 km² and provides accommodation to 161456 populations (2011). This municipality consists of 25 wards.

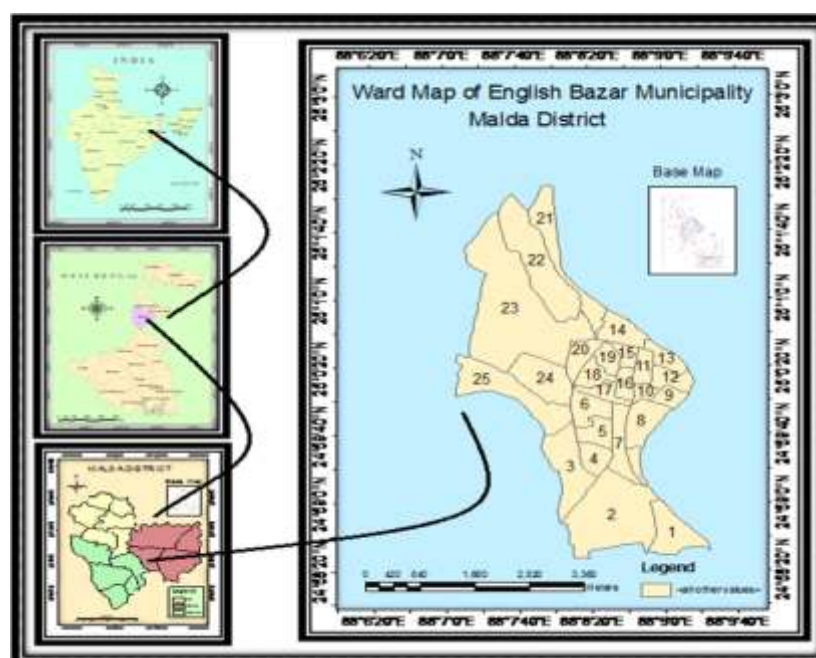


Figure 1: Figure shows the location map of study area

4. Data source:-For this paper, primary and secondary data were collected. Primary data was collected from the field survey and also secondary data was collected from Google earth software such as GCPs (ground control points), Google earth image during the period of the 2006 to 2015 used to prepared and shown of land use and land cover pattern changes in English Bazar municipality, Malda (West Bengal).

4. Methodology:-Different ARC-GIS techniques or methods were used to analysis of this paper and also statistical tools be utilized. These methods or techniques shows under the table.

Data types	Analysis process	Purposes
Maps of Google earth	The digitization techniques (ARC-GIS 9.3)	To prepared land use and land cover thematic map
GCPs	The surface analysis techniques (ARC-GIS 9.3)	To prepared thematic map such as contour, slope, aspect, tin.
Diagrams	Comparative bar graph	percentage of land use and land cover area changes

Figure 1: Table shows Methodology
A. Surface analysis in English Bazar municipality

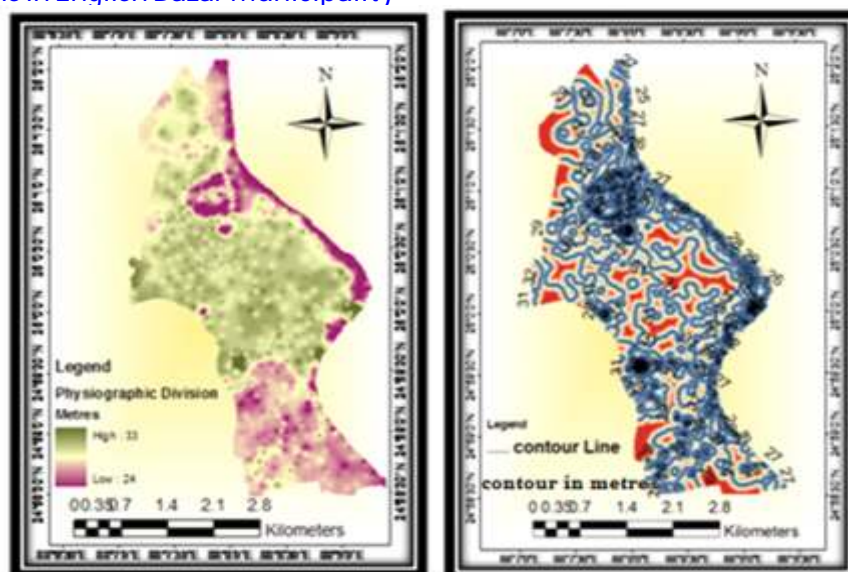


Figure 2: Figure shows physiographic division and contour map

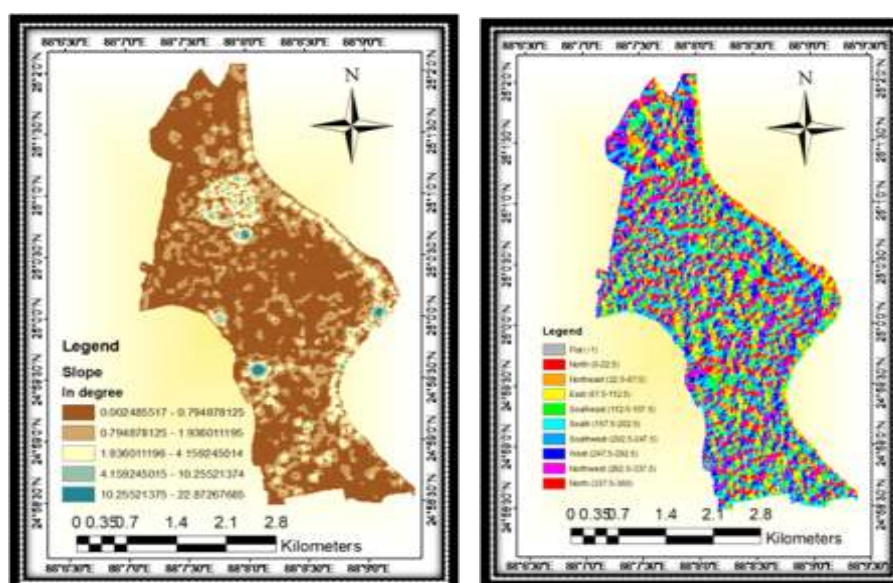


Figure 3: Figure shows slope map Figure 4: Figure shows aspect map



Figure 5: Figure shows view shed map

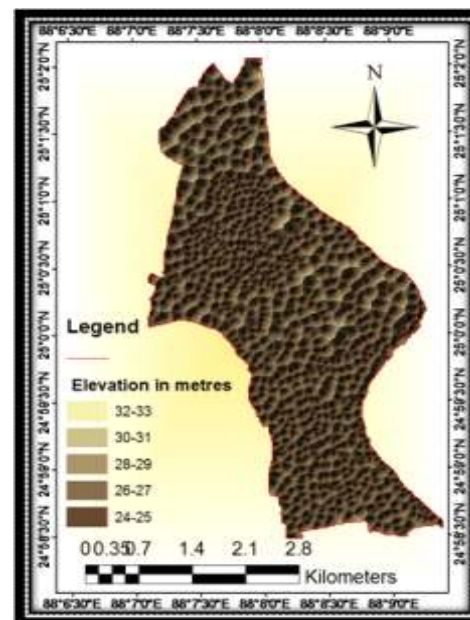


Figure 6: Figure shows TIN map

Surface analysis	Analysis
1. Contour	Highest contour values of English Bazar municipality are 33 metre and lowest contour values of English Bazar is 24 metre.
2. Slope	In raster GIS, the slope is calculated as the maximum rate of change in value from that cell to its neighbours. Highest slope values of English Bazar are 22.87 degree and lowest slope values of English Bazar is 0.79 degree.
3. Aspect	In raster GIS, aspect is conceptualized as the down slope direction of the maximum rate of change in value from each cell to its neighbours. Flat areas are given a value of -1.
4. View shed	Identification of areas of terrain that will be visible from particular points. After visibility analysis, 76.51 percent of area is observed and 23.49 percent of area is not observed in a particular vantage point.
5. Tin	It is digital terrain model. The proportion elevation of digital terrain model (Tin map) of English Bazar varies from 24 to 33 metres.

Figure 2: Figure shows surface analysis

B. Land use and Land cover pattern changes in English Bazar municipality:-The study area includes the following dominated land use and land cover: Vegetation, build-up area, water bodies and fallow land. The result revealed that area under vegetation cover decreased from 18.91% in 2006 to 9.38 % in 2015, whereas fallow land and water bodies have been continuously decrease but build up area has increased from 58.58 in 2006 to 80.25 in 2015.

Land use and land cover changes	2006		2015		Changes 2006-2015
	Area	%	Area	%	
Vegetation	2057.27	18.91	1021.25	9.38	-9.53
Buildup area	6372.12	58.58	8729.21	80.25	21.67
Water bodies	875.53	8.04	325.35	2.99	-5.05
Fallow land	1572.13	14.45	801.24	7.36	-7.09

Figure 3: Figure shows land use and land cover class changes

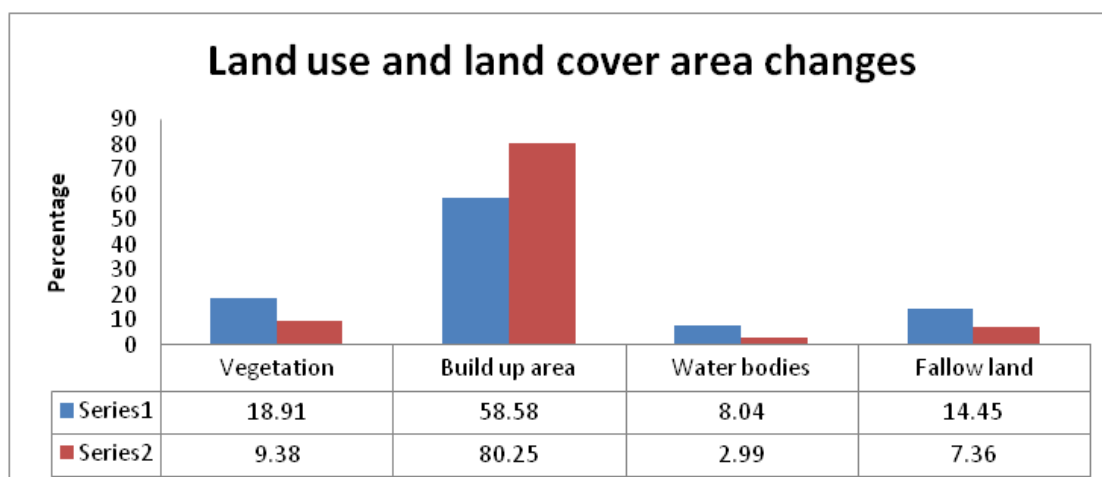


Figure 7: Figure shows land use and land cover area changes

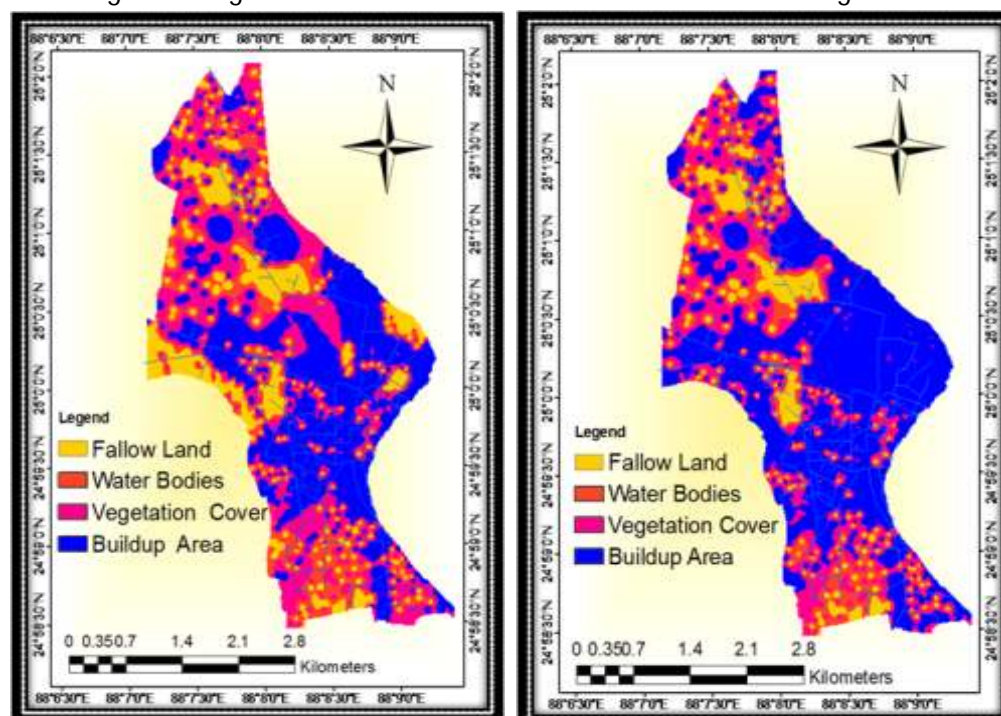


Figure 8 and 9: Figure shows land use and cover class changes 2006 to 2015

CONCLUSION:

GIS has proved to be accurate and efficient tool in surface analysis, land use and land cover and their updatipn. GIS techniques characterized by high accuracy of mapping and measurement. The surface analysis parameters evaluated using GIS which helped to understand various terrain parameters such as contouring, slope, aspect, view shed and also infiltration capacity and runoff etc. But infiltration capacity and runoff are directly related to the slope and structure of land. To prepared TIN map (Triangulated irregular network) that provide the opportunity from extracting elevation information about English Bazar Municipality(Low land due to elevation varies from 24 metres to 33 metres).This area characterized by the dominated land use and land cover such as vegetation cover, build up area, water bodies and fallow land. Build up area has continuously increased from 58.58% to

80.25% whereas others have continuously decreased during the period of 2006 to 2015.

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