

## Analysis of Changing Land Cover in Chittagong City Corporation Area (CCC) by Remote Sensing and GIS

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**ABSTRACT:** Growth pattern and trend is an important factor for a city or municipality because the future condition depends on the growth pattern and trend. Chittagong District is one of the three hill tracts districts in Bangladesh. It is found that growth trend of the Chittagong city is on the north east direction. On the south side it is no possible because of the presence of Patenga sea beach which defines the last boundary of the city area. In this process of urbanization, the physical characteristics of Chittagong is gradually changing as open space have been transform into building areas, low land and water bodies in to build up lands etc. In this project, proper analysis is done and the ERDAS software where build up area, vegetation area and water body is analyzed. Ward wise land cover change also found in this research. By considering this data, it has been found that north east direction is the growth trend. This study can help the future researchers to analysis growth pattern and trend analysis.

**KEYWORDS:** Remote Sensing, Land use, Change Detection, growth trend, spatio-temporal analysis.

### 1 BACKGROUND OF THE RESEARCH

RS and GIS techniques are being widely used to assess natural resources and monitor environment changes. It is possible to analysis land use change dynamics using time series of remotely sensed data. The incorporation of GIS and RS can help analyzing this kind of research in variety of ways like land cover mapping, detecting over the time. Lambin,(2001);

With the advancement of technology, availability of historic spatio-temporal data and high satellite images, GIS and RS techniques are now very useful for conducting researches like land cover change detection analysis. Mundia et al, (2005);

As a tinny district town initially Chittagong started to flourish and by the activities of port area, the city is now expanding which is mostly dependent on the river bank Karnafully. At the very beginning Chittagong town started to grow as a small municipality in 1863 that was inhabited by 25000 people only. In 1864 the city was reconstituted as Chittagong municipality. It was further upgraded to Chittagong Municipal Corporation in 1990. At present the city area is 155sq. km. and is inhabited by around 4 million populations at present. Wikipedia, (2014);

Like many other cities in the world Chittagong, The second largest city of Bangladesh is also the outcome of rapid growth without systematic growth. Chittagong city has undergone radical changes in its physical form, not only in its vast expansion but also through internal physical transformations over the last decades. Ahmed,(2008);

At present time, the growth trend of Chittagong city in on the north east corner of the city. By considering the growth center, growth poles of Chittagong city such as Hatazari, Anowara, Raozan, etc. it is found that growth trend of the Chittagong city is on the north east direction. On the south side it is no possible because of the presence of Patenga sea beach which defines the last boundary of the city area. Parker, et al,(2001);

**POSSIBLE OUTCOME**

Possible outcome in this research is physical characteristics of Chittagong city are gradually changing as agriculture land, water body, sandy land and open space have been transformed into build up areas and its rate.

**APPLICATION OF THE RESEARCH**

In future this research help to find out the city growth trend, future growth pattern, and land use.

**2 OBJECTS WITH SPECIFIC AIM**

Analysis of changing land covers in Chittagong city corporation area.

**2.1 OBJECTIVES OF STUDY**

1. To classify land cover of the study area in different period using supervised classification.
2. To assess the classification using separability for accuracy assessment of the classification.
3. To analysis how the land cover of the study area is changing over the period of time.

**3 METHODOLOGY OF THE RESEARCH**

**3.1 WORKING PROCEDURE**

**3.1.1 SELECTION OF THE RESEARCH AND STUDY AREA**

- ✓ Analysis of changing land covers in Chittagong city corporation area.

**3.2 OBJECTIVES OF STUDY**

1. To classify land cover of the study area in different period using supervised classification.
2. To assess the classification using separability for accuracy assessment of the classification.
3. To analysis how the land cover of the study area is changing over the period of time.

**3.3 DATA SOURCE**

This research is dependent on secondary data source. To prepare the base map for analysis purpose and applying the different methods to achieve this the research objectives Landsat satellite image (1989, 2001, 2013) have been collected from the official website U.S geological survey (USGS).

**Table 1: Detail of Landsat satellite images**

	Landsat_1989	Landsat_2001	Landsat_2013
Date_acquired	1989-01-21	2001-02-07	2013-12-01
Cloud_cover	0.00	0.00	1.11
Output_format	Geotiff	Geotiff	Geotiff"
Sun_azimuth	139.53	139.33	153.95
Sun_elevation	37.15	42.99	42.25
Map_projection	Utm	Utm	Utm
Utm_zone	46	46	46
Grid_cell_size_reflective	30.00	30.00	30.00
Grid_cell_size_thermal	30.00	30.00	30.00
Spacecraft_id	Landsat_4	Landsat_7	Landsat_8

**3.4 BASE MAP PREPARATION AND ACCURACY ASSESSMENT**

For image classification purpose, supervised classification method has been used. Then after achieving satisfactory accuracy result, the base map has been finalized.

*Table 2: Data Separability Of 2013*

signature name	1	2	3	4	5
vegetation	0	8509.74	5983.73	14414.2	4920.68
water	8509.74	0	6218.2	18515.3	9333.72
buildup	5983.73	6218.2	0	13227	3752.65
sand	14414.2	18515.3	13227	0	10665.9
Open space	4920.68	9333.72	3752.65	10665.9	0

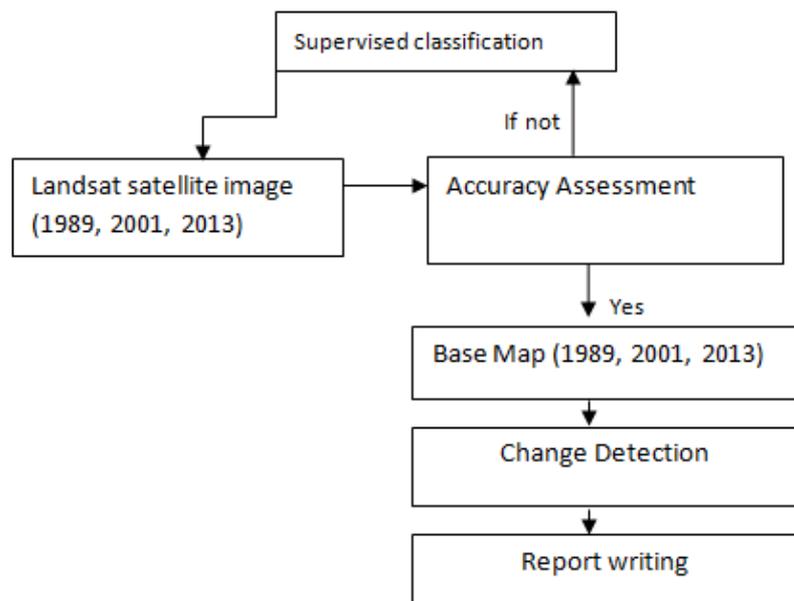
*Table 3: Data Separability Of 2001*

signature name	1	2	3	4	5
vegetation	0	44.42	75.5	82.01	154.86
buildup	44.42	0	76.66	53.52	127.46
water	75.5	76.66	0	126.69	197.16
Open space	82.01	53.52	126.69	0	75.215
sand	154.86	127.46	197.16	75.215	0

*Table 4: Data Separability Of 1989*

signature name	1	2	3	4	5
vegetation	0	23.62	60.66	102.31	57.21
buildup	23.62	0	48.1	91.5	58.31
Open space	60.66	48.1	0	44.2	104.47
sand	102.31	91.5	44.2	0	147.09
Water body	57.21	58.31	104.47	147.09	0

**3.5 TYPICAL FLOW DIAGRAM**



3.6 OUTPUT FILE

3.6.1 LAND USE MAP OF CHITTAGONG CITY

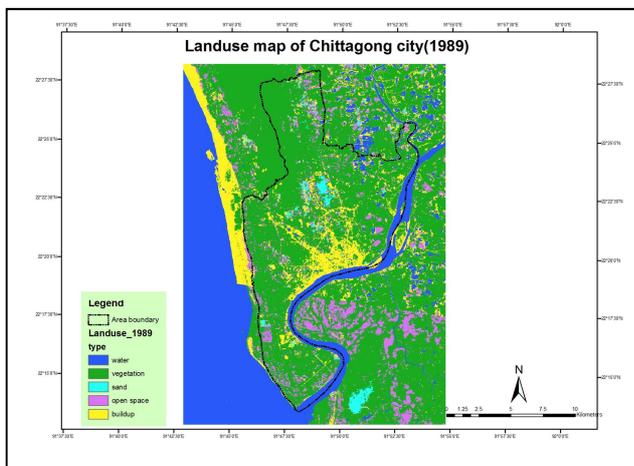


Figure 1: Land use map of Chittagong 1989

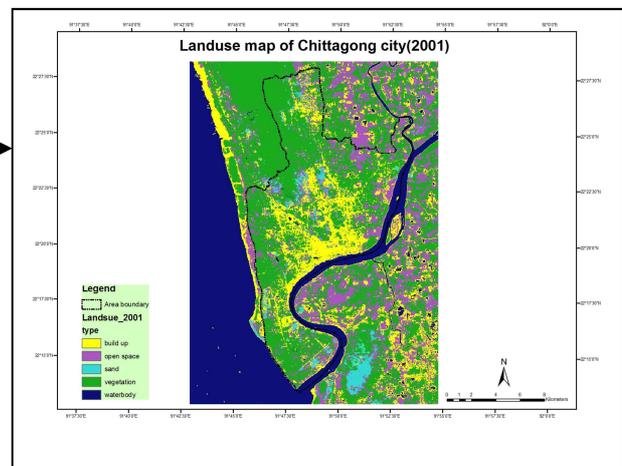


Figure 2: Land use map of Chittagong 2001

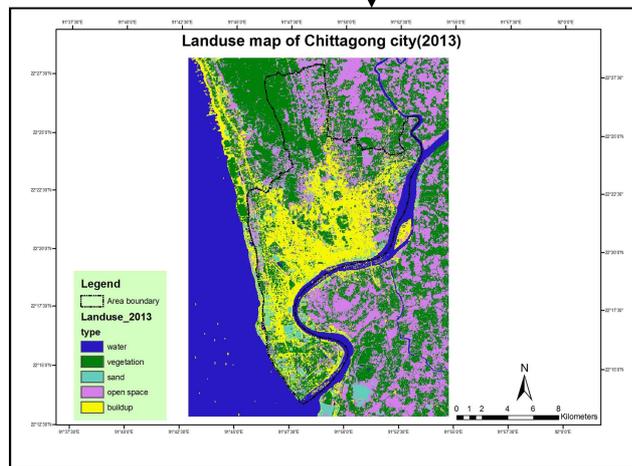


Figure 3: Land use map of Chittagong 2013

3.6.2 CITY GROWTH RATE ANALYSIS (BY USING CHANGE DETECTION TOOL)

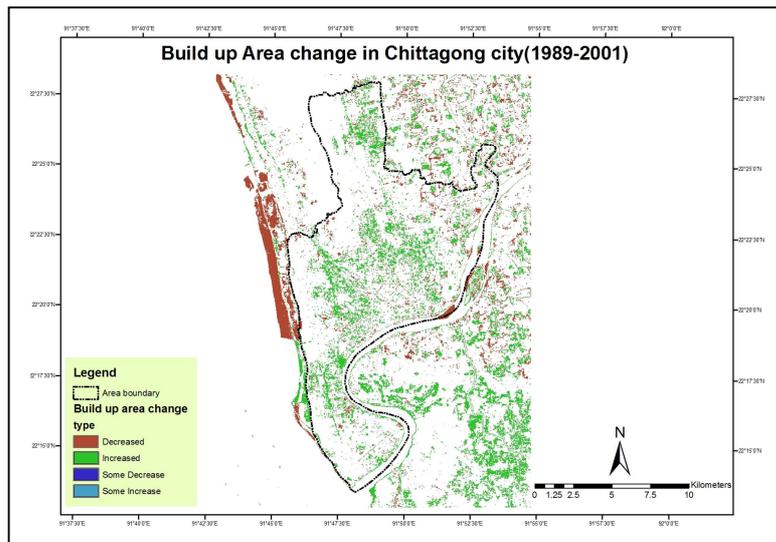


Figure 4: Build up area change in Chittagong city (1989-2001)

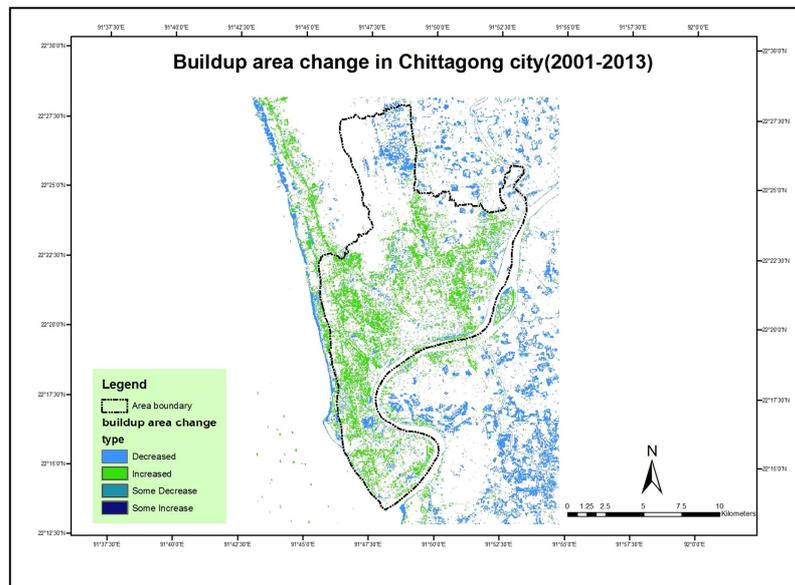


Figure 5: Build up area change in Chittagong city 2001-2013)

3.6.3 CITY GROWTH RATE ANALYSIS (BY USING MODEL BUILDER TOOL)

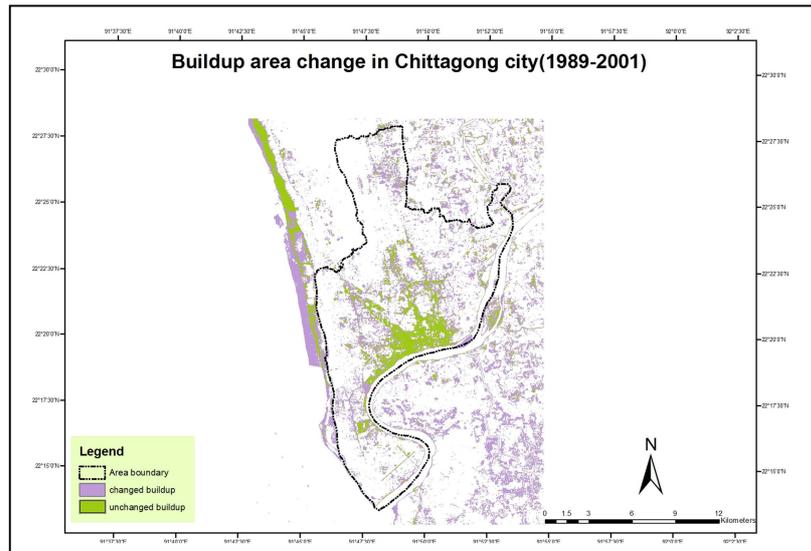


Figure 7: Build up area change in Chittagong city (1989-2001)

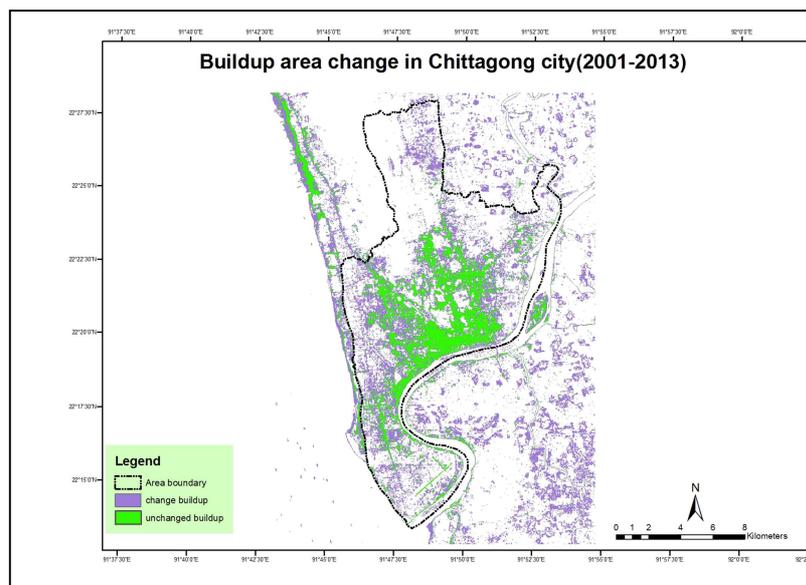
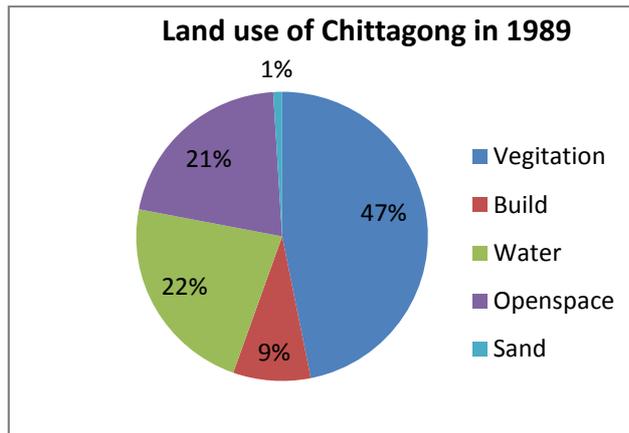


Figure 7: Build up area change in Chittagong city (2001-2013)

4 ANALYSIS AND FINDING

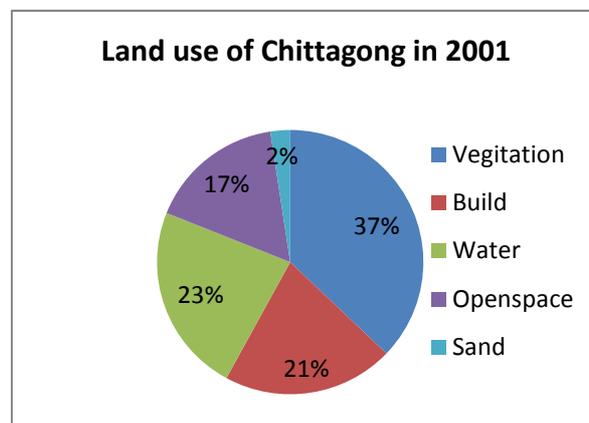
4.1 STATISTICAL ANALYSIS

The growth rate of a city can be identified by evaluating the growth change of buildup area in different time. In this research two tool of remotes sensing were used in to find out the change of different land use which are “Change detection” tool and knowledge “engineering tool”. In this chapter the manipulated data is used for analysis work.



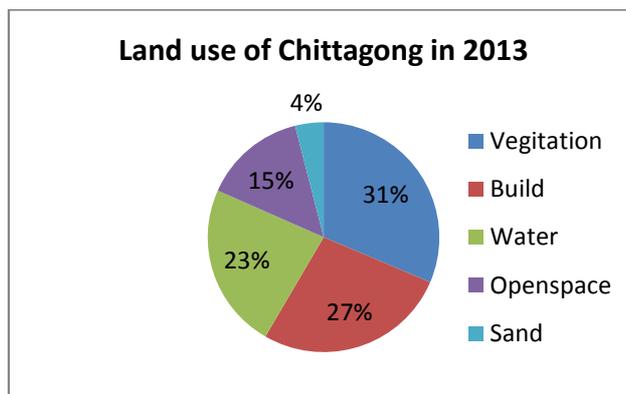
**Figure 8: Land condition of Chittagong city (1989)**

The above chart shows the different land use in 1989 of Chittagong City Corporation area. It can be seen that, about 55% lands were used as vegetation area and 26% as water body.



**Figure 9: Land use condition of Chittagong city (2001)**

From the chart it can be seen that, in 2001 the major land use was vegetation which was 37% and other land uses are water 23% and build up area 21%.



**Figure 10: Land use of Chittagong city (2013)**

The above graph shows the land use of Chittagong in 2013. The most area was covered by vegetation area which was 31% and build up area was 27%.

4.1.1 CITY GROWTH RATE ANALYSIS (BY USING CHANGE DETECTION TOOL)

In this research the growth of a Chittagong city is evaluated through the buildup area changing rate and pattern from 1989-2013.

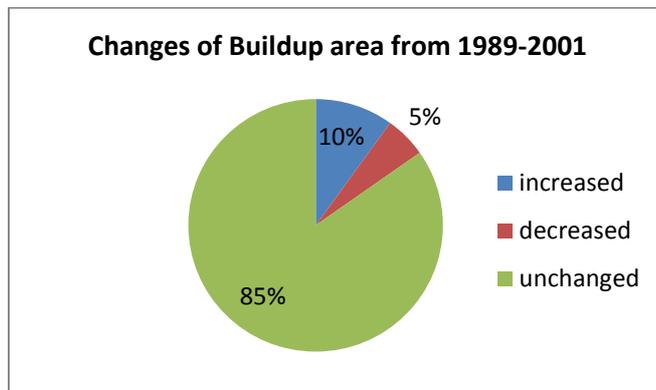


Figure 11: build up area change of Chittagong city (1989-2001)

The following graph shows the buildup area changing rate from 1989-2001. It can be seen that most of the buildup area remains unchanged and 10% of the buildup area has been expanded from 1989 to 2001.

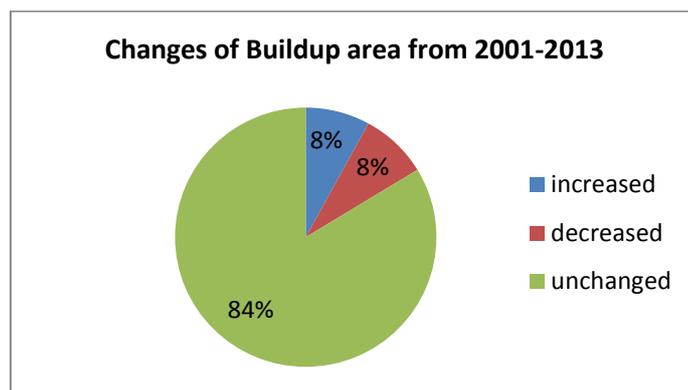


Figure 12: build up area change of Chittagong city (2001-2013)

This graph shows the changing rate and pattern of the buildup area from 2001-2013. From this it can be seen that 8% of the area was increased but again in the urban fringe area 8% of the area was decreased.

4.1.2 CITY GROWTH RATE ANALYSIS (BY USING MODEL BUILDER TOOL)

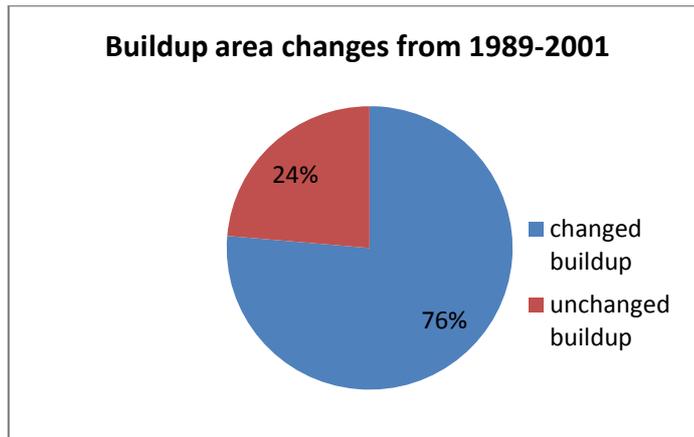


Figure 13: build up area change of Chittagong city (1989-2001)

From this graph it can be seen that most of the area became changed to buildup area from 1989-2001. The changed area from 1989-2001 was 76%.

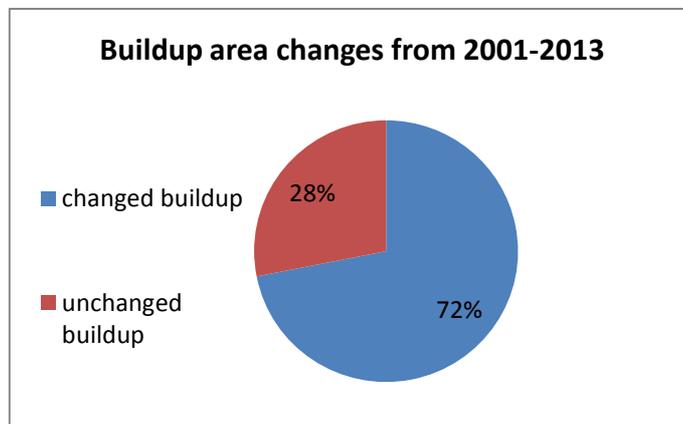


Figure 14: build up area change of Chittagong city (2001-2013)

From this graph it can be seen that most of the area became changed to buildup area from 2001-2013. The changed area from was 72%.

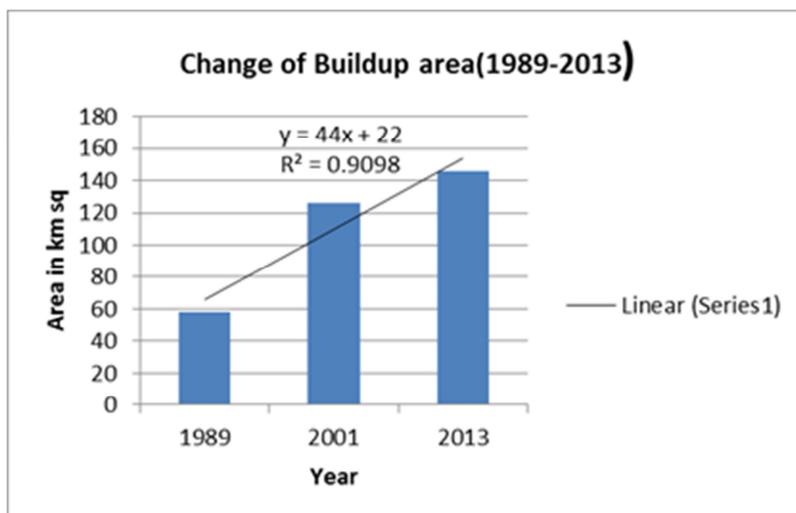


Figure 15: growth rate and trend of buildup area from 1989 to 2013.

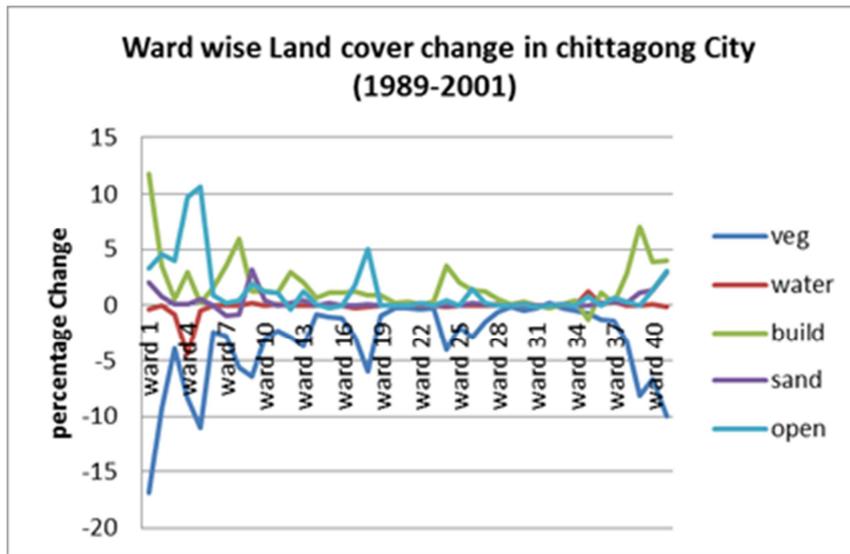


Figure 16: Ward wise Land cover Change in Chittagong city (1989-2001)

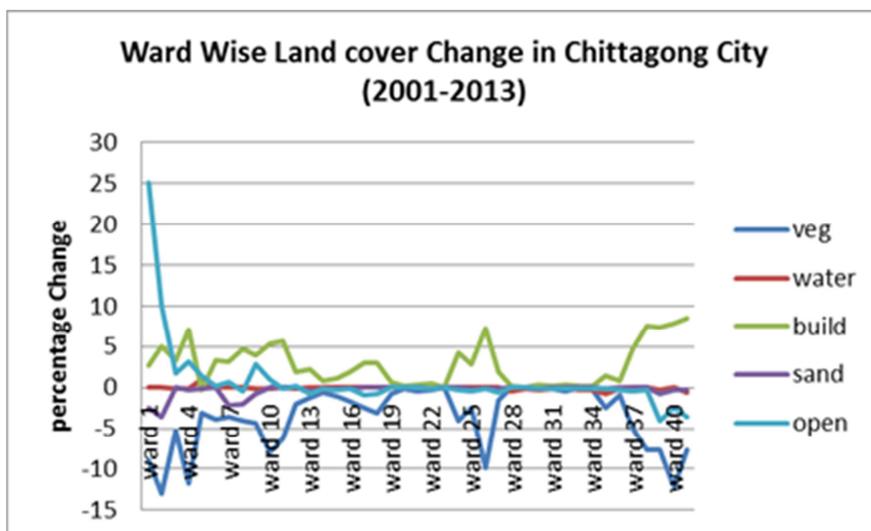


Figure 17: Ward wise Land cover Change in Chittagong city (2001-2013)

#### 4.2 FINDINGS

In this research the growth trend has been evaluated through “The spatiotemporal analysis of Chittagong City Corporation” area by using Change detection tool and Model builder tool in Remote sensing software. Through the analysis of manipulated data it can be seen that the land use change from other criteria to build up from

- 1989-2001 was 76% and 2001-2013 was 72% (by using model builder)
- 1989-2001 the buildup area has increased 10% and 86% area remain unchanged as buildup area and 2001-2013 the buildup area has increased 8% and 84% area remain unchanged as buildup area (by using change detection tool).

#### ACKNOWLEDGEMENT

A formal statement of acknowledgement will hardly meet the ends of justice in the matter of expressing our deep sense of gratitude and obligation to all those who helped us in the completion of this project report.

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