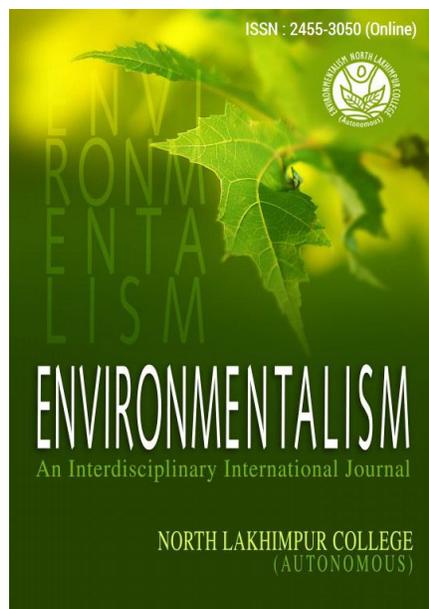


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IMPACT OF ECONOMIC GROWTH ON LANDUSE-LANDCOVER CHANGES OF LAKHIMPUR DISTRICT, ASSAM

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Abstract

The natural and human resources play an important role national economic growth. Natural environment contributes directly or indirectly, by providing resources and raw materials such as water, timber, stones (geo-materials) and minerals that are required as inputs for the production of goods and services. The relationship between economic growth and the environment is complex as well as simple. The study is confined to Lakhimpur district, covers an area of 2277 Km². The increasing population and urban sprawl induced changes of landuse/Landcover. Landuse change is triggered by population and economic growth in recent decades considered being the dominant cause of frequent occurrence of floods here. The study is based on both primary and secondary data sources. The present study aims to analyze the impact of economic growth on environment and its consequences on landuse-landcover changes. The economy is agrarian in character as 91.24% of population are living in rural areas and engaged in primary activities. In 2013, the total forest area of this district is 31097.44 ha. The total number of micro, small and medium industries in Lakhimpur was 18 in 2011-12 and in 2012-13, it was increased to 23. With the mounting of agro-based industries, urban population growth rate is also decreasing as in 1971 the annual urban growth of the district was 10 % and in 2011 the growth was 3.43 % as people are getting employment in their rural areas itself and strengthening their respective economy. For that reason the landuse/ landcover is changing and its impact is coming upon the environment which ultimately take revenge from us if we don't utilize the resources in sustainable way.

Keywords: Economic growth, landuse/ Landcover, environment, population, sustainable

1 Introduction

The natural and human resources can play an important role in the growth of the national economy. It is needless to say that India is a rich country in both of them. The availability of such resources has the ability to generate more production and employment opportunities. Due to lack of their proper utilization and exploitation, the country remains as backward as it was. Economic growth is a pre requisite for human development for any country because it only provides the required resources for improving the capability of people through better education, health and

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other social services. Economic growth in Assam is taking up so rapidly in all spheres of economic indicators in last few years. This helps the income earning opportunities of individuals. While economic growth has produced many benefits and leads to raising of standards of living and improving quality of life across the world which also resulted in the depletion of natural resources and the degradation of environment. The social and economic welfare of human beings is closely associated to environment. Any change in the socio-economic fields will have an impact on the earth's environment and vice versa, whether positively or negatively, immediately or eventually. And in many cases, negative results are irreversible. The Earth Summit held in Rio in 1992 concluded that the economic, social and environmental concerns are inescapably interlinked to world development. Economic development can cause Landcover change to a large extent. Population growth, urban expansion, and economic development were three major driving forces for the change of Landcover (Awan, 2013; Patnaik, 2013; Raj, 2016).

2 Study area

Lakhimpur district, with a geographical area of 2967 sq km is situated in Assam, India. Geographically the district lies in between 26°48' and 27°53' N latitudes, 93°42' 8 and 94°20' E longitudes. As per the 2011 Census of India, the district has a total population of 1040644 persons and more than 91% are rural inhabitants. For convenience of local governance, the district is divided into 9 development blocks and 1117 revenue villages. The district is bounded in the north by tropical evergreen to semi-evergreen reserve forests (Ranga, Kakoi and Dulung) and along the southern border, the major river Brahmaputra flows. Temperature reaches a maximum of 35°C during June-July and falls to a minimum of 8°C in December-January. Average annual rainfall is around 2830 mm as against the average value of

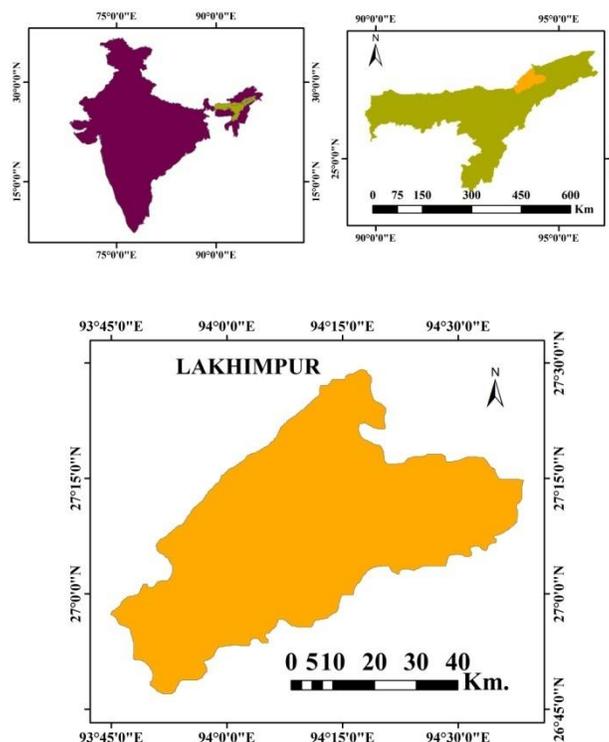


Figure: 1 Map of the study area

2300 mm for the state as a whole. Total agricultural land is 103949 hectare which constitutes 45.65% of total geographical area (2004-05). Lakhimpur is a flood affected district and the agricultural system is affected by flood leading to poor crop production. The present study aims to assess the impact of economic growth on landuse/ land cover change in the district.

3 Materials and methods

The study is based on both primary and secondary data. Primary data i.e. Landsat imageries of different period have been used to prepare the landuse/ land cover map of the district i.e. 1990 and 2010 from USGS. Secondary data are collected from district census handbook, economic survey of Assam; Statistical Handbook Lakhimpur, published report of Lakhimpur District and books, journal. Moreover, observation method has been used to explain the present study more deeply.

4 Results and discussion

Population growth in terms of increased population density is seen as the key factor directly inducing LULC changes. Population growth demands construction of new residential, commercial, utility, and transport infrastructures. They also require conversion of forests, farmlands, and bare soils into built-up areas, causing LULC changes.

4.1 Demography

The total population of Lakhimpur District is 889010 persons, which constitutes 3.34 percent population of Assam. Out of the total population 51.26% are male and 48.74% are female and 92.68% lives in rural and 7.32% are urban. The population of Lakhimpur District is heterogeneous consisting with several religious communities and S.C and ST communities each nursing its own customs and practices. ST population constitutes 23.49% and SC population comprises 7.88% in the district. The dominated religion group in the district is Hindu with 79% population followed by Muslims with 16% and Christian mere 4%. Total number of household in the district is 1, 57,167 out of which 91.25% are rural and 8.75% are urban. Density of the population in the district is 391 per sq. km. Average literacy rate of Lakhimpur in 2011 were 77.20 compared to 68.56 of 2001. Male and female literacy were 83.52 and 70.67 respectively. Total literate in Lakhimpur District were 6, 83,486 of which male and female were 3, 75,552 and 3, 07,934 respectively. It is clear that the growth of population in the district has increased in last few years and urban agglomeration is taken place in the district and mainly Lakhimpur town, resulting to economic up-gradation which ultimately changes the landuse/ landcover of the district (see table.1). Numbers of high rise building, shopping center, school, college including government and private has increased rapidly in the Lakhimpur district. (Source: Statistical Hand Book, 2009, Lakhimpur census 2011, and Assam at a Glance, 2005).

Table 1: Demographic profile of Lakhimpur

District Lakhimpur	Area In Sq. Km	Total Population	Rural Population	Urban Population	Population Density Per Sq. Km.
2001	2277	889010	823857	65153	390
2011	2277	1040644	949348	91296	457

Source: Census of India, 2011

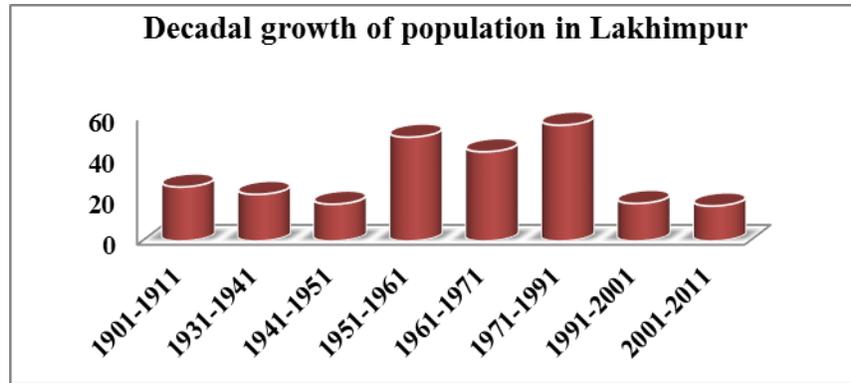


Fig.2 Decadal growth of Population in Lakhimpur district (Source: Census of India, 2011)

The overall trend of urban population of Lakhimpur reveals steady urban growth rate from 1901 to 1941, where the urban growth rate never exceeded more than 37 per cent. Conversely, the decades from 1951-1991 registered rapid increase in urban population with growth rate always above 65 per cent. Most remarkably the 1961 census experienced 126.57 per cent urban growth rate which is the highest in demographic history of Assam. However since 1991 till date the urban growth rate is showing a declining trend, reaching to a record lowest of 27.6 per cent in 2011. Thus although the growth rate of urban population in the state of Assam has been checked to a certain extent in recent time but its contribution towards region’s overall urban population growth is still found to be very significant owing to large urban population base (Chetry, 2014).

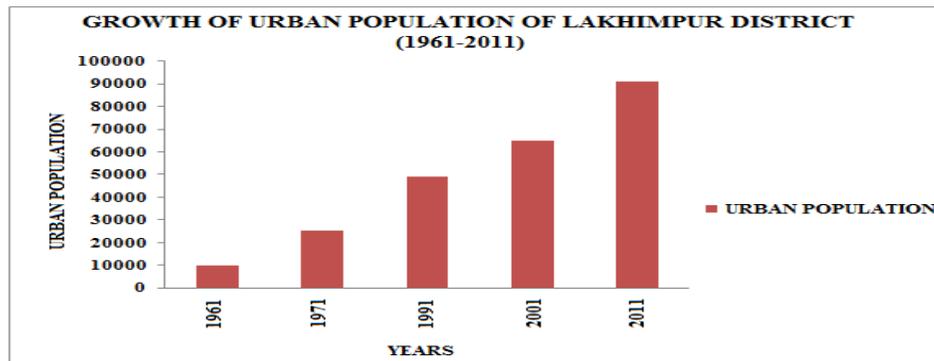


Fig.3 Trend of Urban Population and Growth in Lakhimpur (Source: Census of India, 2011)

4.2 Occupational Pattern

The total working population in 2001 of this district was 4, 97,745. Among working population, 57.87% are main workers and 42.13% are marginal workers and 3, 91,265 were non-workers of total population. On the other hand, in 2011 the figure was decreased to 429995 persons. Among working population, 65.94% were main workers and 34.06% were marginal workers. So it is seen that working population has decreased from 2001 to 2011 but main workers has increased from 2001 to 2011 but marginal workers has decreased. Among the working population in 2001, 67.97% are cultivators, agricultural laborers, household & Industrial workers and others workers are 6.97%, 2.42% and 22.64 % respectively of total working population. Among the working population in 2011, 55.67% are cultivators, agricultural laborers, household & Industrial workers and others workers are 10.21%, 2.55% and 31.56 % respectively of total working population (Source: Statistical Hand Book, Assam, 2014-15). Here we seen that

share of working population has increased in all individual sectors total working population has declined at drastic rate due to over age of male and female both especially female, migration from here to somewhere else, marriage, death, birth and other reasons too. About 80 percent of the population was dependent on agriculture and allied activities for their livelihood in 2001 but the figure decreased on 68% in 2011. The operational holding size in the district is less than 1 hectare. Paddy is the main crop covering about 67 percent of the gross cropped area. Among principal crops of the district Kharif crops cover the lion share followed by Rabi crops like jute, mustard, wheat, pulses.

4.3 Educational Facility

North Lakhimpur town has a better endowment of educational institutions and education sector is more developed in comparison to other infrastructure facilities. As per the census 2011, the literacy rate of the town is 79 percent, where male literacy rate is 83 percent and the female is 74 percent. The district has 1366 primary, 338 middle, 333 high school, 27 higher secondary schools and 12 junior college and 5 major colleges in the area. Few private institutions have been set up recently in the town area to provide qualitative education.

Table.2 Number of Educational Institutions Having Various Facilities in Lakhimpur Up to 31st March/2010

Lakhimpur	Primary School	Middle school	High School	Higher Secondary school	Junior college
Total School	1366	338	333	27	12
Schools having pacca Building	681	165	All	All	all
Schools having Drinking Water facility	1294	312	All	All	all
Schools having cooking shade for midday meal	1372	-	No	No	no
Schools having Toilet facility	786	231	All	All	all

Source: Statistical Handbook of Assam, 2014-15

4.4 Forest area

Forests of Lakhimpur District are mainly tropical rain forest. Total forest area of the district is 35,878 hectare which falls under five Reserve Forests namely Ranga Reserve Forest, 8,529.71 hectare, Pabha Reserve Forest with 1,605.87 hectare, Kakoi Reserve Forest with 4,41503 hectare, Dulung Reserve Forest with 9,900.03 hectare and

Table 3: Area under Forest in Lakhimpur

Forest Division	2010	2011	2012	2013
Reserved Forest	31101.430	32816.112	31097.441	31097.441
Proposed Reserved Forest	1125	-	-	-
Protected Area	1125	-	-	-
Total Forest (Excluding Un-classed State Forest)	32226.430	32816.112	31097.441	31097.441

Source: Statistical Handbook, 2014-15

Kadam Reserve Forest with 3,625.91 hectare. The Kadam is the oldest Reserve Forest of Lakhimpur which was constituted in 1885. The varieties of tree species grown in the forests are Sia-Nahar, Nahar, Bonsum, Amari, Koroi, Jutuli, Hollock, Simul, Outenga, Uriam, Bhomora, Sam, Ajar, Banderdima, Dhuna, Hingori, Poma, Bola, Bhelu, Sonaru, etc. Besides valuable tree species in the wet area of Dullung, Kakoi, Ranga and Pabha reserve forest was rich with Lezai and Jati cane. (Source: Lakhimpur Forest Division, 2003). Dulung Reserve Forest of Lakhimpur district, Assam which lies at 26°48' - 27°53' N latitude and 93°42' - 94°20'E longitude at an altitude of 101 metres above mean sea level, the natural forest site comprises of rich vegetation, degradation of forest is taking place due to human activities and logging of forest tree for the livelihood purposes.

4.5 Villages Electrification

Growth in the consumption of energy is linked to the growth of the economy, modernization, urbanization and improvement of quality of life of the people living in a State or a Country. Large numbers of villages are electrified which is an indicator of development in energy consumption. In 2009-10, 530 villages were electrified but in 2013-14 the number have reached to 1093, almost double in 5 years. While putting the electric posts, trees were cutting indiscriminately which were come across the electric line. Therefore growth of economic activities has negative impact on the micro-environment; on the contrary to positive impact, it is seen in the aspect of development of the area through electrification. Consumption of electricity for domestic, industrial and agricultural purposes is expected to increase fast in the near future in view of increasing demand for electrical goods and electric motors as well as pump-sets for irrigation etc. The present supply position of electricity should improve considerably to attract the prospective entrepreneurs to take up power base industries in the district.

Table4: Electrification of Villages in Lakhimpur

District	No. of villages Electrified (Cumulative)				
	2009-10	2010-2011	2011-2012	2012-2013	2013-2014
Lakhimpur	530	963	1082	1087	1093

Source: Statistical Handbook of Assam, 2014-15

4.6 Transport and communication

A well-developed transport system is a basic pre-requisite for accelerating the economic development of a region. But the transport facility available in Lakhimpur district is quite inadequate. This district does not have well developed economic overheads. One of the major problems in the development of the district is its transport and communication system. A large number of villages are still now not connected through weather roads. Though the roads are constructing by the state Government every year but the quality of the road is not well enough to resist the road from the rainy season. The railway lines in the district are not yet adequately extended. The length of the line in the district is only 214 Kms with 23 small stations. The goods carried by this railway from this district mainly consist of timber, paddy, Jute and mustard seeds. The transport and communication system is easily susceptible to disruptions during the monsoon season and during this season; normal life of the people is disturbed.

The Public Works Department (PWD) of the Lakhimpur is mainly responsible for the development of road infrastructure for transport & communication of the district. From table: 7. it reveals that the total numbers of roads

has increased but the urban roads are not to that mark of the district. Earthen/ Gravelled roads are there but the maintenances of the roads are poor.

Table5: Length of PWD roads by type in Lakhimpur (in km)

District Lakhimpur	2009-10	2010-2011	2011-2012	2012-2013
Black Topped	321	511	590	640
Earthen/ Gravelled	739	563	501	451
Total	1060	1074	1091	1091

Source: Statistical Handbook of Assam, 2014-15

Table 6: Distribution of the number of reporting Offices, aggregate deposits and gross bank credit from Scheduled commercial banks in Assam

District(Lakhimpur)	2010	2012
Reporting Offices	47	52
Deposits	653	9462
Credit	367	5829

Source: Statistical Handbook of Assam, 2014-15

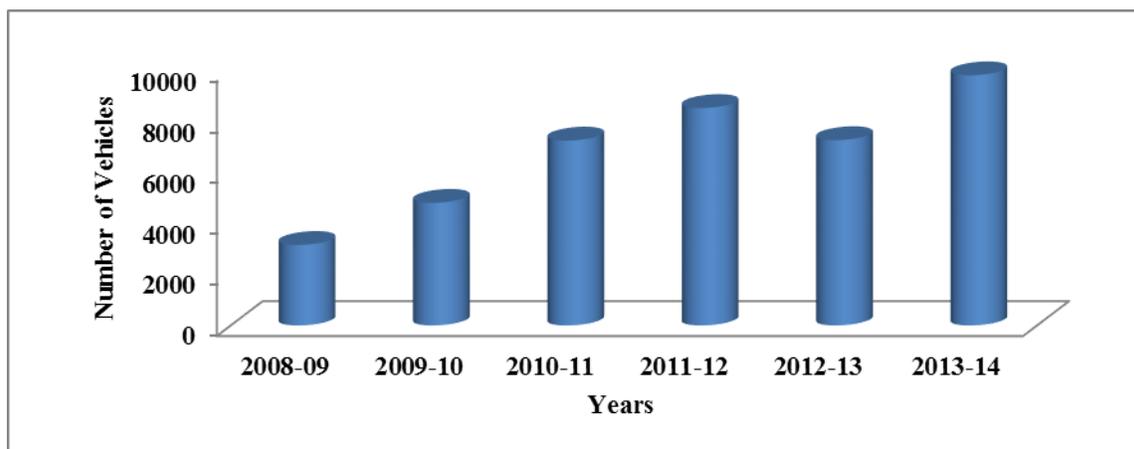


Fig.4 Total Number of Vehicles Registered in Lakhimpur (Source: Statistical Handbook of Assam, 2014-15)

The economic growth results to increase the use of vehicles in Lakhimpur district. In 2008-09 motor vehicle registered was 3157 and in 2013-14 it reaches to 9808. The rapid increase of numbers of motor vehicles on road in Lakhimpur town has been observed over the past few years which show the economic development of it.

Table7: Total number of motor vehicle on road in Lakhimpur district, Assam

Year	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
No. of Vehicles	37409	42360	43868	49597	63583	73028

Source: Statistical handbook of Assam, 2014-15

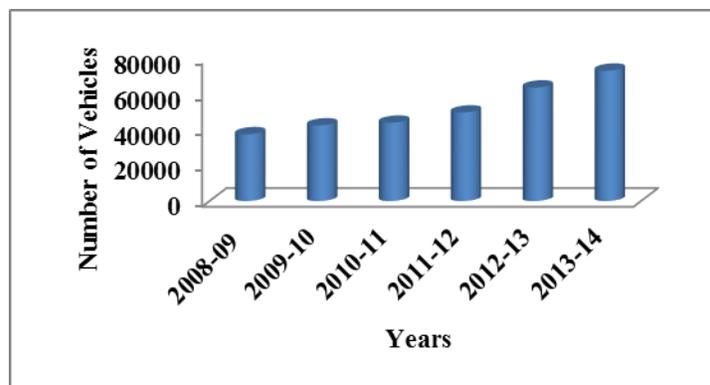


Fig.5 Total number of vehicles in Lakhimpur district, Assam (Source: Statistical Handbook of Assam, 2014-15)

4.7 Small Scale Industries

The workers in small scale industries have increased positively. The small scale industries have played vital role in the fulfillment of socio-economic development perspectives in Lakhimpur. Small scale industries include all the village and cottage industries and handicrafts with some kind of agro-based industries with tea estates. According to the Planning Commission, cottage industries are mainly rural in character and are generally associated with agriculture involving operation mostly by hand and are carried as full-time or as a part-time occupation, primarily by the family members. As small scale industry needs less capital, yield quick returns with less risk, investment in this sector is preferable in Lakhimpur district. This sector of industry is also adoptable to a great extent to the changing conditions and habits of the rural people. It can be easily used as an important tool to reduce the regional disparities. Small scale industries create employment with little capital and facilitate them for mobilization of resources of local technical skill and workmanship. It reduces the distance between the manufacturer and the consumer which in directly provides a healthy business relationship. The development of this sector also bring about significant social and technological changes in the backward rural or semi urban areas and have a great impact on the thoughts and attitudes of mind and standard of living of the people living in this area. With this, some small scale agro based industries were also set up with the technological advancement of agriculture sector (see table). With the coming up of it, the surrounding landuse pattern has changed. In the slant highlands of Lakhimpur district, tea industry is also growing in its own pace. Tea industry provides all the necessary facilities to its employees and workers. While giving necessary facilities, it is obvious that the area where tea industry has set up, also go for the change within and surrounding of the industry. This is the way, landuse/ landcover is changing due to small scale industries because everything happens from a small thing.

Table 8: Total Number of Small Scale Industries with workers

Unit Registered during the year		
	2012-13	2013-14
Micro	22	50
Small	1	3
Medium	-	-
Total	23	53
Total workers	141	475

Source: Directorate of Industries and Commerce, Lakhimpur, 2015

4.8 Landuse-landcover changes of Lakhimpur

‘Land cover’ is the biophysical attribute of the earth surface and ‘land use’ is the human purpose applied to these attributes (Melendez-Pastor *et al*, 2010). Landuse is a continuous as well as a normal process in human inhabited areas. As a land animal human beings essentially depend upon land for a wide variety of uses. Landuse refers to

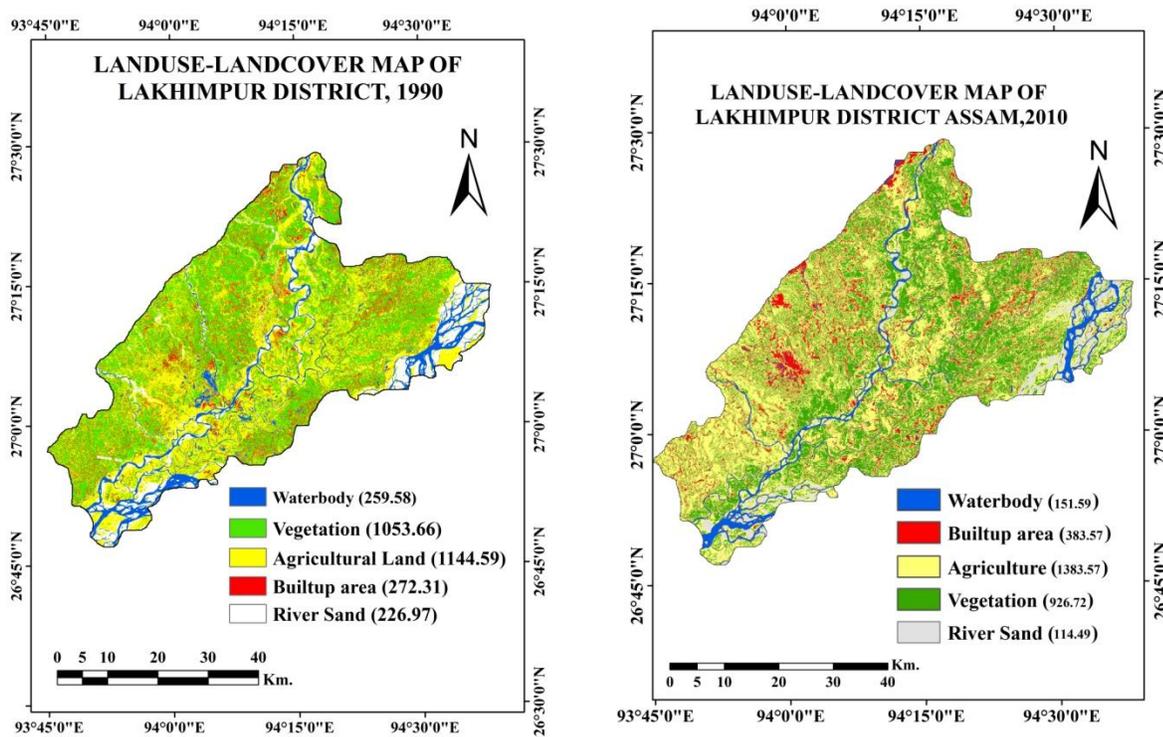


Figure 6: Changes of landuse/ landcover in Lakhimpur district Source: LandSat Imageries of 1990 and 2010

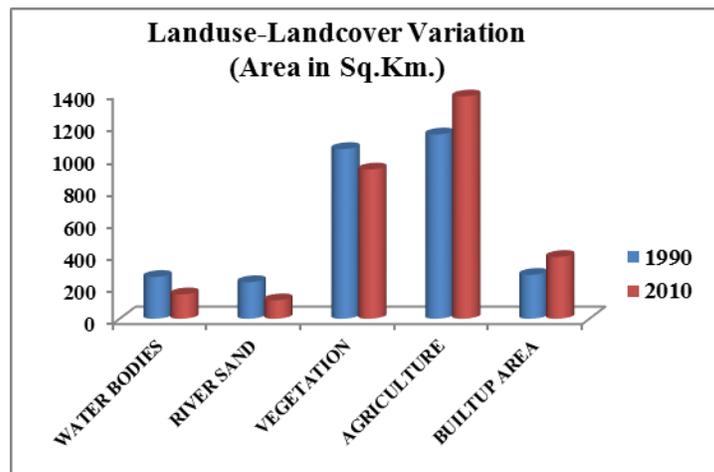


Fig. 7 Landuse-Landcover Variation of 1990 &2010 (area in sq.km.)

utilization of land areas by human being for rational and purposeful objectives. The land use/Landcover 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 agriculture and demographic pressure (Das, 1981; Majumder, 2005). Hence, information on landuse/Landcover and possibilities for their optimal use is essential for the selection, planning and implementation of landuse schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of landuse resulting out of changing demands of increasing population. Landuse/Landcover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. The advancement in the concept of vegetation mapping has greatly increased research on landuse/Landcover change thus providing an accurate evaluation of the spread and health of the world's forest, grassland, and agricultural resources has become an important priority (Ramakrishnan, 1998). Viewing the earth from space is now crucial to the understanding of the influence of man's activities on his natural resource base over time. In situations of rapid and often unrecorded landuse changes, observation of the earth from space provide objective information of human utilization of the landscape (Tiwari et al., 2011). The economy of the district is mainly dependent upon agriculture and mainly cultivation of paddy. The soil of the district is alluvial and fertile and that is why crops flourish here. But the area is facing some serious environmental problems mainly after the mid twentieth century. A close relationship between population growth and agricultural land extension leads to direct impact on forest cover (Sharma, 1979; Billsborrow, 1992) and anthropogenic activities like fuel wood extraction and logging operations are adversely take place in the reserved forest of Lakhimpur district. The situation has been posing serious challenges to the life and livelihood of the people particularly of rural poor whose life and livelihood are very much dependent on the availability and quality of natural resources. As from the Fig.7 it is clear that the variation of all the attributes i.e. water bodies in 1990 was 8.77% where in 2010 it decrease to 5.12 %, river sand in 1990 was 7.67 % but in 2010 it decline to 3.87% , vegetation cover in 1990 was 35.63% of the total area of district but in 2010 it decline to 31.34% of the total coverage, likewise agriculture land and built-up area are showing a increasing trend i.e. 38.70% to 46.69% and 9.20% to 12.97% in 1990 and 2010 respectively. The vegetative cover area has been converted to agriculture land and to built-up area as it can be seen in the fig.6.

5 Conclusion

The foregoing discussion reveals that the development in Lakhimpur district is progressing rapidly leading to changes in the Landcover-landuse of the area. The centre area of the town has almost all sources of infrastructure facilities. This creates traffic congestion at the central part of the town and become hazard prone during peak hour of the day. In future when expansion of the municipality area will be there due to population pressure, demand to access these infrastructure will also increase. This will lead to more congestion in the central part of the town and more time will be vanished in travel to gain these urban utility services. It is found through this exercise that concentration of population and infrastructural facilities decreases from central point of the town to the periphery. Developed central part of town is spread over 18.7 percent of the total municipality area, whereas least developed part and underdeveloped part constitute 36.2 and 17.1 percent of the municipality area (Patnayak, 2013). However, need for infrastructure and services are uniform across the town area. A planned decentralization of these public services in future, especially while approving establishment of such service points, will help in a rational and

uniform development of the town. The intact Landcover has to be modified for developing any region or a place. Therefore landuse-landcover changes have positive impetus on economic growth and on the contrary negative impact on the natural environment.

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