CHAPTER 7
SUMMARY AND CONCLUSION

7.1 SUMMARY

The core theme of the present investigation and analysis is the assessment of resource potentials and impact on development in the Udalguri district under BTAD, Assam. The approaches taken in this investigation is based on the methods and techniques mainly adopted in the different branches of geography and social sciences. Along with the traditional methods the quantitative techniques in the domain of sophisticated tools and techniques of GIS (ArcGIS) are used intensively for the present work. The statistical tool SPSS is also used here for the analysis of correlation and regression of few variables. The required geomorphic, geological, climatic and different forms of socio-economic data are gathered from the Toposheets, Satellite imageries, maps and reports of various publications and the publications of concern department of the state of Assam and central government of India. Intensive field observation and field survey has been carried out for the extraction of maximum possible information for the better representation and meaningful analysis. In this investigation emphasis has been given towards the quantification of information for the convenient transformation to the GIS environment and GIS analysis.

The whole work is divided into three units and subdivided into seven chapters as summarised below.

The first chapter dealing with the introduction of the problem which is subdivided into eight sub chapters viz. statement of the problem, the study area, objectives of the work, research questions, database and Methodology, significance of the study, review of related works and local terms and terminologies used for the work.

The second chapter concern with the introduction of the study area. The chapter is segmented into location, relief characteristics, slope characteristics, dissection characteristics, climatic characteristics, vegetation characteristics and population characteristics.

The Udalguri district is geographically a narrow strip of land in between the alluvial built up plain of the Brahmaputra valley to the south and the Bhutan and
Arunachal Himalaya in the north. The district was a part of the erstwhile Darrang district and the Udalguri along with three other districts under the Bodoland Territorial Council (BTC) is declared as district by the Assam government on 30th October, 2003. Seismically the area is high vulnerable and considered as seismic zone- v. Geologically the area is covered by the horizontal layers of sediments deposited by the northern tributaries of the river Brahmaputra. High fertility, gentle plain, large numbers of stream, prevailing climatic conditions, etc., in the area have together rendered the area as the high carrying capacity zones of population.

The maximum absolute relief or the highest elevation measuring 462 meters/amsl. of Udalguri district is found to exist in the north along the middle part of the boundary and the lowest elevation (52 meters/amsl.) is seen in the south. A classification of fourteen relief zones of the district using GIS shows the largest area coverage under the 70 to 80 meters of relief which accounts for 13.46% of the total area of the district. The district can classify into the three micro relief zones viz.

i) Built up zone in the south,

ii) Terai zone in the middle and

(iii) Bhabar zone in the north of the district.

The relative relief map of the Udalguri district is prepared using Smith’s method and the relative relief of the district varies from 93 meters in the north to a minimum of 1 meter in the south. The district is divided into five zones of relative relief, viz. below 10 meters, 10 to 20 meters, 20 to 40 meters, 40 to 60 meters and more than 60 meters for convenience of analysis and below 10 meters of relative relief zone is found covering the maximum area which accounts for 29.67% of the district’s total area. The relative relief is gradually decreasing from the foothill of Himalaya in the north to the district of Darrang to the south. The computation of mean, standard deviation and co-efficient of variation indicates varying surfaces in the Udalguri district with both absolute and relative relief.

For the understanding of slope characteristics of Udalguri district, GIS technique is applied. The TIN generated, slopes on the map reveals a maximum slope of 27° ranging to a minimum of less than half degree. The slope map of the district is divided into eleven zones ranging from a maximum of 24-27 degrees to a minimum of less than 0.5 degree of slope. First three zones of slope which are less than 2 degrees
occupy more than 98% of the geographical area of the district. This area mostly lies in the south covering majority of areas of the circles like Harisinga, Udalguri and Mazbat. Again, the circles like Khoirabari Kalaigaon, Mangaldai, Dalgaon, Dhekiajuli and Pathorighat have slopes lower than 2° in their entire areas. The remaining 2% areas of the district have slopes higher than 2 degrees.

For the calculation and analysis of DI in Udalguri district Dov Noir's DI formula is used. The calculated dissection index values of grids in Udalguri district is found ranging from 0.01 to 0.5. On the basis of this range the district is divided into five dissection zones of below 0.1 (10%), 0.1-0.2, 0.2-0.3, 0.3-0.4 and more than 0.4. The second dissection zone of 0.1 – 0.2 covers the largest geographical area (41.02%) of the district and the zone is found in all the circles except the Pathorigat and Mangaldai. The mean, standard deviation and co-efficient of variation indicates they are not varying widely in the district.

The Udalguri district is a part of north-east India and characterized by monsoon type of climate. The physiographic characteristics and terrain conditions in and around of the Udalguri district are influenced to the generation of minor temporal variation of prevailing climate.

The geographical location, phygeographic characteristics and climatic condition of the Udalguri district have played their roles in the development of micro-level variation of vegetation types and their distribution. From the IRS P6 LISS III Satellite data based, land use and land cover analysis by the NRSC, during the period of 2005-06, 32.022% (593.0979 sq.km) of the geographical area of the district was under vegetation cover. The spatial variation of vegetation type is observed and the whole district is divided into nine types of vegetation zone and the vegetation type of Tree Clad Open-Area mixed with rural built up is found to cover the largest area (72.63% of total vegetation cover).

Geographically Udalguri district accounts for 2.361% area of the state of Assam and 2.672 % of total population in 2011. The district is inhabited by multi-lingual, multi-cultural and multi religion groups of people. The main languages spoken by the district are Bodo, Assamese, Nepali, Santhali and Hindi. Further more, other local and national languages of India are also use in the district. By religion majority of population in the Udalguri district are follows Hinduism (includes Bathouism and
Brahmaism) and Christianity. The believers of Islam, Buddhism, etc., are also found in the district. Spatially concentration of population is high to the south of the district and it is seen gradually decreasing to the north of the district. According to population census of India the district is home of 832769 people in 2011, with a density of 450 persons per square kilometer. The district has 32.15% ST, 10.00% SC and 57.85% others caste in the district. Other population constitute by different religious and cultural groups of Indian nationals. The rural urban population composition in Udalguri district indicates almost rural character with only 4.51% urban dwellers in 2011. During the year the sex ratio and percentage of children below six years of age in the district are respectively 966, and 13.12%.

The third chapter is concern with the analysis of the nature and locations of resources in the Udalguri district. The available resources of the district are broadly categorized into – (a) natural and (b) human resource for the comprehensive understanding and explanation.

The Udalguri district is rich in natural resources. On the basis of the available resources in the district, they are again grouped into four main groups’ viz. a) Land and soil resources, b) Water resources, c) Geologic and geomorphic resources and d) Biotic resources.

The LULC in the district is divided broadly into five classes and again sub-classified into twenty sub classes. According to the land use and land cover (LULC) map of Udalguri district, 2005-06, out of the total area of 1852.16 km², agricultural land covers 60.744%. The second largest area is covered by vegetation (32.022%) and the vegetation in the district is classified into nine classes. Water bodies cover the third largest geographical area of 6.481% followed by wetlands-inland natural (0.555%) and built up (urban)-mixed built up area (0.198%). Here, the circle-wise LULC map analysis indicated that the Harisinga circle recorded the largest sub-class of LULC with 16 classes and among the circles the Pathorighat circle has recorded the lowest classes of LULC during the period in the district.

The soils of Udalguri district can be divided into five groups such as ALFISOLS equivalent to older alluvial soil (47.18%); ENTISOLS or the younger alluvial soil (19.71%); ENTISOLS equivalent to bhabar (9.17%); MOLLISOLS comprising the terai (15.27) and ULTISOLS which is the brown red and yellow soil
The alluvial soil (older & younger) covers for 66.89% of the district’s geographical area, such soils bear high potentiality agro-economic development. An analysis of circle-wise types and distributions of soil indicates that the Except the Udalguri circle other circles of the district does not have all these five types of soil. Where, the four circles viz. Kalaigaon, Khoirabari, Mangaldai and Pathorighat have only one type of soil (older alluvial).

The Availability of water resources in a region determines the great potentiality for the economic development. The district of Udalguri has a huge stock of ground as well as surface water resources. The district is a part of south-east Asia monsoon climatic region, where, influence of the Himalaya has created conditions for the origin of large number of rivers streams and storage of water in the higher region and then reaching the seas and oceans passing through the adjacent areas. Furthermore, amount of rainfall and type of topography, lithosphere, climate, soil, vegetation, etc. have created conditions for the origin and formation of a considerable numbers of natural wetland as well as artificial water reservoirs in the forms of ponds of different shapes and sizes in the district like other parts of North east India. The water resources of the Udalguri are divided into surface water and the ground water.

The surface water in the Udalguri district of Assam is very rich compared to many other parts of the country. A large number of rivers and streams viz. Pachnai, Dhansiri, Golandi, Nanai, Suklai, Barnadi along with their tributaries draining the district from north to south have exerted high natural potentiality for harvesting of this resource. The spatial distribution of streams in Udalguri district shows its existence throughout the district at varying pattern. The stream water of the district is yet to be utilized properly for the developmental purpose. The field observation along the foothill of the Himalaya has led the research to visualize the existence of large number of small streams within about half of km. apart from east to west. These small streams have been providing with water and accessible networks for the agricultural and other use in the area these very small natural or artificial streams are locally term as “dong”. The average drainage density of the district is 1.006 km/km² where the average stream frequency is recorded as 1.58 streams per 10 km².

The entire district has a length of 357 km. of artificial irrigation canal in six circles with an average density of 193 meters/km². The spatial distribution of irrigation
canal is found highest in the Udalguri circle with a total length of 228.89 km. (435 meters/ km²), whereas the three circles such as Dhekiajuli, Mangaldai and Patharighat have no artificial irrigation canals. It is seen that the canal irrigation system in the district is mainly connected with the Dhansiri Irrigation project.

The Inland Natural wetlands cover 10.28 km² (0.555% of total geographical area) of the Udalguri district. The circle-wise distribution of wetlands in the district shows that the highest percentage of wetland coverage (2.98%) is in the Mangaldai circle, while the lowest (0.12%) is in the Harisinga circle. The spatial pattern of distribution of wetlands in the Udalguri district shows that high percentage of area of wetlands goes to circles located to the south compared to the northern counterparts. These wetlands, in the district have been highly potential for different kind of aquatic resources. The man made/artificial ponds and tanks in Udalguri district cover an area of 12.15 km² accounts for 0.656% of the district’s area.

The levels, potentiality and yields of ground water are seen to vary in the district like other areas of the Brahmaputra valley. The physiographic frame, geological conditions among others have been playing a major role in the extraction of ground water resources. As regards the spatial distribution of ground water there are three distinct zones delimited by piezometric contours in the district. They are distributed in the areas having piezometric contour above 100, 100-50 and below 50 meter’s above the mean sea level.

The geomorphic resources involve geomorphic features and landscape of resourceful characteristics. The geomorphic resources such as relief, slope, drainage density and frequency, surface water bodies, dissection, ruggedness, etc are in Udalguri are explain based on the information viz., Survey of India Toposheets, India and Pakistan map Series U502 prepared by US Army, LULC map of the NRSC and the Canes and Spot Images available (2011-13) in Google Earth. The analysis indicates potentiality of geomorphic resources in the majority of the areas and the prospect of development of the district.

The biotic resource or all the living organisms (plants and animals) in this part of the state is rich like most of the areas of the Brahmaputra plain. The vegetation cover accounts for 32.025% of the district’s total area and the area is a part of the Indo-Burma Hotspot where, rich floral and faunal diversities exist.
Human resource refers to the number of human population the quality of man. The spatial distribution of population in a place or region is influenced by many factors. The Village-wise and circle-wise population distribution in the Udalguri district indicates local variations in spatial concentration. Except forest land and a narrow strip of areas along the Himalayan foothill zone all the places of the district have high density of population. In 2011 all the circles of the district recorded higher density of population (more than 388 persons per km²) than national average of 382 persons per km² and higher sex ratio of 966, which is also higher than the state (954) as well as national average (940).

In 2011 the percentage of children below 6 (six) years of age in the Udalguri district is recorded as 13.12%, which is equal to the national average and lower than the state average (14.47%).

The Udalguri district is found one of the very low urbanized districts in Assam as recorded in the census of, 2011. During the year the district recorded 4.52% of urban population in the district which is very low compared to the state (14.08%) and National average (31.16%). Only three circles of the district namely the Udalguri (7.09%), Kalaigaon (5.97%), and Harisinga (7.08%) have appreciable urban population.

The disparities in the development within the same resourceful area among the so called different caste groups can be observed in many parts of India including Udalguri district. The study area i.e. the Udalguri district has different caste groups and communities according to 2011 census the total population in the district was 831668, of which the Scheduled Tribes (ST) and Schedule Castes (SC) respectively 32.15% and 4.55% of total population. The circle-wise composition of population in the district indicates that the SC and ST together comprise population in the Khoirabari circle with 57.76% followed by Mangaldai (46.93%), Dalgaon (46.74%), Kalaigaon (42.40%), Udalguri (38.76%), Harisinga (31.81%), Dhekiajuli (31.15%), Pathorighat (26.19%), and Mazbat (22.28%).

The quality of working population is an important factor determining the rate of development and quality of man is judged by health and education. The quality of health can access through the study of life expectancy at birth, infant mortality, nutrition levels, disease resistance, access to drinking water facility etc. Life expectancy at birth is one of the parameters of measuring the levels of health quality in a country. In
this study the indication of the quality of life in the Udalguri district is explain with the help of average data of Assam recorded in different reports of the government.

The fourth chapter concern with the resource potentiality and development prospect of the Udalguri district, which includes micro regional pattern of resources and resource potentials, existing pattern of development, existing pattern of human resources development, relationship of resources and development and role of government on resources development.

The disparities of development in many part of the country including the Udalguri district in the Brahmaputra valley of Assam is observed in spite of same nature of available resources in many areas.

The study area, i.e. the Udalguri district in the Brahmaputra valley of Assam consists with nine revenue circles, viz. Harisinga, Udalguri, Mazbat, Khoirabari, Kalaigaon, Dalgaon, Mangaldai, Dhekiajuli and Pathorighat. These nine micro administrative units (circles) of the district are considered here as micro-regions for the study which together comprise 800 villages in 2011 with an area of 1852.16 km².

This district of the Brahmaputra valley is not blessing with any mineral resource but location and the natural environment of different areas have generated a storehouse of resources that are still latent for the development of economy in the area. The existing resource in the area is broadly divided into two categories of Natural resources and Human resources. The study of distribution of sub-categories of these two broad resources in different circles of the Udalguri district has revealed the variations in their distribution and concentrations. These characteristics indicated varying potentialities of development in different micro regions (circles).

The natural existence and distribution of these resources are not even throughout the district and these variations of resource distribution in terms, quantity, quality and potentiality have an influence on the present pattern of socio-economic set up in the circles.

The selected layers of the natural resources in the Udalguri district viz. geomorphic resources (stream frequency, stream density, relief, slope and dissection), soil types, wetland and vegetation cover are considered here for the quantification of spatial distribution of resource in the circles of the district using GIS. The GIS (using ArcInfo raster calculator) integration of selected layers shows a low variations, ranging
from a maximum concentration index value of 7.26 to a minimum of slightly less than 6.26. The whole of the district is divided into three resource concentration areas of below 6.26, 6.26 – 6.68 and 6.68 – 7.26. These three categories of zones cover respectively for 7.87%, 37.25% and 54.88% of the district’s total area.

The first group areas of low concentrations are found in the northern part of the district covering the Harisinga, Udalguri and the Mazbat Circles which together account for 7.87% of the total geographical area of the district. Very small area of the Harisinga circle is spotted by this category in the north east (below 6.26) which accounts for less than one percent area of the circle. In the Udalguri circle this area is seen in the north eastern part which covers about 10% of the geographical area of the circle. In the Mazbat circle area under this group accounts for about 12% of the geographical area of the circle. The second areas of medium concentrations with index value of 6.26 to 6.68 are found in eight circles (except the Dhekiajuli circle) which accounts for 37.25% of the total geographical area of the district. The third areas of high concentrations with index value of 6.68 – 7.26 are found in the six circles which cover for 54.88% of the total geographical area of the district.

An analysis of circle-wise concentration and coverage of high index value (more than 6.68) of resource in the district shows cent percent (equivalent to 2.59% of the district’s total area) coverage of this category of resource potential in the Dhekiajuli circle, where, Mangaldai circle does not recorded any percent of area under this category. The second circle that registered highest resource index value is Khoirabari which accounts for 99.23% followed by Harisinga (72.66% & 22.42%), Dalgaon (56.18 & 2.85%), Mazbat (43.84% & 7.06%), Udalguri (41.46% & 11.79%), Pathorighat (13.44% & 0.02%) and Kalaigaon circle (1.89% & 0.15%).

Therefore, from the analysis it is observed that the entire Udalguri district has low spatial variation of resource concentration and has almost equal opportunities and prospect of development.

Applying the zonal statistics in the ArcGIS, circle wise areas of maximum, minimum and range of index values of quantified resource layers of the district is found out which indicates high range of index value of resource concentration in the Udalguri circle of the district. The second highest range of resource index value is recorded in the Mazbat circle (1.62) followed by Harisinga circle (1.140), Kalaigaon (0.8),
Khoirabari (0.66), Dalgaon (0.58), Dhekiajuli, (0.26) Pathorighat (0.26) and Mangaldai (0.26). The higher value of “range” in the resource concentration indicates the high variability of resource potentials within the same circle (e.g. Udalguri, Mazbat, etc.). The remarkable result of the integration of selected resource layer and zonal statistics analysis using the ArcGIS is that out of 1852.16 km² geographical area of the Udalguri district, the high resource index value (6.68 – 7.2) within the district accounts for 54.88% area. That indicates the majority areas of the district have high resource concentration or high potentialities of resource for development.

The zonal statistics analysis of Udalguri district to identify the numbers of LULC on different types of soils and on different circles of the district also been carried out using ArcGIS. The result of analysis of LULC on different type of soils visualized that the Bhabar soil equivalent to the ENTISOLS has recorded the highest number (14) of LULC in the district and indicated potentiality for rich diversity of LULC and development. The second highest 13 number of LULC is found on the both older alluvial (ALFISOLS) and younger alluvial (ENTISOLS) followed by Terai (MOLLISOLS) and brown red and yellow soils (ULTISOLS) which recorded 12 and 10 numbers of LULC respectively.

The GIS zonal statistics analysis of number of LULC on the different circles of the Udalguri district shows the largest number of LULC in the Harisinga circle (16) followed by the Mazbat (with 15 number), Udalguri (14), Dalgaon (10), Kalaigaon (9), Dhekiajuli (8), Khoirabari (8), Mangaldai (6) and Pathorighat (5).

The existing pattern of development of the Udalguri district in the Brahmaputra valley of Assam is one of the socio- economically backward in nature. The resources (both the natural and the human) available or accessible in the district are yet to be utilized properly. The natural resources available in the district in the forms of land and soil, forest, water, wetlands, scenic beauty etc. are still underutilized. At the same time the levels of infrastructure development in the district is also not so high. The causes of underutilization of available rich natural resources in the district may be many including inadequate knowledge to proper utilization of avail resources by the majority of human force in the district, lack of better technological training to utilize these rich natural resources, lack of government planning and management, etc.
Different type of soils has different productive capacity. The rich fertile soils in the Udalguri district which are under the groups of high productive capabilities are found underutilization in this study. The GIS zonal statistics analysis of the five types of soils and the four types of agriculture practices in the district has visualized that all the four types of agriculture found in the district can be practise in two types of soils viz. the Younger and Older alluvial soils in the district. On the other hand three types of agricultural practise are seen on the Terai and Bhabar soils, where the brown red and yellow type of soil in the district is found devoted to used for only two types of soils. Thus the analysis reveals that the older and younger alluvial soils have higher capabilities and potential for development. Therefore, the circles which shares larger area of these types of soils (compared to the total geographical area) have definitely higher natural potentialities over the areas or circles of low shares of these types of soils.

The study of land use and land cover in the Udalguri district in the section 3.1 reveals that, the district has an area of 1125.07 km² areas agricultural land which accounts for 60.74% of the total geographical area of the district. Out of this area 140.65 km² is covered under the plantation agriculture mainly tea plantation which accounts for 7.594% of the geographical area of the district and equivalent to 12.50% of the total area under agricultural land use and land cover. On the other hand only 5.196% and mere 0.047% of the total geographical area was under the coverage of two-crops and under the zaid crops in the district. Considering the above points the soils of the Udalguri district can be called utilized below to the mark of capability and potentiality.

The study of the artificial ponds/tanks in the district shows that the district is able to develop an area of 12.15 km² of artificial ponds which accounts for 0.656% of the total area of the district which can be used for different purposes including the agriculture and production of fish.

The Udalguri district has prospect of development of tourism industry based on natural beauty, wildlife, unique flora & fauna, holy place, green tea gardens, and introduction of tourist related festivals. The holy place Bhairabkunda is also a place of natural beauty and the meeting place of the three rivers of the Jia Dhansiri, the Bhairavi and the Daifam as well as the meeting place of the Assam, Arunachal and the south eastern small town Daifam of Bhutan. The Rajiv Gandhi National Park located to the
south east of the district; the Barnadi wild life sanctuary, etc are store house of unique flora & fauna.

The study of some selected indicators of infrastructure development in the district has visualized the present levels of infrastructure development in the district. One of the important indicators of levels of development is the spatial connectivity of roads in the district. The roads in the district are digitized from the Google Earth Image (2011-2013) and converted into GIS platform and it is found that the district has a total length of 2197.86 km. of roads (including all category) with a density of 1.19 km./km². According to the economic survey, government of Assam, 2011-12, the Udalguri district has 1458 km. of roads out of which black topped accounts for 405 km. and earthen/graveled roads accounts for remaining 1053 kilometers. Furthermore according to the records the roads can again be divided into state highway (56 km.), major district roads (125 km.), rural roads (1269 km.) and urban roads (9 km.).

The Udalguri district has a total length of 65.62 km. railway line connecting six stations east-west viz. Khoirabari, Tangla, Harisinga, Udalguri, Rowta, and Mazbat through the middle of the district. The process of conversion of the railway line in the district from the metre gauge to the broad gauge is on.

The other selected indicators of infrastructure development in the district are medical infrastructure, educational institutions, post office, electricity and irrigations. According to the econmic survey, government of Assam, 2010-11 & 2011-12, the Udalguri district has better medical facilities compared to state’s average except the sub-divisional civil hospital (S.D.C.H.) and first referral unit (F.R.U.), the facilities of which are not indicated in the reports. The same survey report in the case of educational infrastructure the Udalguri district except the middle school and junior college per 10,000 population all the data indicates the better positions compared to the state,’ average. The report reveals that the density of primary school in the district is 50.241 nos./100 km², the density of other educational institutions are middle school 6.691 nos./100 km², high school 15.891 nos./100 km², higher secondary school 2.629 nos./100 km², and junior college 2.99 nos./1000 km². Compared to the numbers of school against the 10,000 population the Udalguri district has averages of 10.10 primary school, 1.34 middle schools, 3.19 high schools, 0.53 higher secondary schools and 0.06 junior colleges.
According to the data of the Directorate of Economic and Statistics, government of Assam the district has a total of 2019 lower primary and 1498 upper primary school teachers, were, the number of government primary school teachers in the district during 2011-12 is 1959 (97.03\%) in lower primary and 667 (44.526\%) in upper primary school. During the same period the number of teacher in the government recognized upper primary school is 831.

The Udalguri district has six degree colleges affiliated to Gauhati University, out of which Udalguri College has two streams of Arts and Science and Tangla College has three streams of Arts, science and Commerce streams. Remaining four colleges (Mazbat College, Kalaguru Bishnu Rabha Degree College, Khoirabari College and Bhergaon College) have only Arts stream.

The two Colleges, (Udalguri and the Tangla) in the Udalguri district have been provincialised in 2005 along with other 189 Colleges in Assam. According to the data available from the office of the Director of Higher Education, Assam the Tangle and Udalguri College have 58 teaching faculties (Tangla College 41 and Udalguri College 17) and 21 non teaching staff (Tangla College 13 and Udalguri College 8). The district has no higher technical institutions. Two ITI institutions in the district are located at Bhergaon and Mazbat respectively.

According to the economic survey, government of Assam, 2010-11 & 2011-12, the density of post office in the district is 44.21 nos./1000 km², and each post office offers service to more than 10,000 persons. Where compared to the state’s average the density is 51.07 nos./1000 km², and the average service provided by each post office is less than 10,000 population. Since few years back more and more public services in the rural Assam has been serving by the post offices.

The Udalguri district has 800 villages and according to the economic survey, government of Assam, 2011-12, the electrified villages in the district is 92.43\% as compared to the 74.75\% of the state’s average villages.

The Udalguri district has a total length of 357 km. of artificial irrigation canal with an average density of 193 meters/km².

An analysis of development of the circles in the Udalguri district using GIS (using ArcInfo raster calculator) based on the selected eleven (11) indicators, viz. roads (length & density), literacy rate, women literacy, urban population, irrigation density,
percentage of agricultural land use for more than one crop, percentage of non worker population, percentage of area under vegetation cover, percentage of area under ponds/tanks and the population below 6 years of age, shows a index variation range of a maximum 6.84 to minimum of 2.43. The calculated index values of the nine circles of the district on the basis of these indicators reveal the highest level of development goes to the Kalaigaon circle (6.84) among all the circles of the district. The second highest is recorded by the Udalguri circle (5.19) followed by the Pathorighat (5.03), Dalgaon (4.69), Mangaldai (4.61), Harisinga (4.30), Khoirabari (4.15), Dhekiajuli (3.04) and the Mazbat circle (2.43).

One of the perspectives of the resource and development in the Udalguri district of Assam is the share of different sectors to the total district domestic product. The primary sector altogether accounts for 27.46% of the GDDP of the Udalguri district where, agricultural sector shares 24.04% of the GDDP as compared to the 32.88% from the primary sector in the case of the state out of which agriculture shares 22.29% of the state’s total GDP at factor cost by industry of origin at current prices, 2009-10. Other important primary sectors in the Udalguri district are forestry and logging (accounts for 1.91% of GDP) and fishing (1.60% of GDP). The secondary sector altogether accounts for 18.28% of the GDDP of the Udalguri district and 17.18% of the state’s GDP of Assam. Where, remaining more than 50% of the (54.27%) GDDP of the Udalguri district and 49.94% of the GDP of Assam is shared by other than primary and secondary sectors.

Therefore, it is observed that the primary sector in the Udalguri district shares less percentage to the GDDP compared to the state average, where the percentage of agricultural land and the percentage of worker and main worker population is higher than the state’s average.

The study of human resource in the district reveals that the district has no dearth in the number of population size and density. But the district has low literacy rate compared to the state as well as the national averages which indicate comparatively inferior of quality. One of the causes of the low literacy rate in the district may be the high percentage (36.70%) of ST and SC population. According to the census of India, 2011, in the district 41.49% of the population are worker and the figure is higher than the state (38.36%) and the national (53.26%) averages.
The relationship of resources and development in the Udalguri district is carried out with the help of the GIS integrated two result layers of resource index and development index. The resource index values have been classified into nine rank classes (9) at equal intervals. Here considering the circles as zones or development area varieties of resource values in each circle have been analysed using the GIS zonal statistics. The result of the analysis has distinguished the circles within a maximum of 9 (nine) resource classes to a minimum of 2 (two) resource classes. Thus the analysis has rendered that the two circles viz., Mazbat, and Udalguri possess the highest number of resource classes among all the circles. This circle represents all the 9 classes of resources used for the development of the circle. The second highest resource classes (6) have been seen in the Harisinga, followed by Kalaigaon and Khoirabari (5 each), Dalgaon (4), Mangaldai (3), Dhekiajuli, and Pathorighat (2 each).

The analysis of relation between the resource index class and the development index of the circles in the Udalguri district has further clarified that the development and potentiality of development of the circles are unmatched. The class of resources in the two circles viz., the Mazbat, and Udalguri possess the equal number of resource classes (9) but both the circles are legging behind the Kalaigaon which possesses lower resource potential with 5 classes of resource index. The Mazbat circle credited with all the 9 class of resource index but recorded lowest development circle of the district on the basis of selected indicators. The same disparities are also observed in all other circles. The geographical area of the circles and other unconsidered layers (other than the selected indicators) may cause for these disparities in the development of circles on the available variety of resources. The spatial disparities of resource distribution within the same circles may one of the causes for the unparallel in the avail resources and development.

The role of government on resources development is many. The development of a region and use of available resources are largely depends on the policies and planning of the governments and the co-operation by the inhabitants and societies. The Udalguri district was a part of the Darrang district before the formation of the BTAD. Therefore, all the government planning and schemes of the Udalguri district was part of the planning and schemes of the Darrang district before the formation of this new district.
The role of government in the resource development in the Udalguri district of Assam as observed from the field and personal interviews carried out in some selected villages of the district and the secondary sources from the government records are found as follows –

The role of government in the resource development can be discuss through two ways, in the district viz. i) the role to access available resources and their extraction and ii) through the government schemes that added the resource value and its way of extraction as well as present nature of utilization. Where, both the ways to development of resources are largely concerned with the past and present government planning and policies.

The role of government to access or opportunities to use the avail resources should concerned with the development of transport and communication, development of irrigation and hydropower, education and training, government departments and agencies, banking facilities, market facilities, health, government policies and awareness Programme, etc. Transport and communication plays the vital role to access the available resources through their movement from the places of surplus to the deficit. The central and the state government have constructed a total length of 65.62 kilometers of railways passing through the mid of the district (east to west) connecting six stations and 1458 kilometers of PWD (Public Work Department) roads, out of which 405 kilometer (only 27.77%) is blacktopped in 2011.

The development of irrigation system helps in the maximum utilization of agricultural land as well as production of each unit area of land. The Udalguri district has high prospect of irrigation development through multi purpose projects, which can boost the economy of the area through the development of hydro – electric power generation, irrigation for agriculture and development of fishery in the area. The government of Assam initiated a major project in the district (then Darrang district) namely the Dhansiri irrigation project in the year 1975 with its headwork site at Bhairabkunda.

Education and training plays the basic role for the development of human resource as well as the development of the potentialities of available natural resources. In addition to the educational institution in the Udalguri district, discussed in the section 4.2 recently the government has laid down the foundation stone of one engineering
college at Udalguri and there is proposal to set up regional campus of Indira Gandhi National Tribal University of Madhya Pradesh at Bhairabkunda. These educational institutions may backbone for the future development of human resource and wise utilization of available natural resources in the district. The planning for the establishment of Polytechnic and other technical college in the district is still waited and establishment of these types of institutions may enhance the production and value of the local craft of the area in future.

The planning and policies of the government are implemented through the branches of the concern department’s offices and their officials. In the Udalguri district the important government departments that concerned with the resource development are PWD (Public work department), Agriculture, Animal Husbandry and Veterinary, Fishery, Sericulture, Soil conservation, Irrigation, Handloom and textile, Forest, Education (office of the inspector of schools), etc. These departments have been working for the implementation of different Developmental Programmes in the district, the expenditure of government through these departments during the last few years are discussed in the section “government schemes”. These schemes are basically concern with the development of agricultural sector, education, health, road communication, employment generation for unskilled rural poor (NREGA & MGNREGA), etc. In addition to the MPLAD and MLALAD some of the schemes in the district at present are CRF, RKYV, NRHM, NREGA, (NSAP) DRDA, SGSY, etc. The schemes implemented through the DRDA like NREGA, MNREGA, IAY, etc. are implemented as a part of the national policies like job guarantee, shelter etc. for the rural poor.

The other foundation policies and schemes like multi projects covering the generation of hydro-electric power – irrigation – fishery – small scale industries, industrial policies based on the local resource (including food processing, handloom and textile, etc.), development of tourism and related infrastructure, establishment of technical institutions and training for skill development etc. are still to get proper attention in the district.

The fifth chapter concern with a case study of resources potential and development in selected villages. For the purpose 7 (seven) villages of the district have been selected as samples viz. Jamuguri, Phoolbari, Khagrabari, Pakaribari, Hapagaon, Daroga Chuba and No. 2 Sonajuli. All the sample villages are selected considering the
distances from the district headquarter as well as tribal village and tribal and non tribal mixed villages. The major communities in the sample villages are Bodos, Nepali, Assamese, Santhali and Bengali. Except the village Phoolbari other villages have electricity connection. The main source of drinking water is found variation in different villages as well as in different HH within the same village in the forms of river streams, well, tube well and supply water.

Altogether 143 households are selected as sample (Table 5.1). The total population of the sampled HH are 698 (male - 349 and female – 349) with the average sex ratio of 1000. The population below six years of age accounts for 12.46% of the total population and male of this population group is 50.57% The total literate persons of the sampled HH of the villages are 68.74%.

The working group of people in the villages accounts for 49% of the total population of all the villages. The analysis of the nature and characteristics of occupational distribution of the people in the villages shows the workers engaged in agricultural fields are 68.71% out of which 53.80% is cultivators and 14.91% agricultural labourers.

The total landholding of the sample households of the seven villages is 201.58 hectares. The analysis of land use distribution of the village shows that the agricultural use accounts for 74.64% of the total landholdings.

It is observed that the majority of the villages in this part of the state have an opportunity to use the river streams as well as underground water for irrigation purpose. The three sampled villages’ viz., Jamuguri, Hapagaon and Khagrabari are within the zone of Bhairabkunda irrigation project. But still the rainfall (total and temporal) has a great influence on the agricultural practices and production of the area. The amount of water in the river streams of the Bhutan Himalaya is highly fluctuated and it is directly related with the nature of rainfall. Out of the total agricultural land of 74.64% of the total landholdings of the sampled HH as large as 17.34% of agricultural land use areas in the villages have good provision of irrigation water. In spite of large numbers of streams and provision of irrigation in the area it is found that only 12.17% of the agricultural fields of the sampled villages have been using for two rice crops annually. Thus, the data indicates the under utilization of agricultural land in the area. At the same time the average rice production of per hectare of land in the sampled villages have
been recorded only 3303.86 kg./hectare. The rice, wheat and corn are the major crops grown in the villages in addition to different kinds of vegetable (mainly self sustain in nature). The plantations of tea in small plots of land are also observed in the sampled villages. The selected villages of the district have high prospects of agricultural development in the forms of multi-crops farming for commercial purpose. The area has opportunities to avail better irrigation facilities from the river streams that passing through the region in addition to fertile soil, favourable type of climate and high percentage of agricultural workers. The high percentage of population absorbed in agricultural sector followed by lower agricultural product induced by absent of multiple-cropping, absence of commercial attitudes of the agricultural workers as well as absent or not reaching of any government initiatives, etc. in the area may be some of the causes of comparatively remain backwardness of the area even after the more than 60 years of independence of the country.

Thus the study indicates availability of large human force (human resource) as well as rich natural resources in the form of soil, topography, river streams, climate, ground water, etc. in the area. The future projects of connectivity of transport networks, development of education, government initiatives, helps and trainings on the use of land, trainings of the technological know-how for the intensive commercial agriculture, education for the understanding the values of the resources in the area, etc may bring large scale change of the area economically and socially in the future.

The sixth Chapter is concern with the integration of present study and analysis of works. In this chapter the correlation and trend of regression line of the between variables viz. mean resource index and development index; circle-wise literacy rate and development index and the percentage of SC&ST population and development index are carried out. Further, causes of backwardness of the area are pointed out based on the field works and field observations.

Finally, the chapter seven present summary and conclusion with general suggestions.
7.2 CONCLUSION AND FINDINGS

The study reveals that the problem under study bears a great significance in the understanding of the micro regional variation of resource potentials and the prospect of development in the circles of the Udalguri district of Assam. The study and analysis of the natural and human resources, both in district as well as circle level has been carried out here. The characteristics, nature and distribution of resources in the district show the availability of rich resources within the circles and within the district which may exert high potentialities for the development of the entire area. These have been analysed throughout chapters 2 to 3 and the first research question has established the fact.

The district has high potentiality of natural resources and high density of population with large working force but still the resources are underutilized. The people have been using the resource as per the traditional system of man nature relationship and exploring the minimum needs. But still they can explore more benefits form the existing natural resource. The underutilization of resources in the district may be because of lack of proper planning by the government including lack of development of irrigation and improper maintenance of existing irrigation system, lack of knowledge by the workers regarding value of resources around them, lack of education for modern technological know-how, existing socio-cultural system, underdeveloped communication system, absence of social awareness movement for the wise utilization of available resources through the government and NGOs initiative, etc. The chapters 3 to 5 have revealed these problems and the second research question take an opportunity to establish the fact.

The spatial nature and distribution of resources in the Udalguri district have been analysed through the quantification of selected resource as indicators using GIS. The quantified selected indicators layers and their integration has reveals the more or less uniform distribution of resources with minor variations throughout the district. Analysis of these problems has been incorporated in the chapter 4 and the third research question has been helped here to reach the conclusions.

The study of spatial distribution and analysis of resources as well as assessment of resource potentials in the Udalguri of Assam has reveals the existence of rich resources and indicated the high potentiality and prospect of development mainly in
the agricultural and agriculture related activities. In addition to that the resourceful district has an opportunities and potentialities in the tourism-based and forest-based industries. These have been subsequently analysed in the chapters 2 to 5 and the research question four has added an attempt of the researcher to identity the existing problems and exploring the important points to generate suggestion for the future development of the district.

Regarding the fulfillment of objectives framed for favour of investigation and analysis it is argued that:

The first objective dealing with the present pattern of distribution of resources, etc. is rightly addressed in chapters 3 and 4. The second objective covering domain of economic and other kind of activities related to resources has taken a berth in chapters 4 and 5. The third objective bearing benefit of resource use has been scatterly discussed in chapter 4 and 5. Similarly the fourth objective is adequately fulfilled in chapter 5 and 6. The suggestion in chapter 7 deals with the last objective.

**FINDINGS**

(i) The district of Udalguri in the Brahmaputra valley is located broadly on the foothill of the Bhutan Himalaya. As such the district has been composed of constricted foothills (about 15% of the total area) and majority of low to very low relief areas (about 80% of the district’s total area) washed regularly by as many as seven big tributaries oozing at the Bhutan Himalaya and meeting the Brahmaputra.

(ii) Only 15.87 percentage of the district’s total area is having relative relief of more than 60 meters and 90.77% of the total area is having slopes less than 1°. Almost the entire area (98.74%) of the district is having dissection index up to 0.4 while the drainage density is 1.006 on the average, the drainage frequency (No./km²) is only 0.26.

(iii) The district has only been characterised by natural resources of kinds like land, soil resource, water resource, geologic and geomorphic resources, biotic resources and human resources. These resources bear their own and unique importance as resources towards development of the district.
(iv) Of the total land area of the district 60.74% is largely used for agricultural crops of mono type nature. Altogether 9 types vegetation (based on NRSC LULC classification) covering 32.02% of the district’s area have been available on the land and soil of the district.

(v) Water bodies and wetlands in district cover 7.036% of its total area.

(vi) The existence of large tributaries in the district has helped in the construction of canals for utilization land resource and water resources for agricultural purposes.

(vii) The district has been characterised by a number of castes and communities of varying quality and resource potentiality.

(viii) Even as the infrastructural development is less in the district, the average density (km/km²) of roads in the district has helped in development of the district.

(ix) The integrated resource layer is classed into three major areas of more than 6.8 index value, 6.26 to 6.68 as medium index value and less than 6.26 as low index value. The respective area covered by these index values are 54.88%, 37.25% and 7.87% of the district’s total area.

(x) The district has high potential of the uses of resources provided appropriate measures are adopted for the purpose.

### 7.3 SUGGESTIONS

Throughout the study and analysis of the resources and their impact on development in the Udalguri district it has been visualized that the district has natural resources having high potentialities for the more and more development. It again observed that the nature of use of the available resources in the district and the nature and activities of agencies including the government are to be rightly assessed. The formulation of integrated development planning in the district is yet to be appropriately
executed. In addition to giving importance on development of roads, drinking water, medical facilities, education, electricity in the district the following points may be added as suggestions for the enhancement of resource utilization and development of the district.

1. There are immense needs for the generation and updation of resource layers and maps of the district. This can highly help in assessing the value and utilities of each resource layer. For this purpose awareness trainings and programmes for wise utilization may be conducted by the government agencies and the NGOs.

2. Construction of east-west linking roads in the foothill region of the district has been a vital need. The lack of good roads has kept created many villages as remote places even within this small district.

3. Construction of more irrigation projects, small or medium based on the streams on the foothill region needs proper attention for changing the pattern of mono crops to multi crop practices in the district.

4. Establishment of vocational training institutes has been a prime necessity to train the resource users with understanding of resource values and acquiring the knowledge of technological know-how.

5. There are also needs of development of markets and establishment of market centers in favour of right uses of resources and sale of products derived from these resources

The present study of assessment of resource potentials and their impact on development in the Udalguri district of Assam is actually a preliminary one. There are many themes and areas still remaining untouched. The studies of resources in the district through different perspectives may give better understanding of the resources and exploring the better prospects of development of the district in future.