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The dissertation is based on his observation. The candidate has not submitted the dissertation in its entirety or any portion thereof to any other university or institution for any degree.

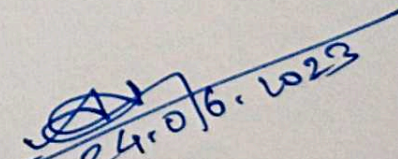
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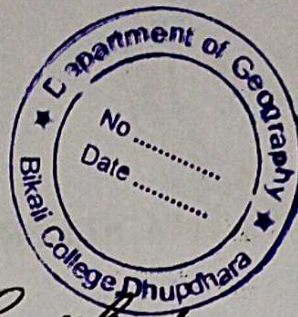

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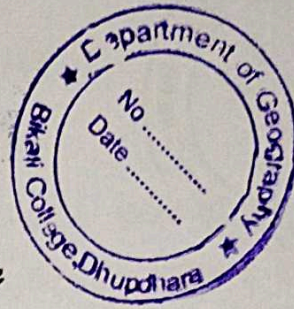
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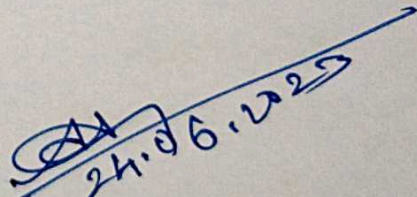
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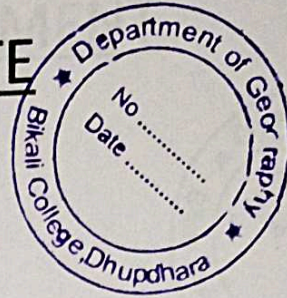
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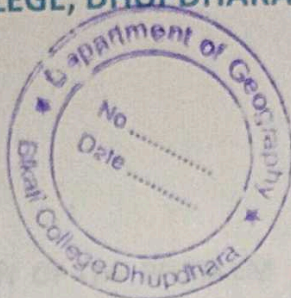
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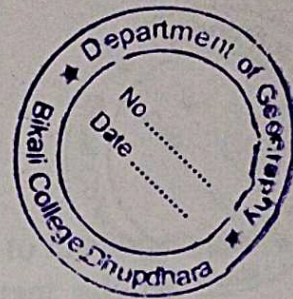
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The dissertation is based on her observation. The candidate has not submitted the dissertation in its entirety or any portion thereof to any other university or institution for any degree.

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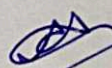
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The dissertation is based on her observation. The candidate has not submitted the dissertation in its entirety or any portion thereof to any other university or institution for any degree.

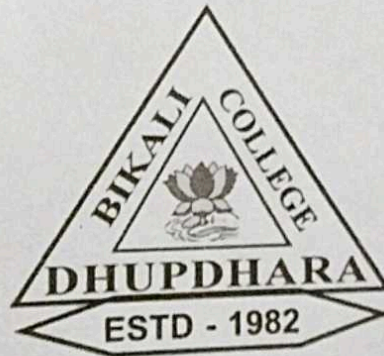

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TOPIC

WOMEN EMPOWERMENT AND FEMALE EDUCATION in Vill-Nagarbera, District – Kamrup (R), Assam

A Dissertation Report
Submitted to the
Bikali College, Dhupdhara

In Partial fulfillment of the requirement for M.A. Geography elective course
name- Population Geography, Course No. 4223



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CHAPTER 1

Introduction of the problem

1.1. Statement of the problem :

Women empowerment and female education is the most important part of the Global society. In India requires to empower women by building education and employment opportunities for them. Allowing women to show up their potential and contribute to the welfare of the nation. Different types of women activities and development of girls education in rural areas in different states in India. In this case, the main problems of female education and women's activities and in this project topic, some noticeable side of women's activities and female education in Geographic study. According to the point "Problems in Women Activities" in the study area that the vast important point which at first study by social and economic geographers.

In the area that found women empowerment problems and female in rural areas face major problems, where women are working in different agriculture, wining farming and another side girls have such problems in educational environment like gender discrimination, household chores, unsafe environment, poverty, early marriage and lack of toilet facilities etc respectively. In Assam, there are thousands of women seen in sectors of Agriculture, winning, farming, hand-loom and educational development field. As like in Kamrup district also have the same types of problems in village level. The women are always suffering barriers and from several problems in everyday life and every year; and identified these problems to universal level for their solution.

Studies about this topic through the questionnaire. More over in the study area some women who are related to winning, farming, agriculture, hand-loom industries and service sector about their problems which they feel during their working time and also in the area such guardian to face such barriers affect in their girl child in schooling time.

Following are main women empowerment and female education of the study area flood problems for agriculture livestock farming, transport and communication, financial problem, social problems, poverty, household chores, lack of toilet facilities, widely separate schools, the roads are non-existent, lack of transport or communication facilities have a more or less marked effect on education at the different levels and also the marketing problems for the

women empowerment in study area not for gets the sufficient higher educational institute in the study area etc.

A Geographical region or a political unit may be taken into consideration to investigate various women empowerment and female education problems, but a very micro level unit namely the village can be taken into consideration for the purpose. Hence the Nagarbera village is taken into study the women empowerment and female education in the area. The topic **"Women empowerment and Female education of Nagarbera village, Kamrup District, Assam"** selected for the desecration.

1.2. Review of relevant literature:

Women studies with a view to integrating different economic or development activities are not very new. Different Social Scientist, Economist and educationalist has written various books in different parts of the world about the women empowerment and female education. Mention may be made about the women's empowering activities and girl's education as a whole in our international record and country is as such- Duflo E. (2014). "Women Empowerment and Economic Development National Bureau of Economic Research Cambridge". UNICEF (2014) "Ending Child Marriage". Progress and Prospects" New York. The website of the World Health Organisation, "Violence Against Women (2016)". Danone Ecosystem (2016), " Women empowerment for inclusive business". Dr Eijariya Rajeen and Sharma. Rahul-2017. " Digital India, A Socio-Economic transformation." Anand.S.and Sen-1995."Gender Inequality in Human Development: Theories and Measurement ." Barkat A 2008, "Women Empowerment: A key to Human Development," Bloom DE, Hartlay. M.Rosovsk,H.2006," Beyond Private Gain: The Public Benifits of Higher education ."Jha.Jyotisha, Ghatale.Neha; Menon, Niveditha,Dutta. Priyanka, Mahendra. Shreekanth-2019,"Women's Education and empowerment in Rural India; Awasthi, Deepa-2016, "Girl Education in India still Miles to cover", Rao.D.B-1998, "Ditric Primary education Programme." Govt of Assam -2003, "Women striving in an Unequal Programme", Ahmed A-1993, " Social Structure and Regional Development; Women Empowerment in North-East India", Kikhi Kedilezo, Das. Amiyo Kumar and Dutta piyashi-2023 "Indegenity, Citizenship and the State; Perspectiones from India's Northeast."

1.3 The Study Area:

The study is conducted in Nagarbera village which is found in Kamrup[®] of Assam, which includes, i.e. Pahalipara chuba, Bilahpara chuba, Gagalmari chuba and Oxitary chuba. The study area is under Chamariya Development Block (Nagarbera) in Kamrup district[®]. In this area inhabited by SC and General people. The area is covered by three communities which are- Muslim, Bengali and Assamese people.

The study area is situated near the Southern Bank of Brahmaputra valley and is 96 km West from Guwahati. The circle name is Nagarbera Revenue Circle, it is a village area of Nagarbera Gaon Panchayat under the Circle. 42.5 km. East from Goalpara District. In the Nagarbera area has a sub-branch of Brahmaputra River which is named Jaljali river, flows east to west direction of the Northern part of Nagarbera. The study area is a part of Nagarbera Area.

The Geographical location of the study area is 90°57' to 91°08' East longitude and 26°3' to 26°8' North longitude. The altitude of the study area is 60 metre from the sea level. The study area covering 1.58sq.km (522.41 hectares).

Nagarbera circle of Kamrup district has total population of 299721 as per the census 2011. Out of which 142611 are males while 133787 are females. In 2011 there were total 15112 families residing in Nagarbera Circle. The study area has total population of 2899 out of which 1533 males and 1366 females. And the study area has 657 families residing in the area. Nagarbera has a population density of 684.3 inhabitants per square kilometers.

1.4 Objective of Study:

The women empowerment and females education is very important in Assam as well as in the other parts of North-east India.

- a) To study the ~~same main objective of the study are~~ physiographical background of the study area.
- b) To study the female literacy of the study area.
- c) To examine the women activities and development of the study area.
- d) To study about the primary occupation of the women in the study area.
- e) To study about the women empowerment scheme for the women in the study area.

1.5 Research Questions:

Women empowerment and female education Panel questions which are specifics for the study:-

- How do you empower yourself and the woman around you ?
- What makes you strong woman?
- How can woman stand in solidarity with each other?
- How can we expand woman's links to each other example-mentorship, coaching and networking?
- How can women "work across the divides" of opinions?
- What do you think are the barriers to access education for female in societies and how can we overcome these challenges?
- What is your understanding of equal opportunities for female and how do you think we all are working towards achieving it?

1.6 Database and methodology:

There are mainly two sources of data. The primary data and secondary data. To collect the first hand data or primary data the method to sample survey is done for the purpose taken interview with the dwellers of the area. The interviews are taken with the help of questionnaires prepared for the purpose. Secondly , the seo=condary data are collected through the Chamaria block development office, Nagarbera and Gaon Panchayat office Nagarbera relating to the study. The official data are also collected from local authority in this respect. The collected data are taken tabulized, analysed and synthesized. Some simple statistical methods such as bar diagram, pie diagram, histogram and frequency polygon and line graph etc are also applied to display the data.

1.7 Significance of the study:

Nowadays, the importance of female education is growing day by day. It is not only important to educate girl and woman, but also it is necessary to provide them with basic facilities. In many countries, specially in developing countries, the literacy rate of female is low as compared to male.

Even in the 21st century many families feel reluctant to send their girls children to purpose schooling and higher studies. One of the primary reason behind such malicious thought is

economic disparity. Many families are unable to send their children to schools. Where it comes to gender, they choose their sons and could not effort education for girl children.

Education is considered the most important tool for empowering woman in society. It is not only limited to developing the personality of an individual but also plays on important role in economic, social and cultural development. Education empowers girls to achieve more in their social, career, economic and family lives. To female education can mean going to class or being trained on capacity building and skills development or better yet being mentored on every essential aspects of WEE. The women empowerment is a global issue and discussion on woman political right are at the forefront of many formal and informal campaigns worldwide.

In present context need to promote the benefits of women's education in the society. Major changes are made in bills to encourage female education. Strict actions are taken and crimes related to gender should be penalized to stop gender discrimination.

CHAPTER-2

GEOGRAPHICAL BACKGROUND OF THE STUDY AREA

The Nagarbera are lies in the western most corner of the south Kamrup (R) the confluence of Barpeta , Goalpara and Kamrup district of Assam. It is almost one hundred eighteen kilometer away from Guwahati city to the west . The geographical location of the area is $26^{\circ}3'N$ to $26^{\circ}8'N$ latitude and $90^{\circ}57'E$ to $91^{\circ}08'E$ longitude. Among the circle area of Nagarbera surrounding the Nagarbera village. There are twenty eight revenue village with an area of 11,500 hectores. The study is the part of Nagarbera village inhabited of community . To eastern part of the Nagarbera village a market is developed long ago which is now from growth center developing to a township. The boundary of the study area may be defined follow:

To the east , Nagarbera market and Karnoi – tributary of the river Jaljali .To the west there lies village Kalubari and to the south Khameri Jan and Gagalmari bil and the village Palahartari and to the north the Jaljali river is flowing .The study area is contained about four thousand five hundred forty two (4542) population.

It is to be noted that the greater Nagarbera area is divided by Jaljali river. The study area is belongs to the weastern part of greater area. It is already that there are twenty eight revenue villages among the whole area . In this whole area the Nagarbera village is also included.

2.1 LOCATION:

The study area is the part of Nagarbera village . To the eastern part of the Ngarbera village a market is developed long ago which is now from growth center developing to township. The area are lies in the western most corner of the south Kamrup District of Assam . It is almost one hundred eighteen kilometers away from Guwahati city to the west. The geographical location of the area is $26^{\circ}3'N$ to $26^{\circ}8'N$ latitude and $90^{\circ}57'E$ to $91^{\circ}08'E$ longitude.

To the east ,Nagarbera market and Kalubari to south Khameri Jan and Gagalmari Bil and the village palahartari and to the north the Jaljali is flowing. The study area is contained about four thousand five hundred forty two (4542) population.

2.2 PHYSICAL BASIS OF LANDFORMS:

The study area is practically plain area with some lowlying areas formed due to the great earthquake of 1897. This place is actually the part of Meghalaya Plateau and made up of red soil. There is elevated part of the plain area which is known as Nagarbera reserve. The main drainage area is the river Jaljali and there are some lowlying areas, some of them are considerably big and known as bill. They are Niradaba bill, Vesamari bill and Gagalmari bill the area is almost inundated by flood water aspect the main P.W.D road. The main road is passed through the village. The other interior place of the village (study area) is connected by village pakka road. The settlement of the area is linear in the interior parts also the inhabitant are settled beside the village roads. It is observed that due to the increase of population there also haphazard settlement in the study area.

2.3 CLIMATIC CHARACTERISTICS:

The study is climatically similar to other parts of control Assam. The Brahmaputra valley as a whole as an integrated part of the south east arctic monsoon region. In Kappen's climatic classification, the region belongs to the types of 'Cwg' i.e- Humid Mesothermal Gangatic type. The climate is characterized by hot moist summer and cool dry winter.

It is well known that there are always variation of climate in relation to attitude of the concerned area presence of water bodies like sea, river, bill, lake, etc. near the study area. Any way the monsoonal climate may be divided into four stapes parts they are – 1. Winter, 2. Pre- Monsoon, 3. Monsoon, and 4. Retreating Monsoon.

The winter monsoon includes the months of December, January and February. During the months, rainfall is very limited and sometimes. Do not occur. The season is cool and pleasant. Average rainfall is less than 5cm and temperature varies between 11°C. As the study area is situated along the river Brahmaputra, it is affected by the land and water freeze and so the climate here is comparatively milder than is the places near the foot hills.

From the last part of February or the first part of March, the pre- monsoon period, the area receives a considerable amount of rainfall. It is mainly caused by the derstems and belong to the family of nor 'westers' or 'Kal bhaisakhi' of Bengal locally

known as bardoyasila. The average rainfall during the period is 15.6cm and the mean temperature is 22°C.

The real monsoon period starts from the month of June and continues up to the middle of September. Heavy downpour of rainfall occurs and it swells the drainage channel of the region especially the tributaries originates from the Meghalaya plateau causing flesh flood.

It this season for the heavy rainfall with the river Brahmaputra tributary Jaljali sub tributaries Karanai and Khameri also swelling. So, it is inundates the study area except comparatively high land. The temperature of this season on average rose up to 25.5°C respectively and rainfall occurs on average 200cm.

Monsoon with rowal takes place from the last weak of October. During this period the winds become north-easterly and while the temperature decrease gradually, the rainfall decrease quite abruptly.

In rainy reason there is always damaged to standing crops, damage of houses, loss of cattle, loss of poultry, and even also loss of invaluable human life (as for example in 1988, one person, in 1996, two person and in 2013, three person). It is sum that there are frequent death of human population during the time of flood.

It is already started that the local character of land from there are some variation in the weather of study area there is slight amount of rainfall received by the Nagarbera area. For the presence of water bodies more foggy weather and during the summer season specially in the month of February and March the area covered by dust. It is due to presence of char area near the study area.

2.4 SOIL CHARACTERISTICS:

Soil is very important content of socio-economic life of a group of people. Soil is the media of population of crops, types natural vegetation and also planted vegetation. So, when we go to examine the socio-economic activity of the people, social character must be taken in to consideration. Because soil is also try look into the soil character of the area. It is also to be noted that the PH value of the soil also important phenomena to be consider when quality of the soil is examined. The PH value is important for the raising out different crops, for digging of fishery etc and etc. In the area, the red soil is dominant soil. Actually the river Jaljali flowing through the greater Nagarbera dividing the region to east-west part.

The eastern part is mainly made up of the greater Nagarbera is dominant by red soil which is also the part of Meghaliya Plateau. In this part there are numbers of lowlying areas i.e- uneven due to the earthquake of 1950 the magnitude of which was more than eight in the richter scale.

In this study area, hence found the four types of principal soil groups-the red soil, the machy soil, the narrow trip of alluvial soil in grayish white. The strip of the soil is present in the bil or in the machy areas. The soil is black colour. Due to presence the human made up from the ratten grasses and the other water born vegetation. The PH value of the four types of soil is almost white in colour and suitable for paddy cultivation. The soil formation is a critical process. The soil layer of the study area is deep. So the tube well might be dig and average up to 120 feet. The soil as a whole are not so much fertile because of the study area belongs to red soil group.

2.5 BIOTIC ENVIRONMENT :

It is a fact that for the increases of population as a whole there are encroachment of land area by the people. Hence the clearing of forest cover and agricultural and settlement purpose, the natural vegetation cover almost cleared up. Even the lowlying areas (bils) also contracted for the above mention purpose. Yet, there are some ramnents of natural vegetation. Almost tham some example may be cited-simul (Bombox malobariecem), Jammu, Urium (Disha Aia dawasica), Poma (Codrella tonne), Jia Dimoru, Sanaru, Jatul etc. There is also various types of water born vegetation found in the area Khagaril. Sacch arum sepontascum, Ulal Imperate arundinaceum, Ikara(sumechorum arundenaceum)etc. The chief agro horticultural product the area rich in Potato, Banana, batalnut, Jakefruite , Mango, Lichhu, Amla, Lemon, Olive, Bokal, Plum etc.

There are also various types of fauna found in the study area. Some of them are Jackles, squirrel, snakes, rabbits, mouse, monkey, doves, cows, common myna. Jungle myna, owls, sparrow, frogs, etc are among the various kind of birds seen in the study area.

Expect the above mentioned flora-fauna, there are also various types of unknown flora in the area. Specially in the hill area, so among unnoticed flora are there. Some types of flora is always seen flourishing in the hill area. As such numbers of fauna are also there. It is already stated that for the enchoament of jungle area and bill area by the human being the number of flora and fauna is decreasing in fast rate. It is due to the over

whelming growth of population. The fauna of the area also due to increasing by human settlement and land use.

Location Structure of the Study Area

The study area is situated in the village of ... The area is bounded by ...

The area is bounded by ... The area is bounded by ...

The area is bounded by ... The area is bounded by ...

The area is bounded by ... The area is bounded by ...

CHAPTER-3

Population Structure of the study area

From the secondary source of data it is found that the total population of Nagarbera village is 4542 according to 2011 census report amount of the population which is living in the study area.

Nagarbera Revenue circle of Kamrup District has total population of 299721 as per the census 2011. out of which 143611 (41.91%) males while the other hand 133787 are females(44.64%) residing in Nagarbera Circle area. The average sex ratio of Nagarbera Revenue Circle is 943. the sex-ratio of Nagarbera is around 943 compared to 958 which is average of Assam.

The Nagarbera village is consisted with four chuba, i.e-Pathalipara, Bilahpara, Gagalmari and Oxitary Chuba. The total household of Nagarbera village is 657. out of 657 household 200 households are selected for sample survey for primary data collection. The selected house hold for the Pathalipara 75 households, 30 households from Bilahpara, 50 households from Oxitary and 45 household from Gagalmari chuba. The population of selected households are 1192 person of the study area. There are 81.71% General people, 18.03% Scheduled caste people and 0.25% Schedule tribe of the study area.

There are 81.71% of General people; 18.03% Schedule caste people and 0.25% Schedule Tribe of the study area.

Table-3.0.1: Population Structure of the Study area

Caste	Total population	Degrees of Population	Percentage of Population
General	974	294.16 °	81.71%
S.C	215	64.93 °	18.03%
S.T	3	0.90 °	0.25%

(Source -Primary Data Collection From The Study Area)

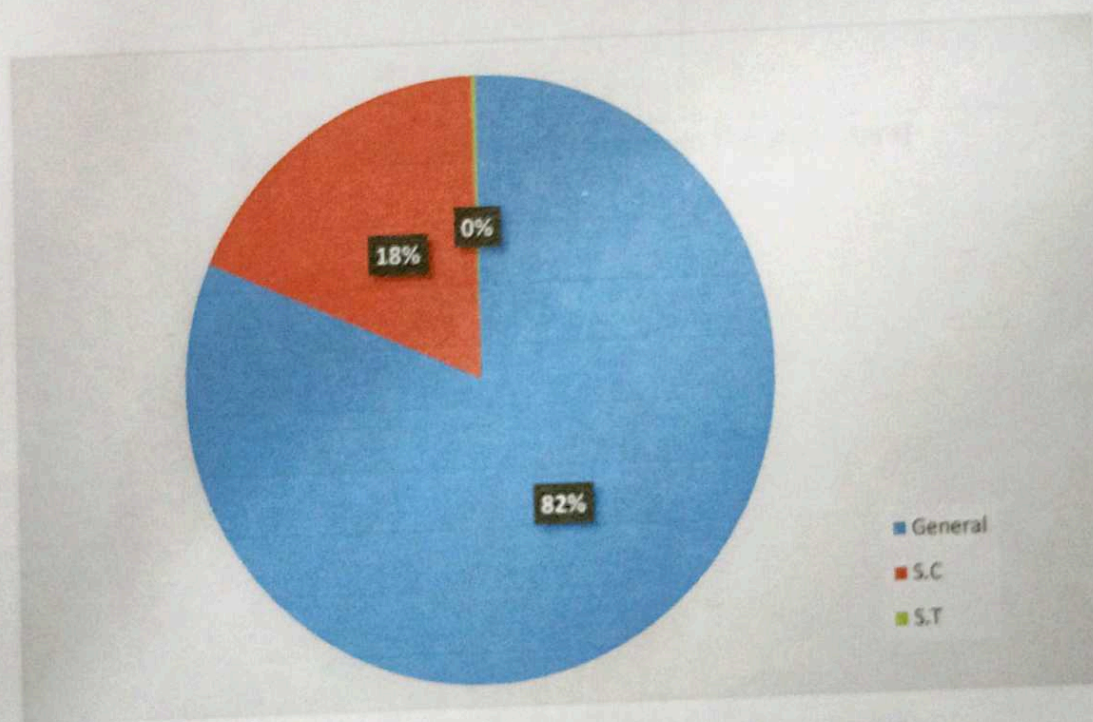


Fig 3.0.1: Population Structure

3.1. Socio-Economic Status of the Study Area:

- **Family System:**

From the primary source of data 200 household are selected for sample survey and in between 200 households there are Joint Family(16%) and 168 unitary family(84%) of the Study Area.

Table 3.1.2: Family System

Total Family	No of Joint Family	Degrees of Joint family	No of Unitary Family	Degrees of Unitary Family
200	32	57.6°	168	302.4°

(Source -Primary Data Collection From The Study Area)

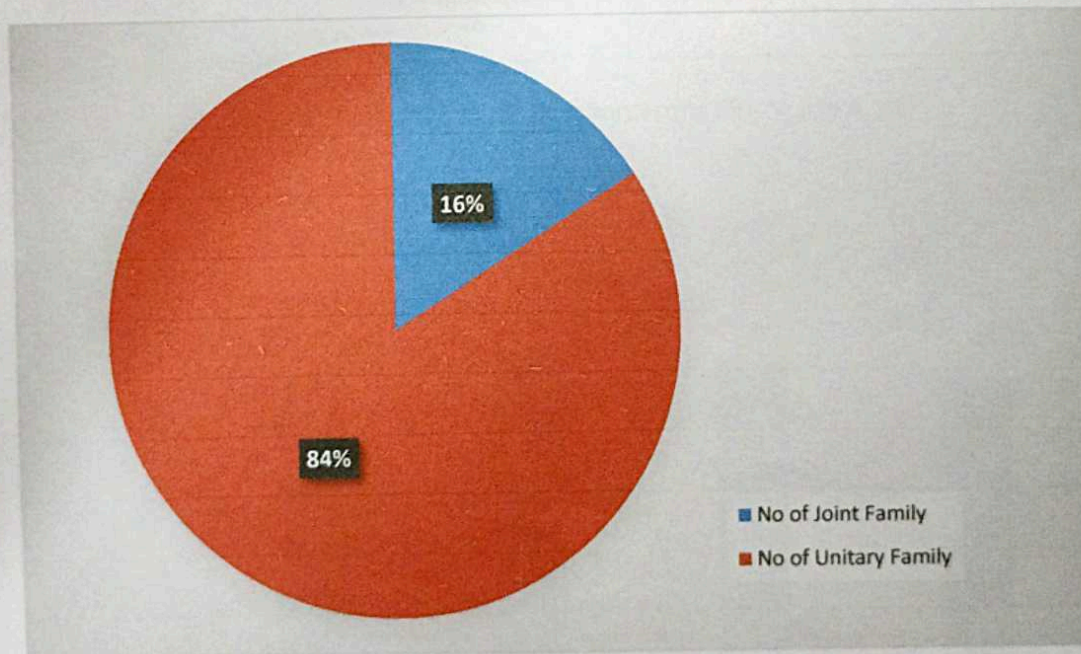


Fig 3.1.2: Family System

- **Age Group :**

The study of the age group is one of the most important factors for socio-economic study. In the study area the age groups are studied with the interval of zero to ten(18.20%), ten to twenty(15.21%), twenty to thirty (14.60%), thirty to forty(13.67%), forty to fifty(13.42%), fifty to sixty(12.58%) and above sixty (12.55%).

Table 3.1.3: Age Group

Class interval	No of person	Percentage of person
0-10	217	18.20
10-20	182	15.21
20-30	174	14.60
30-40	163	13.67
40-50	160	13.42
50-60	150	12.58
Above 60	146	12.55

(Source -Primary Data Collection From The Study Area)



Fig 3.1.3: Age Group

- **Sex Ratio:**

The study of sex-ratio is important for the social characteristics. There should be always balance between male and female ratio, i-e- number of female against number of

male. It is not balanced for example -number of female is much more less than male. It may leads to social unrest. In our country , in the North-Eastern Indian states, the imbalance of sex ratio is found. For that we will have to depended for the life pattern of another states of the country. If number of women is also more than male, there may also be increase of celibacy. There is some other social disorder may happen in the society. So, the study of sex-ratio is very important.

To count the sex ratio the survey is done in the following age group-

Table 3.1.4: Age-sex structure

Class interval	Male	Percentage of male	Female	Percentage of female
0-10	110	50.69	107	49.31
10-20	95	52.19	87	47.80
20-30	84	48.27	90	51.72
30-40	83	50.92	80	49.80
40-50	82	51.25	18	48.75
50-60	74	49.33	76	50.66
Above 60	70	47.95	76	52.05

(Source -Primary Data Collection From The Study Area)

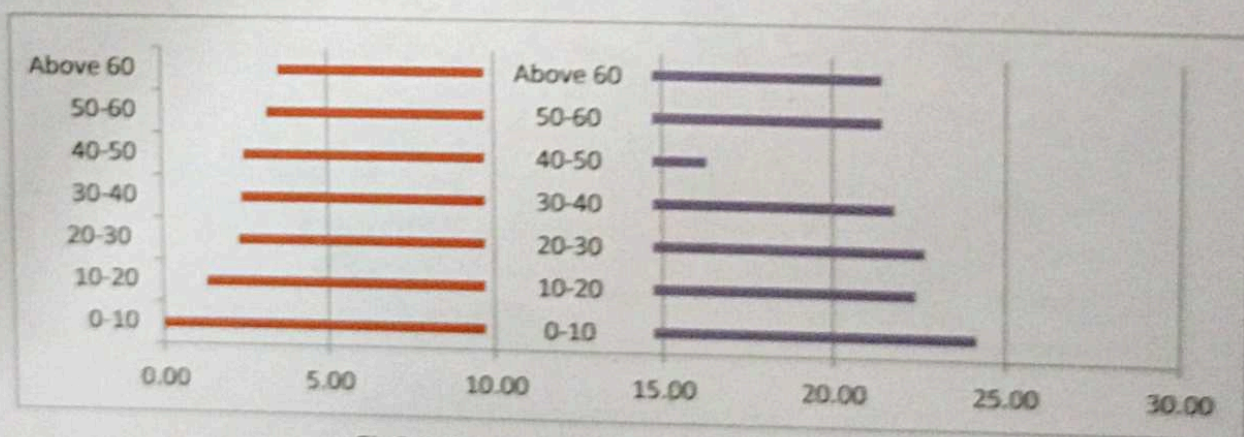


Fig3.1.4 Age-Sex Structure

Occupational patterns:

One of the important socio-economic aspect of the occupational patterns is also taken into consideration. For this purpose the various means of occupation are taken such as their workers(26.69%), Marginal workers (0.52%), Non-workers (72.78%).

Agricultural workers(32.80%), Service Men(16.33%), Business Men and (23.37%) and other workers (27.48%). In general, the occupation of the revenue village people are mainly engaged in Primary occupation i.e- cultivation, Agriculture etc. The following two table represent the occupational pattern.

Table 3.1.5: Occupational System

Occupation	Total Member	Degrees of Member
Agriculture	247	118.09 °
Business	176	84.14 °
Service	123	58.80 °
Others	207	98.96 °

(Source -Primary Data Collection from The Study Area)

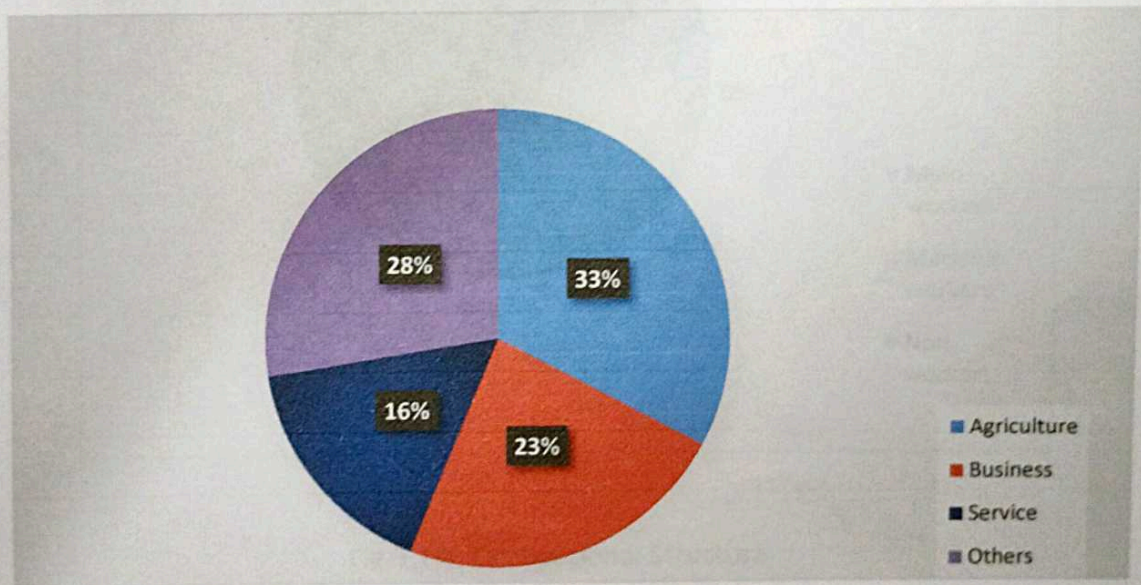


Fig 3.1.5: Occupational System

Table 3.1.6: Occupational Structure

Workers	Total workers	Male workers	% of Male workers	Female workers	% of Female workers
Main workers	774	710	24.49%	64	2.21
Marginal workers	15	6	0.20%	9	0.31%
Non workers	2110	817	28.18%	1293	44.60%

(Source -Secondary Data Collection From The Study Area)

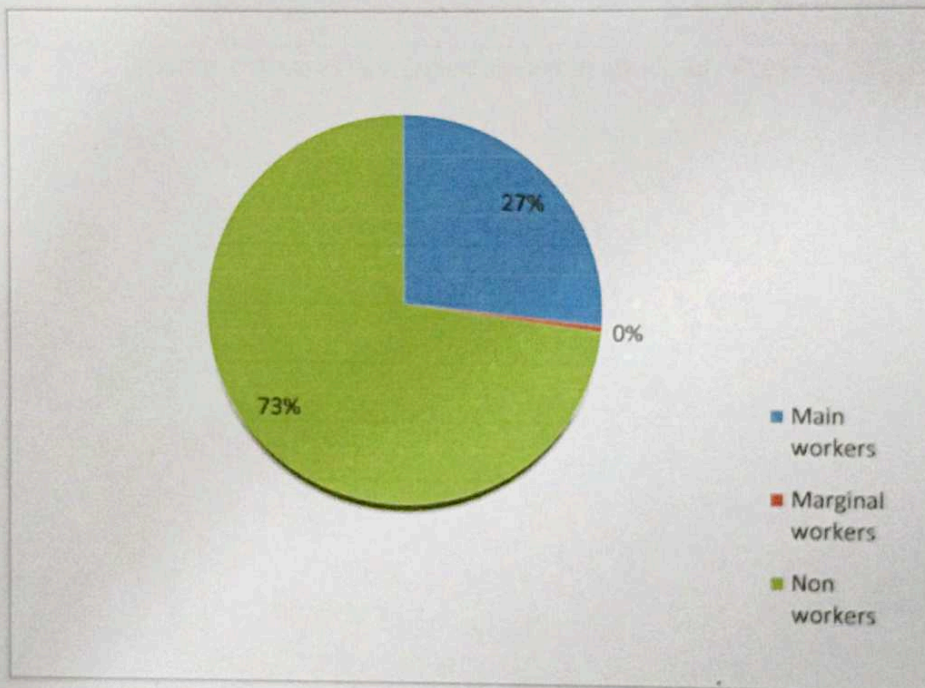


Fig 3.1.6: Occupational Structure

Land Holding size:

From the survey it is clear that the total land holding area of the study area is contains 622.41 hectares but from then 136.1 hectares is built up area and similarly the cultivated land is 228 hectares: fallow land is 92 hectares. Wet land is 23.23 hectares and again the net sown area is covers 148 hectares. So it is clearly noted that land holding capacity is

much more is cultivated land i.e-228 hectares as compared to other land cover area of the study area.

Table 3.1.7: Land Holding Size

Land Holding Type	Total land (hectars)	Degrees of Land
Built-up area	136.1	78.10°
Cultivated land	228	130.84°
Fallow land	92	52.39°
Wet land	23.23	13.39°
Net sown area	148	84.93°

(Source -Primary Data Collection From The Study Area)

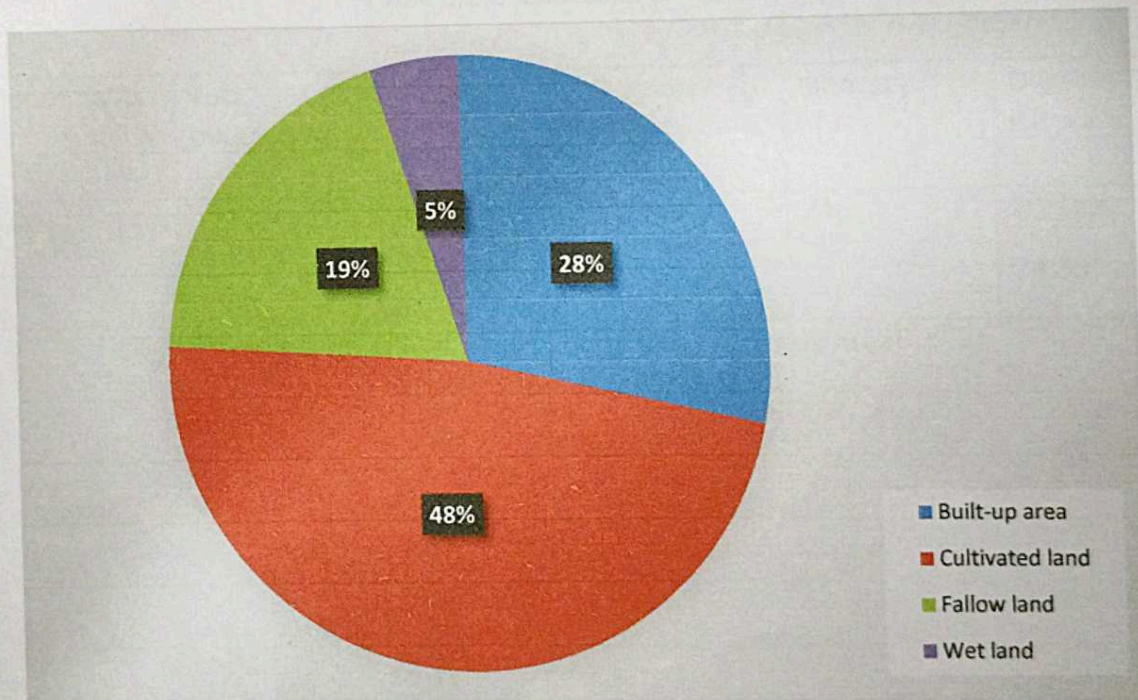


Fig 3.1.7: Land Holding Size

3.2 Literacy rate of the Study Area:

The study area is primary occupied area. So the literacy rate is not very well. But comparatively high percentage is found in B.A/B.Sc/B.Com. From this point of view of educational qualification in this area is not very backward. Now the literacy rate of the study area is comparatively developed.

The study area has 3 L.P School. The total literacy rate is 20.64% and the illiteracy rate is 79.36%. 14.18% Primary level, 12.75% Upper Primary level, 12.08% under HSLC level, 11.66% HSLC level, 11.24% H.S level, 10.65% B.A/B.Sc/B.Com level, 4.36% M.A/M.Sc/M.Com and 2.43% Diploma and Technical level. The educational facility is not very good but the literacy percentage is very high due to socio-economic condition.

Table 3.2.8 Educational Structure

House holds	Total population	Literacy	Degrees of literacy	Illiteracy	Degrees of illiteracy
200	1192	946	79.36%	246	20.64%
			285.7°		74.30°

(Source -Primary Data Collection From The Study Area)

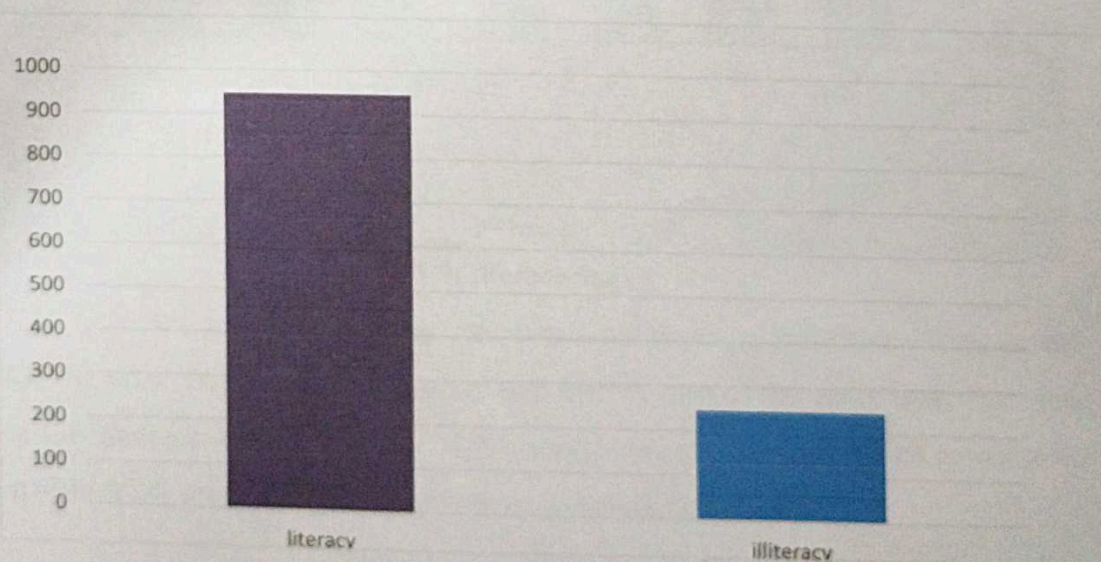


Fig 3.2.8: Educational Structure

Table 3.2.9 Literacy Status

Educational level	No. Of population	Percentage of population
illiteracy	246	20.64
primary	169	114.18
Upper primary	152	12.75
Under HSLC	144	12.08
HSLC	139	11.66
H.S	134	11.24
B.A/B.Sc/B.Com	127	10.65
M.A/M.Sc/M.Com	52	4.36
Diploma & Technical	29	2.43

(Source -Primary Data Collection From The Study Area)

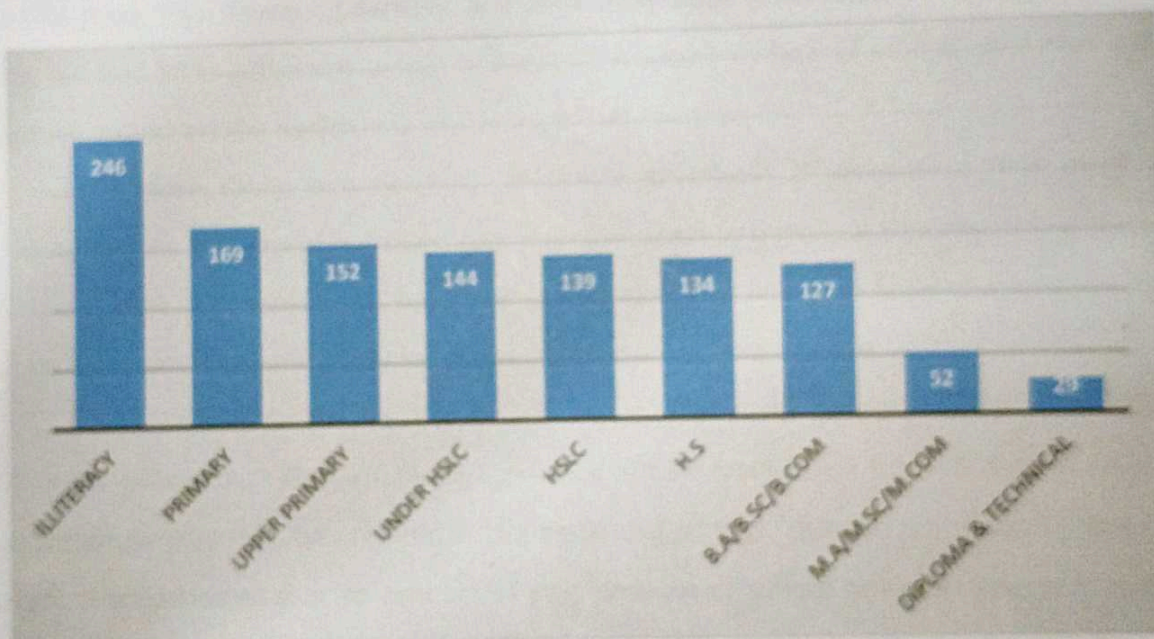


Fig 3.2.9: Literacy Status

This two table showing the educational structure and literacy status of the study area. The table determines the illiteracy and literacy rate of the study area. The table determine the illiteracy and literacy rate of the study area and showing which educational level have highest population and which have lowest population rate etc. .

CHAPTER 4

FEMALE EDUCATION OF THE STUDY AREA

Indian's constitution guarantees free primary school education for both boys and girls upto age 14. These goals have been repeatedly reconfirmed, but primary education in India is not universal overall the literacy rate for woman is 39% versus 64% for men with less than 40% of 333 million women aged 7 and above being literate, according to the 1991 census which means today's there are over 200 million illiterate women in India.

The urban female literacy rate is 64% and rural female literacy is half of it, i.e-31% . As with India as a whole many states have large rural-urban differences in female literacy. This low level of literacy not only has a negative impact on women's lives but also on their families and country's economic development. Numerous studies show that illiterate women have high levels of fertility and mortality, poor nutritional status, low earning potential and little autonomy within household. A women's lack of educational also has a negative impact on the health and well being of her children.

Therefore there is a need for minimum threshold of education that must be achieved before bringing about significant improvements in female autonomy of the literate Female in India, 59 percent only have primary education or less. This level of education may not be sufficient to meaningfully improves the status of these women.

In the backward rural areas of Assam female faces some barriers for their education. The major educational problem faced especially female from some backward rural areas is that although they may be enrolled at the beginning of year, they do not always remain in school. It is estimated that 45 percent of girls dropout of school between grades 1 and 5. Girls are often taken out of school to share the family responsibilities such as caring for younger siblings Girls are also likely to be taken out of school. When they reach puberty because of the high premium placed on virginity. So the proportion of girls attending school decreasing with their age. Again, if a family has to choose between educating a son or a daughter because of financial restrictions, typically the son will chosen. Many parents view educating sons as an investment because the sons will be responsible for caring for aging parents. On the other hand, parents may see the education of daughters a waste of money

as daughters will eventually live with their husband's families and the parents will not benefit directly from their education.

In the study area, mentioned some scenario are to be viewed. The area is consisted with Bengali people and Assamese people. Above the scenario are seen to be in Bengali and Muslim people which are inhabited in Gagalmari and Oxitary chuba respectively. In this two chuba some female dropout students are seen and also the female literacy rate is less than the male literacy rate. Because they faces the barriers for their for their education. The parents of these two chuba thought that education for girl are wastage of money because they live with their husband's family. They do not give value for educating girls. But the Assamese people of the area are against of it. They fully give value for educating girls. They do not agree with the gender discrimination. They think that the girls are equal to boys. And so the literacy rates are almost equal. But in case of their education literacy rate of girls are greater than the boys in those areas. Also have seen that, for technical and diploma education the following rate of boys is higher than girls.

From the collected data in this aspect charted in the following table from illiterate to P.G and technical level.

Table-4.1 Levels of Female Education

Educational level	No. of Female Member	Percentage of Female	No. of Male Member	Percentage of Male
Illiteracy	102	8.56	144	12.08
Primary	79	6.62	90	7.55
Upper primary	72	6.04	80	6.71
Under HSLC	67	5.62	77	6.46
HSLC	73	6.12	66	5.54
H.S	71	5.96	63	5.29
B.A/B.Sc/B.Com	65	5.45	62	5.20
M.A/M.Sc/M.Com	30	2.52	22	1.85
Diploma & Technical	9	0.76	20	1.67

(Source: From Primary Data Collection of the Study Area)

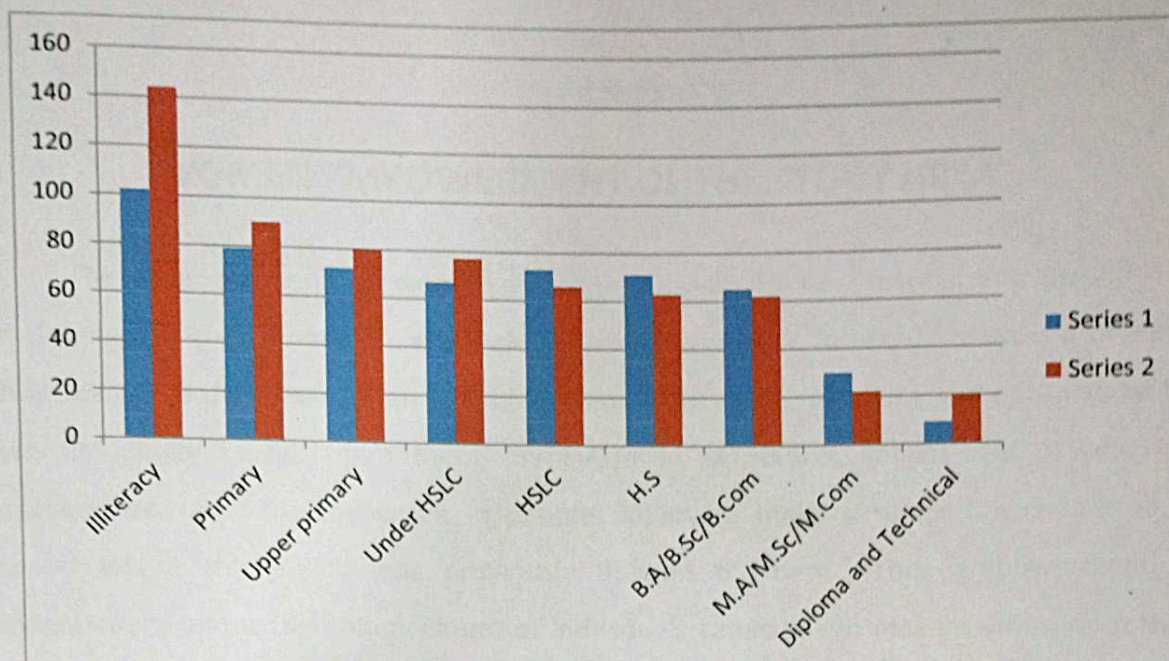


Fig 4.1: Levels of Female Education

From the above table it is clear that the primary, upper primary, under HSLC and Diploma and Technical literacy rate of girls are less than boys. But the HSLC, HS, B.A/B.SC/B.COM and M.A/M.SC/M.COM literacy rate of female are greater than the boys. And also the illiteracy rate of female are less than the male. The educational structure of the study area is not very noticeable. In present time the female of the study area are very conscious about of their education because they want to be independent. Education helps the empowers and build better future for themselves and their families. In the study area the female literacy rate is increasing day by day and it helps to reduce the child mortality rate.

So education is most important to develop a area and society. And female education are most important to developed the all site like the environment of home, society etc. female helps to develop top to bottom of the society.

Nowadays first preference is given to woman. In the study area of 200 households, the 47.64 percent female are literate. Some of them are teacher, officer, clerk etc. Because of having educational qualification of their own they teach their children accordingly.

And other some of them are uneducated which is 8.56 percent are related with agriculture, weaving, livestock farming sector etc. some woman through different educational programs i.e-both formal and non-formal promotes the empowerment of women.

CHAPTER 5

WOMEN EMPOWERMENT OF THE STUDY AREA

The empowerment of women has been shown to be essential for sustainable development and economic growth. What is empowerment? "empowerment is a process which relates to the power of an individual to redefine her possibilities and options and to have the ability to act upon them" by Eyban et al 2008:5. Kabeer ;2001:19, defines empowerment as " the expansion in peoples ability to make strategic life choices in a context where this ability was previously defined to them." Thus empowerment is fundamentally about the enhancement of individuals capacities to make a difference in their surroundings which effects their life.

Women can be empowered in many ways ; socially, economically, politically and legally. This thesis focuses on households dynamics, individual characteristics and gender related constraints, when it comes to social and economic empowerment. In contrast to other terms women's empowerment relates to a process; a progression from one state to another. In addition, empowerment includes agency, in which women themselves are actors in the empowerment process. They must not only be able to make a decision, but be aware of their rights to make it.

Women play important roles in the rural economy; wage earners and entrepreneurs. They also take responsibility for the well being of the members of their family including food provision and care of children and the elderly.

The study areas of women unpaid work, particularly in poor households often includes collecting wood and water. Women from indigenous and grassroots communities are often custodians of traditional knowledge, which is key for their communities livelihoods, resilience and culture. Yet the women of study areas face constraints in engaging in economic activities because of gender based discrimination and social norms disproportionate involvement in unpaid work, unequal access to education, healthcare, property and financial and other services. They are also disproportionately vulnerable to the impacts of environmental disasters and climate change. Promoting and ensuring gender equality and empowering women of the study area through decent work and productive and

sustainable economic growth, but also enhances the effectiveness of poverty reduction and food security initiatives, as well as climate change mitigation and adaptation efforts.

In the study area mainly faced by entrepreneurs problems. The searching for opportunities ability to examine and understanding them an building a successfully business around this opportunity are the essential traits of an entrepreneurs and to be able to do this education is an important factor.

In the area the occupational pattern of women are also taken into consideration. For this purpose the various means of women's occupation are taken such as agricultural sectors, government service, private sector, weaving sector and different other sector. In general the occupation of village people mainly female are engaged in agriculture and weaving or handloom sector.

Following table represent the women occupational pattern of the study area.

Table 5.1: Women's occupational pattern of the Study Area

Women Empowerment	Total Number	Percentage of women
Agriculture	32	7.06
Business	103	22.74
Service	28	6.18
Handloom	134	29.58
Other	156	34.44

(Source- Primary data collection from the study area)

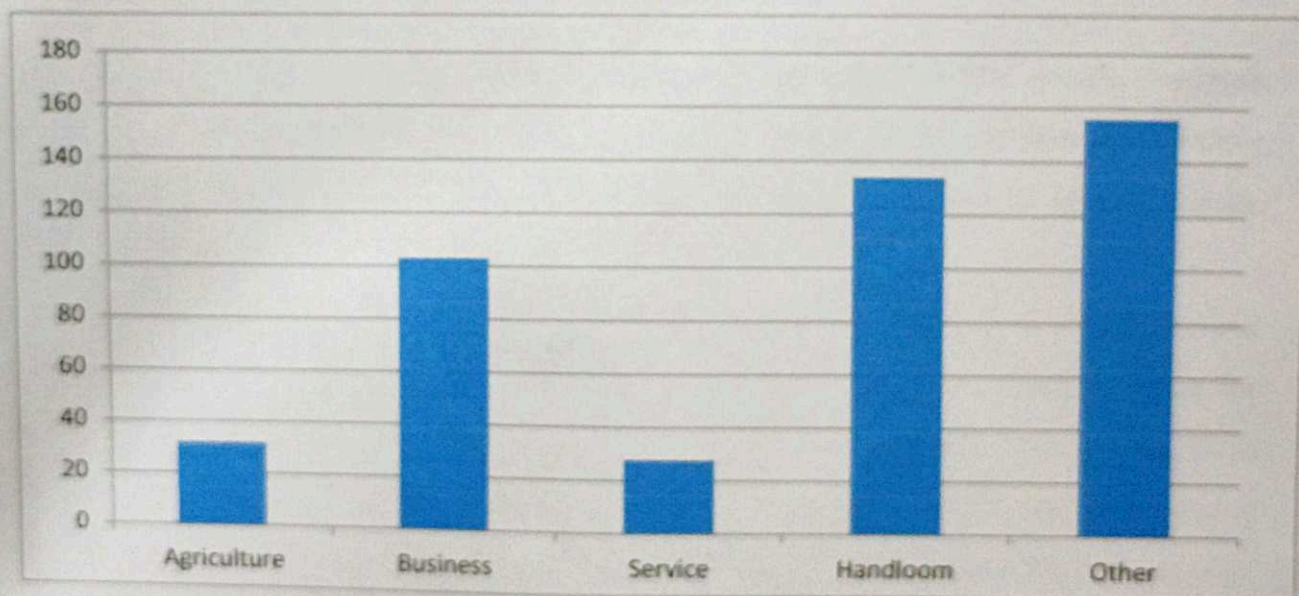


Fig 5.1: Women's occupational pattern

From the table it is clear that 29.58% of Handloom sector is highest and 34.44% engaged with other like-fishery, households industry etc, 7.06% engaged with Agriculture 22.74% Business and 6.18% service sector.

The tabulation form of the occupational structure of the areas are given below-

Table 5.2: Occupational Structure of the study area

Workers	Total works	Male worker	Percentage of Male workers	Female workers	Percentage of Female workers
Main workers	774	710	24.49%	64	2.21%
Marginal workers	15	6	0.20%	9	0.31%
Non-workers	2110	817	28.18%	1293	44.60%

(Source: Secondary data collection from the Chamariya Block Development Office, census 2011)

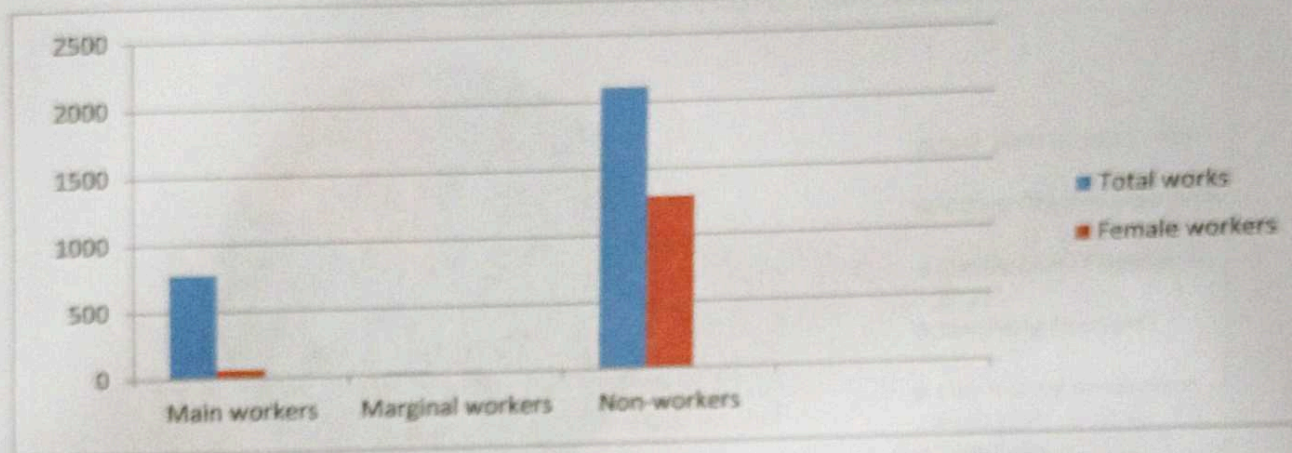


Fig 5.2: occupational structure

From the above table the main workers of male is greater than the female. The main workers of male is 24.49% and 2.21% in female also marginal workers of female is greater than male is-0.31% female and 0.20% in male. The rate of non-workers is 44.60% female and 28.18% is male.

Gender discrimination fear of reaction from society, family responsibilities and commitments are some of the factors that combine together to make a social barrier for women to venture into entrepreneurs. The financial problem of business is related to shortage of adequate finance difficulties in obtaining credit from banks, low risks bearing capacity problem in capital for expression, unaware about appropriate finance sources, complain and lengthy loan procedure etc.

Government provide some scheme for the women empowerment to developed the grassroots women society and seeks to independent women life. Some of the scheme to

provide by Government for the women empower and entrepreneurs through the Block development office.

Table 5.3.: Women Empowerment Scheme of the Nagarbera village

Women Empowerment Scheme	Total Scheme	Degrees of scheme
Self Help Group (SHO)	62	116.86°
Village Organisation (VO)	3	5.65°
Cluster Level Federation (CLF)	1	1.88°
Revolving Fund (RF)	50	94.24°
Community Investment Fund (CIF)	40	75.39°
Bank Loan	35	65.97°

(Source: From Chamariya Block Development Office, Nagarbera)

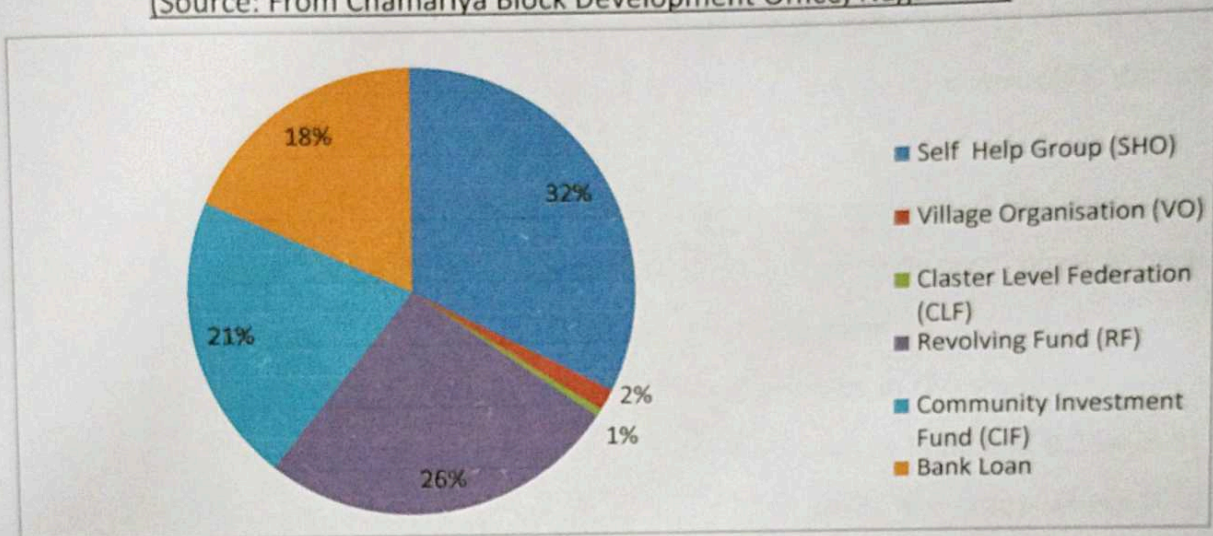


Fig 5.3: Women Empowerment Scheme

Government provides all the these schemes to develop the village area and the village women are be independent in every steps of their life.

Table 5.4: Governmental Scheme for Women Empowerment of the Study area

Government scheme	Member	Degrees of Member
Self Help Group(SHO)	109	108.10°
Revolving Fund (RF)	91	90.25°
Community Envestment Fund(CIF)	85	84.35°
Bank Loan	78	77.35°

(Source: Primary Data Collection from the Study Area)

CHAPTER 6

SUMMARY, CONCLUSION AND SUGGESTION

- **Summary:**

The project report studies the "Women Empowerment and Female Education of Nagarbera Revenue Village, Kamrup(R), Assam". The whole project reports has been divided into Six Chapters.

In chapter-1, deals with the introduction of the problems to be studied including significance, review of relevant literature, study area, objective of the study, research question, data base and methodology, while introducing the problem tries to highlight the Women empowerment and Female Education in Nagarbera Village of Kamrup(R) district case study.

In chapter-2, deals with the analysis of Geographical background of the study area including the other physical parameter related to location of the study area, physical basis of landforms, climatic character soil character and biotic environment.

In chapter-3, also deals with socio-economic characteristics in the study area which includes the population structure which is 81.96% in general, 18.03% in SC and 0.25% in ST category; Family system which is 16% joint and 84% unitary family; age group where 0-10 age group has found highest 18.20% and above 60 has found lowest 12.55% in the study area; age-sex structure which determined the ration between the male and female in the area. The highest male ration found in 52.19% in the 10-20 age groups and the female ratio found in the above 60 age group which is 52.05%. It also discussed about the occupation system of the study area which is found the highest 32.80% in the Agricultural sector and the lowest found in service sector 16.33%. The land holding size of the study area is also discussed in this chapter. The built up area is cover 136.1 hectors highest in the index and the wet land cover lowest area which is 23.33 hectors. The literacy rate is found in primary educational level which is 14.18% and lowest found in diploma and technical level which indicates 2.43%.

Chapter-4, study about the Female Education of the study area which including the literate and illiterates of female and again in which level found the highest literacy rates and lowest literacy rates are discussed. The female highest literacy rates found in M.A, M.Sc, M.Com in

comparison to male. It shows 2.52% female and 1.85% in male member and the lowest literacy rates is found in Diploma and technical level which indicates 0.76% female and 1.67% male in the study.

In chapter-5, deals with the women empowerment of the study area including the primary occupational pattern of the study area, empowerment scheme of the Nagarbera village, total member engaged with the scheme and occupation systems of the village, and occupational structure of the Revenue Circle which is marginal workers: male workers 0.21% and female workers 0.31% ; main workers: main workers 24.49% and female workers 2.21% and non-workers:-28.18% male workers and 44.60% female workers found in the area. The five occupational systems are found in the study area. The highest 29.58% women engaged with the handloom sector and 6.18% engaged with service sector. 9the 109 (30.03%) member engaged with the self help group: 25.07% engaged with the Revolving fund, 23.42% are community investment fund and 21.48% have bank loan which is provided by the government.

In the Chamaria Development Block, Nagarbera, the total 62 self help group, 3 village organization, 1 cluster level federation, 50 revolving fund, 40 community investment fund and 35 bank loan is provided by government for the women of this area.

- **CONCLUSION:**

This report discussed the Women Empowerment and Female Education of Nagarbera Revenue Village, Kamrup(R), Assam with the main aim of development f women activities and female literacy rate of this area. The aggregate model showed that there is a verity of women empowerment and activities of women and also the female rate is comperision to male literacy rate. It remove the barrier for the women and seeks them to be idependent. Geography, environment and community play a part of shaping the informal institutions, which in turn, shape women empowerment possibilities. This verifies the relevance of investigating the different sides of women's empowerment and not looking at it as and overall index. Women's empowerment is multidimensionl and at different stages of the empowerment process women may have different needs.

This study shows that social and cultural norms are present in regard to determining women's status within the household and the role in she has in society. The gender related constraints found in intra-household relations were captured in the study area. In order to

increase women's economic status, policies should continue to support women's organizations and self-help groups, which are directed towards education vocational training, employment and access to microfinance. This is in line with the recommendations given in the World Survey on the Role of Women in Development (UN DESA, 2009:91).

The findings in this report support policies which have been used to empower women in study area, e.g.: Promoting education and delaying age at marriage with an exception of decision-making in the households in the study area. Education of female is a highly relevant investment in regard to women's empowerment.

At the end of it self, it is not enough to address women's empowerment in regard to mobility, voice, decision-making power in the households, freedom from domestic abuse and property rights. Women need to understand their rights, which they can do through education, but gender-related constraints hinder their possibilities to used them.

• SUGGESTIONS:

The higher education facilities should be utilized and there should be proper facilities in the school and colleges for the girls.

Awareness programs should be organized among the people of backward area and they must be taught the importance of sex-education and the effects of early marriage and extra marital affairs.

Self defense training should be given to the women which can make them more stronger and feel more secure.

The schemes that Govt. is providing for the women should be well applied & some organization should be built that can empower women.

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**QUESTIONARY OF RESEARCH PROJECT FOR COMPLETION OF M.A 4TH SEMESTER(MAJOR)
FINAL EXAMINATION 2022-23, DEPARTMENT OF GEOGRAPHY, BIKALI COLLEGE,
DHUPDHARA
ON
HOUSEHOLD SCHEDULE**

1. Name of the family head:
2. Family type: Age: Sex:
Joint: Unitary:
Caste: Community: Religion:
3. Mother tongue:
4. House type: A.T: Semi R.C.C: R.C.C:
5. Card Holder: B.P.L: A.P.L: GENERAL:

6. (a) Family Age Structure:

Sl no.	Name of Family Members	Age	Sex	Married	Unmarried
1					
2					
3					
4					
5					
6					
7					
8					

(b) Family Education Structure:

Sl no	Name of family Members	Illit eracy	PRIMAR Y	Upper primar y	Unde r HSLC	HSL C	H S	B. A	B.S C	B.CO M	M. A	M.S C	M.CO M	DIPLOMA & TECHNOLOG Y
1														
2														
3														
4														
5														
6														
7														
8														

(c) Family Occupation structure

Sl no	Name of Family Members	AGRICULTURE	INDUSTRY	DRIVER	BUSINESS	FISHERMEN	SERVICE	CARPENTER	BUILDER	OTHERS
1										
2										
3										
4										
5										
6										
7										
8										

(d) Land use pattern (in Bighas):

Total land	Home stead	Kitchen/ Vegetable/ Garden	Rice/Irri Cultivated land	Fallow Land	Waste land	Fishery land	Others crop land	Net area shown

(e) Crops production per bighas (in Quintal):

Boro	Sali	Ahu	Irri	Jute	Sugar cane	Rape/ mustard	Vegetables	Potato	Pulses	Wheat	Fishery's	others

(f) Unemployment Status:

Sl no	Name Of Family Members	Educated	Uneducated	Landles	Capital less	Religion customs	Insufficient govt. aids	others
1								
2								
3								
4								
5								

6									
7									
8									

7. Family Budget:

(a) Family Income (in Rupees per year):

Agriculture	Industry	Driver	Business	Fishery	Service	Carpenter	Builder	others

(b) Family Expenditure (in Rupees per year):

Food	Clothing	House repairing	Education	Medicine	Festival	Agriculture	Electricity	others

8. Social Amenities:

Club	Library	Electricity	Playground	P.O	Health centre	Bank	Public pond	Beel	Namghar	mandir	others

9. Women Empowerment each Family:

Women member	Agriculture	Industry	Driver	Business	Fishery	Service				G.P	A.P	Others
						Teacher	Bank	Administration	Others			

10. Government scheme for Women Empowerment:

Sl no	Name of Family Members	Microfinance	Bank loan	Self help group	Revolving fund	Community investment group

11. Livestock farm:

Livestock's	Cattles	Goats	Buffalos	Ships	Hen	Duck	Broiler farm	Pigs	Horses	others

12. Family problems/ social problems/ natural problems:

.....

.....

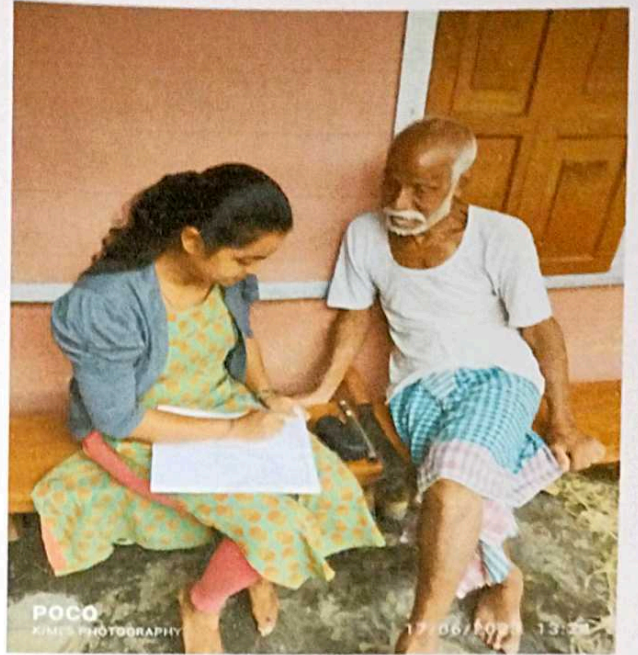
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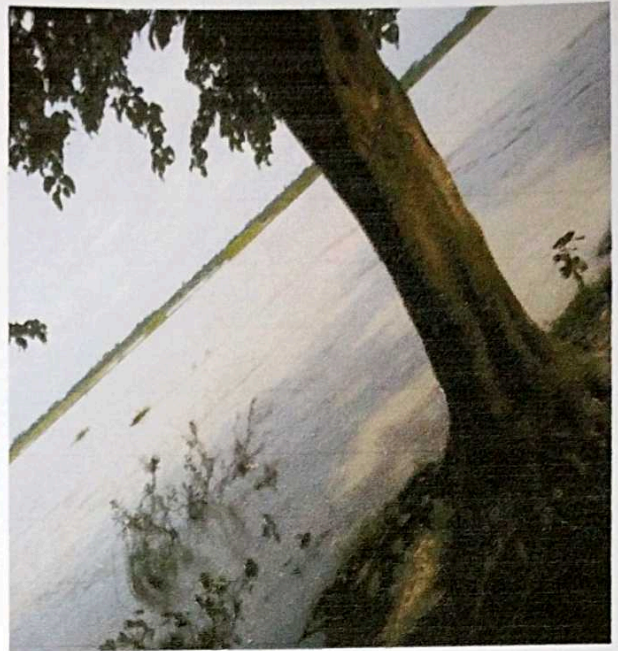
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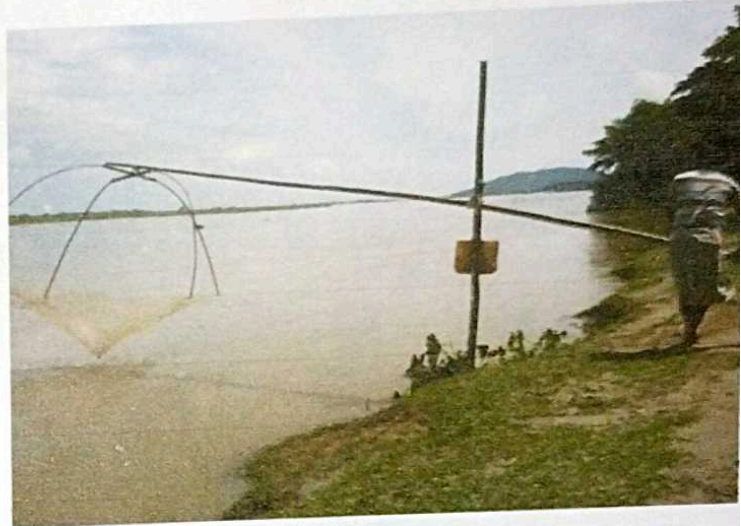
PHOTO PLATES



During Primary and Secondary Data Collection



KORNOI, JAJALI RIVER AND FISHARY LAND



WEAVING, FISHARY AND BAMBOO OCCUPATION



CROP AND VEGETABLES CULTIVATION AND BATTLE NUT PLANTATION

**“IMPACT OF URBANIZATION ON WETLAND: A CASE STUDY
ON DEEPOR BEEL USING GIS AND REMOTE SENSING
TECHNIQUES”**



A dissertation submitted for the partial fulfillment of the requirements for the
award of the degree of

MASTER OF ARTS IN GEOGRAPHY

Submitted by

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M.A.4th semester

Roll No.PA-211-095-0016

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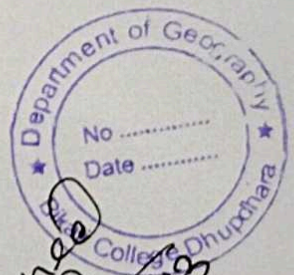
Supervised By

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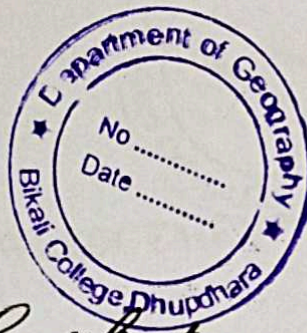
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*Examined
by
26/01/19*



Certificate

This is to certify that Mallika Rabha bearing Roll No. PA-211-095-0016 and Registration No. 18073036 of 2018-19 is a bonafide student of 4th semester of M.A Geography of the Department of Geography, Bikali College, Assam. She has carried out the dissertation entitled “**Impact of Urbanisation on Wetland: A Case Study On Deepor Beel Using GIS and Remote Sensing**” under my guidance and supervision for the partial fulfillment of the requirement of the Degree of Masters of Arts.

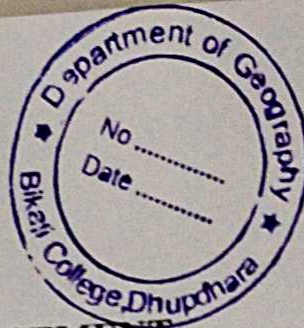
The dissertation is based on her observation. The candidate has not submitted the dissertation in its entirety or any portion thereof to any other university or institution for any degree.

Princi Gogoi

Supervisor

Assist. Prof Dept. of Geography

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Mallika Rabha

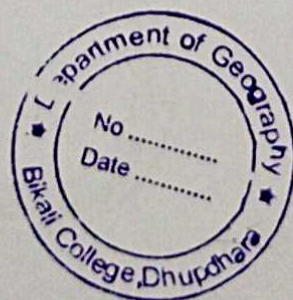
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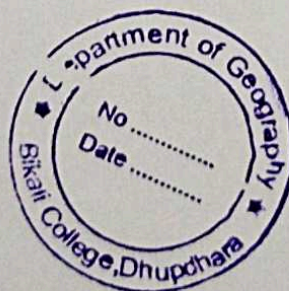
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CHAPTER 1:

1.1 Introduction:

Wetland is a distinct ecosystem that is flooded or saturated by water either permanently (for years or decades) or seasonally (for weeks or months). The primary factor that distinguishes wetlands from terrestrial land forms or water bodies is the characteristics vegetation of aquatic plants, adapted to the unique anoxic hydric soils. Wetlands are considered among the most biological diverse of all ecosystem, serving as home to a wide range of plant and animal species.

Wetlands contribute a number of functions that benefit to people like ecosystem services and include water purification, groundwater replenishment, stabilization of shorelines and storm protection, water storage and flood control, processing of carbon, other nutrients and pollutants and support of plants and animals. Wetlands are vital ecosystem that enhance the livelihoods for the millions of people who live in and around them.

Wetlands play an integral role in the ecology of watershed. The combinations of shallow water, high levels of nutrients and primary productivity is ideal for the development of organisms that form the base of the food web and feed many species of fish, amphibians, shellfish and insects. Many species of birds and mammal rely on wetland for food, water and shelter, especially during migration and breeding. Wetland occupy an important transition zone between land and water and are considered among the most biologically diverse and productive ecosystem in the world.

One of the Ramsar site situated in Assam is "Deepor Beel. It is the largest and only Ramsar site in the Brahmaputra valley which was included under Ramsar list in 2002. Deepor beel is an abandoned channel of the Brahmaputra river which denotes a typical wetland comprising of core and fringe area. The deepor beel is home of several endangered species such as Asiatic elephants, leopards, flying cats, many migratory birds etc.

The degradation of the Deepor beel is seen day by day due to the various anthropogenic factors such as waste disposal, illegal human settlement, railway line construction which have divided the wetland into two parts and growing croplands. Landscape development Index (LDI) indicates the impact of surrounding land use pattern

have increased on the wetland from 1989 to 2012. Wetland was converted into grassland which is the direct effect of various anthropogenic factors. Moreover, there is change in the catchment of the Deepor Beel caused by urbanization and deforestation. According to the current vulnerability assessment conducted by TERI of the Guwahati city, it is found that rapid unplanned urbanization and change in land use pattern has put immense pressure on the natural landform and on the entire ecosystem of the city.

1.2 Statement of the problem:

Urbanization refers to the process in which a large population is concentrated in urban areas whereby the rural share of the population predominantly becomes low. It is considered as the increase in the areas to accommodate urban population and development at the cost of fringing of existing urban area. It is complex phenomenon. Since the dawn of human civilization, every city around the world irrespective of its size has encountered urbanization. Population and economic growth have encouraged urbanization throughout the world and the number of urban towns and cities has drastically increased over the decades. Urbanization is inevitable for the development of a country. It makes a significant contribution to the country's GDP. However, urbanization is often responsible for the myriad of modern problems facing humanity. It is predicted that by 2050 about 64% of the developing country and 86% of the developed country will be urbanized. This is predicted to generate artificial scarcities of land, lack of drinking water, playgrounds and so on for most urban dwellers.

The world has experienced a tremendous increase in its urban population. In 1960, 33.61% of the population lived in urban areas which rose to 46.69% in 2000 and by 2019 the percentage of the population living in urban areas rose to 55.71% (world urban population 1960-2021). During 2020-2025 the average annual rate of change of the urban population is expected to grow at 1.73%. The world's urban population is assumed to increase by 2050 to 68% (UN report: World urbanization prospects, the 2018 revision). However, in developed countries growth of population is low therefore their urban population will also be moderate shortly and they have a nearly high population who already lives in cities. On the other hand in developing countries whose growth of population is very high are likely to have more contributions towards the world's urban population.



During 1961-2011, there was a rapid growth of the urban population in India due to the social and economic development of India which leads to massive migration of population from rural to urban areas for the pursuit of employment opportunities and to improve living standards. Out of the 1210.2 million total population of India, the urban population was 377.11 million and the level of urbanization stands at 31.16% (Census of India 2011).

Assam, a state in northeastern India where the majority of the population depends on agricultural and allied activities as the source of livelihood is also experiencing fast urbanization over the years. Similarly in 2001 the percentage of urban population to the total population in Assam was 12.72 which has increased to 14.10% wherein the country share of urban population is 31.16% in 2011. Guwahati being the largest city of Assam has also witnessed rapid urbanization over the years.

The wetland Deepor Beel is an important natural wetland. It has both biological and environmental importance besides being the only major storm water shortage basin for Guwahati city. The Deepor Beel faces multiple kinds of pressure dependent on the driving forces at play. The change in wetland ecosystem are the consequences of urban development, dumping ground in the eastern side of the wetland, constructing of the railway line which divided the wetland into two parts, increase of population pressure on land, growth of industries in the fringe area of the wetland and the poaching of the migratory birds to sell in the local market. All this driving forces become problematic to the ecosystem. Water pollution is a major problem to the wetland. Water quality deteriorates due to pollutants such as fertilizer, pesticides used in agriculture suspended solids, industry waste in and around wetland. This has impacted on the overall health of aquatic animals in the wetland systems.

1.3 Review of Literature:

Saikia Jekulin Lipi (2019) in her journal "Deepor beel wetland: Threats to Ecosystem service, their importance to Dependent communities and possible management" evaluates wetland changes due to various anthropogenic factors. The restoration and conservation of

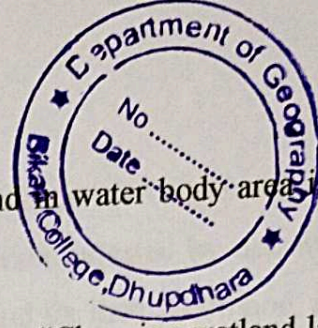
the wetland became the need of the hour due to growing frequent flooding in the Guwahati city. The study has reviewed the ecosystem services of the Deepor beel using the DPSIR framework and find that the main threats to the wetland are water pollution, decline in fish population, land use pattern and decrease in number of plant and animal species. there is a strong link between the main pressure on the wetland and its impact on provisional and regulatory services of the beel.

H. Jesse Walker *et. al.* (1987) journal name is “ Wetland Loss in Louisiana” write about coastal wetland loss in Louisiana, now considered amount to more than 100km sq/year is receiving ever increasing amounts of attention. This loss is the result of a variety of complex interactions among a number of physical, chemical, biological and cultural processes. Important geologic phenomena include sea-level change, subsidence, compaction and change in location of deltaic depocenters. During the last few decades, the human factor in wetland loss has increased drastically. The placement of dams and levees across and along the tributaries and distributaries of the Mississippi River have reduced both the amount and texture of sediment reaching the coast.

Kalita Mamita *et. al.* (2018) the study topic is “ Vegetation coverage change and risk assessment- A case study of Chandubi lake, Assam”. They examine on two major issues. Firstly, the study of vegetation loss and secondly to map the wetland loss over 16 years from 2000 to 2016 using Remote Sensing, GIS (Geographic Information System) analysis. In this study also highlights the need of remote sensing for risk assessment study for facilitating the ways for its restoration. The study through NDVI and NDWI concluded that the beel has undergone major vegetation cover change and wetland loss over 16 years (2000 to 2016). The area was having 40.75% in 2008 which reduces drastically by 5.67% in 2016. It has been found through NDVI that the total area of water bodies within study area has reduced by 79.57% from 2000 to 2016. NDVI reveals more built up increase from 12.69% to 50.40% in 16 years.

Choudhury Moharna *et. al.* (2020) in their research work “Wetlands are in peril, A case study of Son Beel wetland of Assam, India” evaluates that the health of the wetland is steadily deteriorating as a result of a series of internal as well as external factors. This study has been carried out to understand the wetland's current situation. GIS and Remote Sensing based studies shows that the ecosystem is facing both natural as well as anthropogenic threats. It is observed that there is a significant change in land use/ land cover patterns during

the last five years (2011 to 2015). A sharp decreasing trend in water body area is noticed during the recent years compared to the previous years.



Tamuli Trishna moni and Bora Ashok K (2021) studied about "Changing wetland landscape and effects of urbanization study on Silsako wetland of Guwahati." They find out that the wetland is affected by unplanned urban expansion and rampant encroachment virtually causes changes of the landscape of the beel. Silsako is getting degraded due to impact of fast growing urban development resulting a host of problems like waterlogging, reduction in aquatic flora and fauna, loss of water quality and other environmental problems. Using GIS they find out that in 2020 it was reduced in area by 32.31 ha. and during the primary survey it came to notice that 12 hectars of wetland area is being illegally occupied by human settlements and some structures have come up including road work. This study has revealed the gravity of degrading ecological problem of the wetland which calls for an adequate interdisciplinary policy and political will to implement sustainable management programmes for protection of the ecologically sensitive ecosystem in Guwahati city.

Phukan Pratyashi and Saikia Ranjan (2014) "Wetland and its conservation: A case study of selected wetlands of Golaghat district, Assam India." Six selected wetlands are surveyed to find out the use of wetlands and human interference on them. Waste disposal is the main concern issue of human interference and fishing activities have also resulted in degradation of wetland. Most of these wetlands are situated at along the riverside of mighty Brahmaputra and some of the wetland situated under the area of Kaziranga National Park. Decreases in volume of the sample wetland are the human encroachment for cultivation of the bank.

Mahmud Malik Sezanet *et. al.* (2011) in their journal "Remote Sensing and GIS based Spatio-Temporal Change Analysis of Wetland in Dhaka city, Bangladesh" evaluates wetland changes in Dhaka metropolitan area, Bangladesh, between 1978 and 2009. Spatial and temporal dynamics of wetland changes were quantified using four Landsat images, a supervised classification algorithm and the post-classification change detection technique in GIS environment. The analysis revealed that the area of wetland and rivers & khals in Dhaka city decreased significantly over the last 30 years by 76.67% and 18.72% respectively. This changing trend of wetlands makes the drainage system of Dhaka City vulnerable, creating water logging problems and their consequences.

Das Inamoni (2015) in her research paper 'Degradation of Wetland Environment: A case study of Dora Beel of Kamrup District Assam' studied about the status of wetland and

analyze its environmental degradation. The Dora beel wetland has been experiencing serious anthropogenic threat from agricultural intensification, pollution, infested by invasive weeds etc. The local people of the area directly dependent on wetland for their livelihood, and filled the land for settlement, construction of motorable road from north to south is found at eastern side of the wetland. It becomes grazing ground for cattle like cow, goat in winter season also. Using the wetland for grazing land, dumping of domestic waste, garbage etc. are prominent at the beel site. Besides these construction of Brewery industries at the beel has been laid down by government that will further deteriorate the existing vulnerable condition of the beel. The changing land use system and the livelihood has a great impact to the degrading biodiversity of the wetland which is a matter of concern.

1.4 Objectives:

1. To study the land use and land cover change of Deepor beel
2. To identify the causes of degradation of Deepor beel
3. To assess the impact of urbanization on the wetland

1.5 Research Questions:

To find out the occurrence of certain problems faced by a particular area it is important to know about the causes which is possible through enquiries. In order to achieve the goal of the objectives the following research questions are framed:

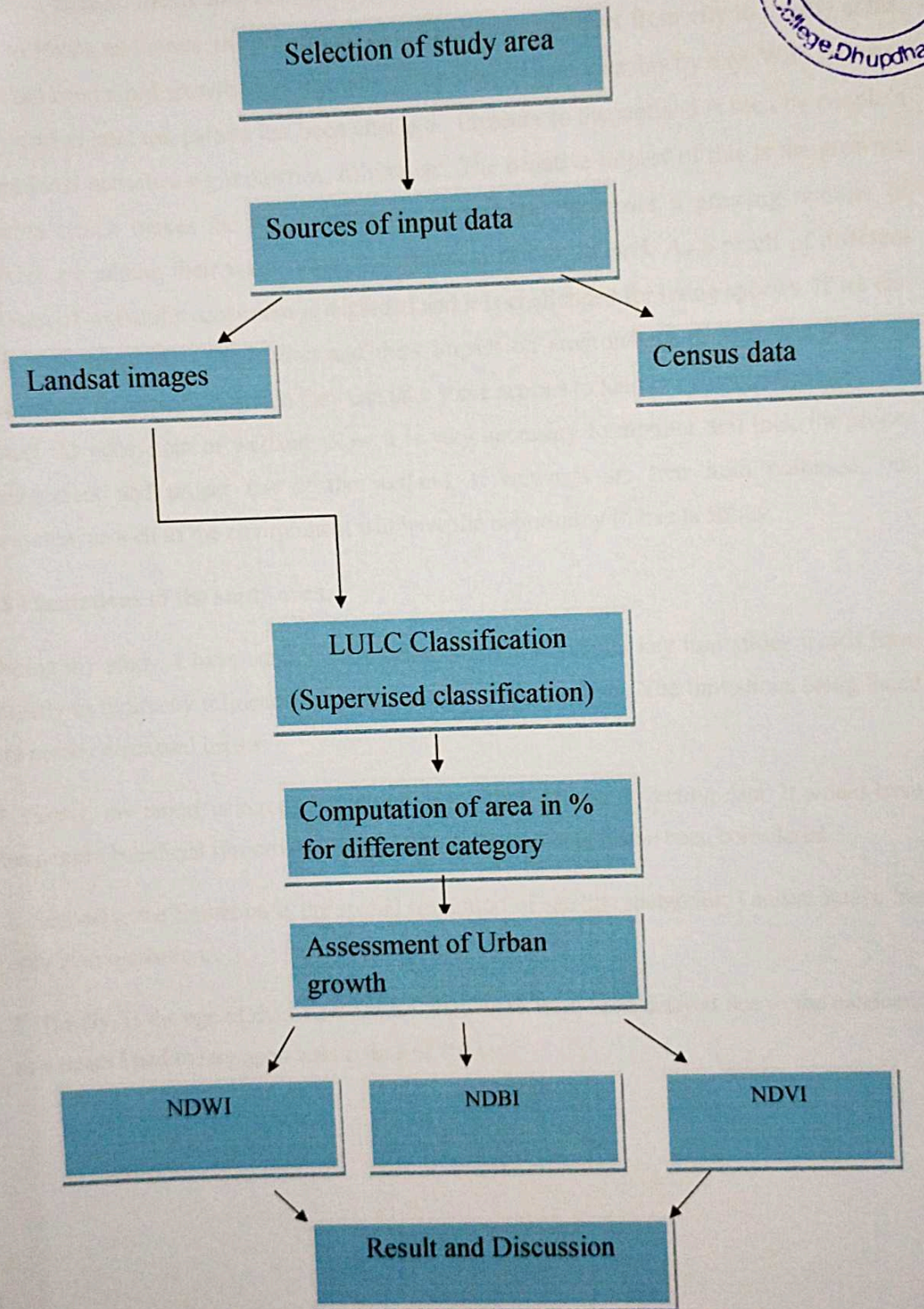
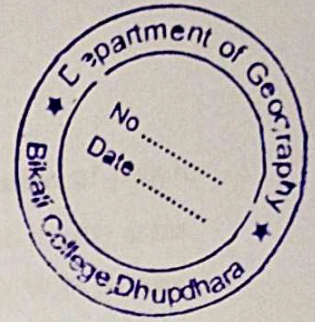
- What are the factors responsible for urbanization?
- How does urbanization have an impact on the human and physical environment of Deepor beel and its neighbouring areas?
- Why people used to stay near Deepor beel

1.6 Methodology:

A methodology is a technique designed to carry out research, a task, or any particular activity. Methodology is the philosophical framework within which the research is conducted or the foundation upon which the research is based (Brown, 2006). To carry out the study on impact of Urbanization on the Deepor beel wetland area following methodology has been undertaken.

The study is mainly based on a secondary source of data. Firstly literature review is done related to the topic of interest. The data relating to population and area have been collected from various published sources which are then ordered, tabulated and various statistical diagrams have been prepared with the help of Microsoft excel. Satellite imageries were collected from the United States Geology Survey in order to depict various analyses related to urbanization. Geo-spatial maps were generated by using World Geodetic Survey(WGS,1984) and Universal Transverse Mercator Projection (UTM) through Arc GIS software.

METHODOLOGY FLOWCHART



1.7 Significance of the study:

As I have already mentioned that Urbanization is the increase in the proportion of people living in towns and cities, the population of a place may spill over from city to nearby areas. There has been rapid growth of settlements in the Deepor beel area day by day. With increase in population land use pattern has been changed. Pressure to the wetland is seen by people's occupational activities e.g industries, fishing etc. The negative impact of this is the growing pollution which makes the soil infertile for agriculture. Moreover a growing number of factories are adding their waste water and garbages to the wetland. As a result of different activities of wetland's ecosystem is degraded and it is challenged for living species. If we can show the causes of urbanization and their impact on environment through the study to government or some NGOs then they can take some actions to help our environment and also protect the ecosystem of wetland. Now it is very necessary to monitor and look for proper management and proper use of the wetland. If wetlands are free from pollution, our ecosystem as well as the environment will have the opportunity to live healthily.

1.8 Limitations of the study area:

During my study, I have continuously being exposed to certain key limitations which have directly or indirectly influenced the whole outcome of my study. The limitations being faced are hereby discussed below.

1. Firstly, my report is mainly based upon secondary data as collecting data. It would have been more beneficial if more methods of data collection could have been considered.
2. Secondly, the limitation is the spatial resolution of satellite imageries; Landsat image has only 30m resolution.
3. Thirdly, is the age of data, new census 2021 work have been delayed due to the pandemic as a result I had to rely upon census data of 2011.

CHAPTER 2

GEOGRAPHICAL BACKGROUND OF THE STUDY AREA

2.1 Physical settings :

2.1.1 Location:

Dipor beel or Deepor beel is located to the south-west of Guwahati city, in Kamrup Metropolitan District. Deepor beel is the only Ramsar site of Assam. Recognising its international significance, Deepor beel was added to Ramsar list as number 1207, due to its unique role in the social, ecological and cultural, social life to the population of Guwahati. This wetland is located between 26°08'N to 26°13'N latitude and 91°36'E to 96°41'E longitude. The average altitude is 50 to 57 meters above mean sea level. It covers an area of more than 40 square kilometres. The beel and its adjacent villages fall under Azara revenue circle of Kamrup-metro district. The national highway 17 is on the northern side of the Beel and touches its periphery at various places such as Dharapur, Azara etc. It is representative of the wetland found within the Burma Monsoon Forest Biogeography region. The wetland supplies a diverse group of goods and services to the local community and animal population. The wetland was declared as a Ramsar site in 2002 and within the Ramsar site was proposed as a wildlife sanctuary. It houses 80 to 120 Asiatic elephants. The wetland serves as a major fish breeding and nursery ground and supplies fish stock to other nearby waterbodies.

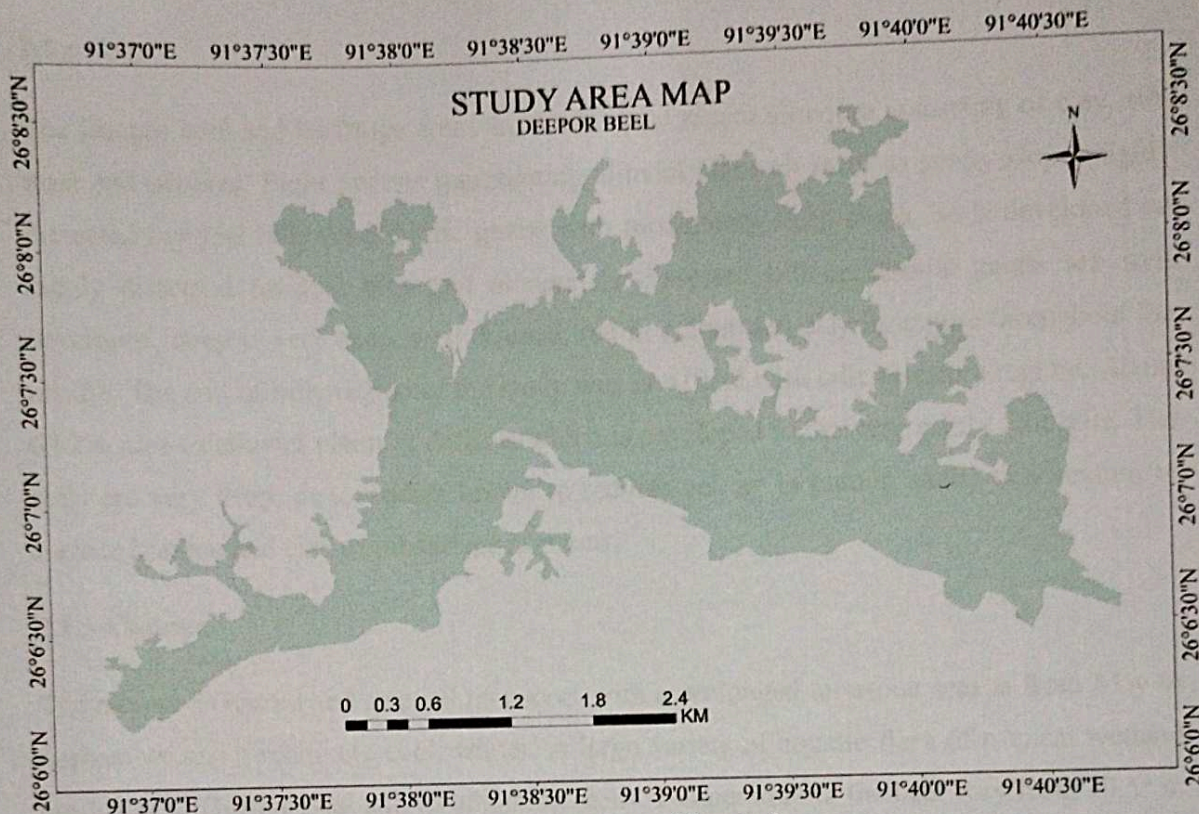


Fig 2.1: Location map of the study area

2.1.2 Physiography: The beel is bounded by the steep highlands on the north and south, and the valley formed has a broad U-shape with the Rani and Garbhanga hills forming the backdrop. The geologic and tectonic history of the region provide the links to the hydrology and channel dynamics of rivers and pattern and intensity of land use in the area. It is commonly stated that the beel together with those adjoining it are an abandoned channel of Brahmaputra consisting of clay, silt, sand and pebbles, the highlands immediately to the north and south of the beel are made up of gneisses and schists of the Archaean age.

2.1.3 Drainage: The Basistha and Kalmani rivers and local monsoon run-off are the main sources of water to the lake, between May and September. Khonajan channel drains the beel into the Brahmaputra river, 5 km to the north. It acts as a natural stormwater reservoir during the monsoon season for the Guwahati city (stated to be the only major storage water basin for the city's drainage with about four metres depth of water during monsoon dropping to about one metre during the dry season). The beel has a perennial water spread area of about 10.1 km square, which extends up to 40.1 km square during floods. However, an area of 414 ha has been declared as "Deepor Beel Sanctuary" by the Government of Assam. As per a Remote Sensing Study the wetland area is reported to have reduced to 14.1% (405 ha) from 1990 to 2002.

2.1.4 Soil:

The Deepor beel and its fringe areas are made up of recent alluvium consisting of clay, silt, sand and pebbles. Eight pedons representing alluvial plain on level to gently slope, highly dissected residual hills on granitic gneiss with moderately steep slope. Soils developed on highly dissected residual hills and moderately dissected hill on granite gneiss are well developed, deep to very deep, well drained, red in colour and clay in texture throughout the profile. The soil of hilly region of the study area is Alfisol with udic moisture regime. About 62.2% area of alluvial plains is Alfisols which is developed in the very gently foot hills. The soils are very deep, dark reddish brown to reddish yellow in colour, sandy clay texture in surface horizon and clay in subsurface horizons.

2.1.5 Climate:

The climate is humid and tropical monsoon, with a prolonged monsoon season from May to September and a relatively cool, winter. A large variety of aquatic flora of tropical wetland are found in Deepor Beel and its adjoining areas. Temperature in the beel vary from 10.6° to 32°c. During the winter months, when the size of the lake reduces in area by about 50%, the shore area (up to 1 km) is cultivated with rice paddy when the climate is also relatively cool and dry. The tropical monsoon climate prolongs from May to September when it is humid. Pre monsoon showers are experienced between March and May.

2.1.6 Natural Vegetation:

A large part of the beel during summer is covered by aquatic vegetation, like water hyacinth, aquatic grasees, water lilies, etc. Dominant tree species in the nearby deciduous forests include Teak, Banyan tree, Silk Cotton Tree, etc. The dominant aquatic plants include Water Hyacinth, Water Lettuce, Duckweed, Tape Grass, Hydrilla, Water Bindwood, Red water Lily, etc.

2.1.7 Animal Species:

In the nearby Rani RF and other forested areas, mammals such as Hoolock Gibbon *Hylobates hoolock*, Assamese Macaque *assamensis*, Rhesus Macaque, *Macaca Mulatta*, Capped Langur *Trachypithecus pileatus*, Slow Loris *Nycticebus coucang*, Leopard *Panthera pardus*, Jungle cat *Felis chaus*, Leopard cat *Prionailurus bengalensis* etc. In addition to a huge number of residential birds. Deepor beel provides shelter to a large number of migratory birds each year like Siberian cranes. During winter, it witnesses some of the large congregations of aquatic birds. It is considered one of the staging sites for migratory birds in India. Some unique migratory bird species that can be spotted here are the white-eyed pochard, the graylag goose, Baer's pochard and the gadwall, a dabbling duck. Approximately, 50 fish species and aquatic resources provide livelihood support to about 1,200 households residing in about 12 villages on the fringes of the wetland. A rich variety of other aquatic species comprises 20 amphibians, 18 snakes, 12 lizards, and 6 turtle and tortoise species are listed. Many wild Asiatic elephants from the Rani and Garbhanga Reserve Forests in Kamrup East Division can be seen. Some endangered species, like Lesser Adjutant Stork, Spot-billed Pelican, Baer's Pochard, Greater Adjutant Stork, White Bellied Eagle, etc that are included in IUCN Red List, are also seen here.

2.2 Demographic Settings

2.2.1 Population:

The north-eastern part of the beel is contiguous with several thickly populated villages, extending up to a major highway NH17 on the east. Deepor beel area is surrounded by 12 villages. The total population of these villages is upto 6000.

Table 2.1: Village wise population of neighbouring areas of Deepor beel

Name of the villages	No. of households	Population	Name of the revenue villages
1. Khanamukh	50	250	Dharapur
2. Hirapara	80	400	Azara
3. Gohaingaon	60	300	Azara
4. Kewatpara	80	240	Azara
5. Matiapara	100	400	Kahikuchi

2.2.4 Transportation:

The nearest bus stand to Deepor Beel is Dharapur Bus Stop which is 11.6 km away. The nearest junction to Deepor Beel is Kamakhya Junction which is 14.4 km away and can be easily reached by rickshaw. The distance between Deepor Beel and Guwahati airport is 9.7 km from here taxis can be taken.

CHAPTER 3

LAND USE LAND COVER DYNAMICS:

3.1 Introduction:

Land cover maps are tools that provide vital information about the earth's land use and cover patterns. They aid policy development, urban planning, and forest and agricultural monitoring. Land cover indicates the physical land type such as forest or open water whereas land use documents how people are using the land. By comparing land cover data and maps over a period of time, coastal managers can document land use trends and changes. Land use and land management practices have a major impact on natural resources including water, soil, nutrients, plants and animals. Land use information can be used to develop solutions for natural resource management issues such as salinity and water quality.

Analysis of land use and land cover change is a key aspect of the landscape dynamics or environmental health evaluation at different spatio-temporal scales. Assessment of land uses, land cover change is of prime importance in evaluating the environmental and ecosystem management, conservation, resource management and sustainable environmental management.

A change in land use and land cover imparts a significant impact upon the environment. The policymakers require data of the land use and land cover changes for proper implementation of policy to ensure the sustainability of the environment and human and environment-friendly urban growth. "Remote sensing is the noncontact recording of information from the electromagnetic spectrum by means of mechanical, photographic, numeric, or visual sensors located on mobile platforms" (Jay Fussell et al.) The use of remote sensing (RS) together with Geographical Information System (GIS) is one of the most effective information

technology tools to produce Land use and land cover change information. It is one of the important means to show change detection. This study deals with its aims to explore the causes of land use and land cover change and the impact of resultant urban expansion upon humans and the environment.

3.2 Land use land cover classification:

The present study is carried out by dividing land use and land cover categories into four classes as Built-up areas, Agricultural lands, Vegetation, and Waterbody. The feature of each classified category is described below:

A. Built-up areas: In this category, all residential types like high-rise buildings, huts, hotels and restaurants, all manufacturing industries ranging from light industries to heavy industries, commercial, recreational areas such as parks, stadiums, playgrounds, etc. Transportation means like roads, railways, airfield, educational institutions like schools, college, university, etc, hospitals, public and semi-public buildings, all are included in Built-up areas.

B. Agricultural lands: This category includes all cultivated lands use for the production of a variety of crops. Other than the growing of food crops, it also includes other types of agricultural activities like horticulture, pisciculture, cultivation of tea, etc.

C. Vegetation: It includes all the forest cover types and other vegetation types like scrublands, grasslands, etc.

D. Water body: This category includes all types of surface water bodies like rivers, ponds, lakes, reservoirs, etc.

3.3 Spatiotemporal changes of land use and land cover classes:

To provide a suitable picture of the spatial expansion of the urban area in the study over the years based on its temporal changes the built-up area of the study area has been adopted as the indicator for the analysis because of the fact that the built-up area is the key indicator of the urbanization.

From the analysis, it has been found that the expansion has taken place in all direction of the wetland over the years. The Indian Railways constructed the southern railway track in 2001, an action which gradually divided the Deepor Beel into segments and thus affected the

wetland in particular and the ecosystem as a whole. Illegal settlements, setting up of factories, construction of highways, etc. have also hampered the wetland in many ways. The following land use and land cover maps of different years give us a clear glimpse of how urban area is expanding. The red pixel representing settlement has significantly increased itself within the years from 2002-2022 which implies how it has encroached upon the area covered by vegetation.

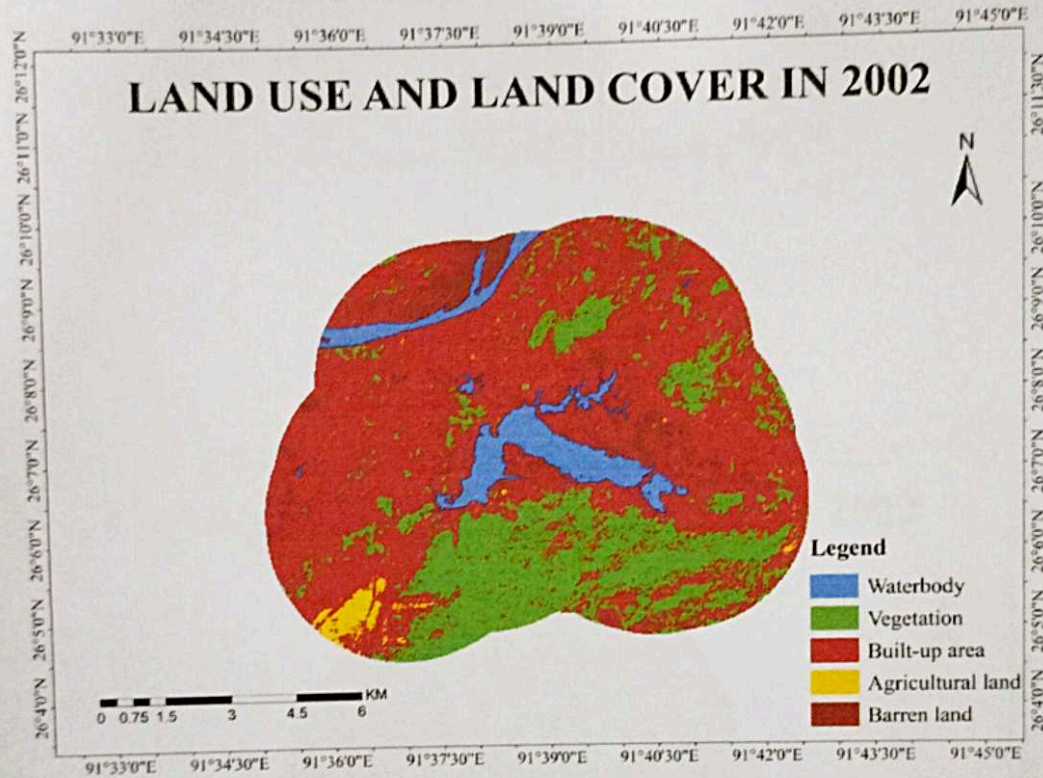


Fig no. 3.1 Land use and land cover map of 2002

Table no 3.1 Land use and Land Cover, 2002

LULC categories	Area in sq km	Percentage (%)
Agricultural land	1.88493	1.86
Barren land	14.1161	13.96
Built-up area	48.9609	48.41
Vegetation	29.767	29.43
Waterbody	6.41624	6.34
Total	101.14517	100.00

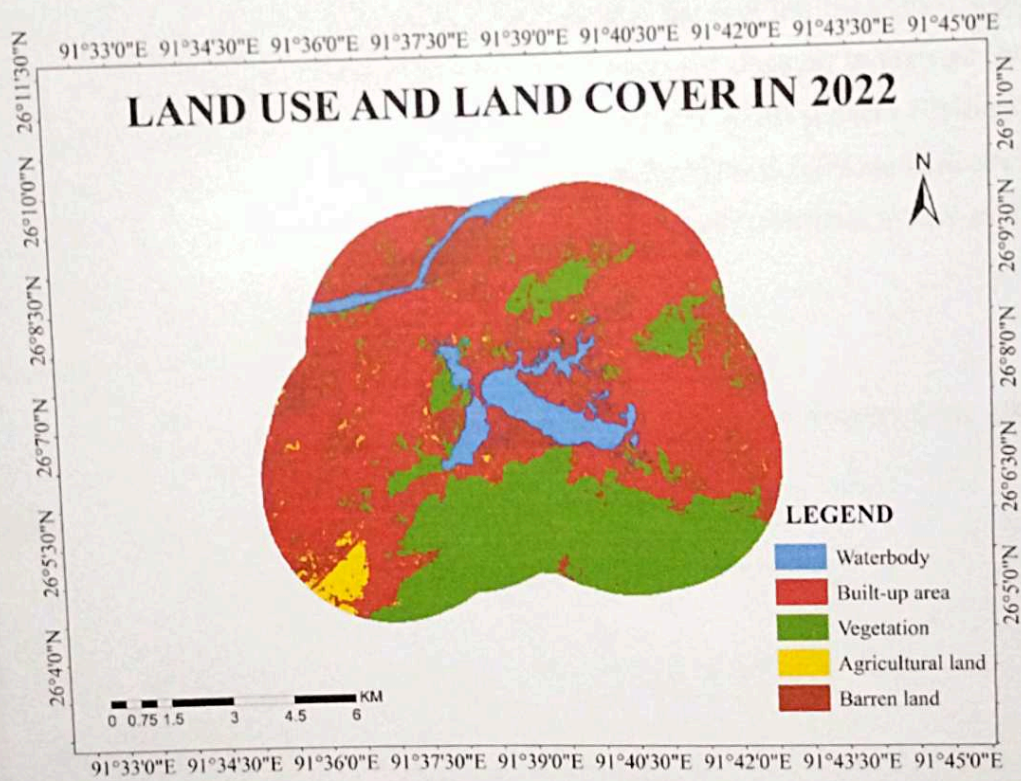


Fig 3.2 Land use and land cover in 2022

Table 3.2 Land use and Land cover in 2022

LULC categories	Area	Percentage (%)
Agricultural land	1.46162	1.45
Barren land	6.53736	6.46
Built-up area	61.3066	60.62
Vegetation	24.8057	24.53
Waterbody	7.02769	6.95
Total	101.139	100.00

From the above figure and table, we can conclude that the area has undergone significant changes during 2002-2022. Nearly every aspect has witnessed changes. In the year 2002 the built-up area was 48.41%. In 2022 it has increased to 60.62% which is about 12% increase in built-up area. These changes in the spatial expansion of the built-up areas are basically due to the expansion of households and other social and urban infrastructures in the study area brought by growing population over the years.

3.4 Change analysis in Land use and Land cover categories:

To analyze land use land cover change in the study area. Satellite imagery from 2002 to 2022 acquired from USGS.

Table 3.3: Change analysis 2002-2022

LULC categories	2002	2022	Change
Agricultural land	1.86	1.45%	-
Barren land	13.96%	6.46%	-
Built-up area	48.41%	60.62%	+
Vegetation	29.43	24.53	-
Waterbody	6.34	6.95	+

During the stage from 2002 to 2022, positive changes have occurred in the case of built-up areas. From the following table the area of built-up area increase 48.41% to 60.62% from 2002 to 2022. The dominant changes have occurred in the case of built-up areas which is about 12% increase. Vegetation cover has also decreased 29.43 to 24.53 from 2002 to 2022. Vegetation cover has decreased to some extent since most of the people converted into their habitation areas.

The above table indicates the change in land use and land cover categories. The maximum change has occurred in built-up area in the year 2002-2022. The minimum decrease is seen in agricultural land.

3.5 Change detection analysis:

From the following figure and table, it can be analyzed that the maximum change has occurred in the categories of built-up area and vegetation. It shows that barren land is encroached by built-up change in 3%, vegetation is encroached by built-up area is 4%, built-up area changed to barren land 9% due to might be industrial work.

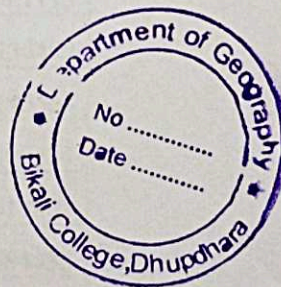


Table3.4 Change in the land use land cover categories from 2002 to 2022

Change (2002-2022)	Area change
Agricultural land - Agricultural land	0.929848
Agricultural land - Barren land	0.172263
Agricultural land - Built-up area	0.348883
Agricultural land - Vegetation	0.007954
Barren land - Agricultural land	0.079155
Barren land - Barren land	2.793233
Barren land - Built-up area	3.00283
Barren land - Vegetation	0.197847
Barren land - Waterbody	0.455184
Built-up area - Agricultural land	0.835017
Built-up area - Barren land	9.348843
Built-up area - Built-up area	40.776624
Built-up area - Vegetation	9.370999
Built-up area - Waterbody	0.924686
Vegetation - Agricultural land	0.031991
Vegetation - Barren land	0.766551
Vegetation - Built-up area	4.1113
Vegetation - Vegetation	19.730497
Vegetation - Waterbody	0.146565
Waterbody - Agricultural land	0.00414
Waterbody - Barren land	1.018307
Waterbody - Built-up area	0.684632
Waterbody - Vegetation	0.432429
Waterbody - Waterbody	4.887205

CHAPTER 4

ASSESSMENT ON DEEPOR BEEL:

4.1 Application of GIS and remote sensing various indices in wetland monitoring:

NDBI, NDVI, NDWI are used in project work to extract the required project work to extract the required images from the selected area and wetland. These indices help in the modeling, predicting to get a distinctive appearance of objects. With the help of NDVI, the difference between visible and near infrared reflectance of vegetation cover is described. The NDVI value ranges from -1 to +1. Lack of vegetation is indicated when the NDVI value is negative or close to zero, whereas a high value or close to 1 indicates high concentration of green and matured vegetation (Cai Gao, 1996). NDWI is used to portray the water features and soils rich in moisture. The NDWI values range from -1 to +1. The value of -1 to 0 indicates no water content and the value +1 indicates availability of water content.

4.2 NDBI Analysis:

The Normalized Difference Built-up Index (NDBI) uses the NIR and SWIR bands to emphasize manufactured built-up areas. It is ratio based to mitigate the effects of terrain illumination difference as well as atmospheric effects. The NDBI values range from -1 to +1. High NDBI values indicate that the built-up areas and low NDBI values show the other regions.

The formula of calculating NDBI is -

$$\text{NDBI} = (\text{SWIR} - \text{NIR}) / (\text{SWIR} + \text{NIR})$$

In the following figure red color represents the built-up areas. Here we can observe the increase in the value of built-up area from 2002-2022.

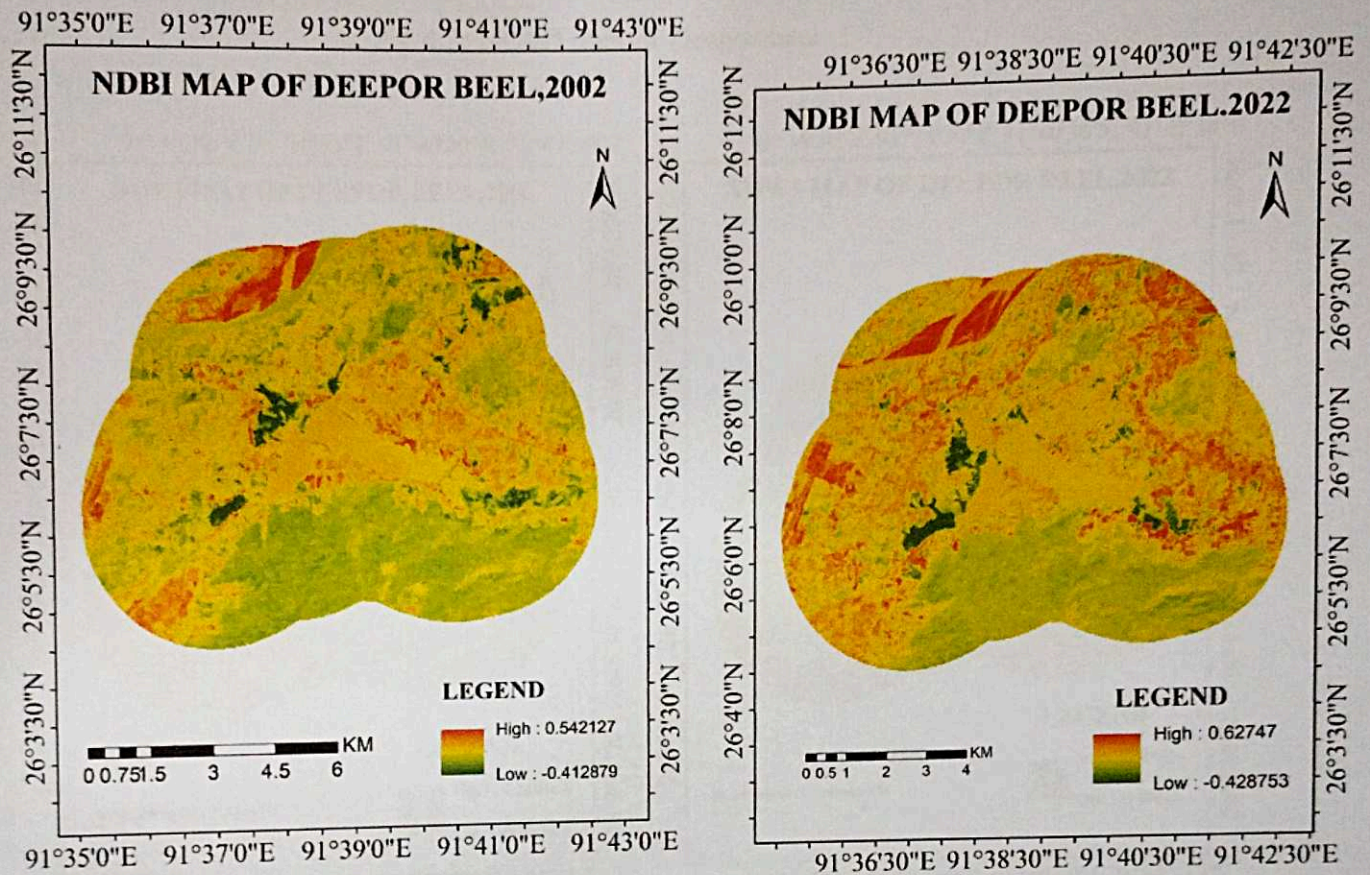


Fig 4.1: NDBI map of Deepor beel

4.2 NDWI Analysis

The Normalized Difference Water Index (NDWI) is used to highlight open water features in a satellite image, allowing a water body to “stand alone” against the soil and vegetation (<https://eos.com>). It may refer to one of at least two remote sensing derived indexes related to liquid water.

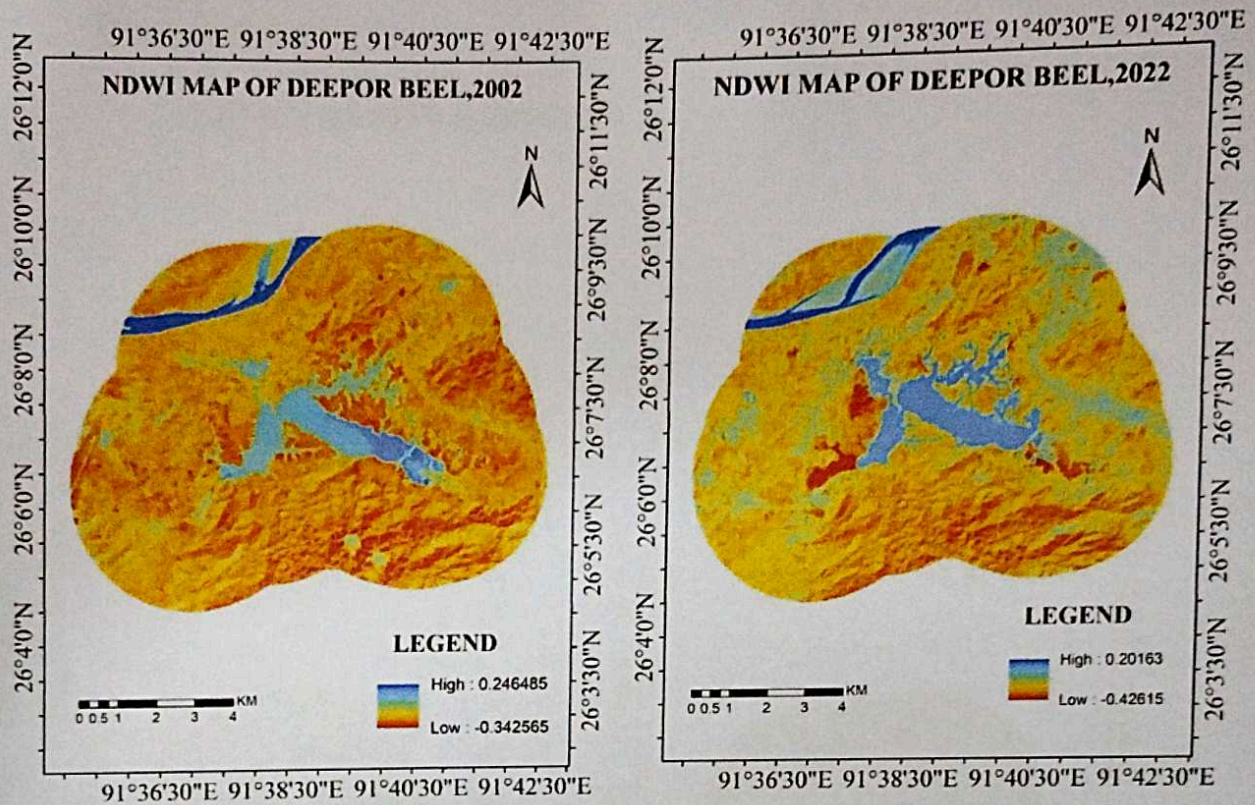
The formula of NDWI is:

$$NDWI = (NIR - SWIR) / (NIR + SWIR)$$

Here +1 signifies the presence of extensive deep water bodies and -1 is for vegetation cover.

The NDWI is used to monitor changes related to water bodies.

Fig 4.2: NDWI map of Deepor beel



As water body strongly absorb light in visible to infrared electromagnetic spectrum, NDWI uses green and near infrared bands to highlight water bodies. It is sensitive to built-up land and can result in over estimation of water bodies.

4.3 NDVI ANALYSIS

Normalized Difference Vegetation Index (NDVI) quantifies vegetation by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs). It is based on the spectral reflectance of green plants. Its value lies between -1 to +1. NDVI value which is negative represents deficiency of vegetation. It indicates how thick the vegetation cover in a particular area. High NDVI value represents dense and healthy vegetation while lower value or near to zero represents scarce vegetation or without vegetation. For example, when we have negative values, it's highly likely that it's

water. On the other hand, if we have an NDVI value close to +1, there is a high probability that it's dense green leaves. But when NDVI is close to zero, there are likely no green leaves and it could even be urbanized area.

The formula of NDVI is-

$$\text{NDVI} = (\text{NIR} - \text{RED}) / (\text{NIR} + \text{RED})$$

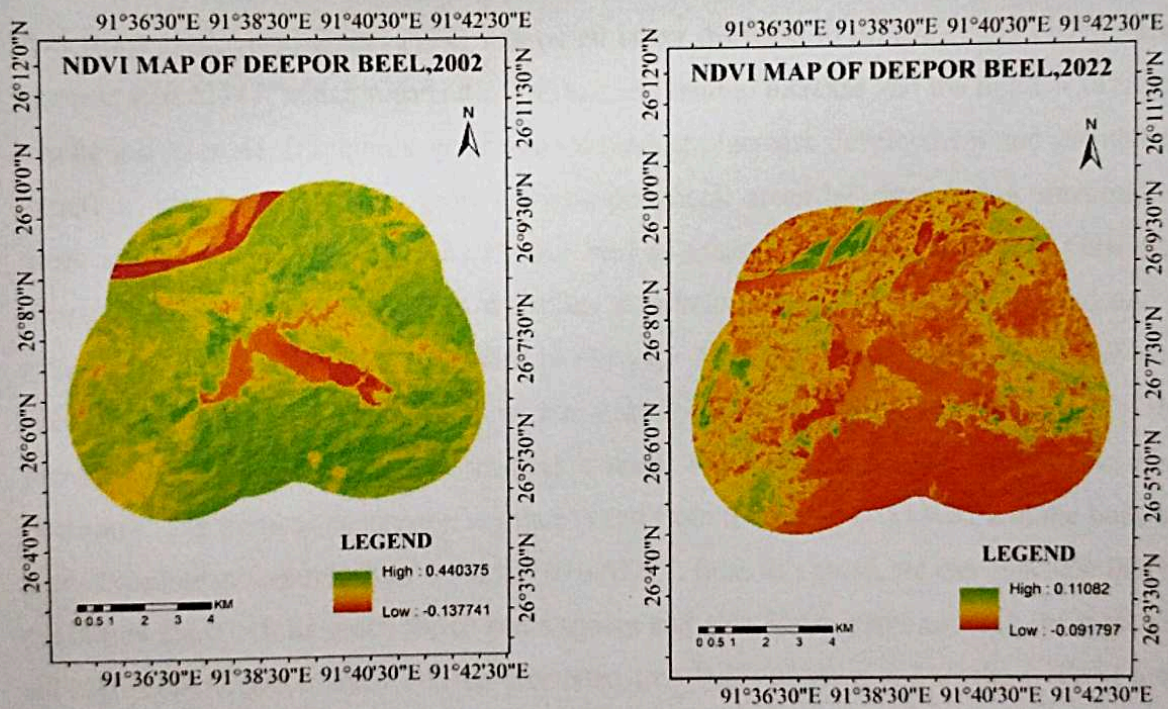


Fig 4.3: NDVI map of Deepor beel

4.4 Correlation between NDBI, NDWI and NDVI:

Table 4.1 : correlation between NDWI and NDVI

Year	NDBI		NDWI		NDVI	
	High	Low	High	Low	High	Low
2002	0.542127	-0.412879	0.246485	-0.342565	0.440375	-0.137741
2022	0.62747	-0.428753	0.20163	-0.42615	0.11082	-0.091797

There is a negative correlation between NDBI, NDWI and NDVI. As the value of NDBI increases NDWI and NDVI also decreases of the study area. In 2002 the maximum NDBI value was 0.542127 whereas the maximum NDWI value was 0.246485 and maximum NDVI value was 0.440375 which is higher than NDWI. This means that vegetation cover was more than water body. In the area 2022, vegetation cover decrease to 0.11082 and NDBI value increase to 0.62747, which means the development tend to increase and the number of urban population increase. It requires space to accommodate increase development and population therefore urban areas start to grow towards peripheral areas by encroaching surrounding green spaces and water spaces. As Deepor beel is situated in peripheral area of Guwahati metropolitan, the development and the urban population pressurized on the wetland and it also affects the ecosystem of wetland. In the year 2002 the NDWI maximum value was 0.246485 and decrease to 0.20163 in the year 2022 of the study year because of the increasing of built-up in wetland area, as a result vegetation cover and water cover also decreases. The trend of decreasing vegetation and from 0.440375 to 0.11082 and the built up areas continue to increase from 0.542127 to 0.62747. from this trend, we can conclude that in the future there will be much fewer green spaces and also fewer water cover in the wetland; all the available green areas will be converted into built-up areas and in the wetland area some parts were started to convert to built up areas. People buries soil in low water areas of Deepor beel wetland and build houses because lack of space in Guwahati city and it's peripheral areas.

4.5 Causes of Degradation of Deepor beel:

Biotic diversity change and climate change is the major problem caused by rapid and unplanned development of urbanization. High population growth and more demand for land have been changing the urban landscape of Guwahati city. Urbanization in Guwahati is complex, diverse and fragmented which results in the modification of the natural land cover of the city (Borthakur Monjit, Nath Bhrigu Kr.).

According to experts, many fish species in Deepor Beel have become extinct and many are facing the threat of extinction because of continuous water pollution. Further alteration of the beel can cause flash floods. The wetland ecosystem is disturbed by the railroad in its southern boundary. The wetland is experiencing adverse human activities; filling of wetlands for habitation purpose, cutting sides of wetlands, pollution, fishing, killing of migratory birds, excessive fodder practices etc.

For the past 15 years, from 2006 municipal solid waste of Guwahati has been unscientifically dumped next to the Deepor beel in Boragaon (24ha) lies in the eastern corner of Deepor beel. Later it shifted to another location in 2021. Filling of wetlands for habitation, excessive pollution from the dumping site is causing the degradation of wetland. The Northeast Frontier Railway (NER) constructed a railroad along the southern boundary of the deepor beel in 2001. The wetland ecosystem has disturbed by the railroad as it has fragmented the wetland into two parts. Pollution from industries and dumping site is causing extinction of fish species.

4.6 Impact of urbanization on the human and physical environment on Deepor Beel area

Urbanization has both positive and negative impact. The positive effects of urbanization are the higher standards of living associated with better food, better education, housing, health care and creation of employment opportunities, technological and infrastructural advancement. Nearly everywhere around the globe along with the town and cities, we witness its various implications upon the environment and human beings. In some ways, it helps in economic development and creating opportunity for people and enhancing economic growth while in some other ways it acts exactly the opposite creating an unfavorable environment for living and degrading the environment. The same consequences can be observed around the study area.

Deepor beel is a permanent fresh water lake and the only Ramsar site in Assam is experiencing adverse human activities; filling of wetlands for habitation, cutting the sides of wetland, pollution, fishing, killing of migratory birds, excessive fodder practices etc. For the past 15 years, municipal solid waste of Guwahati has been unscientifically dumped next to the Deepor beel. The dumping site set up in 2006 and it shifted to another location in 2021, about half a kilometer from old site, although huge amounts of legacy waste still remain. According to experts, many fishes in Deepor beel have become extinct and many are facing the threat of extinction because of continuous water pollution. Further alteration of the beel landscape can cause flash floods. The wetland ecosystem is disturbed by the railroad in its southern boundary.

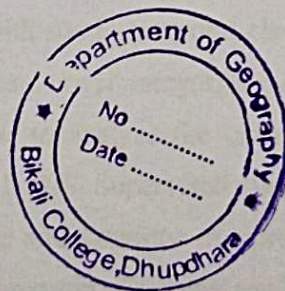
Rapid growth of city population and land cost increase has resulted in the encroachment of the Deepor beel. Northern and eastern parts of the Beel have been occupied by the private as well as the government organizations. Encroachment has blocked the natural drainage pattern of the Deepor beel causing the water level imbalance in the Beel. Soil erosion and improper catchment treatment and agriculture practices have led to sedimentation in the beel. Encroachment problem and land use change has changed the spatial pattern Deepor beel water area. In a study shows that the change in permanent water land has decreased day by day. The permanent lake water area has decrease from 7.1 sq km in 1991 to 5.2 sq km in 2001 and to 4.2 sq km in 2010 (Deka Jyotishman et al). Decrease in water body spatial extent of Deepor Beel is indication of adverse impact of urbanization. Growth of aquatic weeds has seen in deepor beel area. Major cause of weeds growth is mainly because of the nutrients and sewage flow to the beel. Chemical manure in the agricultural land in the nearby areas of the beel increases the nutrient supply to the beel. Guwahati oil refinery waste is directed through Bharalu and Kalamani rivers to the beel. The channels also carry other industrial and hospital waste to the beel. The water has turned black and smelly. Sewage discharge into the water might have caused the fall in oxygen levels resulting in the death of fishes.

Dumping of municipal solid wastes in its close proximity at Boragaon by the Guwahati Municipal Corporation(GMC) has pushed the wetland's pollution to alarming levels. The problem has got aggravated during the monsoons with rainwater sweeping large amounts of garbage from the dumping site to the beel. which result death of fishes. Later the dumping site shifted to another location but huge amounts of legacy waste still remain. Farmers, residents, scientists and environmentalists allege that pollution from the waste dump is harming residents, livestock and aquatic fauna. Buffaloes of residents in Paschim Boragaon

village near the Deepor beel, graze on ground adjacent to the wetland, feeding on the abundant greens. Recently 14 buffaloes developed severe health issues after grazing there; four of them died soon after. This is suspected to be because of pollution in the wetland that is adjacent to the Guwahati Municipal Corporation's waste dump.

There are lots of stone quarries existed in the Rani hill. During rainy seasons the mud water coming from the hills and settled under the bill which causes siltation and results in the decreasing the depth of the beel. Establishment of industries within periphery of wetland ecosystem is leading to water quality deterioration and soil pollution. Permitting temporary brick kilns and associated soil quarrying from within the wetland have led to massive destruction of top soil and other ecosystem components. There are long term negative environmental impacts of establishment of brick kilns on soil productivity and soil micro flora and fauna.

Hunting, trapping and killing of wild birds and mammals and community fishing activities has adversely affected the beel ecosystem. Community fishing and catching of gravid and brood fishes are causing sharp decline of fish productivity of the wetland. Species diversity and species habitat has been changed due to the unplanned fishing practice performed by the village people near the fringe areas of the Deepor beel.



CHAPTER 5

SUMMARY AND CONCLUSION:

5.1 Summary:

The present study is conducted in order to understand the impact of urbanization on human being and environment of Deepor Beel area. The entire study is accomplished in five chapters. The main objectives have been formulated in order to fulfill the aim of the study. Various geographic techniques and ArcGIS have been used to the work. The first chapter of the study constitutes an explanation and evaluation of available literature done ny the researchrers related to impact of urbanization, stating objectives of the study, methodological approach of the study as well as significance and limitation of the study. The chapter give a general review of the present study.

The second chapter tried to sketch out the physical, demographic and socio-economic background of the study area. Deepor Beel is only Ramsar site of Assam, it is located to the south-west of Guwahati city. The beel is bounded by the steep highlands on the north and south and the valley formed has a broad U-shape with the Rani and Garbhanga hills forming the backdrop. The Basistha and Kalmani rivers and local monsoon run-off are the main source of water to the lake.

The third chapter mainly deals with spatio-temporal changes in the study area. It also tried to show changes in land use and land cover categories over different periods. 2002 and 2022 have been taken as the base year to analyze the changes. Satellite imagery of two different period has been acquired from USGS. Supervised classification has been done, from this, it is found that built-up areas of the area continue to increase while the vegetation land and water cover continues to go on decreasing. Thus we can conclude that the increase of built-up areas is happening by the encroachment of areas over surrounding water and green spaces. Also Guwahati Municipal Corporation's dump waste affected the wetland very badly, polluted the wetland and deteriorated water quality which causes extinction of fish species. This will lead to a serious problem in the upcoming days thus people should be aware of this fact and should take immediate steps so that wetland's environment grow in a sustainable manner.

The fourth chapter mainly focuses on the assessment on Deepor beel. Here NDBI, NDWI, NDVI techniques are used to show the value of increase and decrease. With the result of NDBI the increasing of built up areas is seen through year while NDWI value decreases from 2002 to 2022 due to habitation purposes and industrial work on surrounding of wetland. and also the value of NDVI decreases over the year, people started to cut forest for their fulfillment of needs. With the going on project of smart city many construction has going on over the Guwahati city people facing lack of space for their habitation, people shift their habitat to near wetland area later filling the wetland for habitation.

5.2 Findings

From the present study, we can conclude that urbanization is occurring in the study area and still continues to grow in the future. The area has witnessed tremendous growth in its population as well as an increase of dwelling areas, business and trade activities, development activities etc. it has increased in such a rapid manner that it started to grow towards periphery areas to accommodate increased population and commercial activities.

One of the main causes of growing built-up area in wetland area because of lack of spaces in city and increases of population in Guwahati city. Many industrial works in going on near the wetland and it affected the wetland ecosystem through the pollution that come from industrial work. Farmers left with no jobs or no source of income that's why they practices fishing in wetland and it results decreases of fish species.

5.3 Suggestions

For the better development of city and for better environmental conditions of the study area, the following suggestions can be followed:

1. There should be proper management of the wetland and surrounding area near wetland
2. Government should make some actions for the people to make the wetland in good condition and also waste disposal should not be to throw away to the water
3. Government should take strict actions on illegally constructed buildings, illegally constructed industry. There should be a frequent clean up of disposal that found on water

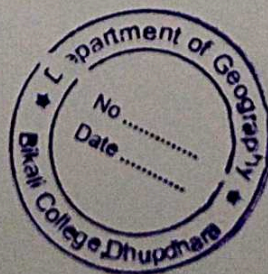
4. NGO should take some actions to make the local people of the wetland area know about the importance of wetland, importance of biodiversity and make better environment for the wetland
5. Problem of solid waste disposal is one of the burning problems in the study area. For this problem, three basic principles of Rs such as Reuse, Reduce and Recycle of waste can be followed.

5.4 Conclusion

The prime aim of the study is to identify impact of urbanization on Deepor beel wetland by making use of Remote Sensing data from USGS. Landsat 7 imagery is used for 2002 and Landsat 9 imagery is used for 2022 year. The results of the study that the built-up areas of Deepor beel's surrounding area are increased over the years as the population to grow rapidly. The spatio-temporal changes of land use land cover categories shows that vegetation cover and water cover tremendously decreased as compare to other categories. This clearly shows that increasing of built-up areas is occurring over the years. One of the unique features of Deepor beel is its location in the midst of a heavily populated and industrialized area. The wetland serves as a buffer between the city and the rural areas, providing important ecosystem services such as water purification and flood control. It is also important source of livelihood for the local communities, who rely on the lake for fishing, agriculture, and other activities.

Unfortunately, Deepor beel faces a number of threats, including pollution, habitat destruction and overuse. The lake is vulnerable to contamination from industrial and agricultural runoff, as well as from untreated sewage. Habitat destruction is also a concern as the wetland is being encroached upon by urban development and illegal logging. Despite the challenges, there are efforts underway to protect and conserve Deepor Beel.

In conclusion, Deepor beel is a vital and unique wetland located in the heart of a heavily populated and industrialized area. It provides important source of livelihood for the local community.



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