Landuse Patterns and Socio-economic Conditions of Mandra mouza, Munshiganj

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Abstract

Bangladesh is experiencing an increasing rate of land use change as a result of population dynamics, economic development, climate change, improved accessibility and technological developments in agriculture in recent years, but no quantitative analysis of land use change at the micro scale exists so far. Here, we identified the drivers of land use change in combination with environmental and socioeconomic observations at semi-urban level.

To investigate the micro level existing land use pattern, socio-economic status and environmental characteristics, the Mandra mauza in Munshiganj district was selected. Total 268 samples have been taken through a questionnaire survey and the plot-to-plot survey was conducted on 130 plots to fulfil the objectives. This study demonstrates the land use pattern, environmental and socio-economic characteristics of the study area. The area was dominated by Built-up areas, wetlands and agricultural land (cropland and inter-culture). The study also tried to identify the land use changes that took place over the years and the factors working behind it.

However, the findings of this study provide valuable information to support the sustainable development of urban and rural land use and planning processes and forecasting future possible land use changes on that locality.

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Chapter 1

Introduction

1.1 Introduction

Research comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications. It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories.

A research project may also be an expansion on past work in the field. To test the validity of instruments, procedures, or experiments, research may replicate elements of prior projects or the project as a whole. The primary purposes of basic research which is opposed to research are documentation, discovery, interpretation, or the research and development of methods and systems for the advancement of human knowledge. Approaches to research depend on epistemologies, which vary considerably both within and between humanities and sciences.

For acquiring knowledge through practical observation there is no other way without observing different physical and socio-economic conditions of various region of a country. Geographers use spatial analysis to define a particular region that process is based on practical analysis rather than descriptive method. Usually as a student of Geography and Environment we get a yearly tour trip somewhere around in Bangladesh. We try to learn many important aspects through it.

Therefore, we are the students of 2019-20 Honours 4^{th} year students went to Mandra mouza, Munshiganj district. The trip that was conducted consisted of interview sessions, observation sessions and recreational event in and around the study area.

Although the time span of the trip was limited to few days, Observations, regarding the changes in land use patterns and socio-economic conditions of the inhabitants were noted throughout the trip. So, the focus of the research report would be on the land use patterns and socio-economic conditions of the local people inhabiting there.

1.2 General Background

To investigate the micro level existing land use pattern and socio-economic status, the Mandra mouza in Bhagyakul union under Sreenagar upazila of Munshiganj district was selected. As Bangladesh is a land hungry and densely populated country, land use planning is sensitive in terms of societal and development point of view. Every inch of land in this country is valuable. But there is a lack of a comprehensive land use change database in the country. Only in depth knowledge on existing land use can save Bangladesh.

But selecting the right survey area was a huge task especially during the time of a pandemic as we had a limited time allocated to conduct the field study. We wanted to select an area where we can see the transitions happen in real-time regarding changes in land use patterns and socio-economic conditions. Besides, it needed to be located at a short distance to reduce the amount of travelling time. Finally, after a few discussions with the GIS and Research group our honourable course teachers decided the study area keeping all the things in mind.

1.3 Significance of the Study

We know that the accuracy of land use data depends upon the level of study. Although there are few studies that identify the land uses in a district level scale, there is a lack of micro level land use surveys. Micro level studies are important in order to identify local issues of land use and then relate these to the district level and subsequently nation level studies. There is study on the land use pattern of Dhaka city but we see that the smaller urban centres are highly neglected. Therefore, our study shall work in order to provide a comprehensive updated land use database for the study area.

The Land use Survey conducted maybe also be transformed into a Master Plan for the paurasavha and therefore may facilitate the growth of urbanization in the paurasavha. The socio economic survey also facilitates to understand the social dynamics that are leading to such changes and therefore this form of study shall set the direction for various other studies to address the major issues of the paursavha.

1.4 Aim of the Study

Human intervention and natural phenomenon cause change in land use day by day. Availability of accurate land use information is essential for many applications like natural resource management, planning and monitoring programs. Landuse Change has become a central component in current strategies for managing natural resources and monitoring environmental change. So, land use study is a must in developing geographic knowledge.

This field work is designed to develop first hand skills on land use survey and associated socio economic conditions. It is mandatory for 4th year students in the Department of Geography and Environment, to achieve sufficient experience in data collection of practical field work in order to gain firsthand skill in land use survey, environment analysis and socio economic studies etc.

1.5 Objectives

The main objectives of our field study was-

- To know about the current status of land use pattern and multifarious socio-economic condition of the study area
- To link up the relationship between land use pattern and socio-economic status of the study area
- To explore the factors affecting the existing land use pattern

1.6 Study Area

Situated beside the Padma river, Mandra is a semi-urban urban area of Bhagyakul union under Sreenagar upazila of Munshiganj district. Its distance from the country's capital Dhaka is about 59 kilometers. Mouza is the lowest administrative division of Bangladesh. Mouzas are also referred as villages in Bangladesh.

The mouza comprises an area of about 2.16 square kilometres. Total population is 269801 and population density is 3316 per square kilometres. The urbanization rate in the area is about 5.72% and the number of households are 57344. It is recorded as mouza number 99 in the records of Department of Land Records and Survey (DLRS).

Fig 1.1: Mandra mouza (Source Field Survey 2021)

Basic info of Sreenagar Upazilla

Urbanization Rate: 5.72%

Density per sqkm: 3316

Population Growth Rate: 1.26%

Population: 269801

Household No: 57344

Mauza No: 99

(Source: All data were collected from BBS Census data 2011)

1.7 Limitations of the Research

A number of problems were there to be faced. Some of them are as follows:

- **Short period of Observation:** The overall period of observation was very short, summing up to a total of three hours only. Hence thorough investigation into the study area was not possible.
- **Overgeneralization:** This report is being prepared on the basis of findings from a total of four interviews of the dwellers in the study area. As proper data analysis from all the researchers was not possible to accumulate, the study suffers from a lack of diversity among perspectives.
- **Biased Responses**: The respondents are often found biased to the issues which we are investigating.
- **Area Coverage by the Researcher:** It was not possible for every researcher to cover the whole of the study area which occupies a large area.
- **Insufficiency of secondary data:** The number of prior research conducted is less. As a second year student, we had limited knowledge about how to collect data interviewing respondents.

1.8 Conclusion

In order to acquire profound knowledge and practical experience there is no alternative but field survey. A survey can modify a potential amateur into an efficient person. (Jerin, 2013). At the end of this chapter, it can be said that the aim and objectives of the study has a definite destination.

Chapter 2

Methodology

Methodology describes the procedures to be followed for carrying out a research. It also explains the tools/methods to be used and how they will be used for collection and analysis of information relevant for the research work. The study has used data from primary and secondary sources. Further information has been collected from different sources like books, websites, reports and studies conducted by donors, UN and NGOs etc.

2.1 Types of Data Collected

(a) Primary Data

Primary data was mainly collected through questionnaires, informal discussions and consultation meeting with the locals and high ranking officials. The sources were-

- ***Observation*** - Closely observing the lifestyle, adjustment and behavioural patterns of the local people of the study area. The roads transportation methods, agricultural practices, institutions were also a matter of interest.
- ***Sample Survey*** - The primary data has been basically collected by direct interviews & informal discussions with the dwellers and institutes of Mandra study area. The students were provided with questionnaires by the course teacher. The questionnaire is just a formal guideline. Besides the students captured many photographs that are relevant to the purpose of the study. In total 268 respondents were approached with the questionnaires.
- ***Personal Interview:*** also called as a face-to-face survey, is a survey method that is utilized when a specific target population is involved. The purpose of conducting a personal interview survey is to explore the responses of the people to gather more and deeper information
- ***Land-use Survey*** - This was done using the fractional code method. Since our area was relatively small this type of a survey allowed us to take detailed data by dividing the study into 130 small grids thus we were able to input codes that attributed the features in that area in a short time.

- ***Fractional Code Method:*** A fractional code list containing land use codes based on various land use classifications were used to collect data in tables against the polygons drawn in the images. One of the leading geographers of the first half of the twentieth century, Vernor C. Finch played a major role in reshaping the way spatial information is cataloged and used. Fractional code allows for the collection of vast amounts of data for relatively small areas.

(b) Secondary Data

The secondary information is collected from various books, documents, research articles, newspaper articles that are related with the objectives of our study.

2.2 Working Procedure

This includes the way the data to be collected were selected and obtained, the field work and data collection and finally the processing of the obtained data. Hence the methodology of the field work could be broken down into three major segments:

1) **Pre-field Work Preparations**
2) **During Field work**
3) **Post-field Work Data Processing and Analysis**

1) Pre-field Work Preparations

This part comprises of-

- Site selection
- Dividing the study area into several grids
- Base map production
- Preparing questionnaire

- **Site selection**

  Every year 4th year students are required to go on a field study at a selected site as a part of this course. The purpose of this course is to train the students in field techniques and methods of rural and urban land use survey, environment and socio economic studies. But selecting the right survey area was a huge task especially during the time of a pandemic as we had a limited

time allocated to conduct the field study. We wanted to select an area where we can see the transitions happen in real-time regarding changes in land use patterns and socio-economic conditions. Besides, it needed to be located at a short distance to reduce the amount of travelling time. Finally, after a few discussions with the GIS and Research group our honourable course teachers declared the Mandra mauza as our study area keeping all the things in mind.

- **Base map collection and digitization:** The second part of the work required obtaining a base map of the study areas. Hard copy maps (CS and RS) were collected from Department of Land Records and Survey (DLRS) using specific JL code for the specific Mouza. The entire map was scanned and produced into machine readable format. The image was then georeferenced using Arc GIS software. After Geo-referencing the entire study area was extracted. The entire study area was divided into 167 grids and distributed among 9 groups. Each group then digitized the specific area they were assigned to do.

Fig 2.1: Map CS (Source: DLRS)

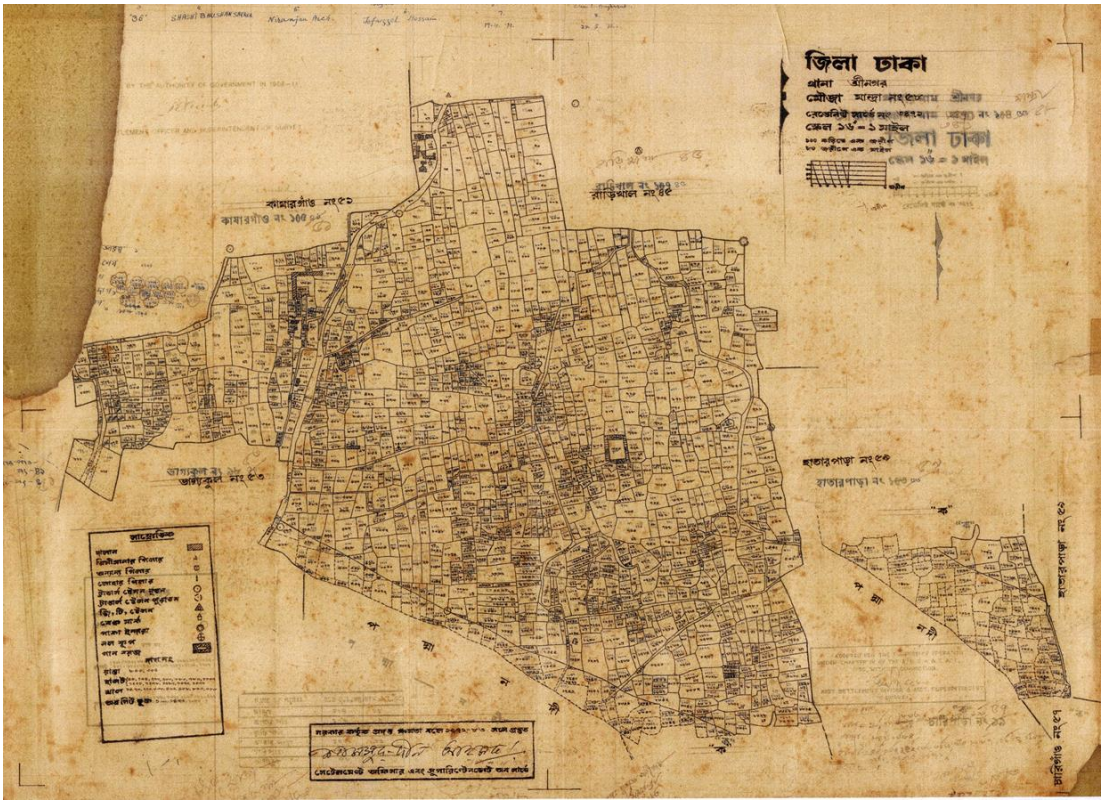

Fig 2.2: Map RS (Source: DLRS)

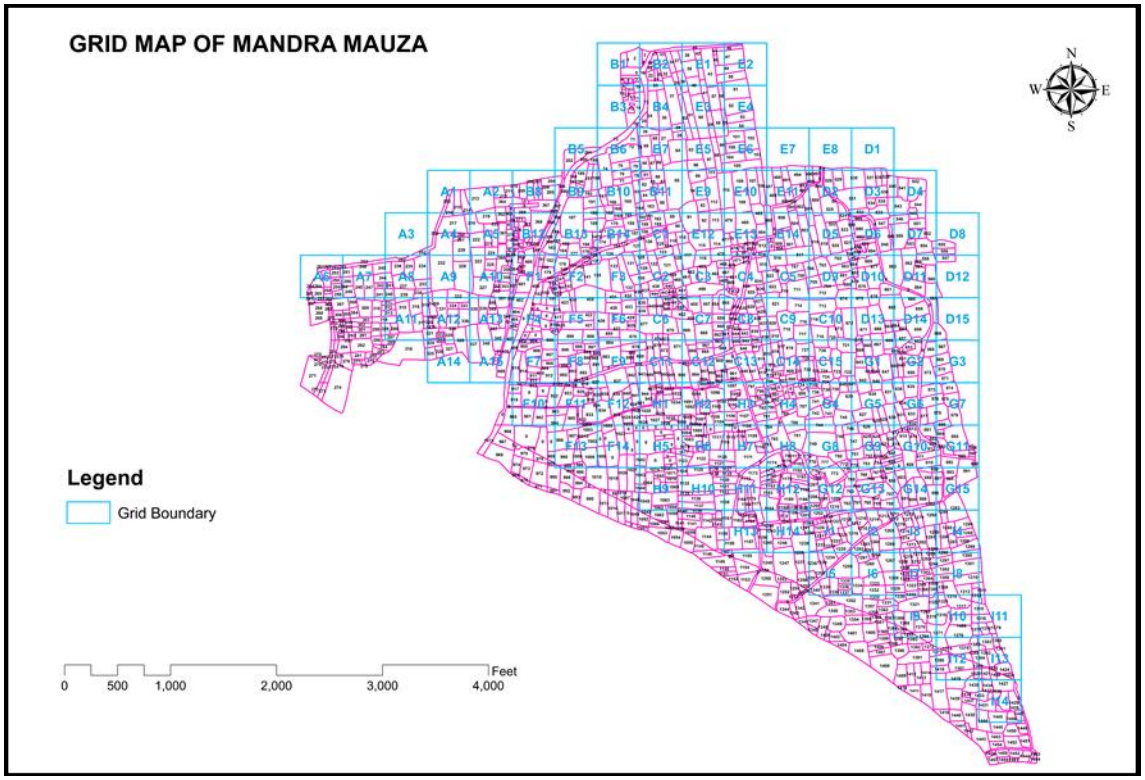

Fig 2.3: Full grid plot without base map (Source: Field Survey 2021)

- **Collection of Google Earth Image:** The boundary obtained in the previous step was exported as a kml file which was then loaded in Google Earth. A grid was simultaneously developed using the boundary shape file in Arc Map and the grid was overlapped with the boundary kml file in Google Earth. At last using the grid and the boundary, Google Earth Images were downloaded which helped in locating features in the study site during the field work. The required maps were printed

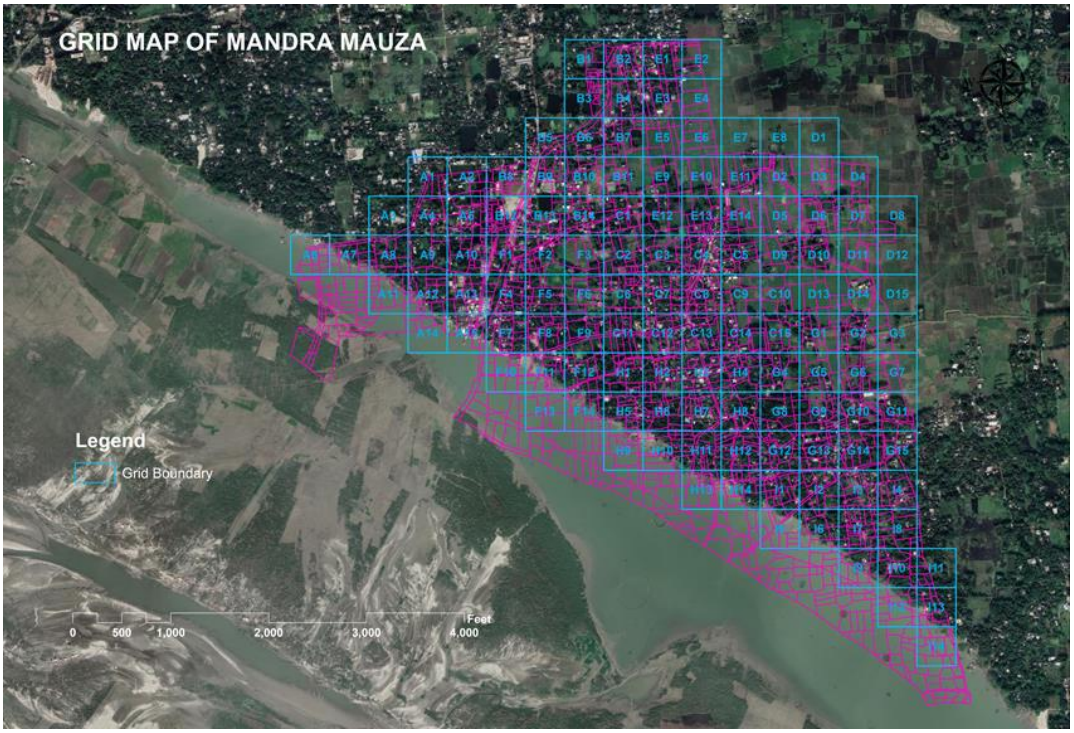

Fig 2.4: Collecting Google earth images for field work (Source: Field Survey 2021)

- **Questionnaire and Code sheet development:** A questionnaire was developed to obtain qualitative idea about regions' land use and socioeconomic condition. The questionnaire helped to obtain quantitative data to assess the aspects such as the demographic information, household related information, land use behaviour, health related information and the environmental information.

  Around 268 households were surveyed by the students divided into 9 groups, each group containing 10 members from which later two members formed a group to perform the land use and socioeconomic condition of their assigned plots. The fractional code list was prepared and provided to the students to familiarize with it.

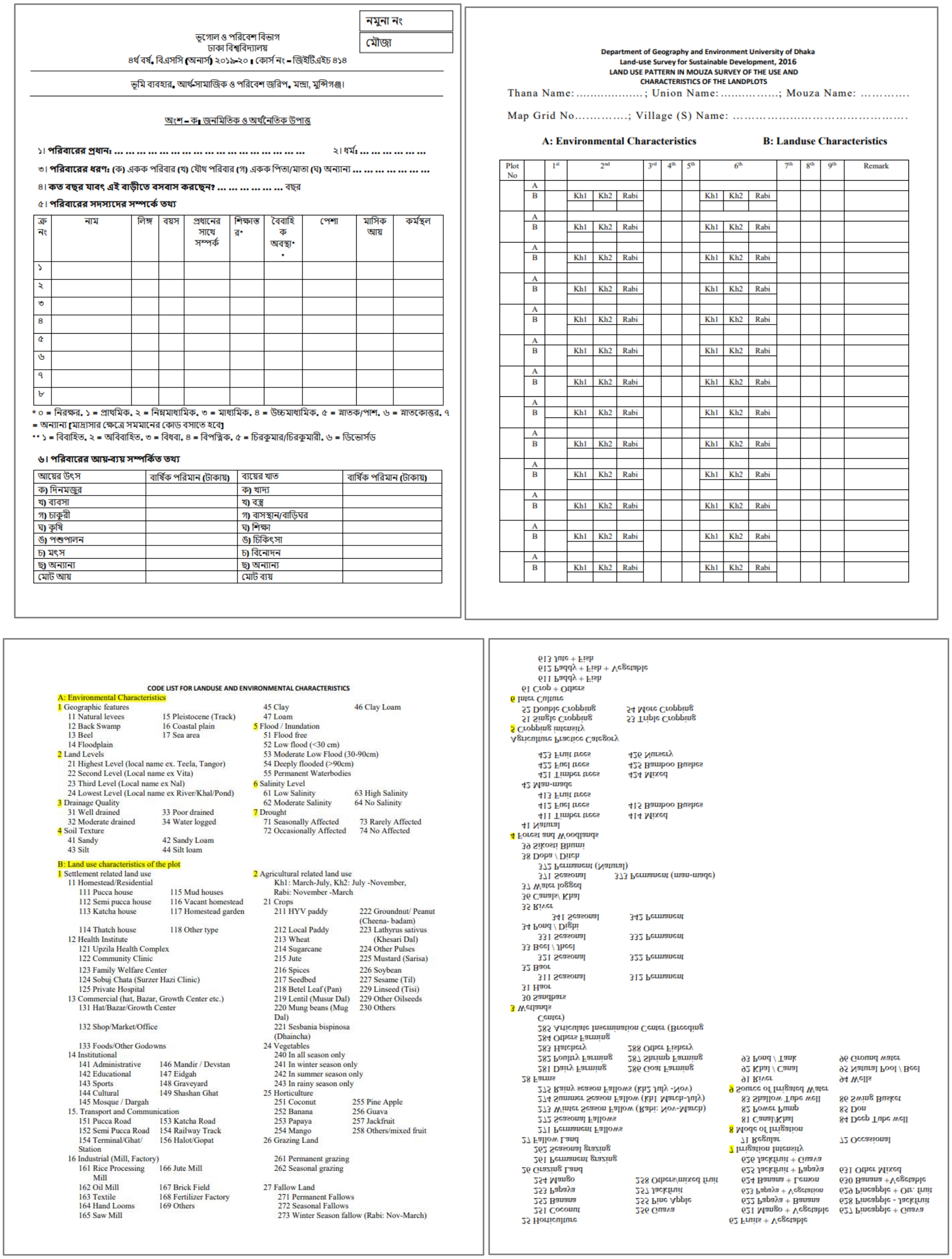

Fig 2.5: Prepared questionnaire and code sheet for socio-economic study (Source: Field Survey 2021)

2) During Field Work

- **Plot surveying in land use survey** Identifying the location of grid using grand master map and group master map. Determination of grid features in the field. Comparing the feature with the map. Redrawing will be done if we find any changes. New features will be drawn in the field. Specific numbers will be assigned with the features.

  After identifying the location of grid, we have to determine the grid plots in the field. Identifying plots is one of the major challenges in this survey. If a plot contains two different land use, then we take majority portion land use, if a plot contains fifty fifty ratio land use, then we take both land use and we cannot change plot number but can write as 1a or 1b

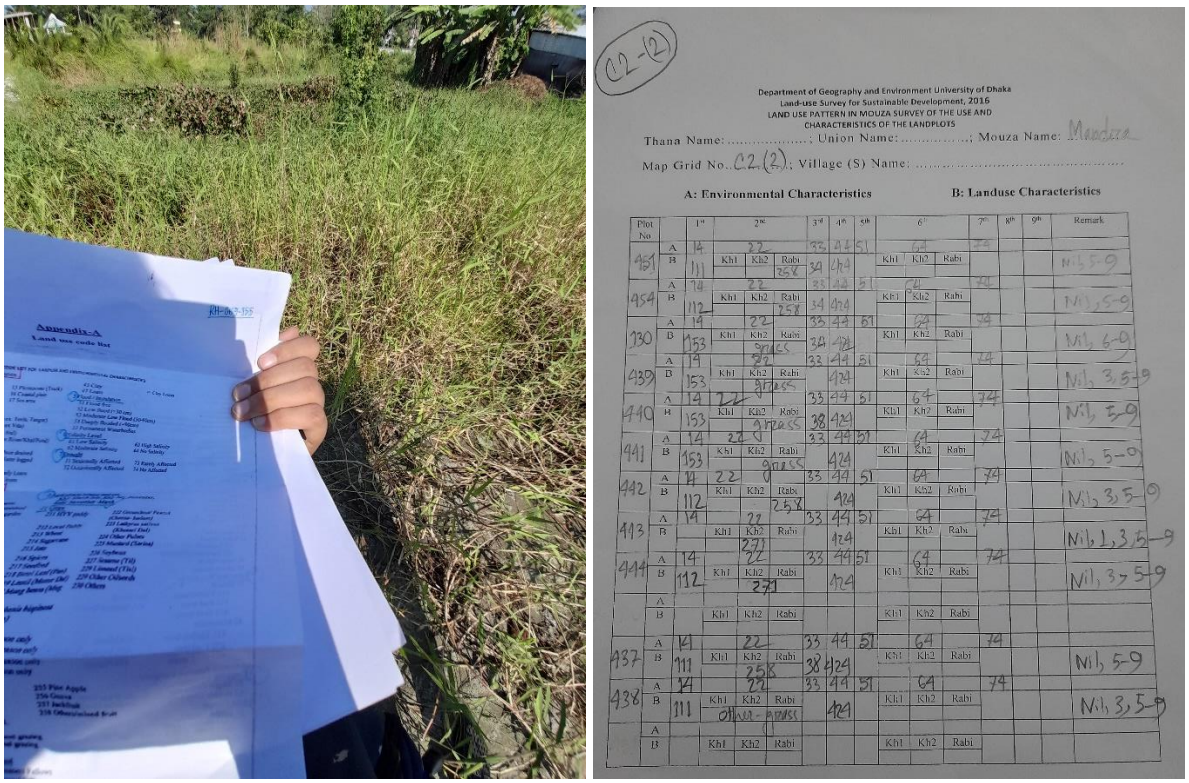

Fig 2.6: Plot surveying in land (Source: Field Survey 2021)

- **Fractional Code Method:** Used to collect land use characteristics. Fractional code list method is used for this survey. This method was invented by Vernor C. Finch which allowed for the collection of vast amounts of data for relatively small areas. (Corbett, John, 2001)

- **Questionnaire survey:** Questionnaire survey has been carried out simultaneously along with land use survey. 3 questionnaires were completed by each student. The questionnaire contained both structured and semi-structured questions and collected data on the socioeconomic, household, land use, health and environmental aspects.

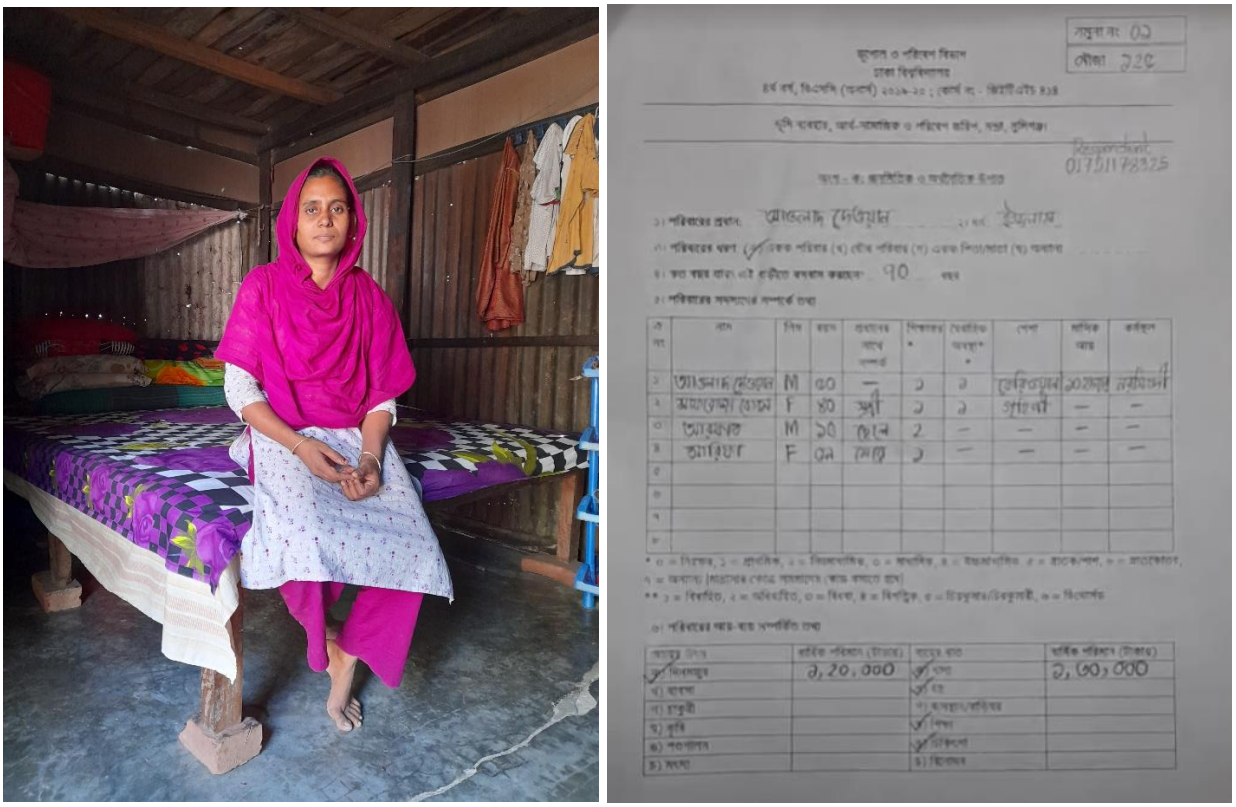

Fig 2,7: Pictures of interviewing respondents and a sample questionnaire (Source: Field Survey 2021)

2) Post-field work data processing and analysis

- **Image and Map processing**

The redrawn maps were scanned then georeferenced. Re-digitization was done from the georeferenced images. The attributes were input against each feature in ArcMap software, following the recorded characteristics in the code data sheet. All work was merged into one complete area. Any mistakes or errors were fixed. The complete shape was used to generate different land-use maps

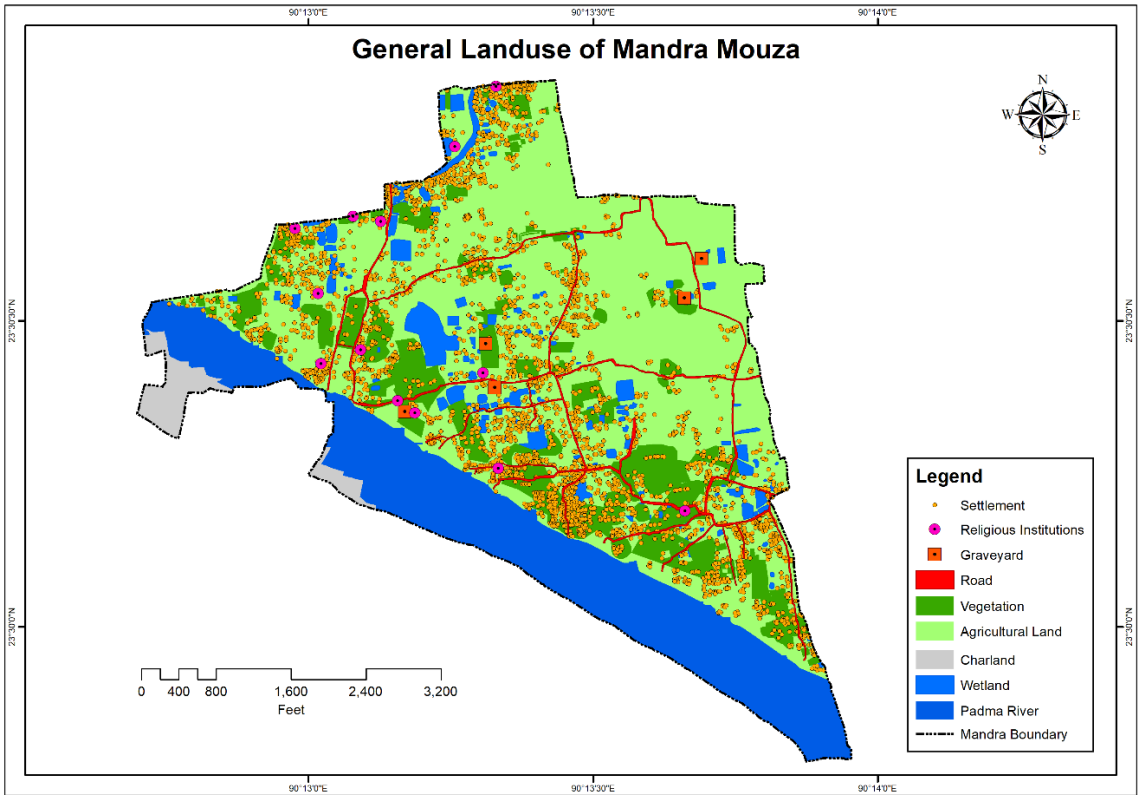

Fig 2.8: Land-use map of Mandra (Source: Field Survey 2021)

- **Questionnaire Data Processing & Analysing** Collected data was entered into a frequency table and processed in SPSS for analysis. Primary and secondary data was analysed both quantitatively and qualitatively. According to the nature of the data and interpreted. Data table, graphs and charts were produced and presented in the study findings section. Data acquired from land-use survey were processed by using various GIS and Remote Sensing software such as ArcGIS, SmartGIS, Erdas Imagine etc.

- **Accuracy Assessment** For testing the accuracy of the land use map we used the kappa accuracy assessment. This type of accuracy assessment is regarded as a benchmark and most widely used system of testing the accuracy of the image classification.

  For our 2021 classification, Overall Accuracy: 90.67%

  Kappa Coefficient: 0.8815 or 88.16%

  According to Kappa Scale accuracy greater than 75% is regarded as excellent and can be used for study. So, the land use classification was done correctly.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Name	Religion	F.Type	Gender	Members	Occupation	Education	Income	Savings	Loan_Amount	Loan_Source	Emmigration	I_Country_Name
2	Jotsna Begum	1	2	2	3	2	0	600000	2	1000000	3	1	Saudi Arabia
3	Mala Shaha	2	1	2	4	2	2	120000	1	100000	3	1	Portugal
4	Md Mohsin Akhond	1	1	4	3	3	4	144000	2				
5	Omor Faruk	1	2	1	5	2	3	700000	1	0		1	Qatar
6	Ripon Matbor	1	1	1	5	7	0	720000	1	400000			
7	Harun Shareng	1	1	1	5	7	0	10000	1	300000			
8	Shah Alam	1	1	1	5	3	0	350000	2	200000	3		
9	Md. Belal hossain	1	2	1	4	1	5	1560000	1			1	Saudi Arabia
10	Bushra Begum	1	1	2	5	0	0	60000	1	150000	3		
11	Mridha Shahin	1	1	1	8	3	3	2000000	2			1	Italy
12	Rabeya Beum	1	1	2	3	3	4	480000	2	90000	5	1	
13	S M Shajahan	1	2	1	4	2	3	2040000	1			1	Saudi Arabia
14	Tazul Islam	1	1	1	8	2	2	20000	2				
15	Deloyar Pathan	1	2	1	6	2	0	10000	2				
16	Aktar Ali	1	1	1	2	3	1	40000	2				
17	Sohanur Rahman	1	2	1	4	2	0	250000	2			1	
18	Kazi Deewan	1	2	1	3	3	0	180000	2			1	
19	Selina Begum	1	2	2	6	2	0	340000	1			1	
20	Ali Akkas Hauladar	1	2	1	8	2	1	360000	2	100000	1	2	
21	Md. Babul Mridha	1	1	1	4	2	3	400000	2			2	
22	Md. Mujibor Sheikh	1	1	1	2	2	2	240000	1	60000	1	2	
23	Humayn Mridha	1	1	1	4	2	0	240000	2	100000	2	1	
24	Md. Sowkot Mridha	1	1	1	4	2	0	120000	2	60000	2	1	
25	Harun Mridha	1	1	1	2	2	2	180000	2			1	
26	Md Siddiqur Rahman Akond	1	1	1	2	2	4	192000	1	50000	1		
27	Jogobhodo Saha	2	1	1	4	2	3	180000	2	60000	3		

Fig 2.9: Questionnaire Data Processing & Analysing (Source: Field Survey 2021)

2.3 Limitations of the Study

- Time constraints in every task are the major problem to carry out this mega task
- Surveyors are not professional and GIS skill varies from student to student which makes the complete study difficult.
- Identification of objects become difficult because of tree canopy.
- Data can be affected by characteristics of both respondent or interviewer.
- Respondent may not provide accurate or complete information.
- The resolution of google earth image is low.
- It is difficult to identify feature from earth image when digitizing.

2.4 Conclusion

To undertake the mammoth task, different groups in different stages have been formed. With their hard work, the successful field work has been undertaken and we were able to produce our land use maps and summarized the dataset for further analysis which will give us idea about the land use pattern and the socio-economic and environmental characteristics of Mandra mauza.

Chapter 3

Literature Review

3.1 Introduction

Land is a very important finite resource which is one of the natural bases for human life and for the maintenance of all terrestrial ecosystems. Over millennia, people have become progressively more expert in exploiting land resources for their own ends.

Land and Land Resources refer to a delineable area of the earth's terrestrial surface, encompassing all attributes of the biosphere immediately above or below this surface, including those of the near-surface climate, the soil and terrain forms, the surface hydrology (including shallow lakes, rivers, marshes and swamps), the near-surface sedimentary layers and associated groundwater and geo-hydrological reserve, the plant and animal populations, the human settlement pattern and physical results of past and present human activity (terracing, water storage or drainage structures, roads, buildings, etc.) (FAO/UNEP, 1997).

The limits on these resources are finite while human demands on them are not. Increased demand, or pressure on land resources, shows up as declining crop production, degradation of land quality and quantity, and competition for land. Attention should now be focused on the role of humankind as stewards rather than exploiters. Therefore, the idea of "land use" comes in to ensure the proper usage of land resource.

This land use, carried on a land, is characterized by the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it (FAO/UNEP, 1999). Land use does not consider production only, but also land functions such as protected areas, land recreation, road-building, waste disposal sides and use restricted areas such as buffer zones for exhaust gases, areas for regenerating groundwater, buffer zones for traffic noise pollution, etc.'(Amler et al., 1999).

Land use survey is the study and recording of the way in which land is being used in an area; usually classified as commercial, industrial, public, residential, etc. (McGraw-Hill, 2003). Land use survey is very important in finding out the existing land use conditions of a particular area.

3.2 Land

Land, the mother of resources (Mia and Islam, 2005; Iftekhar, 2006), is being considered as a prerequisite for all development purposes especially for sustainable development (Iftekhar, 2006). Land, therefore, refers to the basic natural resource that provides habitat and nourishment for living organisms (Mia and Islam, 2005) or the means for livelihood with potential revenue if properly utilized (Iftekhar, 2006).

Though, Stewart (1968) and Wolman (1987) defined land as the wide range of natural resources from the atmosphere above the land surface down to some meters below the surface, FAO (1992) defined not only as soil but also as landforms, climate and hydrology, plant and animal population, and the physical results of human activity like terraces and drainage works. Moreover, despite the similarity in physical characteristics across the universe (Zubair, 2006), its supports can vary over time and space according to the management conditions and uses (Mohammad, 2009).

3.3 Land use

The relationship between man and land is inseparably closed. That means, land has been the source of man's food, shelter, clothes, etc., that is why, people has been using land in many ways which is changed according to place and time as well as the social and economic needs of people, So I think Man have to know about the land resource and land use in order to meet his own needs. The term Land use has been attempted to be defined differently from various perspectives by different scholars. Land use has been seen as a product of interactions between a societies cultural back ground, skill, and its physical needs in one hand, and the natural potential of land on the other hand (Rarn and Kolarkar 1993). Land use is also defined as people's activities on land which are directly related to land (Clawson and Stewart 1965), (Burley, 1961).

Land cover + land utilization = Land use.

In that sense we can say it is one of the main conditions, to visualize the development planning of any developed nation. AS a nation we are in the developing group. The barriers of the development are our population and a limited land resource. In this present world, it is obvious to prepare and correct data to fulfill the present needs as well as for the future generation's betterment. Through the long history, it is found that scientists are trying to control land use and to preserve its quality by their research. At different times, different geographers have worked for the Nature in type of

land use. Although, the land survey system had been much improving in the ancient Egyptian Nile civilization.

The study if Land use is very important both to the user of the land parcel as well as to understand the environment around. The Land use pattern of an area changes along with time, according to need. The changes are related to the overall functional demand and physical environmental change. Without knowing the Land use-changing pattern, it is impossible to make a future development plan for an area or region (Khorram et at. 1991). For the best use of any parcel of land, it is very essential to know the potentiality of that land recourse and the Land use changing trend of that area. At a more mundane level, interaction occurs between everyday behavior and future Land use patterns: existing Land use arrangements in part determine where people live, where they work and how and when they travel there, where they shop, where they play, etc., while such behavior in turn helps to shape future Land use patterns (Rhind and Hudson, 1980).

3.4 Land Use Change

Land use change is being considered as the single most important appearance of human interaction on atmosphere (Mohammad, 2009) and includes alteration of land covers (Lesschen et al., 2005) either in the form of agricultural intensification or changes in farming system over time (Farrow and Winograd, 2001) due to influence of population and economic expansion (Mohammad, 2009). Briassoulis (2000) has defined land use change as the quantitative increases or decreases in the area of a given type of land use while Wu and Li (2013) defined as any changes in arrangements, activities and inputs that people undertake in certain land cover type.

Precisely, land use change refers to changes in land use morphology over time with respect to particular socio-economic factors (Grainger, 1995; Zubair, 2006) which may include both temporal and spatial dimensions (Long et al., 2007).

3.5 Historical Phase of Land-Use Survey

3.5.1 Global Perspective

Land survey was initiated in Egyptian civilization, modern land use survey, with a purpose to find out the land utilization, was first acquainted in late 20th century by a British geographer. In England with the aid of Grammar School students, L. Dudley Stamp conducted a land use survey

during 1930s. Mapping was carried out by volunteers at the scale of six inches to the mile (1: 10,560) using around 20,000 six-inch field maps (Coleman & Maggs, 1965).

An ordinance map of a small locality was the output of this survey. Thus, land use survey was introduced in England. And after the termination of the Second World War, Stamp again conducted land use survey in that same area for detecting the change in the land use pattern in that area after fifteen years. Besides maps and regional summaries, publications leading from the surveys included Stamp's 1937 and 1948 books The Land of Britain (Stamp, 1937; Stamp, 1948). The International Geographical Union (IGU) created a land use commission during the first decade of 1948 and in 1952 all the geographers of the world were invited by this commission to be trained in the field of land use survey. This is how land use survey was initiated and spread out across the globe.

3.5.2 Local Perspective

Bangladesh scenario Dudley Stamp introduced land use survey in Bangladesh during 1950s. He helped the Department of Geography, University of Dhaka, to create first land use map. Since 1980s Bangladesh government is assimilating land use data in every 10 years. Considerable number of researches on land use has been conducted on Bangladesh. However, almost all of them are either about temporal change detection of land use or land use classification. Moreover, a number of researches have been conducted on urban areas, focusing on urban growth or environmental change because of urbanization. Mamun (2013) identifies the change of land use pattern taking Dhaka, the capital, as a case study. A micro level study on a thana of capital Dhaka, conducted by Raihan & Kaisar (2012), detected the land use change occurring over 10 years (1997-2006). Another micro level study (Kumar & Ghosh, 2012) took an island as study area and detected the change occurred in the period of 22 years. The changes in homestead, agricultural and forest land over 30 years' time period around the Sundarban Mangrove Forest area was detected by Rahman & Begum (2011).

In addition to understanding the changing pattern of land use, Islam & Hassan (2011) focused on the agricultural condition of the study area and finds out that agricultural use of land is decreasing at an alarming rate. They assumed after 217 years' agricultural land will be entirely replaced by other type of land use. However, they did not consider any other factor while assuming this definite year of replacement. Chowdhury (2011) took the initiative to identify the LULC change of entire

Bangladesh. However, they took a very short span of time for studying (2000-2008) and limited their study on land cover change detection. Another study on whole Bangladesh (Dey et al., 2012) focused on land erosion and loss of land because of natural and anthropogenic factors. While doing so, this study also identified whether this land degradation was changing land use. These studies are primarily focusing on land use change detection or analyses of changing pattern. There are some studies which just do not emphasize on land use change detection; rather focus on the consequences or reasons of it.

Soil Resource Development Institute (SRDI), Ministry of Agriculture, Bangladesh has conducted agricultural land availability survey in 2013. SRDI has identified land use of whole Bangladesh. The area of Bangladesh represents 144,873, 145,306 and 145,778km2 during 1976, 2000 and 2010 respectively. Overall land gain was 905km2 (90,512ha) during 1976 to 2010 due to accretion in the southern coastal zone of Bangladesh

3.6 Land Use Survey Techniques

Land use survey techniques may be conducted either by:

i. Proximate Sensing Technique:

In the proximate sensing technique, the maps, diagrams and sketches are drawn by measuring the land with the help of survey equipment's. Preparation of layout plans and topographical maps may be cited as some of the examples of proximate survey technique. The main advantage of the proximate land use survey is that it brings the surveyor in close contact with the ground reality, i.e., the earth surface. The changes, if any, may also be recorded on the spot. The topographical maps, however, provide very little information about the use of land. Moreover, such survey can be done only with the help of skilled and trained persons. It is a time consuming technique for which a lot of funds should be available.

ii. Remote Sensing Technique:

Remote sensing is a technique developed in recent years for the preparation of land use maps. It is a kind of technique which gives quick results and reduces unnecessary fieldwork. The most popularly used remote sensing technique to prepare land use maps is the aerial photography survey. In recent years, the satellites or spacecraft fitted with various remote sensing appliances like electro

optical and non- photographic sensors have added a new dimension to these techniques. The satellite imageries are prepared with the help of remote sensing techniques. These imageries enable researchers to prepare inventories of the natural resources and to classify land use data more accurately and rapidly than is possible by using aerial photographs. The satellite imageries are of great help in making agricultural land use maps which serve as the basic tools for regional planning and development.

iii. GIS and Remote Sensing Based Land Use Study: A New Trend

- Dewan & Yamaguchi (2009; 2012), using the satellite images between 1975-2003 and socio-economic data, showed that substantial growth of built up areas, which is occurring mainly because of population growth and economic development, causes significant decrease of water bodies, cultivated land, vegetation and wetlands.
- Mamun (2013) identifies the change of land use pattern taking Dhaka, the capital, as a case study. A micro level study on a thana of capital Dhaka, conducted by Raihan & Kaisar (2012), detected the land use change occurring over 10 years (1997-2006).
- Another micro level study (Kumar & Ghosh, 2012) took an island as study area and detected the change occurred in the period of 22 years. The changes in homestead, agricultural and forest land over 30 years' time period around the Sundarban Mangrove Forest area was detected by Rahman & Begum (2011).
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just do not emphasize on land use change detection; rather focus on the consequences or reasons of it.

- Dewan & Yamaguchi (2008) identified the relationship between land cover changes and river and their results revealed that rapid changes in land cover play a crucial role in intensifying the flood process.
- Factors influencing the development of land-use systems were explored in the study of Rasul (2004). They showed that institutional support, productive resource base and distance to the market and service center were the main factors responsible for the development of three different

3.7 Importance of Land Use Survey

As Bangladesh is a land hungry and densely populated country, land use planning is sensitive in terms of societal and development point of view. Every inch of land in this country is valuable. Only in depth knowledge on existing land use can save Bangladesh.

- **Economic bases of area:** Land use study gives an understanding of how a fraction of a land is being used and what are the economic bases or economic outcomes of that particular use. Recently, the environmental and social factors are studied as well. The land use study can give 17 an understanding of the economic strengths of a region and can help identify the possible potentials and barriers of development. The study of the land use in relation to environment can give an idea of how sustainable the land use is, in context to sustainable resource use, waste management and natural stewardship.
- **Policy making:** It is impossible for policy makers to take any productive development decisions without fully understanding the present condition of land use, the drivers of land use practices and the chronological changes of land use behaviors. This importance comes from the fact that for understanding what is to be needed, it becomes necessary to understand what is already there and what is not.
- **Planning:** For any kind of land of planning, land use survey is of utmost importance.

In the Context of Bangladesh

Bangladesh is the most densely over populated delta in the world where land is one of the scarcest resources. It's a small country with an area of 148,460 Sq. Km and a population of 160 million.

Per capita land use is the lowest except some city based countries like Singapore. Using each parcel of land prudently is crucial for proper development. Information on existing land use is thus of utmost importance for better use of land.

There is a tremendous pressure on land for ever increasing population, to provide spaces for their work, residence and other purposes. The population density of the country is as high as 1100 people per square kilometers which mean that the demand for land is extremely high. In order to ensure that land use is being used sensibly, the importance of land use study is overwhelming.

In policy making: Different governmental, non-governmental and international organizations are working to gather land use related information for policy makers. Some of these organizations are Survey of Bangladesh, Bangladesh Institute of development Studies (BIDS), Bangladesh Bureau of Statistics, Center for Environmental and Geographic Information Services (CEGIS), Ministry of Agriculture, Ministry of Land, Ministry of Planning etc.

The findings of land use study are clearly observable in the introduction and devising of major policies like National Land Use Policy,2001; Khas Land Settlement Policy, 1997; Non-agricultural khas Land Settlement Policy, 1995; Khas Land Settlement Policy for Hotel-Motel,1998; Balu Mohal and Sand Management Rules, 2011, etc. and The Acquisition and Requisition of Immovable Properties Ordinance,1982. The main objectives of these policies are providing guidelines for sensible land use, for example 'National Land Use Policy, 2001' are criteria based uses of land, providing guidelines for usage of land for the purpose of agriculture (Crop production, fish cultivation and rearing of ducks and chickens), housing, afforestation, commercial and industrial establishments, rail and highway and for tea and rubber gardens. This policy mainly identifies limitation of land use and management of limited land resources of the country.

So, as a student of Geography and Environment and a future leader of the country, land use study is needed to ensure sustainable development in all sectors of Bangladesh. In this regard, land use study of urban and rural area has much importance in the context of Bangladesh.

3.8 Land Use Trends in Bangladesh

Bangladesh has a population of 153 million with an expected increasing rate of 1.37 percent (MoF, 2013) causing direct conversion of productive lands into non-productive uses (Mia and Islam, 2005). In last century, only 23 percent of total land area was cultivated by tenants or owner cum tenants and 45 percent by paid laborers (Hasan and Mulamottil, 1994). Mohammad (2009) showed that land has decreased by about 50% during 1970-1990 while arable land per economically active person is only 0.8 ha compared to more than 12 ha in developed countries (Graff, 1993; as cited in Mohammad, 2009). Moreover, land demand for non-agricultural purposes and urban uses has increased sharply in last decades though still agriculture is the major activity (Choudhury, 1987; as cited in Mohammad, 2009). Consequently, despite much fertile land Bangladesh is marginally deficient in food grains (BBS, 2006).

Trends of land use patterns in south-west part of Bangladesh are notable over last decades due to her major land uses (i.e. agriculture, shrimp and fish farming, forestry, urban development and settlement) and especially due to rising demand and huge populations in corresponding areas (Ahmed, 2011; Rahman and Begum, 2011).

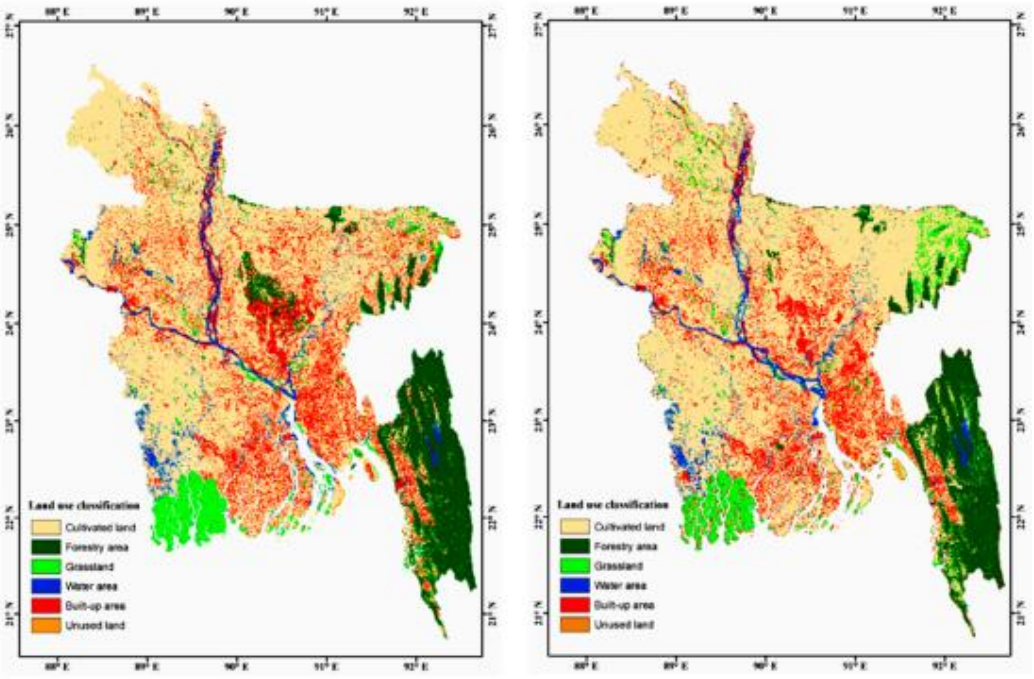

Fig 3.1: Comparison of actual (left) and simulated (right) land use situation in Bangladesh, 2010.

Cultivated land, forest area and built-up area are the major land use types in Bangladesh. Competition exists among the six land use types in different scenarios (baseline, ecological protection priority and economic growth scenarios). It mainly shows a decrease of cultivated land and increase of built-up areas.

Meanwhile, when the ecological condition is considered, forest area and grassland area show a positive relationship with ecological protection. However, when economic growth is considered, a dramatic increase of built-up area is seen. These changes might be due to the effect of different influencing factors on different land use pattern. Under the baseline scenario, every land use type would primarily expand or decrease according to their previous existing areas.

By 2020, both forest area (13.35%) and grassland (12.89%) would be expanded from the other lands, i.e., water areas, unused lands, and cultivated lands. The main expanded grass land areas are located mainly in the northeast (Sylhet Division), and in forestry areas in the Chittagong hill tracts area. During baseline period, water areas are reduced (35%) as the water areas are affected by the annual change of rainfall, increased temperature, and population growth.

By 2030, under baseline scenario, both forest area (13%) and built-up area (5%) would be increased, mainly due to the shrinkages of grassland (14%), and water area (34%). Under the baseline scenario, an increase of built-up area and decline of cultivated land is common feature due to the pressure of Sustainability huge populations. The dramatic change in land use types, including the reduction of water area by 35% and 34% in 2020 and 2030, respectively, will lead to shortage of water resources in Bangladesh. Under the ecological protection priority scenario, the study assumes a land use that is under strict environmental protection policy from 2010 to 2030.

Under the ecological protection priority scenario in 2020, both forest area (18%) and grassland (12%) would be expanded. The shrinkage of water areas (35%), cultivated land (2%) and unused area (45%) would be mostly responsible for this expansion. By 2030, under ecological protection priority scenario, forest area and grassland would be increased by 35% and 30%, respectively. On an average, water areas and cultivated land decrease by 6% and 35%, respectively, which indicates that the regulation has significant effect on checking the huge expansion of built-up land. Under the economic growth scenario, the expansion of built-up area is strikingly clear when compared to the other scenarios for 2020 and 2030, and with the actual map for 2010. This expansion of built-up area by 46% (2020) and 51% (2030) would be due to the shrinkage of cultivated area (8.24%

and 7.78%, respectively), and the conversion of forest area (3.53% and 6.48%), and grassland (11.06% and 24.33%). In total, unused area is very small in Bangladesh but it was also converted to built-up area. water areas (35%), cultivated land (2%) and unused area (45%) would be mostly responsible for this expansion.

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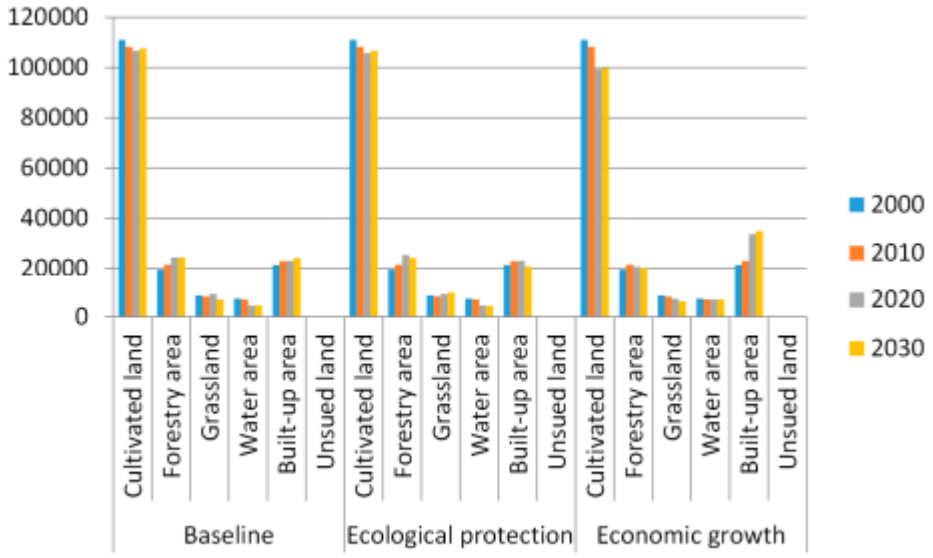


Fig 3.2: Land use structure changes under baseline, ecological protection and economic growth scenarios.

3.9 Conclusion

Land use survey serves as a tool for sustainable land management, planning and policy framework. Not only that, but also land use survey is crucial for many important aspects. It serves the base for regional planning. Developed countries are utilizing their land use data at their very best level with modern technologies where Bangladesh is lagging behind.

Chapter 4

Land use Patterns of Mandra mauza

4.1 Introduction

One of the major objectives of the field study was to observe the existing land use patterns of Mandra mauza. According to the collected field data, various maps were produced to represent different types of land uses in this area. Land use was divided into several categories such as residential, commercial, agricultural, industrial etc. For land use survey we collected data of two main characteristics of the study area. They are-

A. Environmental Characteristics

B. Land Use Characteristics

4.2 Environmental Characteristics

Environmental characteristics are the physical attributes of the land resulting from the natural forces and has no or less impact of human activities. It focuses on the physical characteristics of land and can highly influence any land use. The environmental characteristics considered in this study were:

1) Geographic features

2) Land Levels

3) Drainage Quality

4) Soil Texture

5) Flood/ Inundation

1) Geographic Features

Geographical features are naturally-created features of the Earth. Natural geographical features consist of landforms and ecosystems. For example, terrain types, physical factors of the environment) are natural geographical features. Conversely, human settlements or other engineered forms are considered types of artificial features. For describing land use of any region, geographical features play a vital role. It is also of the factors that affect land use. In Mandra mouza, several types of geographic features were found.

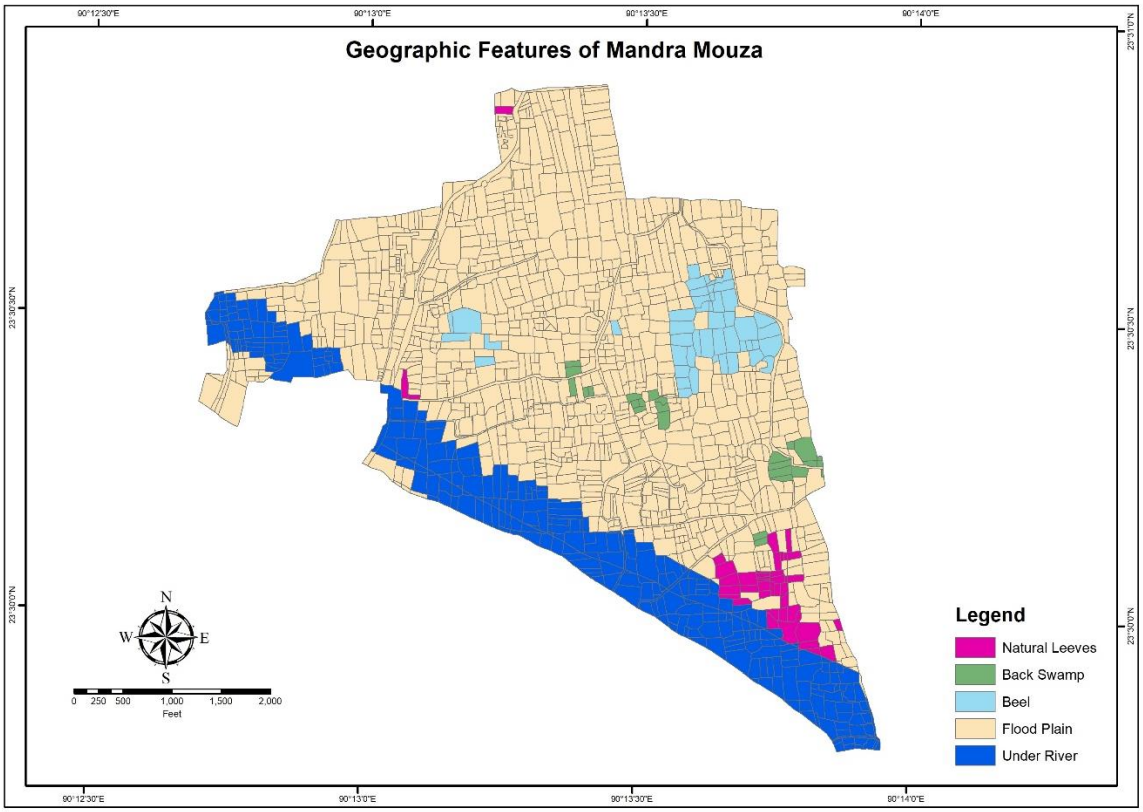


Fig 4.1: Geographic features of Mandra mouza (Source: Field Survey 2021)

Table 4.1: Geographic features of Mandra mouza

Geographic Feature	**Area(Sqm)**
Flood Plain	1463839
Under Water	396132
Beel	89963
Natural Leeves	48578
Back Swamp	27362

We can see from the map that our study area was mostly floodplain (72%) though some black slope, beels, back sweamp and naturals levees exist. A floodplain or flood plain or flood-plain is an area of land adjacent to a stream or river which stretches from the banks of its channel to the base of the enclosing valley walls, and which experiences flooding during periods of high discharge.

2) Land Levels

Land level indicates the topographic condition of the area. Drainage, water logging, flooding and various biotic environments are associated to land levels.

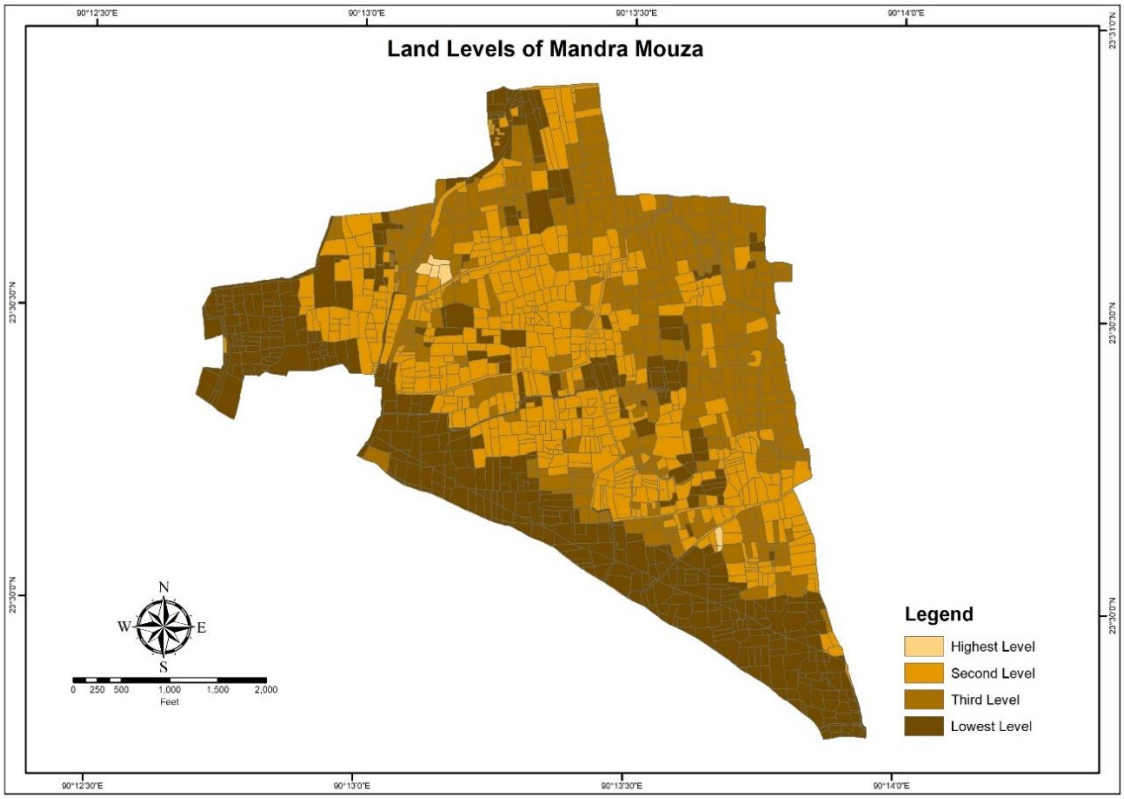


Fig 4.2: Land level map of Mandra mouza (Source: Field Survey 2021)

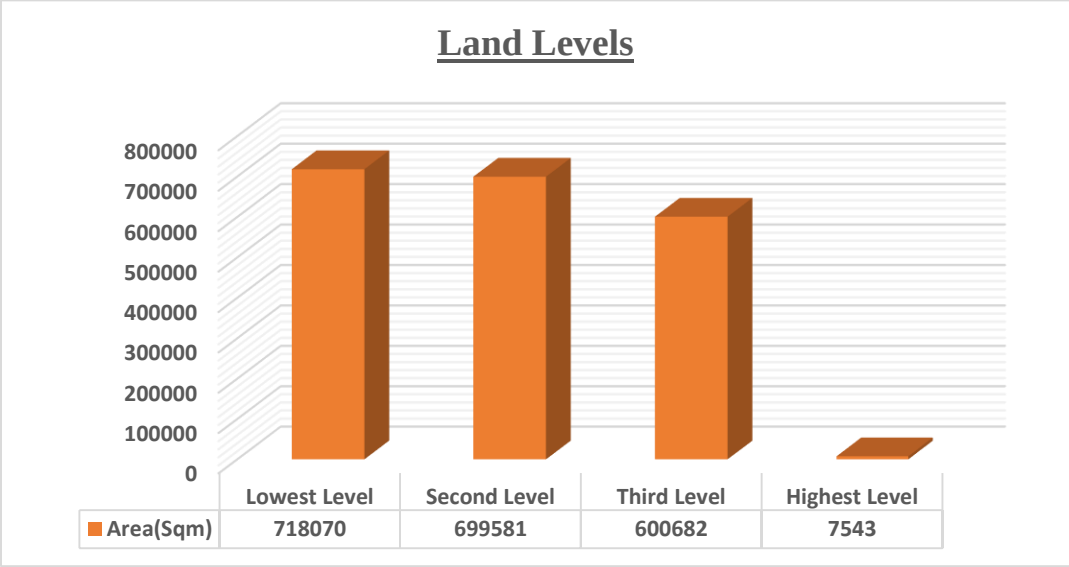


Fig 4.3: Land levels of the study area (Source: Field Survey 2021)

As far as elevation is concerned we can say that the land level of the majority area is at lowest level. Then comes the second level which are also linked with residential, industrial and commercial zone. It is pretty good in terms of combatting flood. There are some areas which are at third level- which could be prone to damage from flood. And then some scarcely located high land in the North-west part.

3) Drainage Quality

Drainage quality is an important issue for the land use pattern. A drainage system is accountable for getting rid of the surplus water either on the floor's surface or the root area of any property. It is also possible for surplus water to accumulate from the rainwater or the usage of an excessive amount of irrigation water. It is imperative to drain the water for clearing the system as well as pipes since it might otherwise lead to leaking, flooding, filthy smells, slow draining, in addition to water damage.

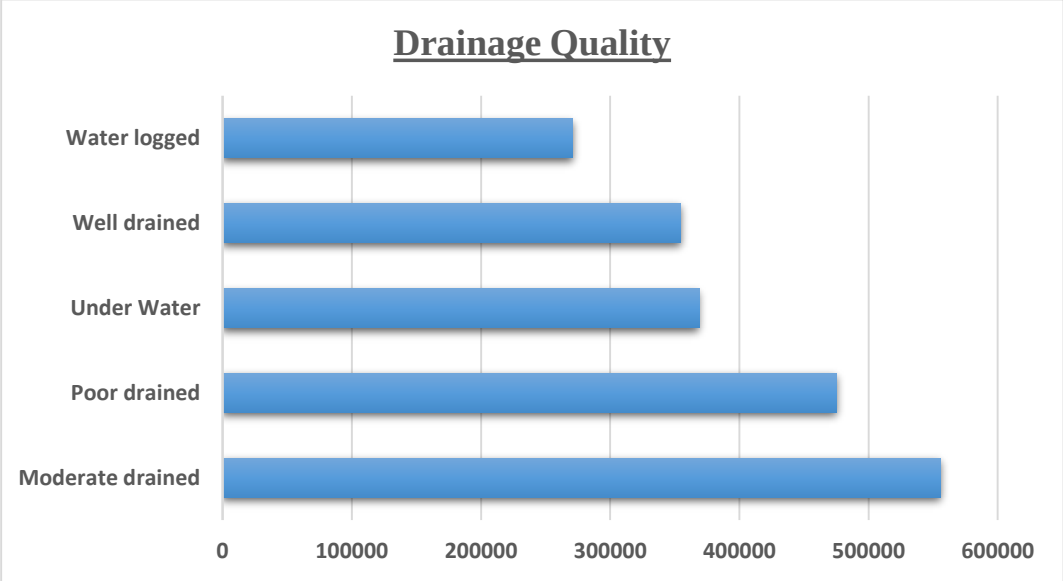


Fig 4.4: Drainage quality of the study area (Source: Field Survey 2021)

As we can see that most of the area is moderately drained and poor drained. Then there is around 368854 square meter area that go under water. The rest is either well drained or water logged. A lot of people in the study area complained about no proper managements or infrastructures exist to manage the drainage system in the area. The accumulated water often hampers their daily activities and also causes various skin diseases.

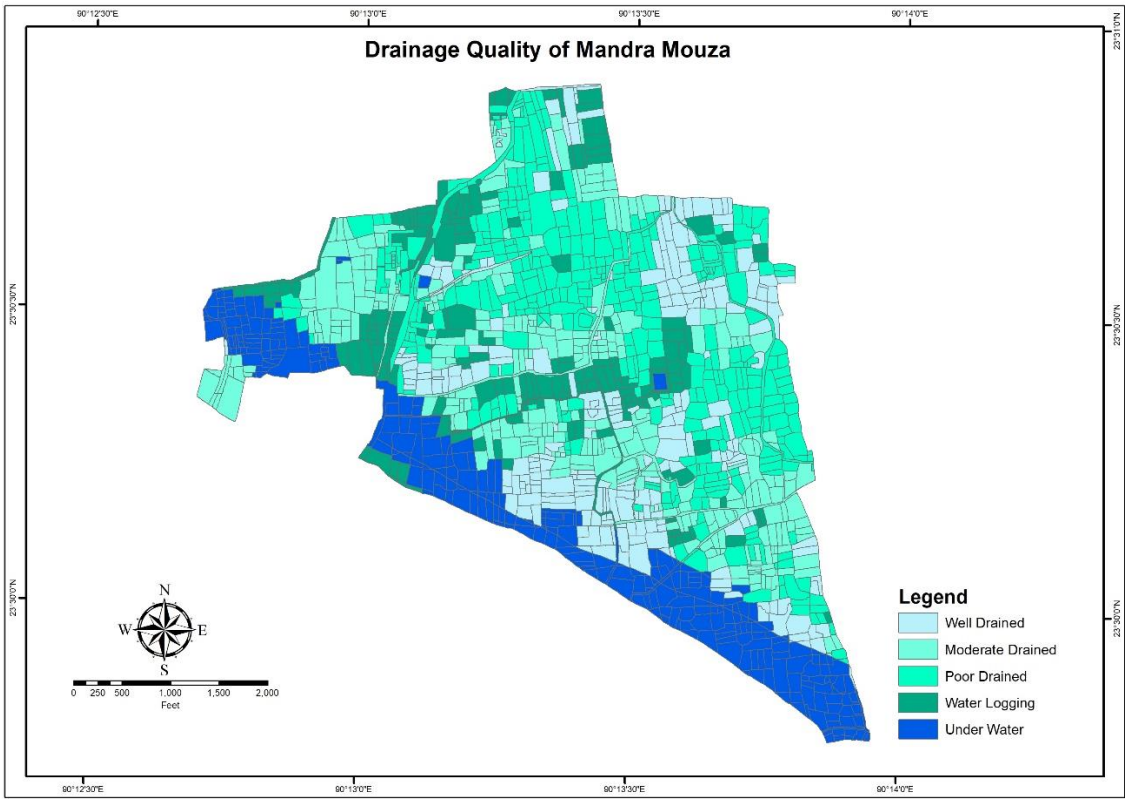


Fig 4.5: Drainage quality of the study area (Source: Field Survey 2021)

4) Soil Texture

Soil texture (such as loam, sandy loam or clay) refers to the proportion of sand, silt and clay sized particles that make up the mineral fraction of the soil.

Texture is important because it influences-

- The amount of water the soil can hold
- The rate of water movement through the soil
- How workable and fertile Soil texture (such as loam, sandy loam or clay) refers to the proportion of sand, silt and clay sized the soil is.

There are various kinds of soil textures present in the study area. But upon closer inspection we can see that the study area has mostly silt loam, sandy loam, clay loam textured soils. But as it gets close to the river area, there is an ample amount of sandy textured soil begins to appear.

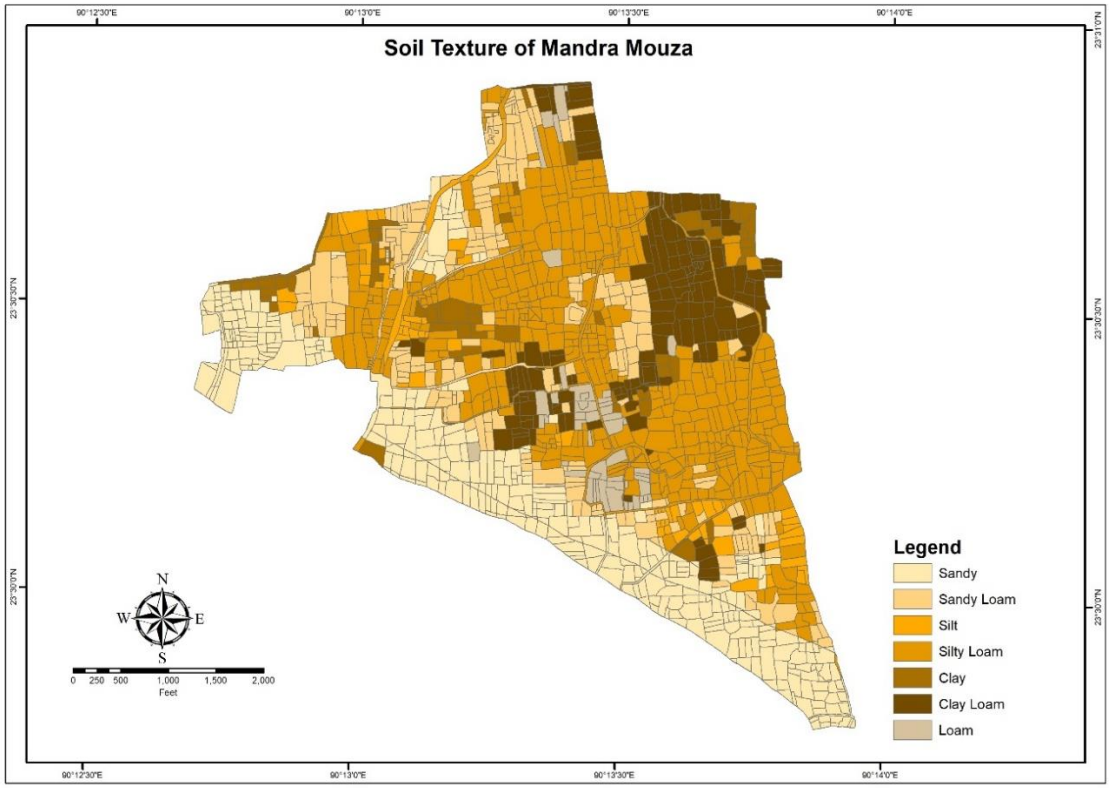


Fig 4.6: Soil texture of Mandra mouza (Source: Field Survey 2021)

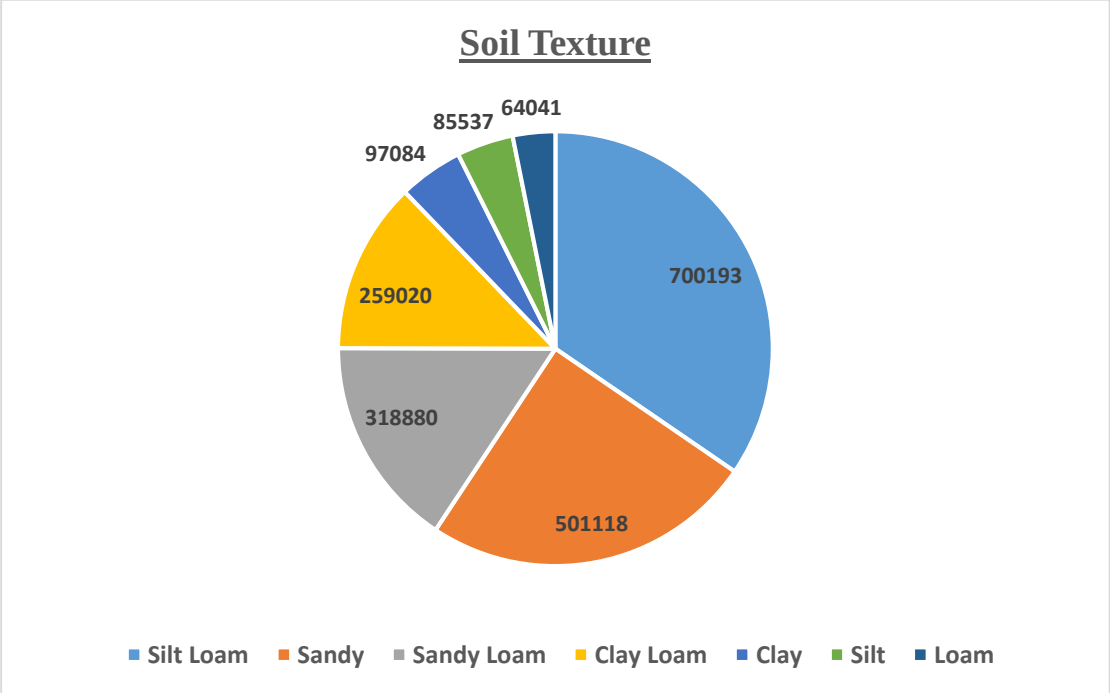


Fig 4.7: Soil texture of Mandra mouza (Source: Field Survey 2021)

5) Flood/ Inundation

Here we can see that most of the areas are either flood free of experience moderate flooding. Flood free areas are situated in the North-western part and moderate flooding areas can be found in the eastern part of the study area.

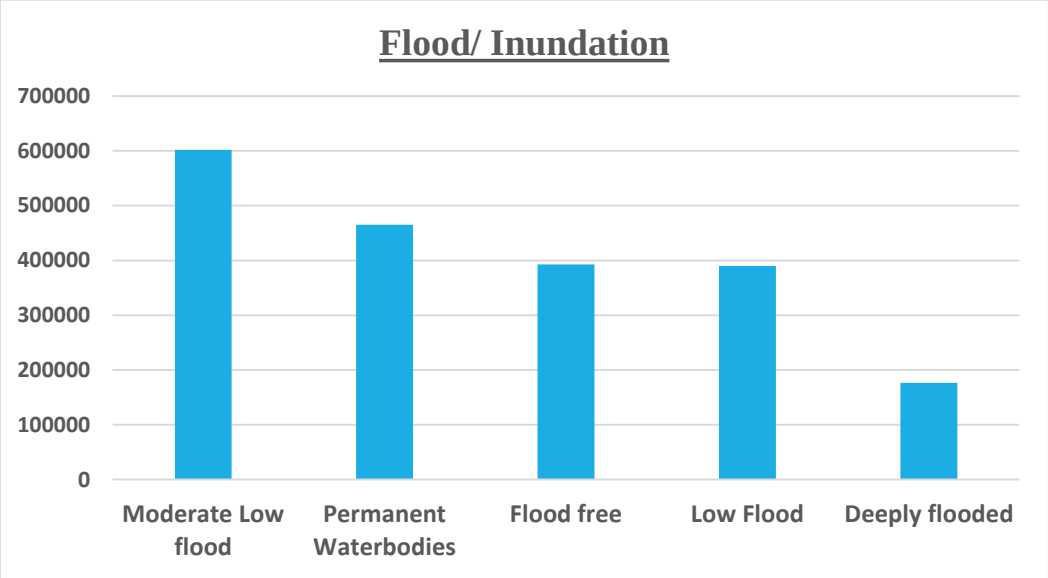


Fig 4.8: Flooding levels of the study area (Source: Field Survey 2021)

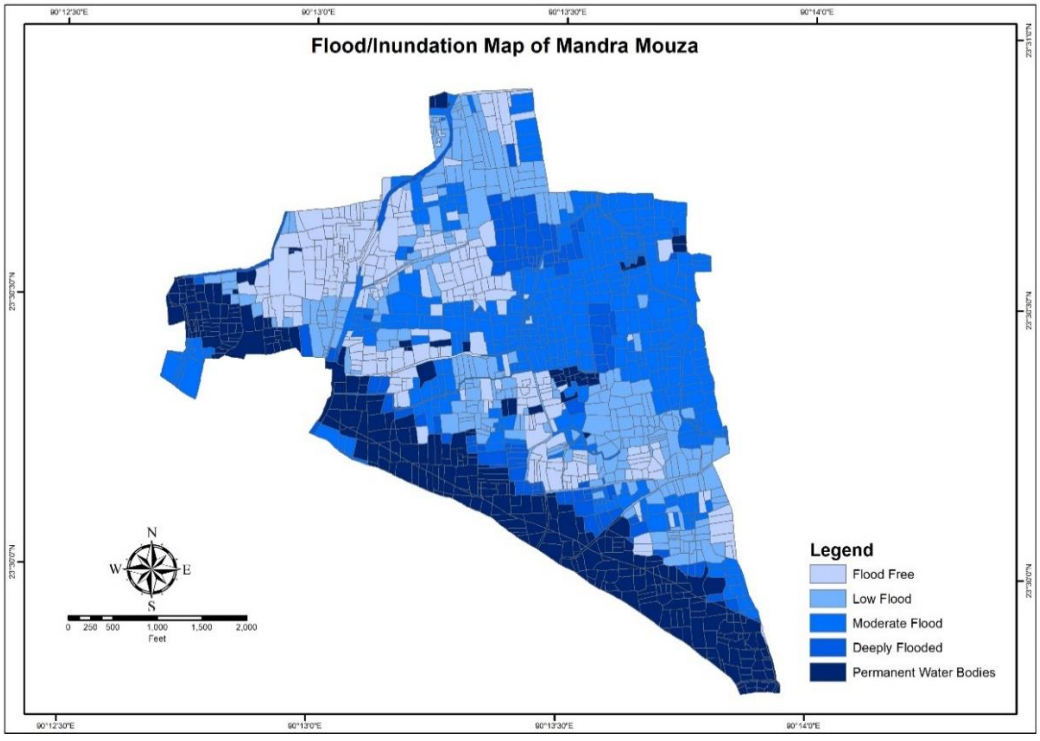


Fig 4.9: Flood map of the study area (Source: Field Survey 2021)

4.3 Land Use Characteristics

Land use characteristics are those that are characterized by human activities. It focuses on how the lands are used by people and what purpose does it serve. The land use of the area has been classified into the following categories-

1) Settlement related land use
2) Agriculture related land use
3) Wetlands
4) Forest and Woodlands
5) Cropping intensity
6) Inter-culture
7) Irrigation intensity
8) Mode of irrigation
9) Source of irrigated water

1) Settlement related land use

A settlement is a place where people live. A settlement could be anything from an isolated farmhouse to a mega city (settlement with over 10 million people). Settlements come in all different shapes, sizes and locations. The function of a settlement can be identified by looking at its shape, size, site and situation.

The situation of a settlement is its location in relation to surrounding human and physical features. The site of a settlement is the land upon which it was built. We usually describe the situation when we are telling someone where a settlement is. These include single-family housing, multi-family residential etc.

(Fig 4.11) expresses that the settlements are clustered beside the roads. There are mostly semi-pucca and katcha houses with katcha roads and very little open space. Besides, market center, educational institutions, mosque, graveyard, sport fields are also seen. The amount of pucca roads and concrete buildings are scarce in the area.

The natural landscape is modifying rapidly into a cultural landscape. As a result, many agricultural lands there can be seen transforming into some type of settlements increasingly.

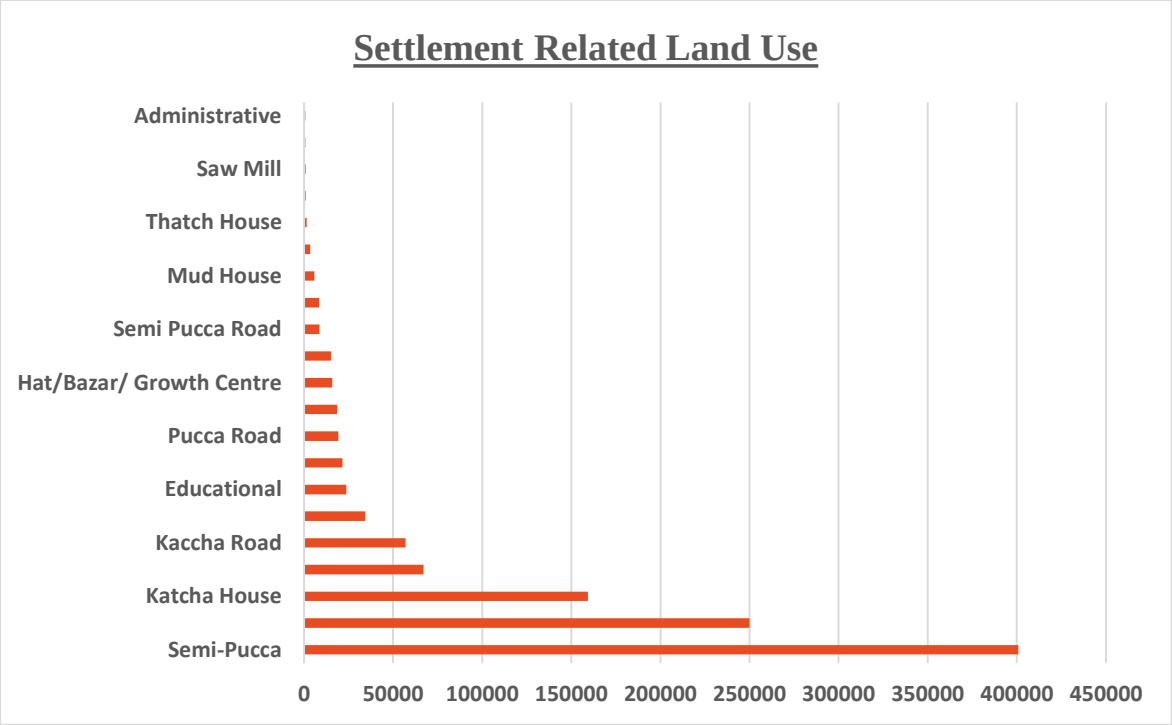


Fig 4.10: Settlement related land use of Mandra (Source: Field Survey 2021)

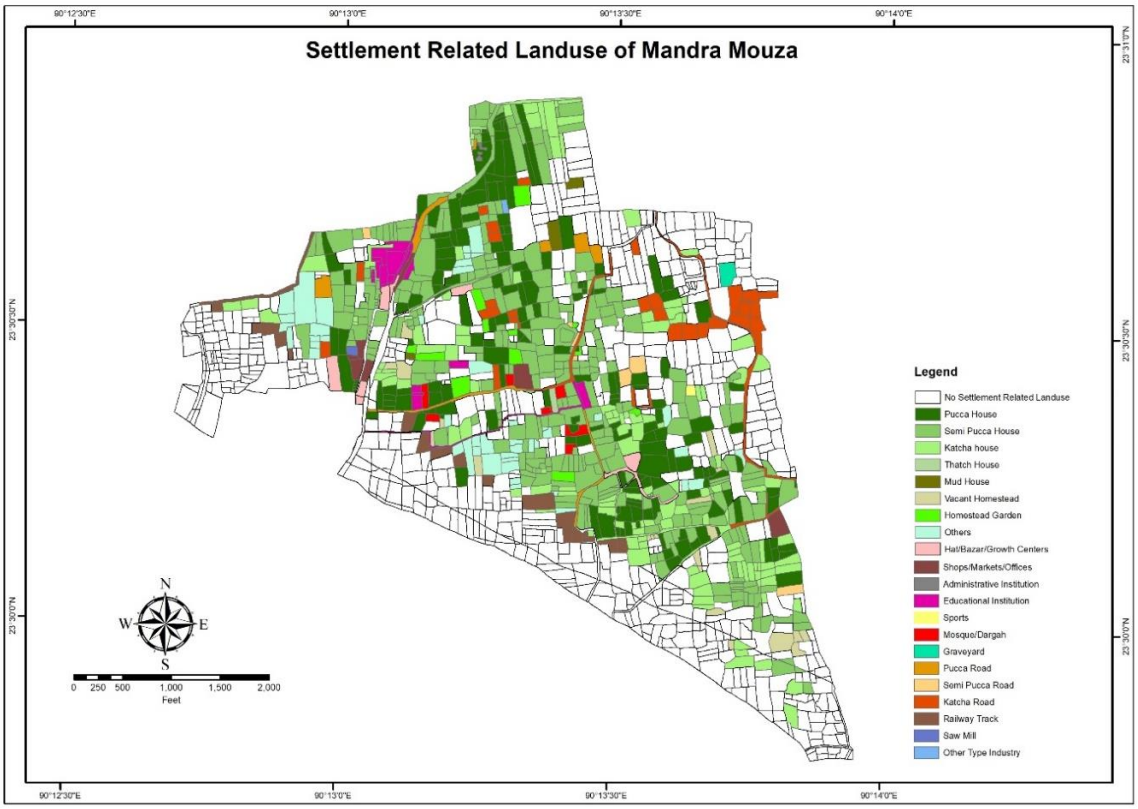


Fig 4.11: Settlement related land use of Mandra (Source: Field Survey 2021)

2) Agriculture related land use

From the agricultural land use pattern, we can see that a vast area of the Southern and South-eastern part has no agricultural activates because of the inundation of lands from river flooding. The dominant agricultural type is other with was grass. Besides, there were sporadically planted vegetation and fruit trees found in the area.

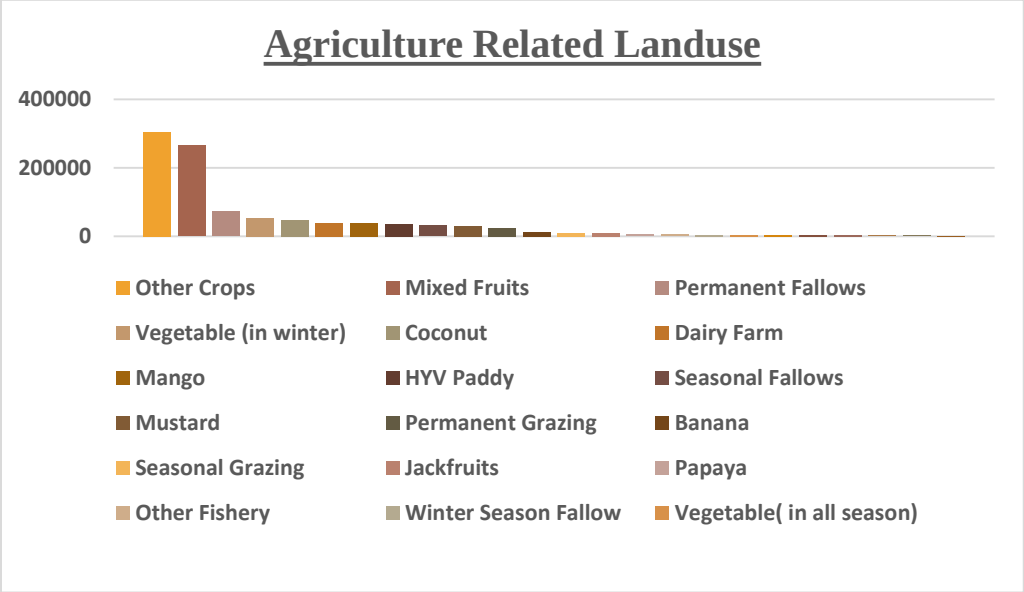


Fig 4.12: Agriculture related land use (Source: Field Survey 2021)

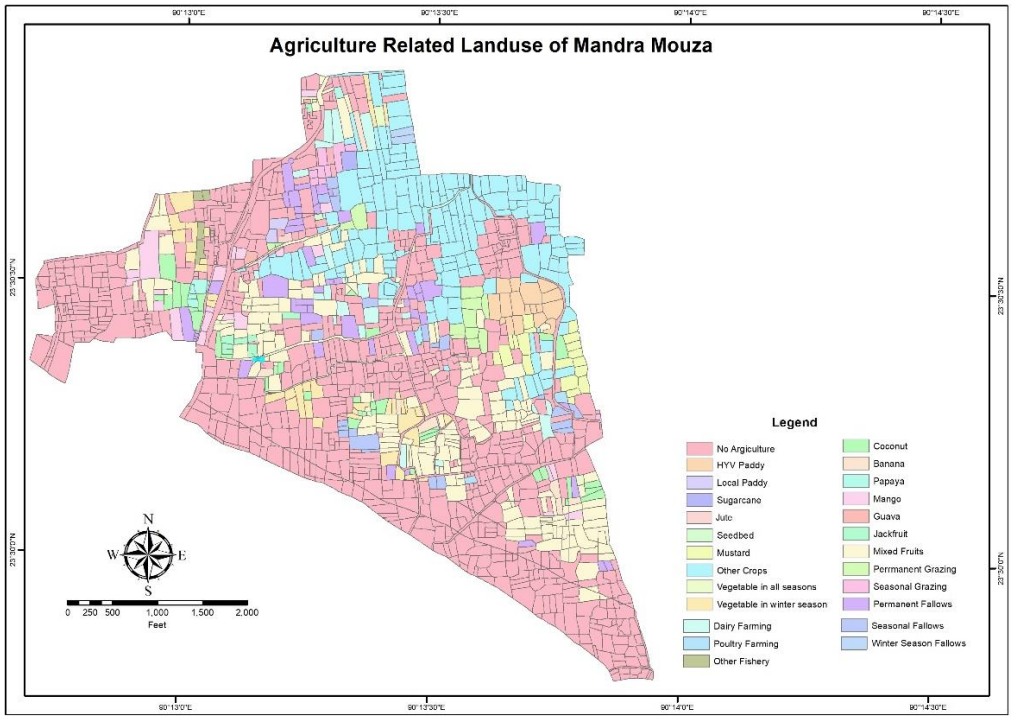


Fig 4.13: Map of agriculture related land use (Source: Field Survey 2021)

3) Wetlands

Most of the places in the study area contain no wetlands. But there can he found some seasonally waterlogged areas due to the rainfall, low land and poor drainage system. Besides, a number of seasonal and permanent ponds are also there that are often used to perform domestic chores.

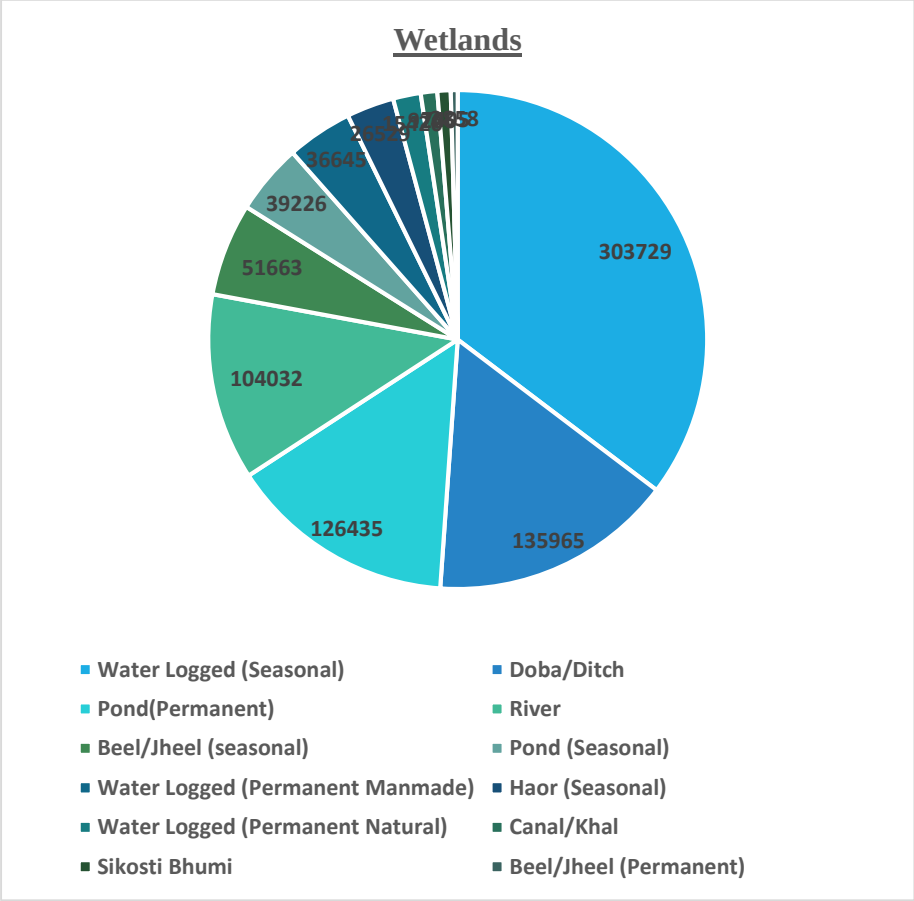


Fig 4.14: Wetlands of Mandra (Source: Field Survey 2021)

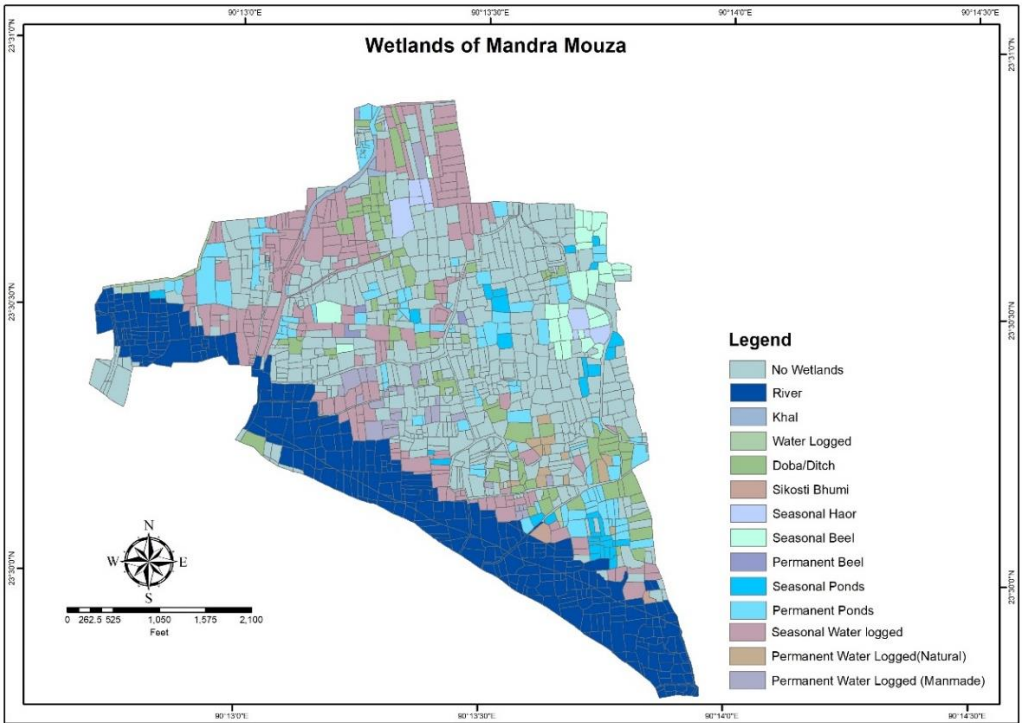


Fig 4.15: Wetlands of Mandra (Source: Field Survey 2021)

4) Forest and Woodlands

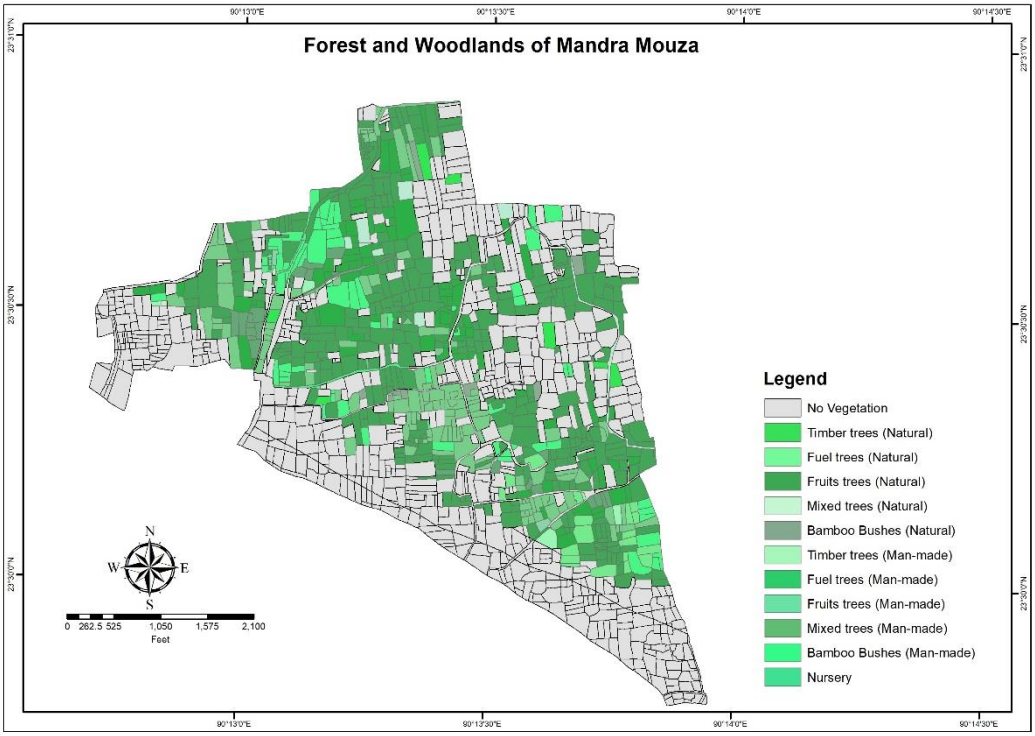


Fig 4.16: Forest and Woodlands of Mandra (Source: Field Survey 2021)

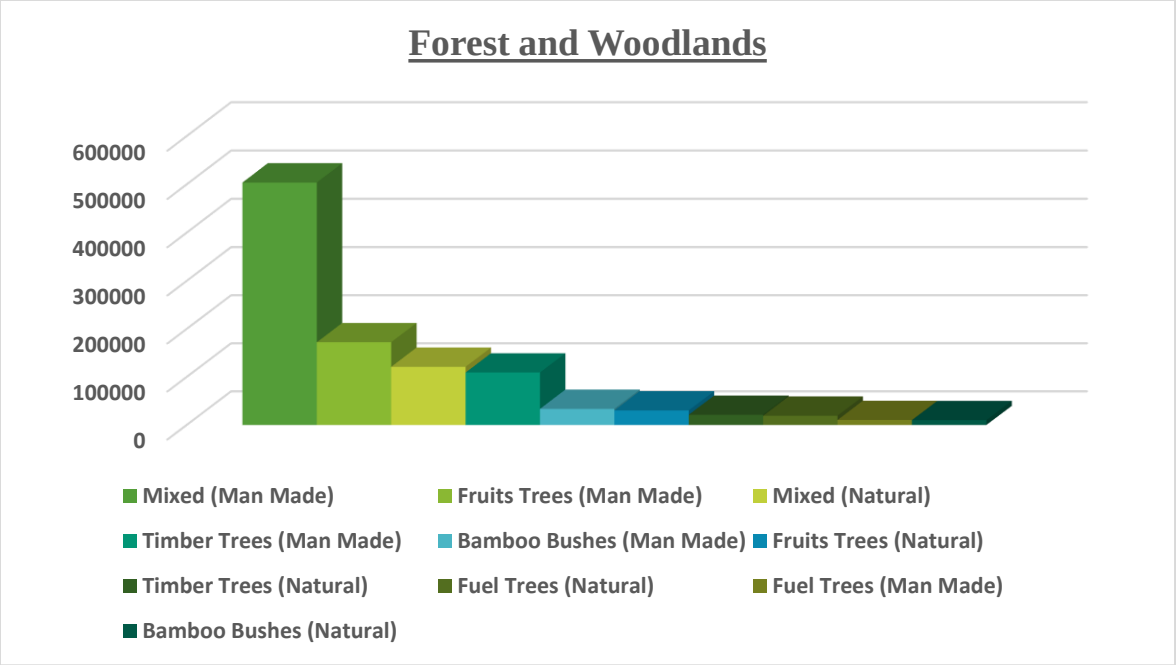


Fig 4.17: Forest and Woodlands of Mandra (Source: Field Survey 2021)

There are mainly mixed woodlands both grown naturally and manmade are common in the study area. Besides, Fruits and timber trees grown by people can also be seen near peoples' homesteads. Some scarcely distributed bamboo bushes were also found.

Fig 4.18: Forest and Woodlands of Mandra (Source: Field Survey 2021)

5) Cropping intensity

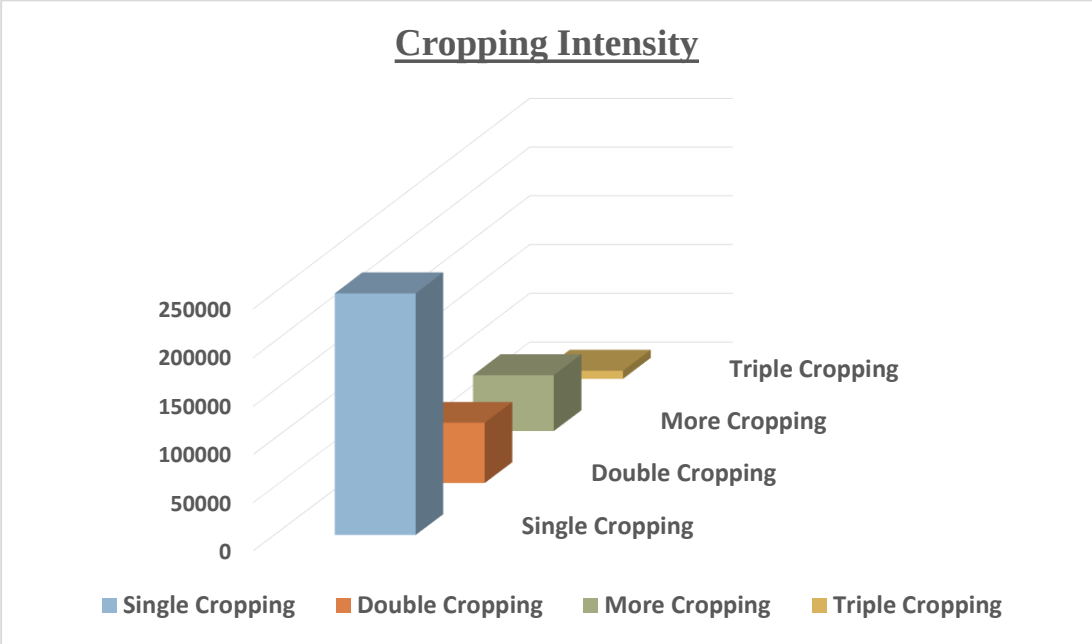


Fig 4.19: Cropping intensity of Mandra (Source: Field Survey 2021)

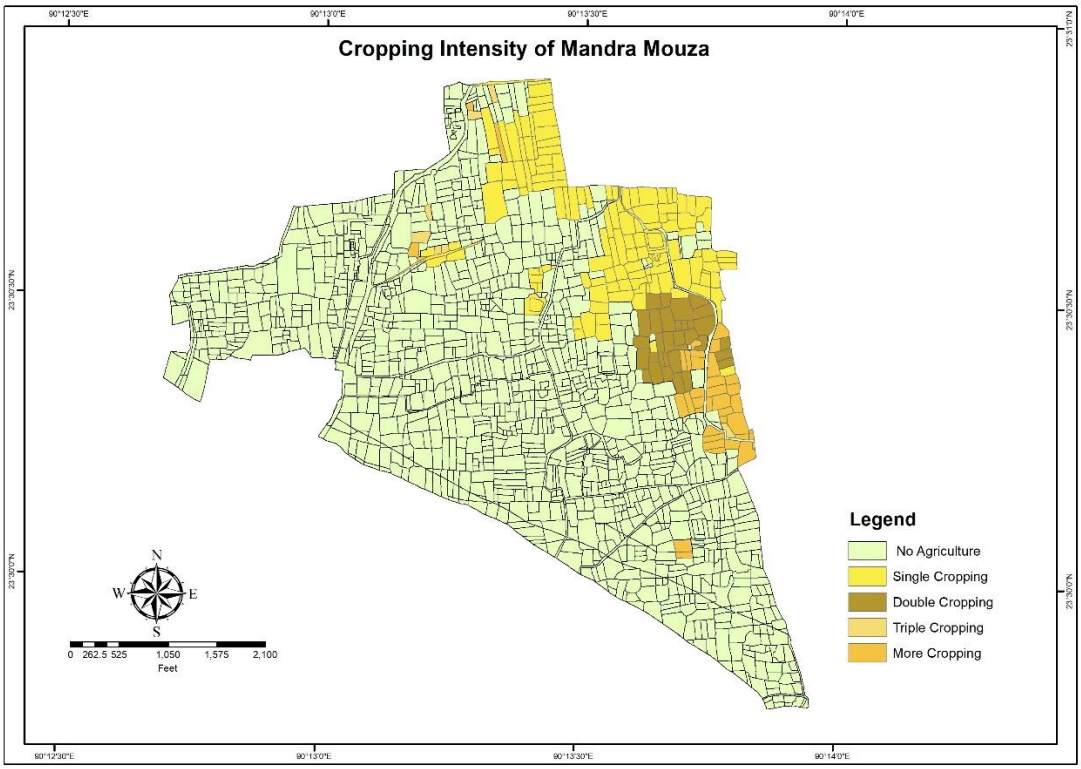


Fig 4.20: Cropping intensity of Mandra (Source: Field Survey 2021)

As we already know that there is not much agricultural practice in Mandra mouza, but whatever agricultural practices remain that have single cropping system mostly. For example, Grass. Besides, double and more cropping system can also be found in the eastern sides of the mouza.

6) Inter-culture

Inter-culture of an agricultural land refers to the number of crop grows in a parcel of land at the same time. It is the practice of simultaneously growing two or more crops on the same plot (as in alternate rows).

The common types of inter-culture seen our study area was banana and vegetables, paddy and fish, mango and vegetables, papaya and banana, jackfruit and guava, papaya and vegetable, fish and vegetable, jackfruit and papaya, paddy, fish and vegetables and mostly other mixed.

Fig 4.20: Inter-culture of Mandra (Source: Field Survey 2021)

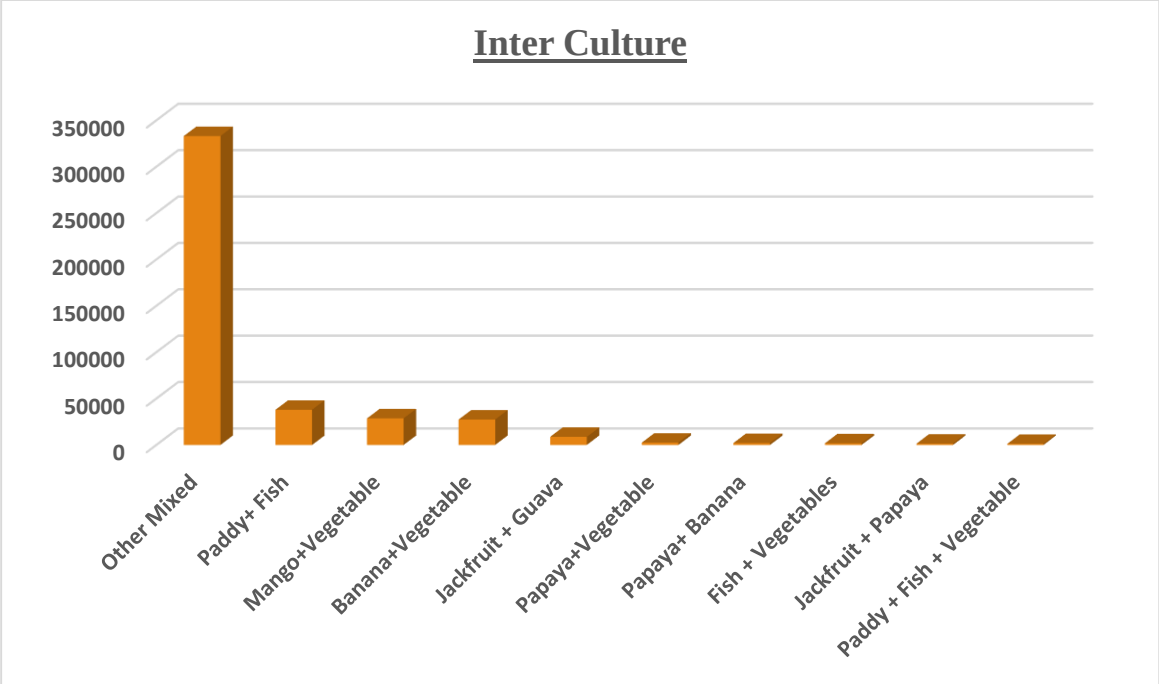


Fig 4.22: Inter-culture of Mandra (Source: Field Survey 2021)

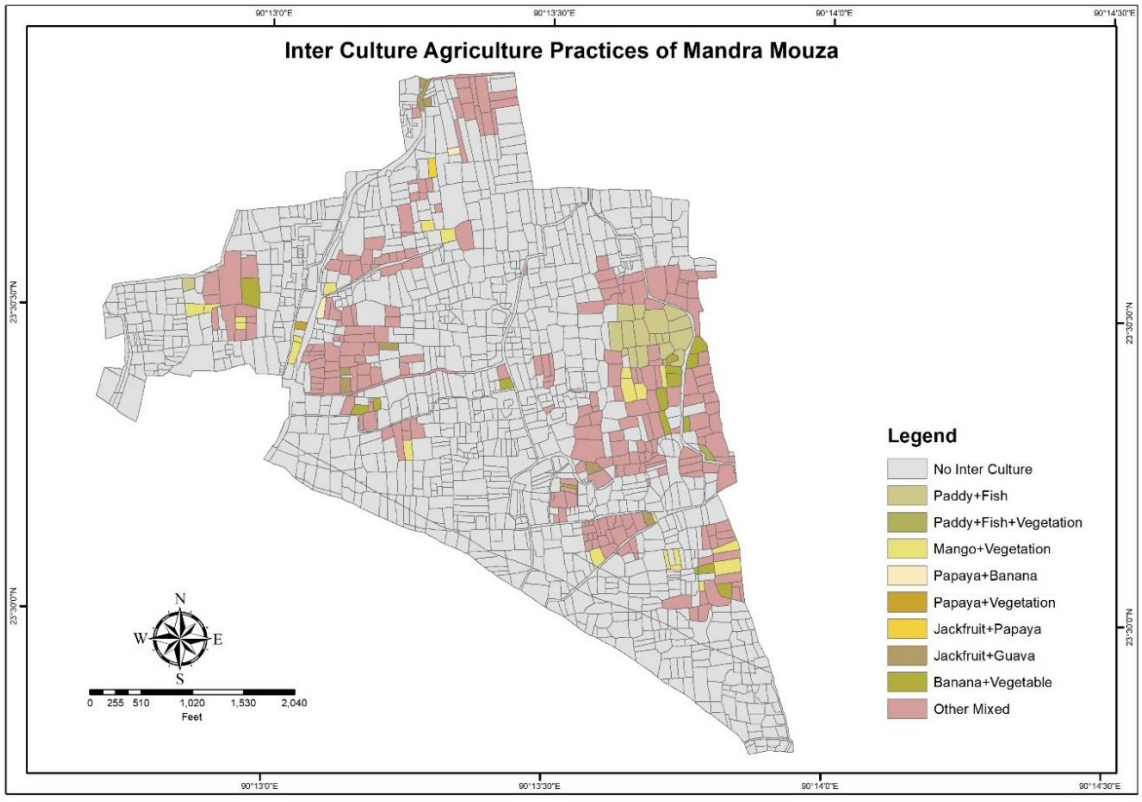


Fig 4.23: Inter-culture map of Mandra (Source: Field Survey 2021)

7) Irrigation intensity

Irrigation is the process of applying controlled amounts of water to plants at needed intervals. Irrigation helps to grow agricultural crops, maintain landscapes, and revegetate disturbed soils in dry areas

The frequency, rate, amount and time of irrigation are different for different crops and also vary according to the types of soil and seasons. For example, summer crops require a higher amount of water as compared to winter crops. Here, in our study area most of the area have no irrigation, some North and North-wester part gets occasional irrigation and least presence of regular irrigation in the eastern parts were found,

Table 4.2: Irrigation intensity of Mandra (Source: Field Survey 2021)

Irrigation Intensity	Area(Sq.m)
Regular	95728
Occasional	163727

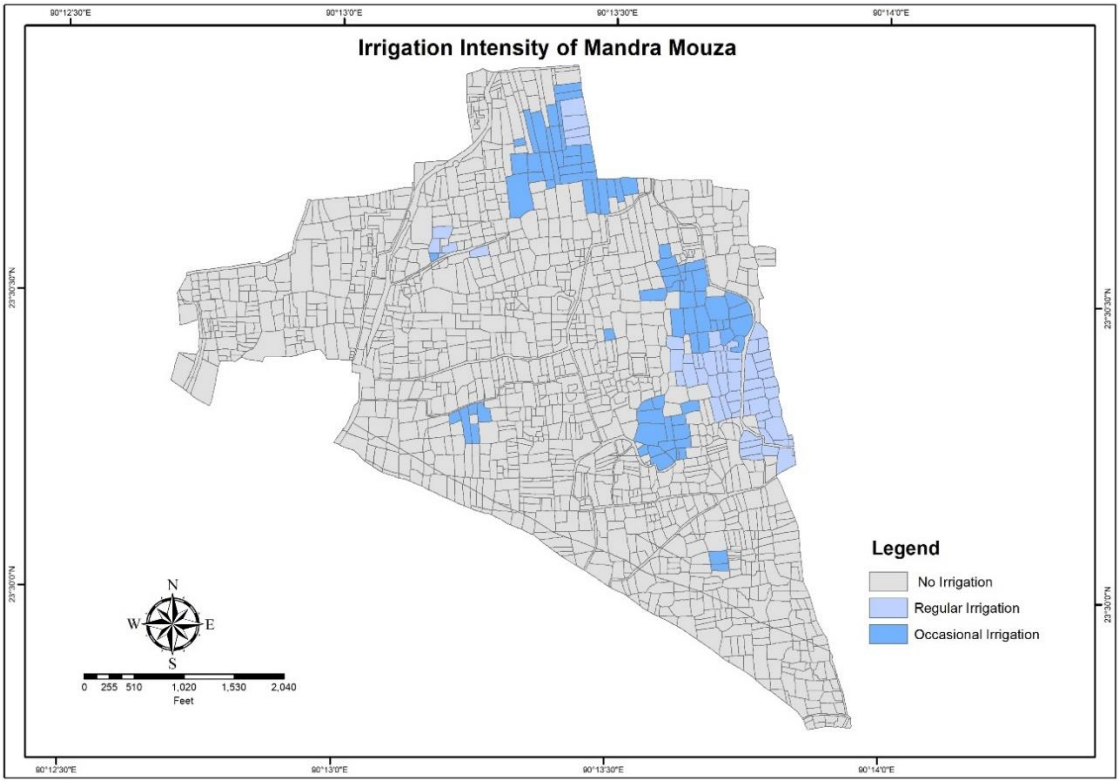


Fig 4.24: Irrigation intensity of Mandra (Source: Field Survey 2021)

8) Mode of irrigation

As stated previously, most of our study area receive no irrigation, and the remaining irrigated areas are supplied water using power pump, deep tube well, shallow tube well and canal or khal.

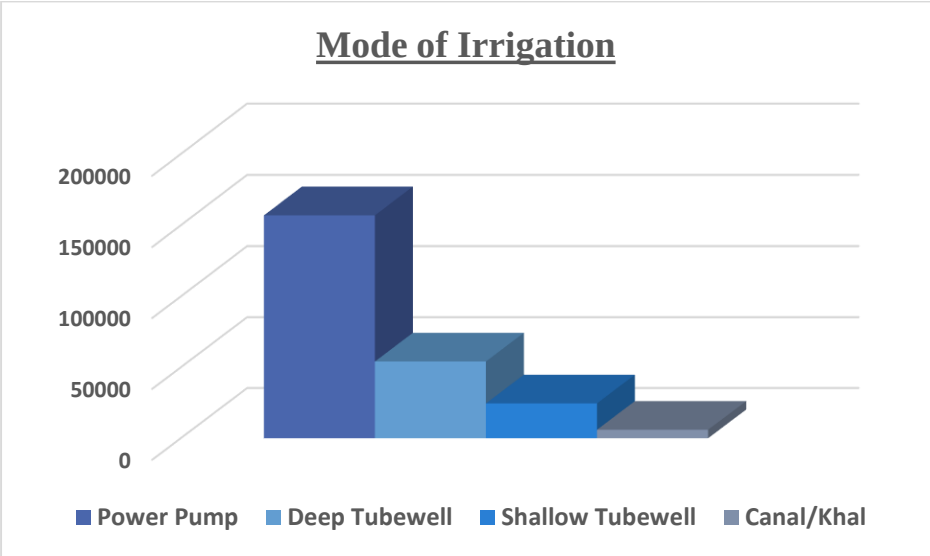


Fig 4.25: Mode of Irrigation (Source: Field Survey 2021)

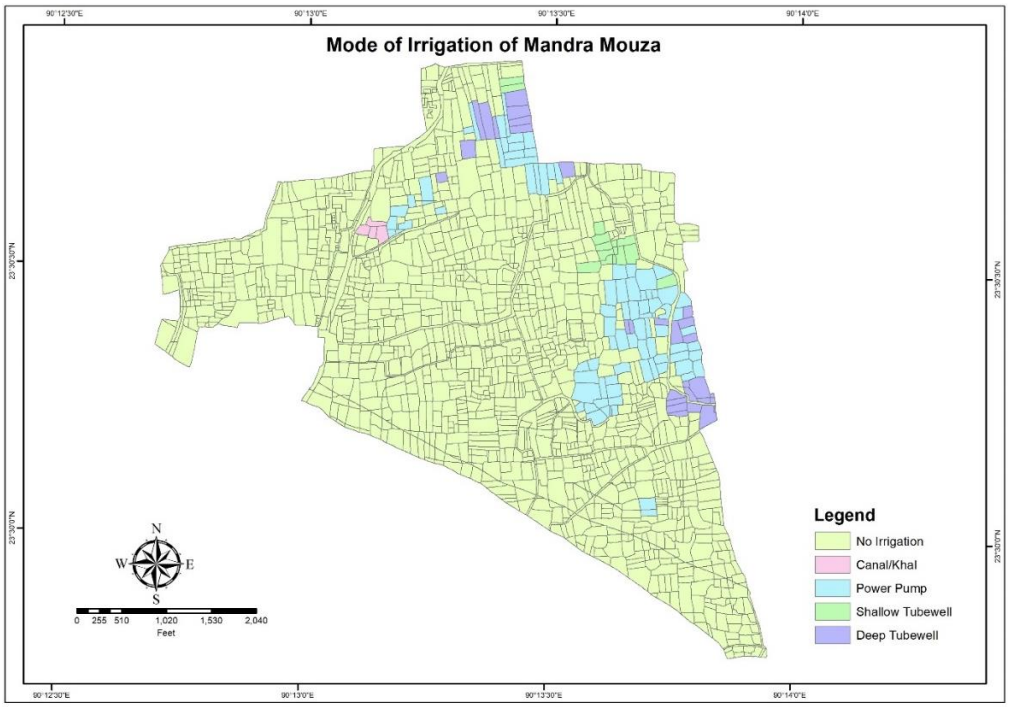


Fig 4.26: Mode of Irrigation (Source: Field Survey 2021)

9) Source of irrigated water

The major sources of water for irrigation in the study area are ground water, ponds, natural pools, beel and the nearby river.

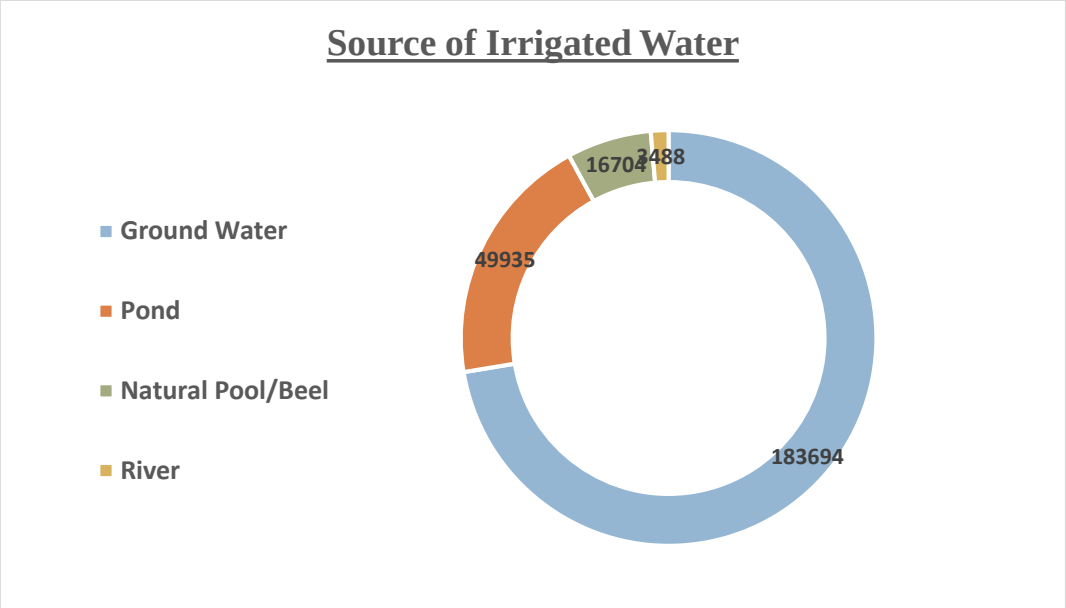


Fig 4.27: Source of Irrigated Water (Source: Field Survey 2021)

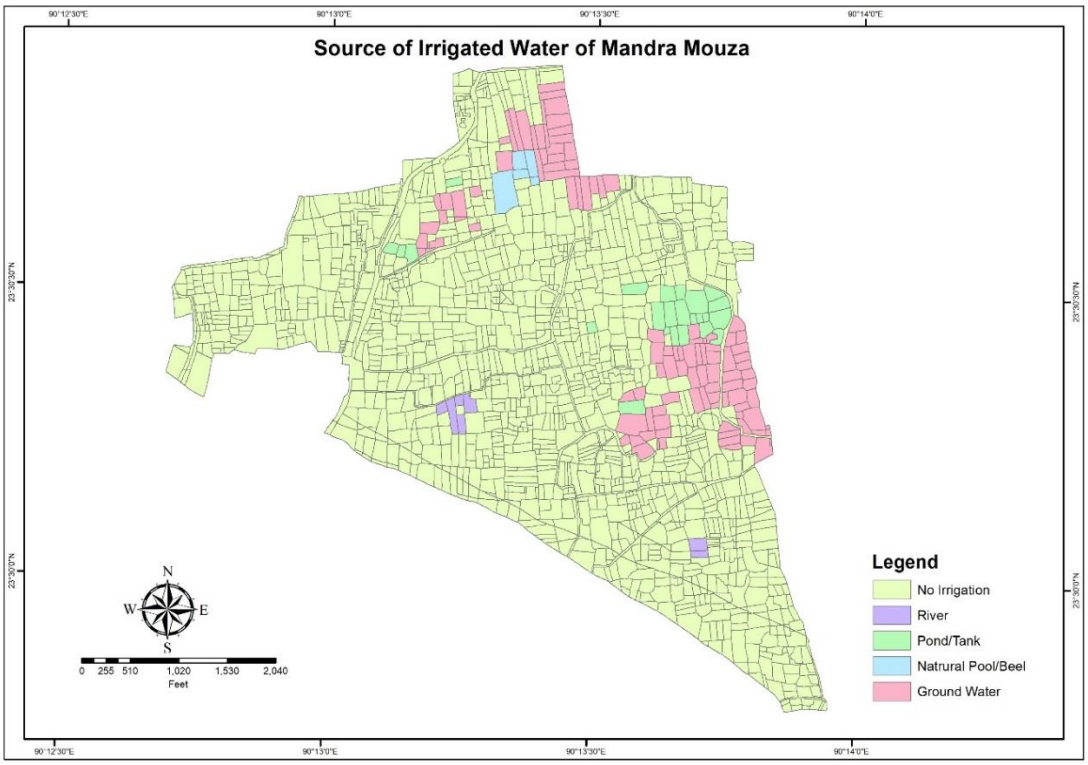


Fig 4.28: Source of Irrigated Water (Source: Field Survey 2021)

4.4 Conclusion

Land use varies from area to area. The concept 'Land use' is vast and it's the consequence of a large number of operative forces.

Chapter 5

Socio-economic Conditions

5.1 Introduction

It is critical to understand that land use decisions are made and influenced by environmental and socio-economic factors across a wide range of spatial scales, from household level decisions that influence local land use practices, to policies and economic forces that can alter land use regionally and even globally. (Stead, 2001)

Socio-economic conditions of an area are very important to analyze the social and economic characteristics of it. The socioeconomic conditions of an area have a great influence on existing land use pattern and correspondent changes in land use pattern.

The socio-economic condition of an area or region means its demographic characteristics, use of resources and various economic, financial and social indicators. The level of income, availability of social and civic facilities determines the pattern of land uses.

Identifying the causes of land-use change requires understanding both how people make land-use decisions (decision-making processes) and how specific environmental, economic and social factors interact to influence these decisions (decision-making context).

5.2 Demographic Condition

The male and female gender percentages are respectfully 92.9% and 7.1%. Total Birth rate in the study area is 2.06% and total Death rate is 0.85%. Both calculated in terms of 100 people.

About 69.4 % of the families surveyed are Nuclear families, single parent family is 0.4% and 30.2% are joint in nature. This is indicative of the fact that the area is semi-urban in nature. In our study area we found that

In terms of religion, it can be seen that the Muslims are predominant in the urban area because of Muslim majority presence in the country, having a percentage of 93.7%. On the other hand, the Hindu religion people make 6.3% of the local population.

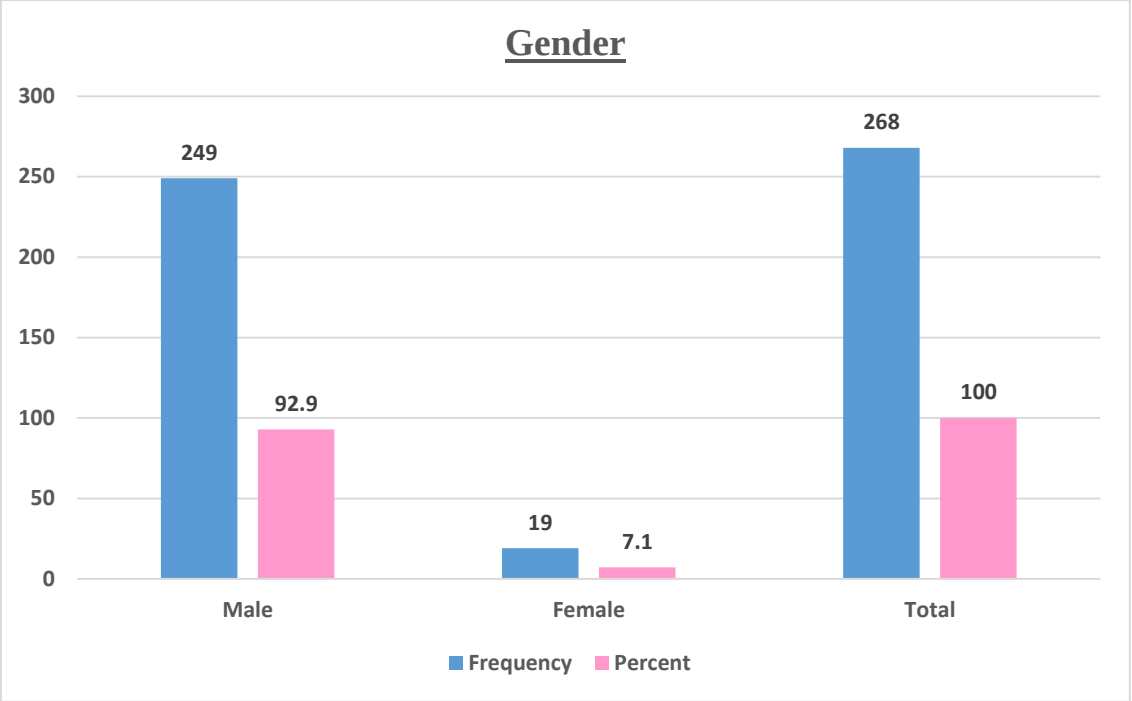
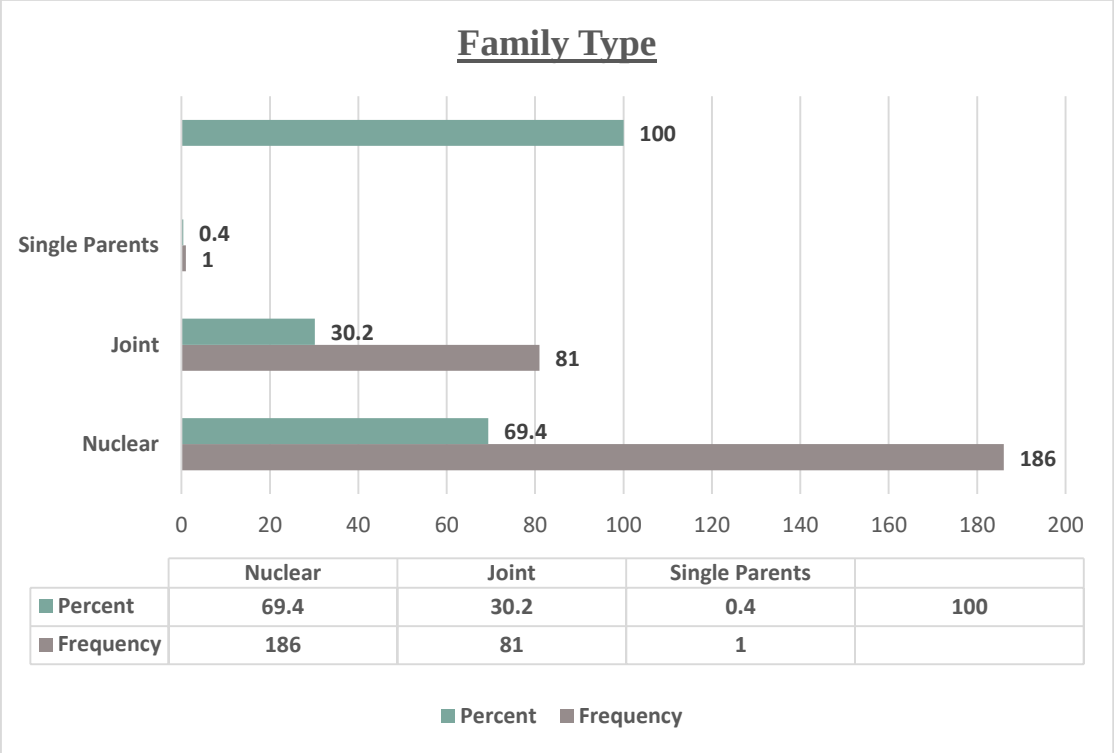


Fig 5.1: Gender percentage of Mandra (Source: Field Survey 2021)



	Nuclear	Joint	Single Parents	
Percent	69.4	30.2	0.4	100
Frequency	186	81	1	

Fig 5.2: Family types of Mandra (Source: Field Survey 2021)

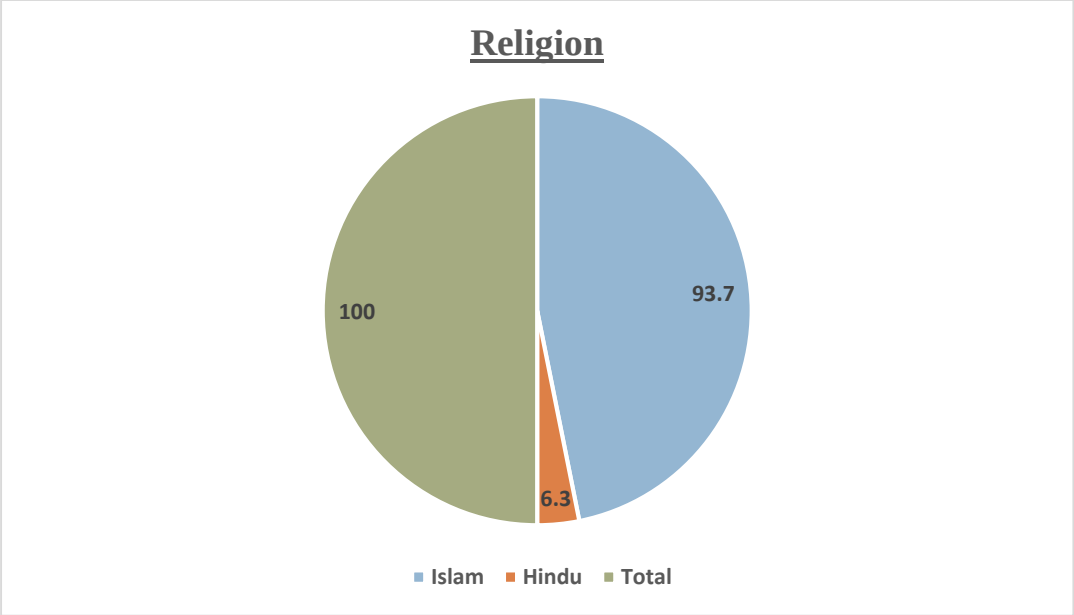


Fig 5.3: Religion types of Mandra (Source: Field Survey 2021)

5.3 Education

All in all, while the overall literacy may be high but there are few people who have higher education. The people of the area have a tendency of going abroad in search of work as a result most of them do not complete their studies here and leave for another country to get better work and salaries.

While 21.6% of the people of this area were uneducated, the remaining 78.4% have some form of education. People who were only literate up to primary level are 29.9%. 14.9% have received secondary education, 8.6% of the people have studied up to higher secondary level, 3.4% people are graduates, 4.1% are of post-graduate level.

There are also other forms of educational institutes, such as: Madrasa. The literacy percentage of this type education is 0.4%.

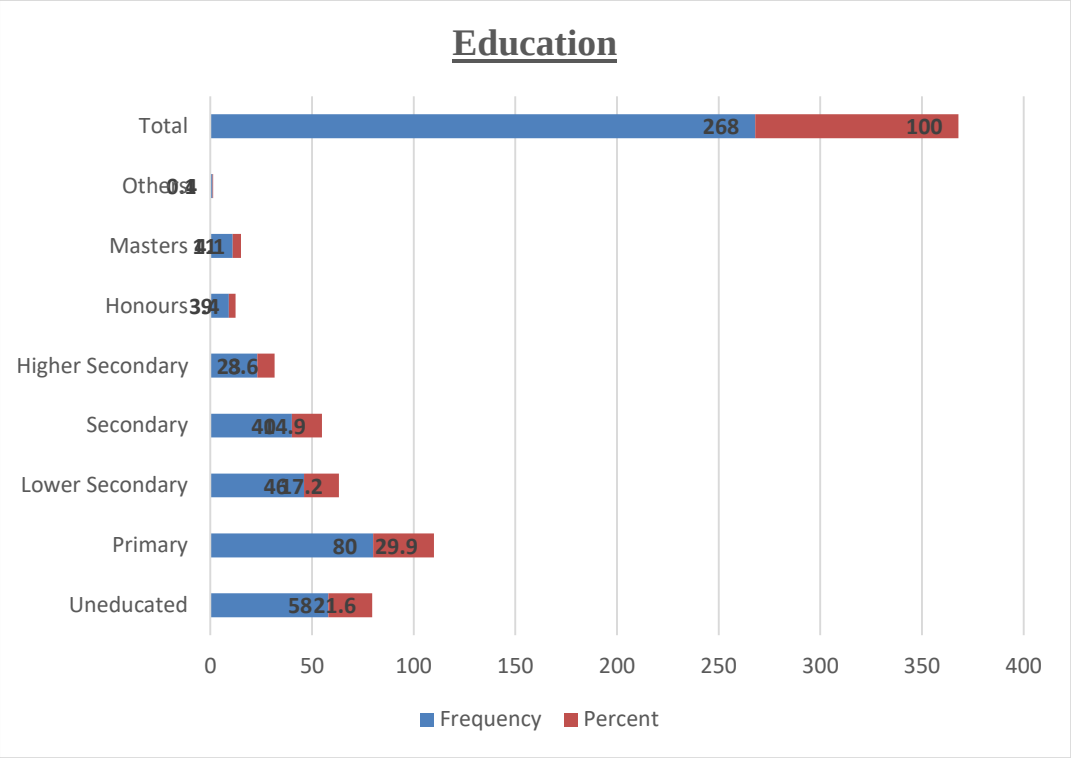


Fig 5.4: Education of Mandra (Source: Field Survey 2021)

Fig 5.5: Bhagyakul Harendralal School and College (Source: Field Survey 2021)

Fig 5.6: Primary School and College of Mandra (Source: Field Survey 2021)

5.4 Settlements and Household Facilities

Most households have a semi-pucca and pacca bedroom structure and this also stays true to the characteristic of semi-urban area. No matter the family condition, the locals were trying to build their main room of the household of good and long lasting structure. In most houses which were financially doing unwell had the kitchen in a shack while the main bedroom has still semi pucca or pucca structures.

The percentage of semi-pucca settlements were 41.4% which is around half of the total households. The pucca settlements had a percentage of 24.5%, the second common household type after semi-pucca. Besides, 18.7% katcha, 12.7% wood built, 2.6% hut etc. were also found.

Fig 5.7: Semi-pucca settlements of Mandra (Source: Field Survey 2021)

Also, in the households, there were various kinds of modern amenities available according to the affordability of the locals. These includes TV, fridge, sewing machine, computers, DVD etc. There were also a few percentage of people who owns none of it as they could not afford.

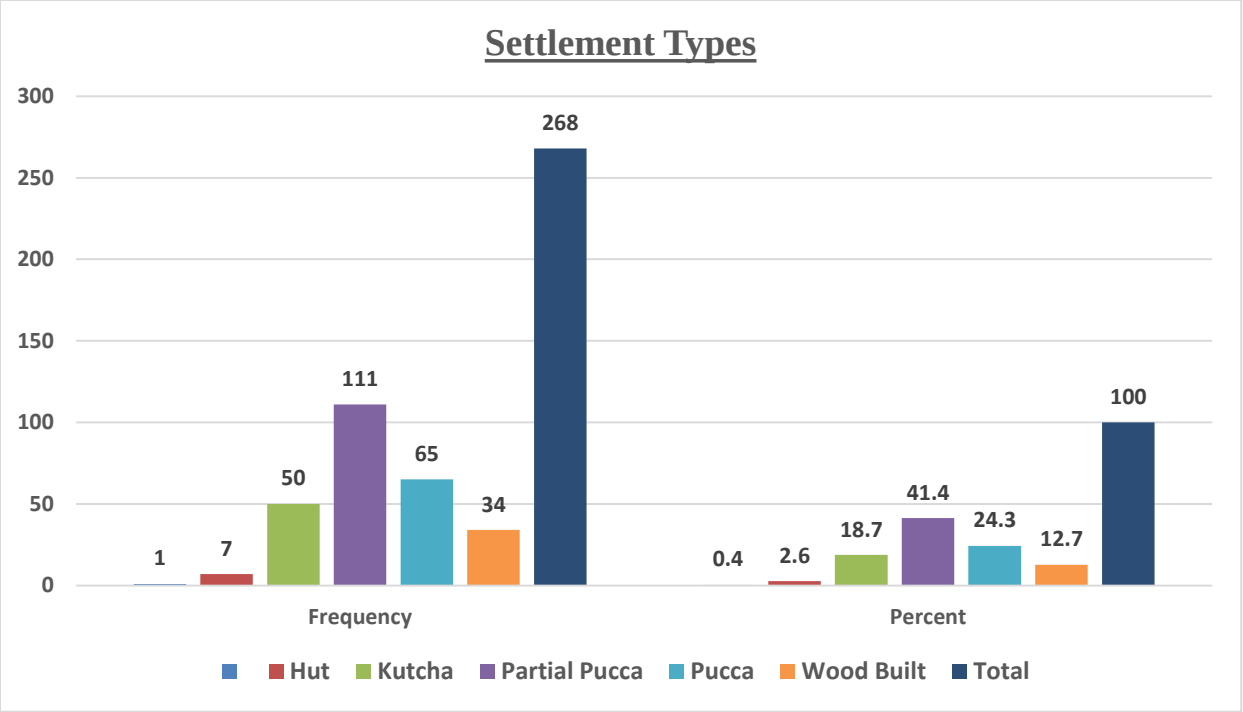


Fig 5.8: Settlement types of Mandra (Source: Field Survey 2021)

The drinking water sources of the area are tube well, well and supply water among which tube is most dominant source with 81.3% percentage. The other two source have 9.3% and 5.2% use.

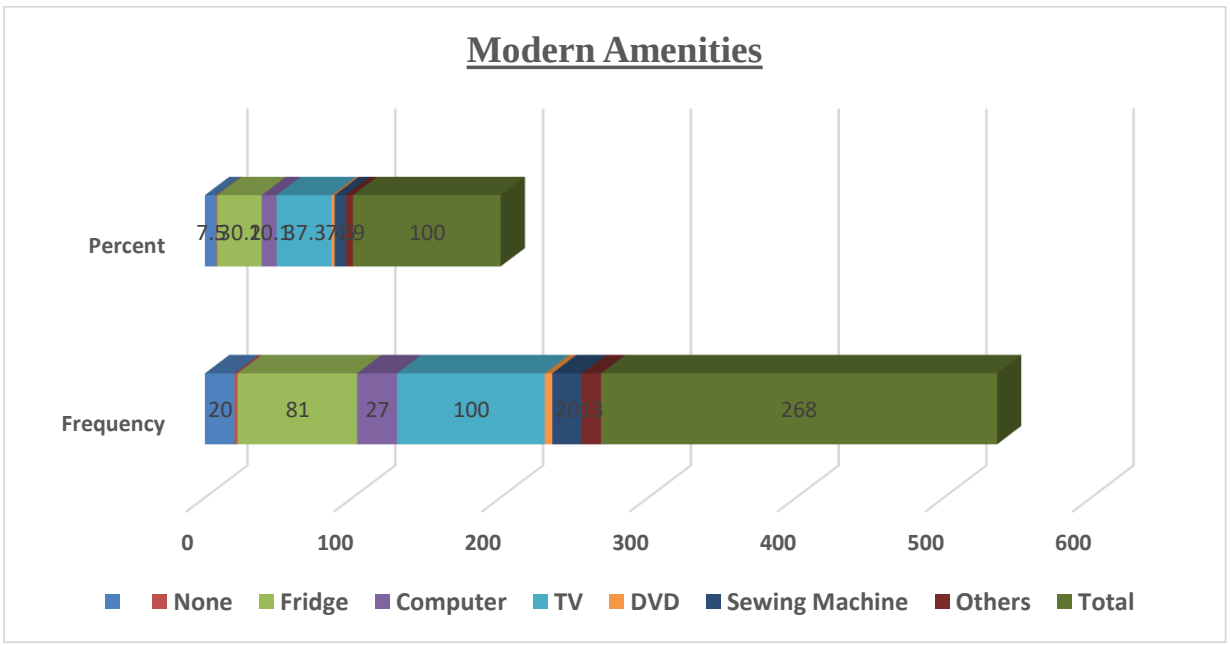


Fig 5.9: Modern household amenities of Mandra (Source: Field Survey 2021)

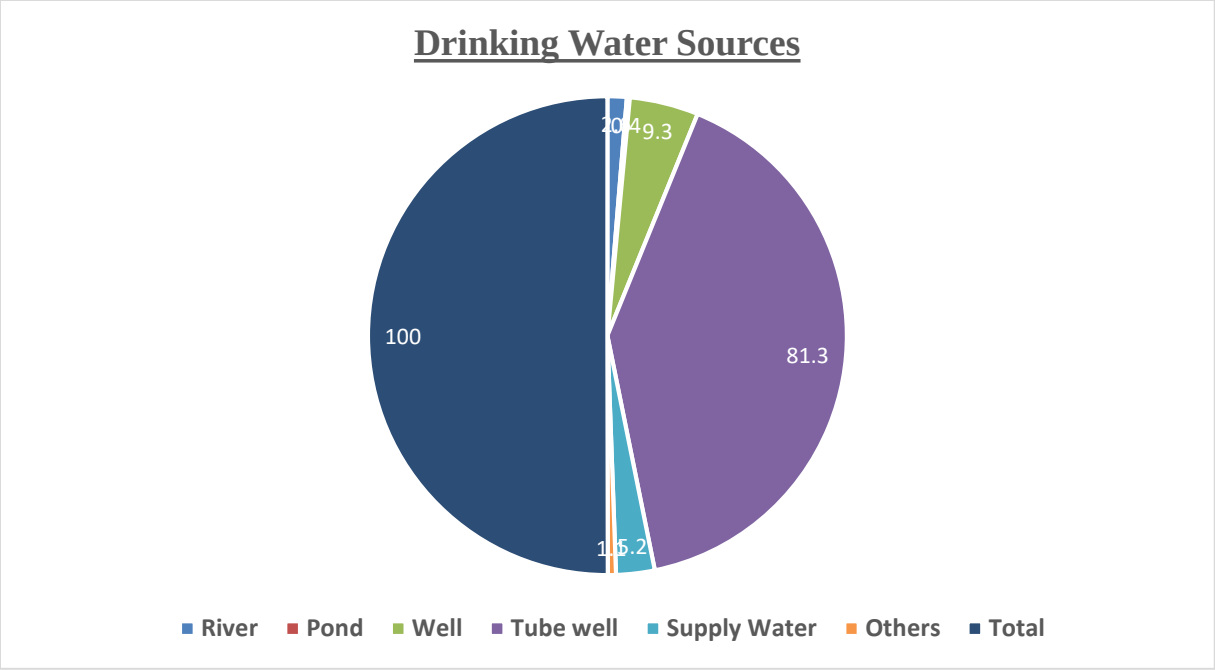


Fig 5.10: Drinking water sources of Mandra (Source: Field Survey 2021)

Besides, the households also have various types of toilets of which pucca and katcha sanitary are the most common ones having percentage of 53% and 38.4% respectively.

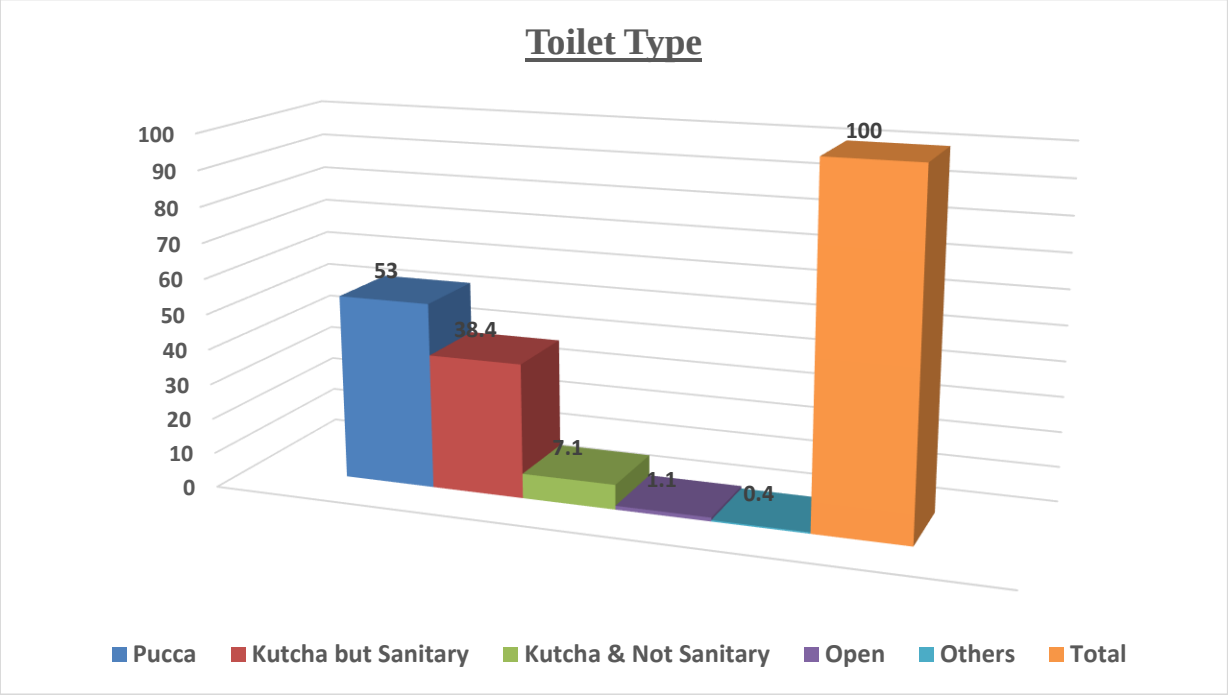


Fig 5.11: Types of toilets of Mandra (Source: Field Survey 2021)

5.5 Transport

From our analysis we found that the most common modes of transport are rickshaw or van with 53.4% use, then comes motor vehicle with 13.8% use, CNG and boats with 10.1% and 9.3% use.

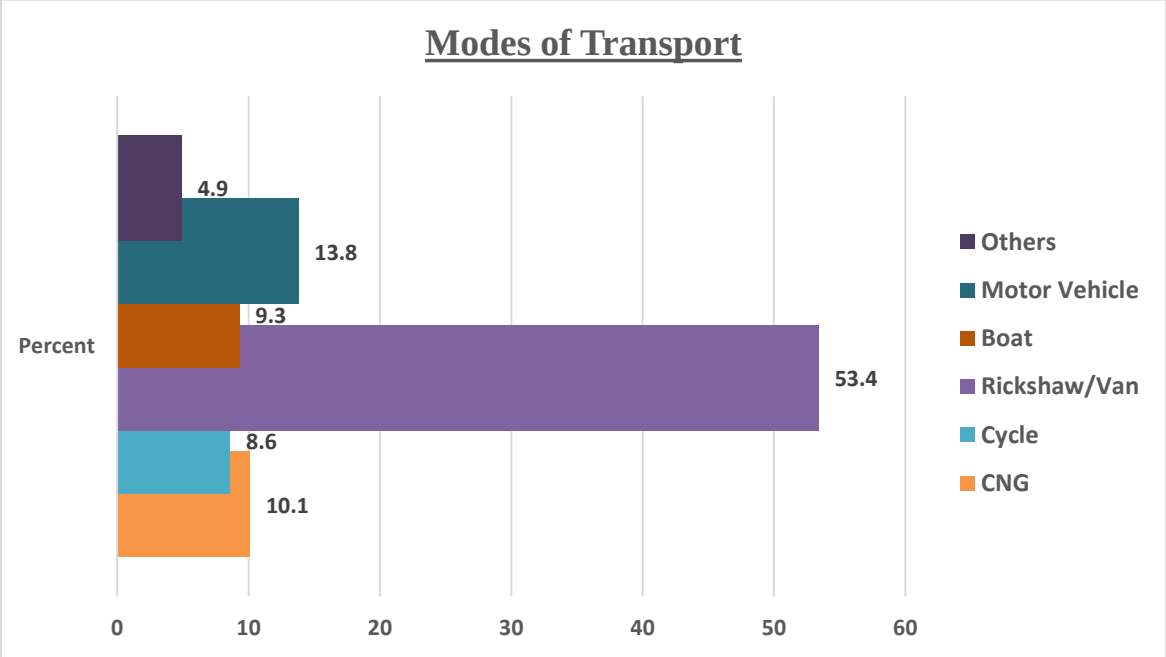


Fig 5.12: Modes of Transport (Source: Field Survey 2021)

Fig 5.13: Modes of Transport of Mandra (Source: Field Survey 2021)

5.6 Farming and Homestead Gardening

There is a common practice of homestead gardening, dairy farming, poultry, fisheries etc. were seen near by many houses. The summarized results are shown below-

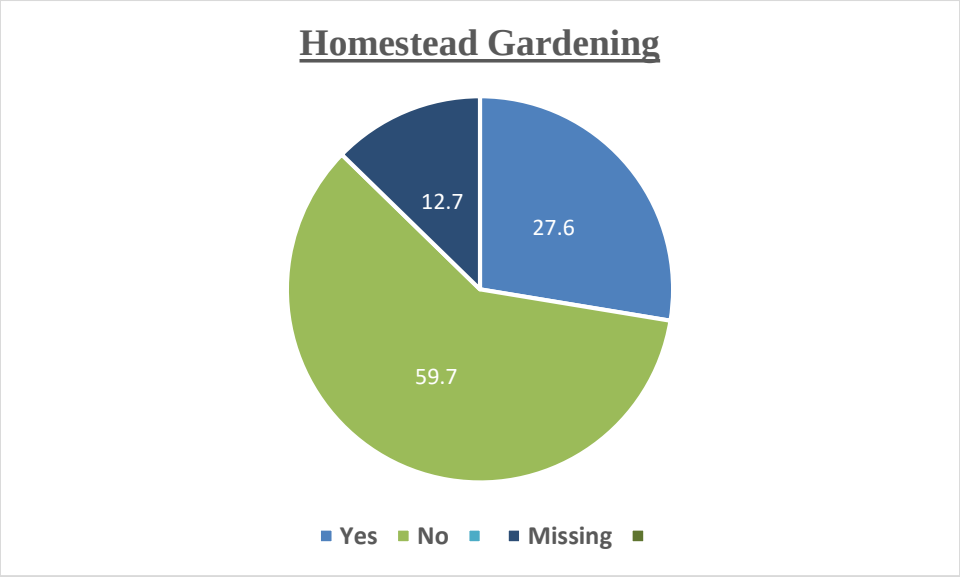


Fig 5.14: Practice of homestead gardening at Mandra (Source: Field Survey 2021)

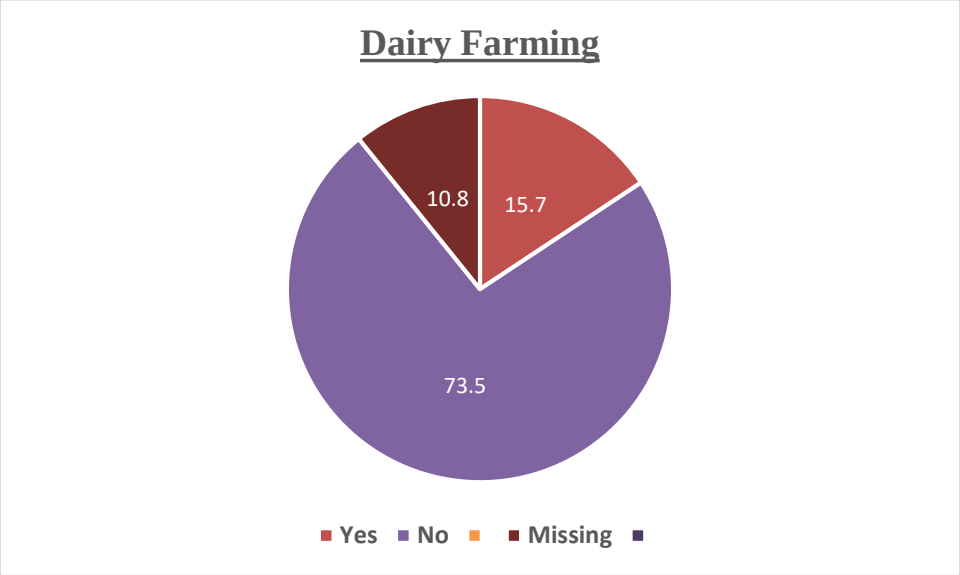


Fig 5.15: Practice of dairy farming at Mandra (Source: Field Survey 2021)

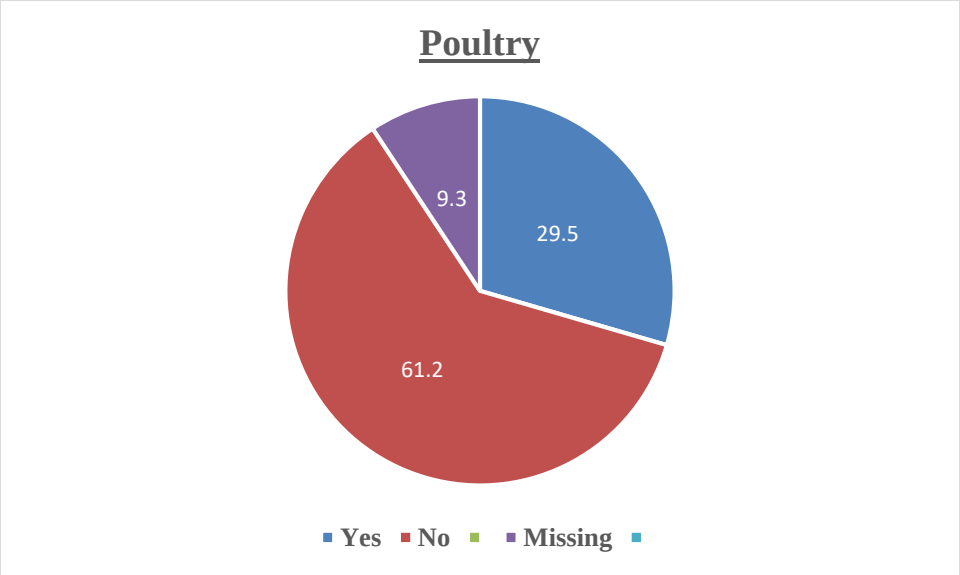


Fig 5.16: Practice of poultry at Mandra (Source: Field Survey 2021)

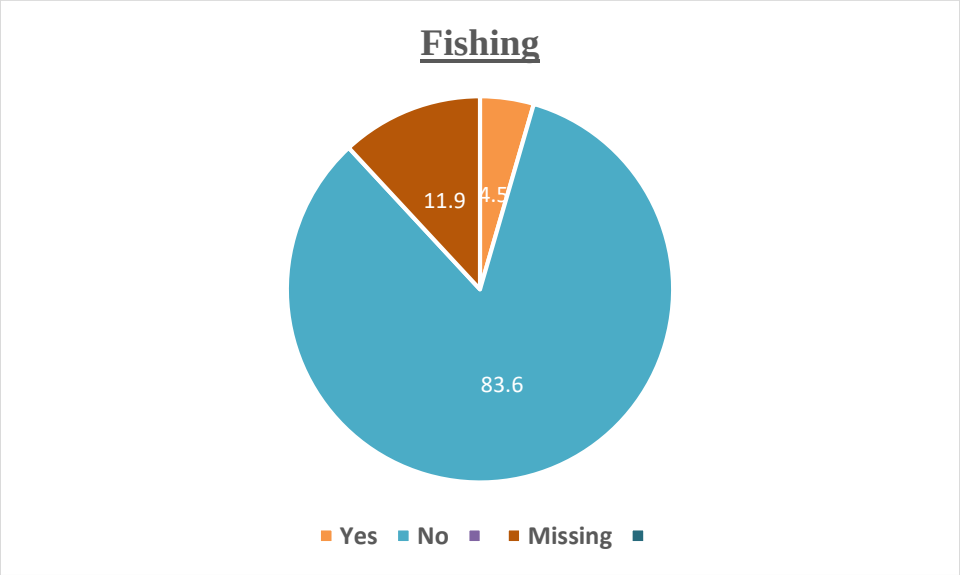


Fig 5.17: Practice of fishing at Mandra (Source: Field Survey 2021)

5.7 Economic Conditions

The occupations that the people of the study area associated with are mentioned below-

Table 5.1: Occupations of the people of Mandra (Source: Field Survey 2021)

Occupation	Frequency	Percent
Laborer	32	11.9
Business	102	38.1
Service	43	16
Farmer	9	3.4
Dairy farmer	16	6
Fisherman	20	7.5
Others	46	17.2
Total	**268**	**100**

From the above (Table 5.1) we can see that most of the people in the area are involved in business, around 38.1%. Besides, 16% are in service, 11.9% are labourer, 7.5% are fisherman, 6% run dairy farms and 3.4% are farmers. The income ranges are shown below-

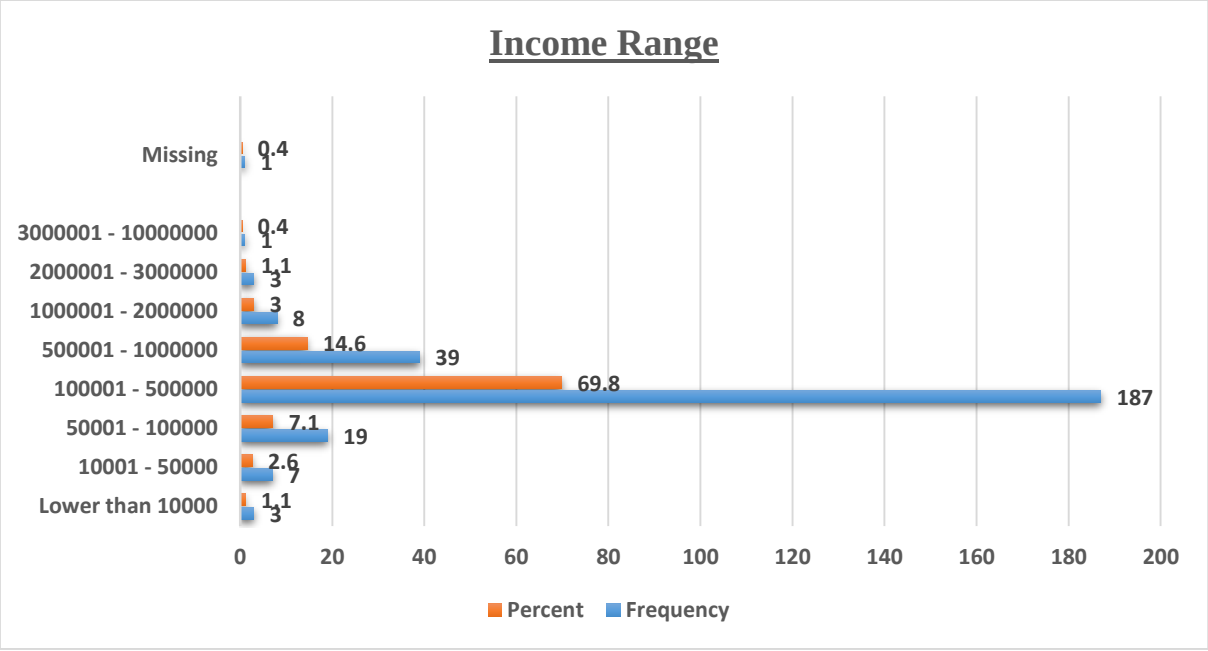


Fig 5.18: Income range of the people of Mandra (Source: Field Survey 2021)

The people of the study area have also mentioned about taking loans from various sources in various amounts. The most common source is Bank and the amount ranges from 10-50 thousand.

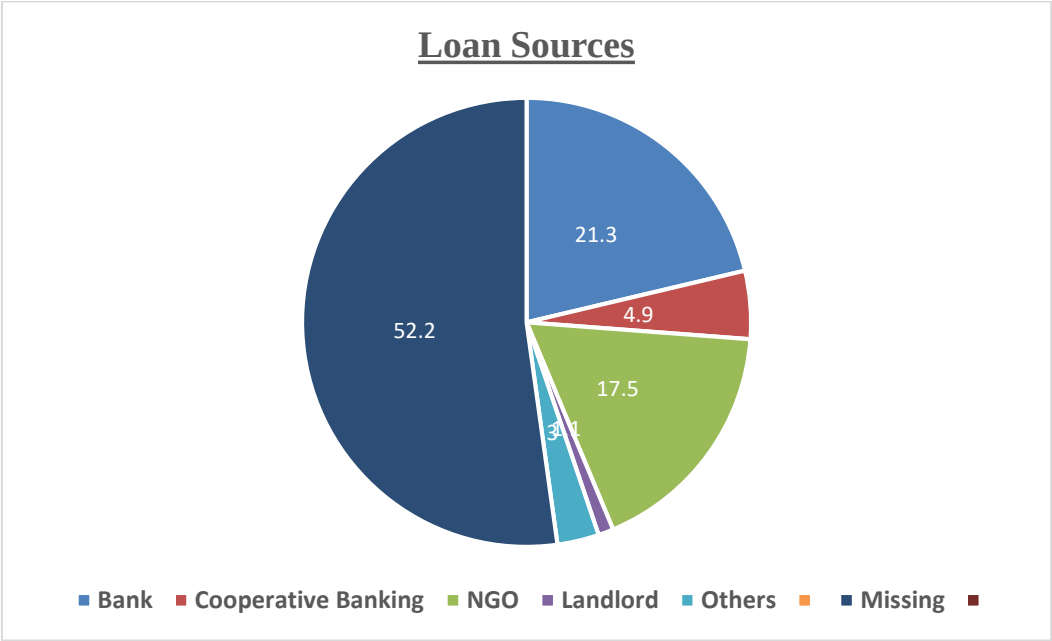


Fig 5.19: Loan Sources (Source: Field Survey 2021)

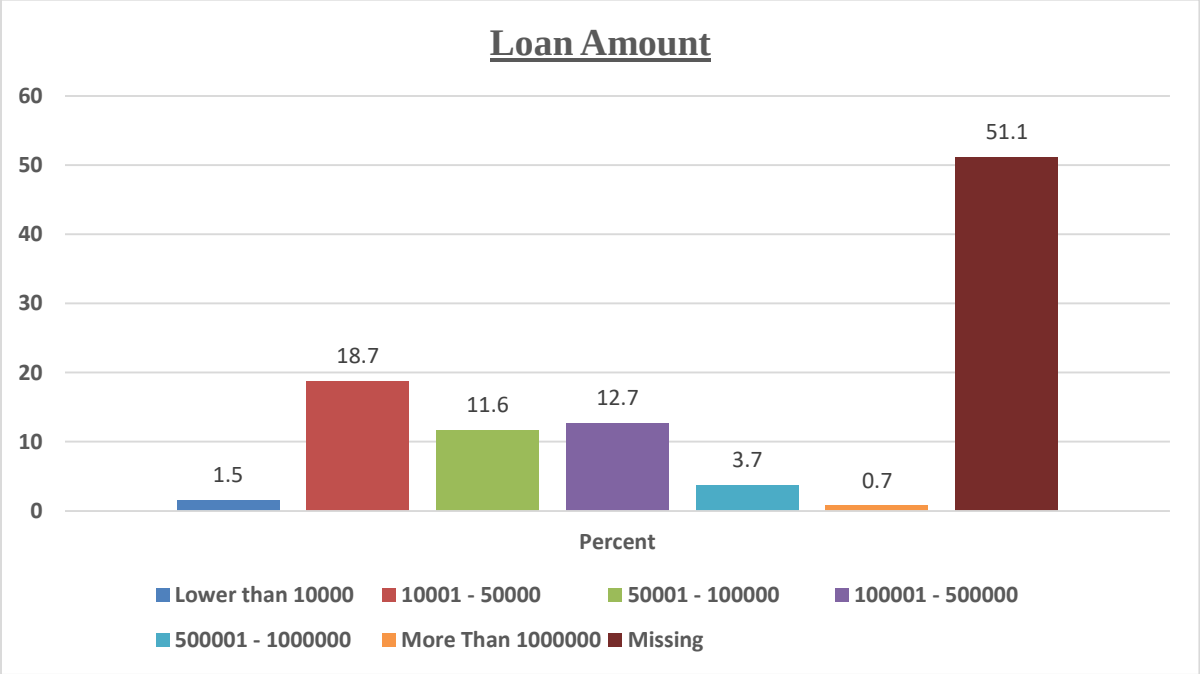


Fig 5.18: Loan Amount (Source: Field Survey 2021)

5.8 Migration Trends

By analyzing the data, we can see that most people (43.3%) have been born here, very few people have migrated here. In case of immigration, most people from the study area have migrated to Saudi Arabia (14.6%), UAE (1.9%) and Qatar (1.5%).

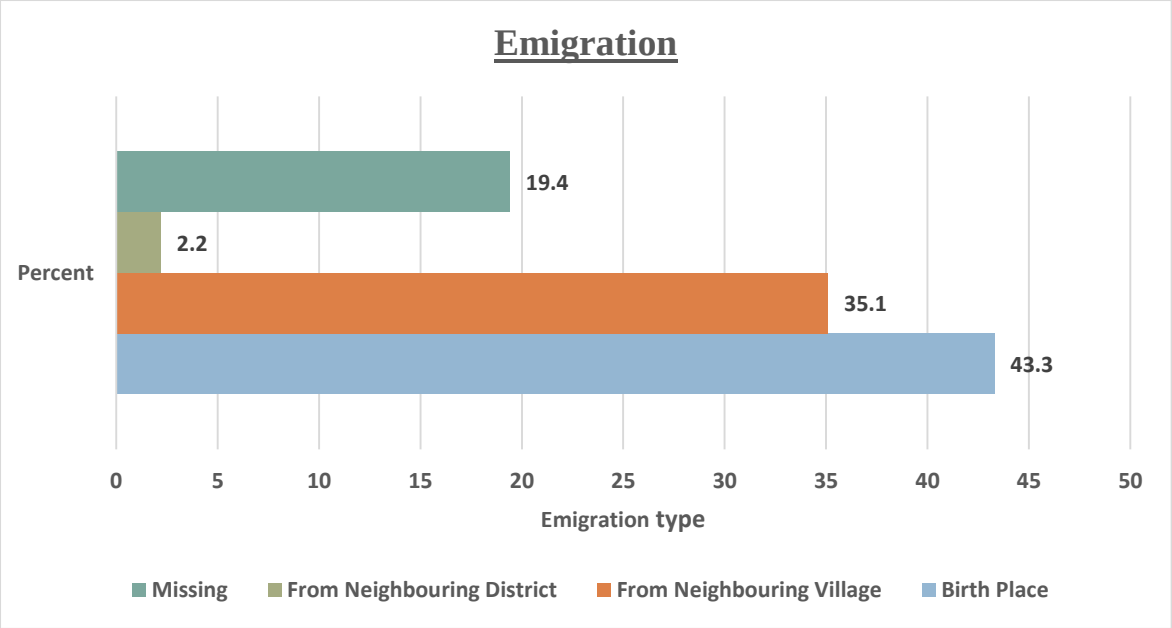


Fig 5.19: Emigration of Mandra (Source: Field Survey 2021)

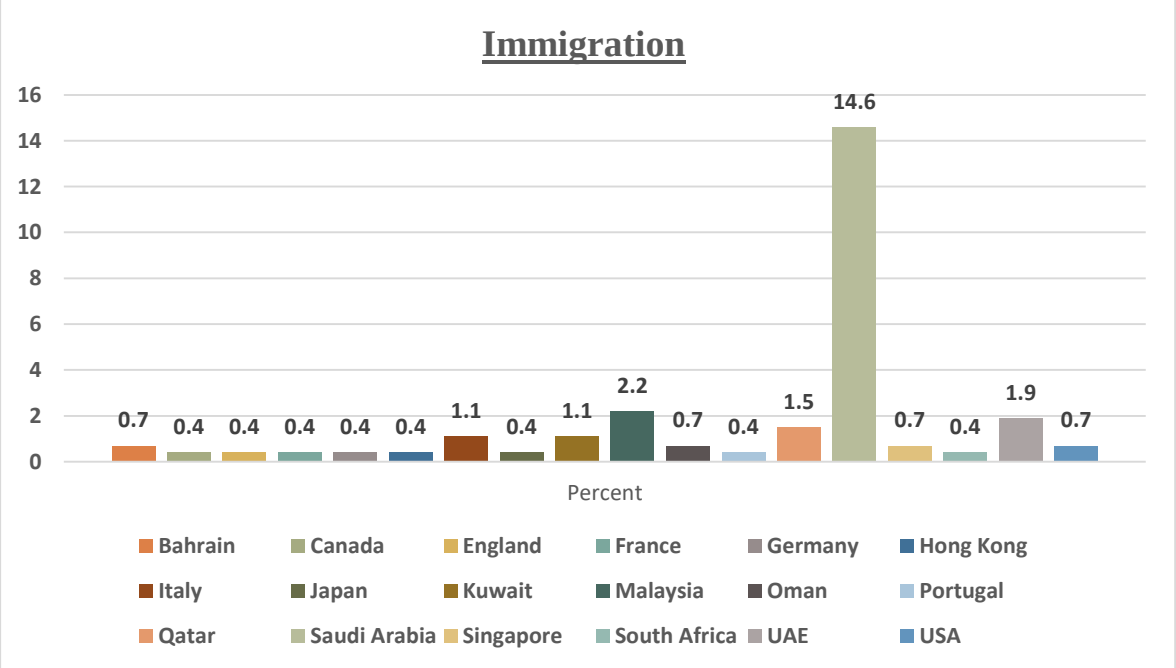


Fig 5.20: Immigration of Mandra (Source: Field Survey 2021)

And the amount of remittance the immigrant people send are most commonly ranges between 10,000-50,000 taka, says about 15.3% people. The second highest rate is 50,000-1,00,000 taka sent by 3.7% of the immigrants.

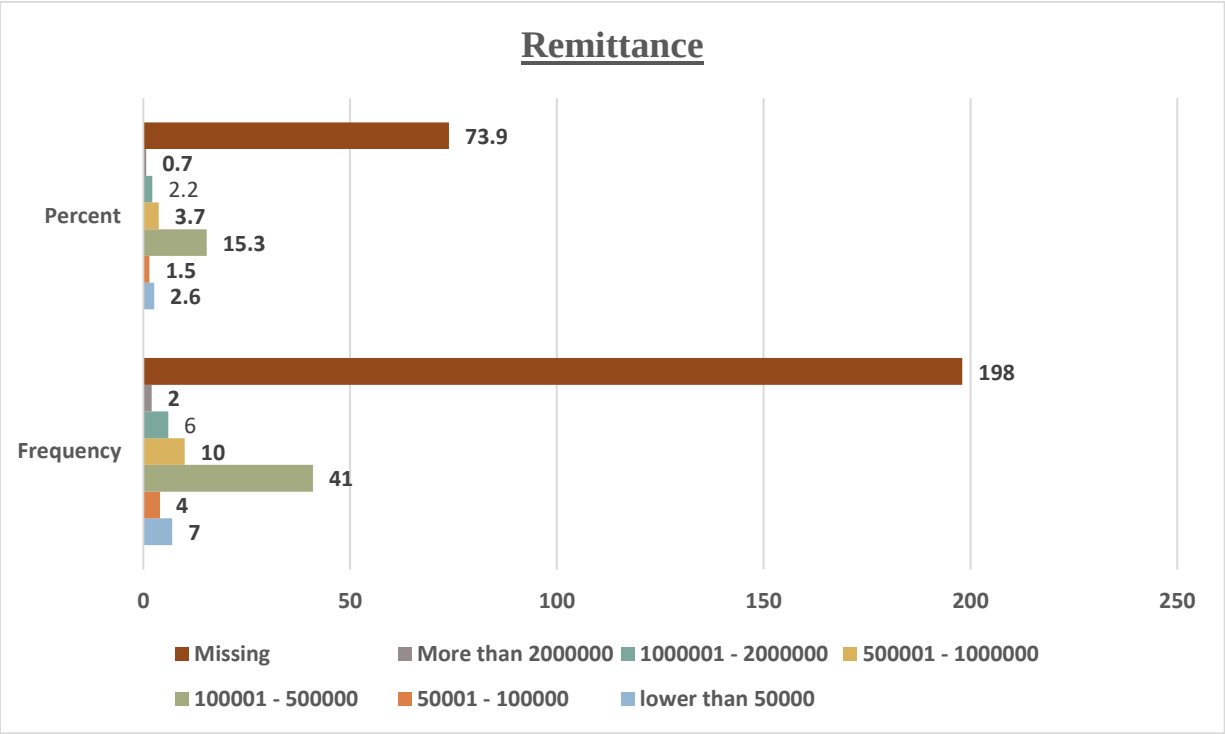


Fig 5.21: Amount of remittance (Source: Field Survey 2021)

5.9 Social Satisfaction and Security

For any area to be liveable, it needs to provide its people a sense of security and satisfaction. In our field survey we also analysed the social security level and also the social satisfaction level of the people residing there by using Likert scale.

Keeping in mind the overall social conditions of the study area, we asked them to comment about their satisfaction and security level that they feel residing in the area. Most of them responded positively stating that whatever the existing social problems and lacking, they feel satisfied and secure living in the area. Especially the women do not feel scared or uncomfortable while working or going outside no matter what the time is. The figures are shown below-

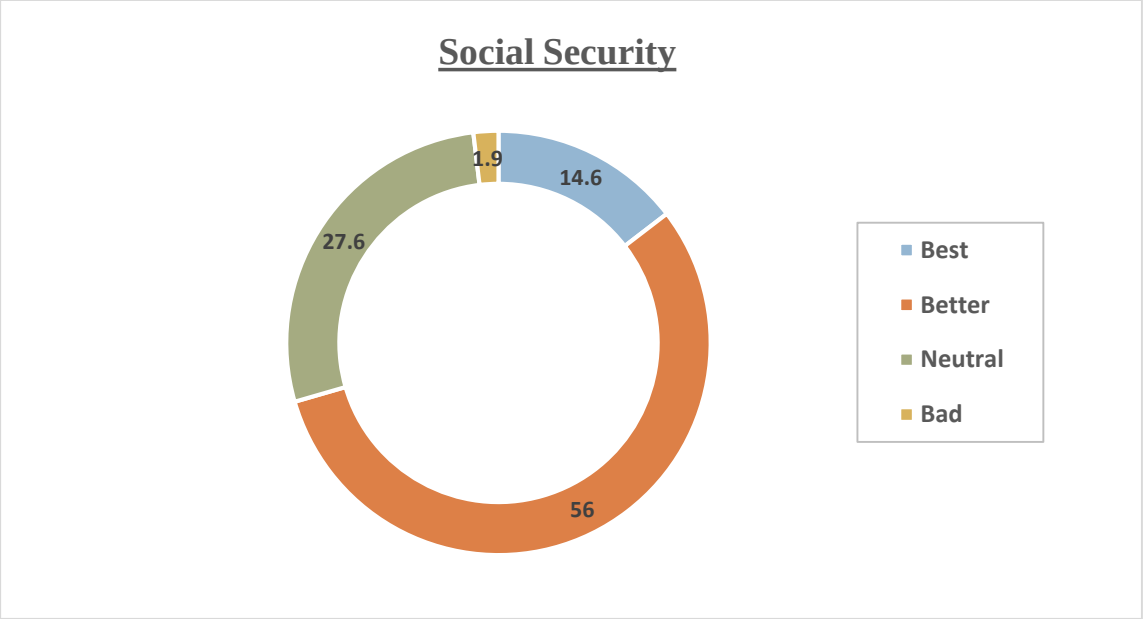


Fig 5.22: Social security level (Source: Field Survey 2021)

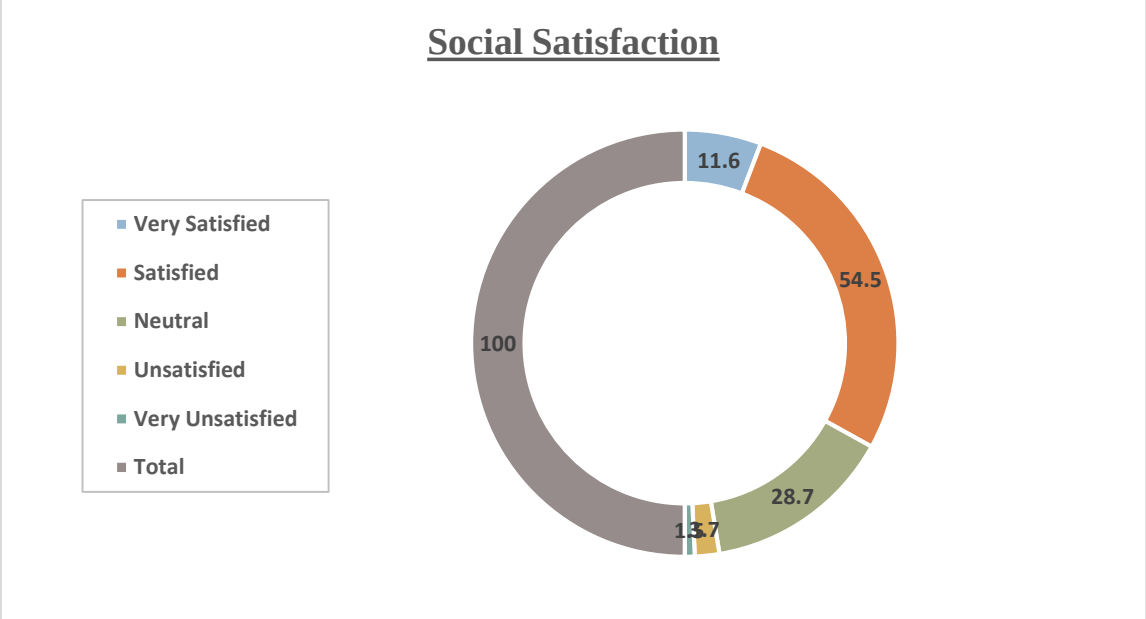


Fig 5.23: Social satisfaction level (Source: Field Survey 2021)

5.10 Conclusion

From the above analysis it can be said that the parameter which are used for determining the socioeconomic and land use pattern and relationship between these two, display that all are affected and influenced by each other. The above issues like income, expenditure, savings, loans, land amounts, migration influence land use significantly.

Chapter 6

Land Use Change Factors

6.1 Introduction

Land use changes can be described by the complex interaction of behavioral and structural factors (Verburg et al., 2004) which are driven by a combination of the so called land use drivers classified as socio-economic, political and biophysical factors (DeKonind et al., 1999; Stomph et al., 1994; Veldkamp and Fresco, 1997) along with some recent one like climatic and demographic factors, level of poverty and economic as well as institutional structure of the resource use (Mohammad, 2009). Therefore, driving forces are generally subdivided into two groups- proximate causes (Activities or actions that directly affect land use) and underlying causes (Fundamental forces that underpin the proximate causes including demographic, economic, technological, institutional and cultural factors) (Lesschen et al., 2005).

6.2 Global Land Use Change Factors

Researchers over time have pointed out numerous causes such as rapid growth and development of civilization (NASA, 2006), population and demands of food resources (Yadav et al., 2012), population and poverty driven deforestation, increased presence of shifting cultivators, triggering mechanisms for rapid development, globalization, low per capita land (Lambin et al., 2001), dam construction (Tefera and Sterk, 2008), economic growth and development, climate change, development of roads and electricity, improvements in irrigation, technologies, penetration of commercial forces (Uddin and Gurung, 2010), consumer tastes, international trade, weather, local rules (Lubowski et al., 2008), desire for profit, utility maximization, cost minimization, (Veldkamp and Lambin, 2001), soil suitability, population density, rainfall and accessibility, market conditions (Lesschen et al., 2005), increasing income, urbanization, infrastructural development, national and international policies, land tenure and property rights, bio-energy, land degradation (Nkonya et al., 2012), soils erosion, reduced rainfall, floods and siltation (Houghton, 1994), land ownership, non-agricultural occupation (Quasem, 2011), fertility (Mohammad, 2009). However, according to the words of Iftekhar (2006) land use change occurs because of the combined effect of social, political and economic conditions of a region or a country.

6.3 Land Use Change in Bangladesh

During past few decades Bangladesh has experienced rapid land use changes more or less for the above stated causes (Ahmed, 2011; Iftekhar, 2006; Mohammad, 2009) while south-west regions are being observed to have frequent changes due to the effects of increased salinity intrusion as well as natural disasters (Ahmed, 2011), intensive agriculture practices and changing land quality (Uddin and Gurung, 2010; Minar et al., 2013).

However, Rahman and Begum (2011) showed two causes of land use changes in coastal region such as natural (i.e. global warming, climate change, sea level rise (SLR), coastal flood, salinity intrusions, water logging) as well as anthropogenic forces (e.g. population growth, unplanned cultivations, salinity intrusions, water logging, misuse of Sundarbans, political unrest, illiteracy of local people about effect of land cover changes, poverty, higher expectation).

6.4 Land Use Change Scenario of Mandra

Land use change is being considered as the single most important appearance of human interaction on atmosphere (Mohammad, 2009) and includes alteration of land covers (Lesschen et al., 2005) either in the form of agricultural intensification or changes in farming system over time (Farrow and Winograd, 2001) due to influence of population and economic expansion (Mohammad, 2009).

Precisely, land use change refers to changes in land use morphology over time with respect to particular socio-economic factors (Grainger, 1995; Zubair, 2006) which may include both temporal and spatial dimensions (Long et al., 2007).

For further analysis of the study area two land use classification of the study area was done. The purpose of this classification is to have a better understanding about the changes that took place over 15-year period.

For land use classification 2021, Sentinel 2 imagery was used and for the 2006 Landsat 4-5 thematic mapper was used.

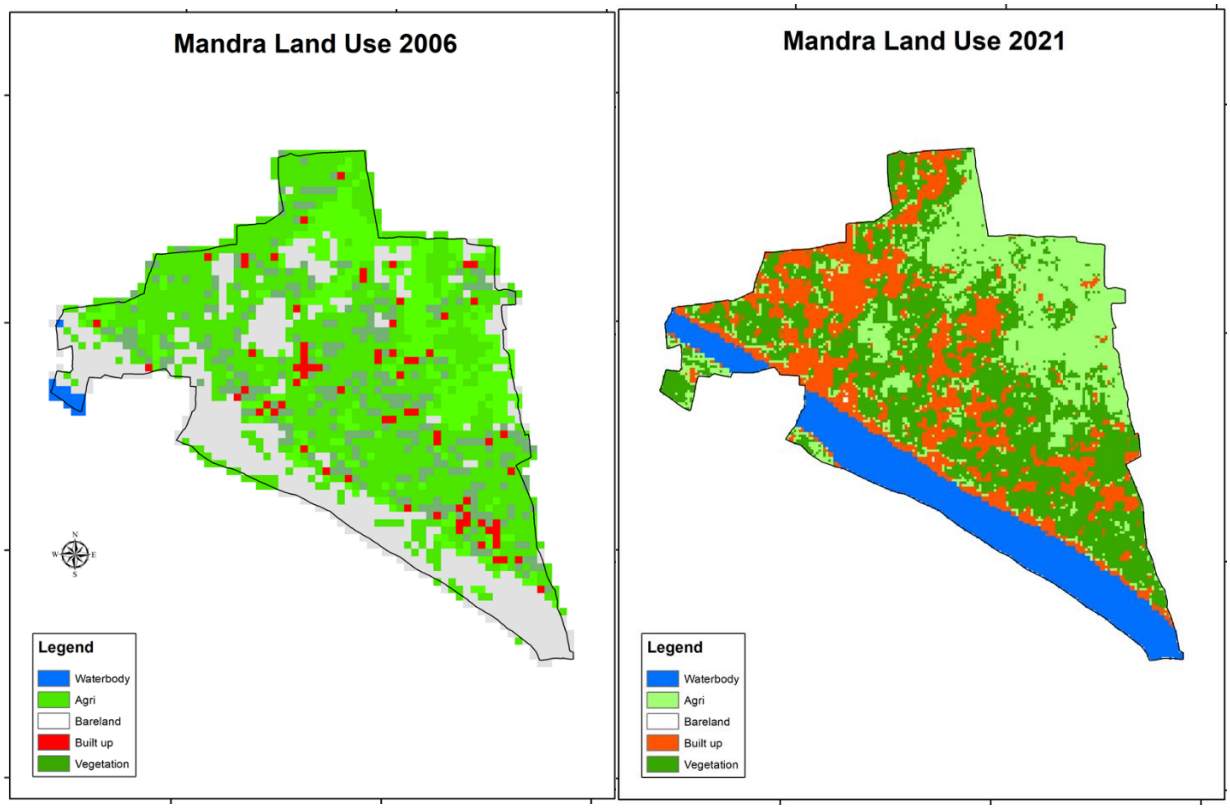


Fig 6.1: Land use change scenario of Mandra (Source: USGS)

From our pre-field study and post-field study questionnaire survey analysis we can clearly see that there has been a drastic increase in the number of built-up areas and decrease in agricultural lands.

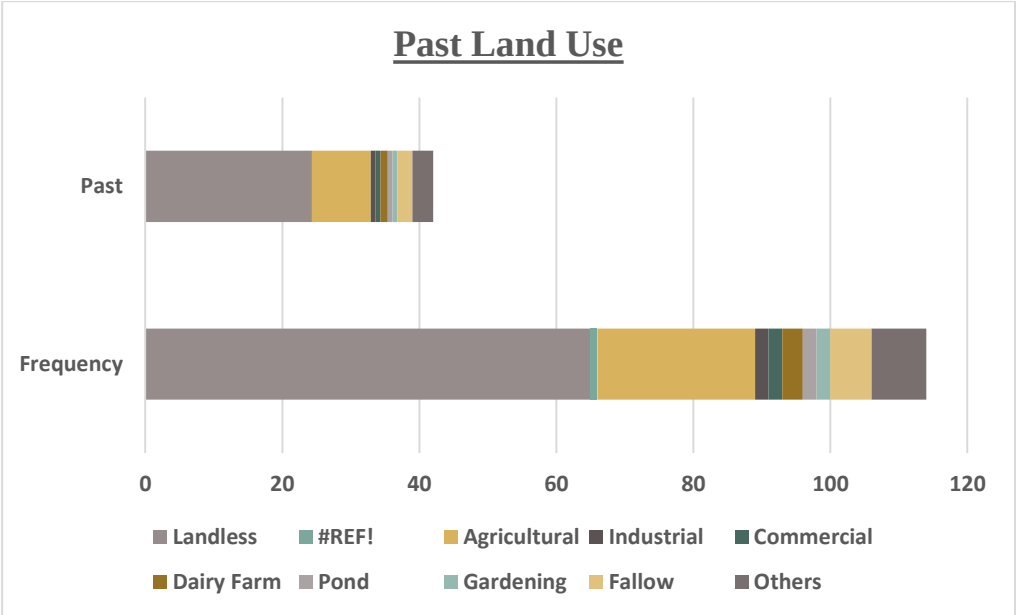


Fig 6.2: Past land use scenario of Mandra (Source: Field Survey 2021)

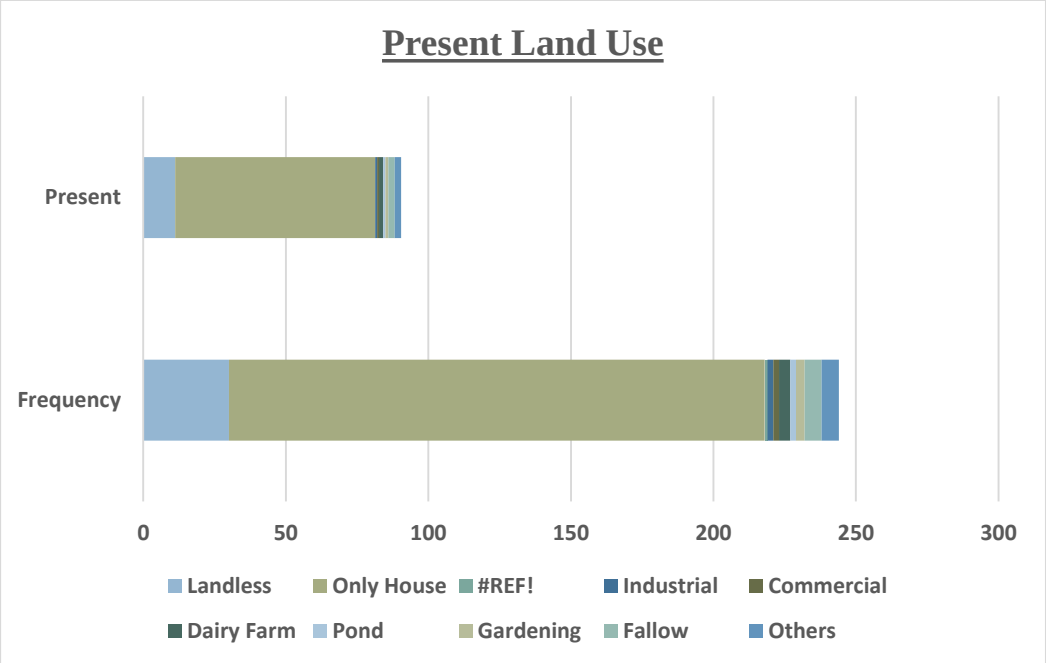


Fig 6.3: Present land use scenario of Mandra (Source: Field Survey 2021)

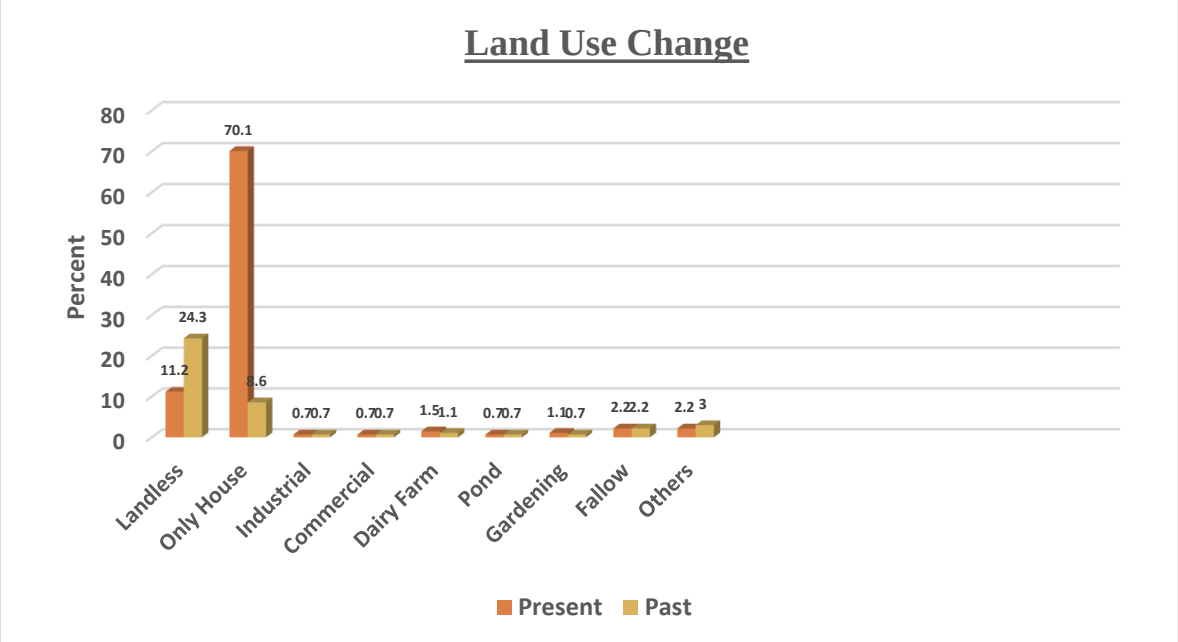


Fig 6.4: Land use scenario of Mandra (Source: Field Survey 2021)

6.5 Land Use Change Factors of Mandra

Factors that contributed behind the land use change of our study area are-

A. Population Expansion

B. Land Fragmentation

C. Transport and Communication Facilities

D. Technological Development

E. Natural Disaster

A. <u>Population Expansion</u>

<u>Table 6.1: Fertility and Mortality rate of Mandra (Source: Field Survey 2021)</u>

Fertility rate

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	28	10.4	15.7	15.7
	1	72	26.9	40.4	56.2
	2	54	20.1	30.3	86.5
	3	15	5.6	8.4	94.9
	4	5	1.9	2.8	97.8
	5	4	1.5	2.2	100
	Total	178	66.4	100	
Missing	System	90	33.6		
Total		268	100		

Mortality rate

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	41	15.3	32.3	32.3
	1	68	25.4	53.5	85.8
	2	14	5.2	11	96.9
	3	3	1.1	2.4	99.2
	4	1	0.4	0.8	100
	Total	127	47.4	100	
Missing	System	141	52.6		
Total		268	100		

If we look at the fertility and mortality rate of Mandra, we can realize that the fertility is 2.06%, whereas the mortality rate is far less than that, only 0.85%. This creates extra population that compete for the same amount of land that previously existed.

As a result, to provide shelter for this extra population, the agricultural lands are turning into built-up areas. As a matter of fact, the land use is changing in the study area.

B. <u>Land Fragmentation</u>

Land fragmentation is defined as the situation in which a single farm or ownership consists of numerous spatially separated plots. As joint families breaking up into nuclear ones, the land is also getting divided. And with the change of ownership of land, the land use is also changing according to their own preferences and conveniences.

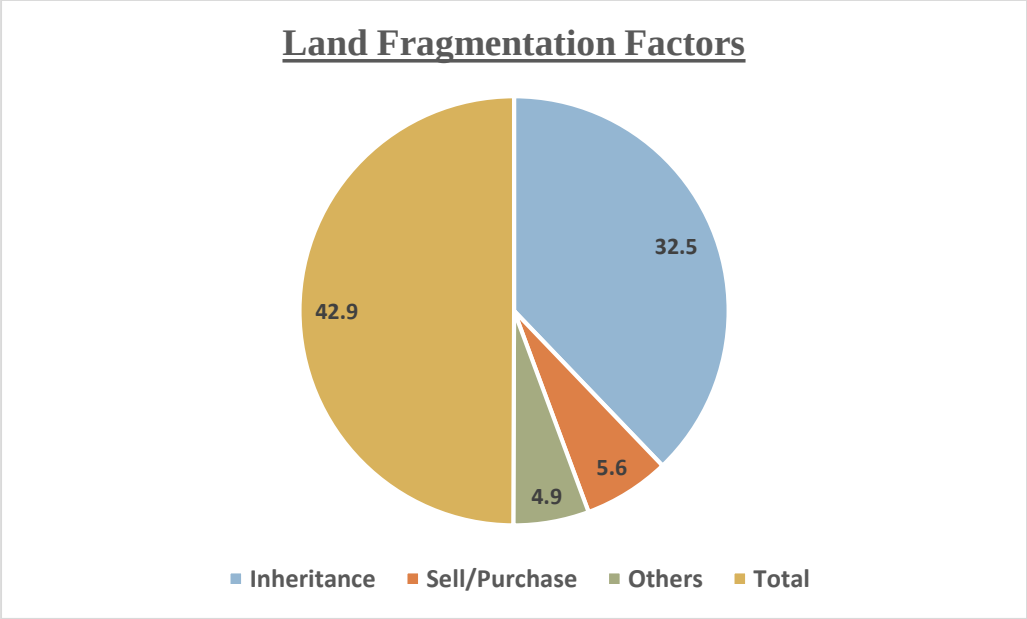


Fig 6.5: Land Fragmentation factors (Source: Field Survey 2021)

C. Transport and Communication Facilities

The interactions between transportation and land use are also part of a complex framework that includes economic, political, demographic and technological changes. Changes in transportation technology, investment and service characteristics can alter overall accessibility levels as well as the relative accessibility of different locations. The recent trend towards digitalization is providing a new impetus to urban mobility such as on-demand services and the availability of large amounts of information about the characteristics of urban travel.

Land use and transportation are interdependent, similar to a chicken-and- egg relation. Effective utilization of land stimulates urban activities, and roads and other transportation facilities are maintained so as to allow for new transportation-related activity.

With the development of transport networks and communication facilities the flow of goods, services, people, ideas have been easier than ever before. All these work behind the change of a landscape. It is acting as a driving force of changing the land use of the short distant areas like our study area Mandra.

D. Technological Development

Agriculture has benefited from new technologies such as crops for new biofuels and modern irrigation systems. Adoption of these new technologies has had a profound impact on land use and land values.

The Green Revolution spread 'modern agriculture' to agricultural areas of the world through the creation of new products and practices. The adoption of agricultural technology brought about great changes in land use. The growth of new cultivated varieties, expansion of existing crops and deforestation are some of the results of this process.

This agricultural boom has had consequences in terms of expanding some of the traditional areas for some crops, adapting new varieties, and of geographical changes in agricultural frontiers. As a result, less agricultural land is required to produce food the increased population and the additional lands are turning into settlement areas. Thus, the land use changing.

E. Natural Disaster

Due to the disaster prone nature of the river bank areas people often have to leave or loss their lands and migrate somewhere else to lead a safer life. Thus, many land uses get changed over the period of time.

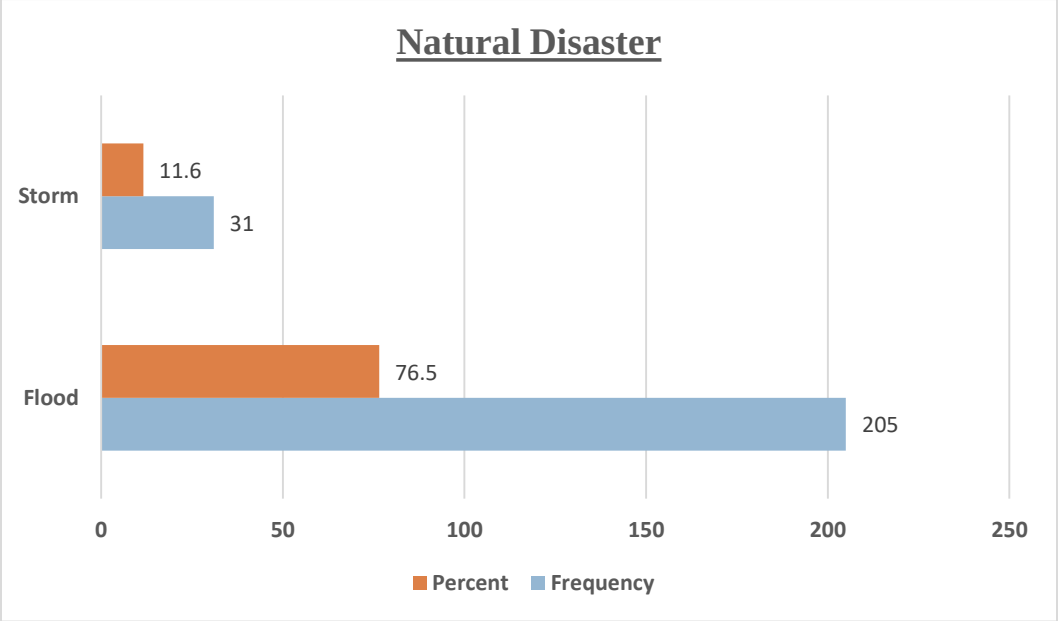


Fig 6.6: Natural Disasters in Mandra (Source: Field Survey 2021)

6.6 Impacts of Land Use Change

Land use changes have come into view as one of the key drivers of ecological changes (Kueppers et al., 2004; Foley et al., 2005; Serneels and Lambin, 2002) because of its potential effect of causing various sudden but catastrophic environmental and socio-economic problems (Wang, 2012; Mia and Islam, 2005).

Human use of land has altered structure and functioning of ecosystem (Vitousek et al., 1997) and keeping pace with this IPCC (2000) stated that expansion of agriculture has come into present form through conversion of forests and grassland during past 140 years. Kitamura and Kobayashi (1993) and Houghton et al. (1999) have pointed out that wrong land use has led to serious problems such as degradation and deforestation of tropical forests, climate change with the problems of greenhouse effect, loss of biodiversity and negative changes in regional hydrology and biogeochemical cycles (Chase et al., 1999; Mas et al., 2004).

However, researchers have pointed out some of the frequent impacts of land use and cover changes such as rapid conversion of potentially productive land to unproductive purposes (Houghton, 1994; Lambin et al., 2003), change in biotic diversity (Sala et al., 2000), important tradeoffs for sustainability, food security, vulnerability of people and ecosystems (Lesschen et al., 2005), deforestation, diminishing soil fertility, permanent degradation of land productivity (Islam and Weil, 2000), inundation of grazing lands, soil erosion, reduction of traditional farming, sedimentation (Tefera and Sterk, 2008), climate change, deforestation, natural hazards (NASA, 2006; Lubowski et al., 2008), climate variability, land degradation, vulnerability of places and people (Veldkamp and Lambin, 2001).

Here is to be remembered that all impacts are not negative because changes in land use patterns are also associated with increases in food and fiber production with more efficiency and well-being (Lambin et al., 2003; Vitousek et al., 1997) despite its externalities (Turner II et al., 1995; Lambin et al., 1999; Aylward, 2000).

In our study area, due to these unplanned land use change tendency various environmental and ecological impacts have been seen. People mentioned about water logging problems due to unplanned built-up areas, sensing environmental changes, like irregular rainfall, increased heat as well as rotting of fruits and vegetables due to power line radiations. The figures are shown below-

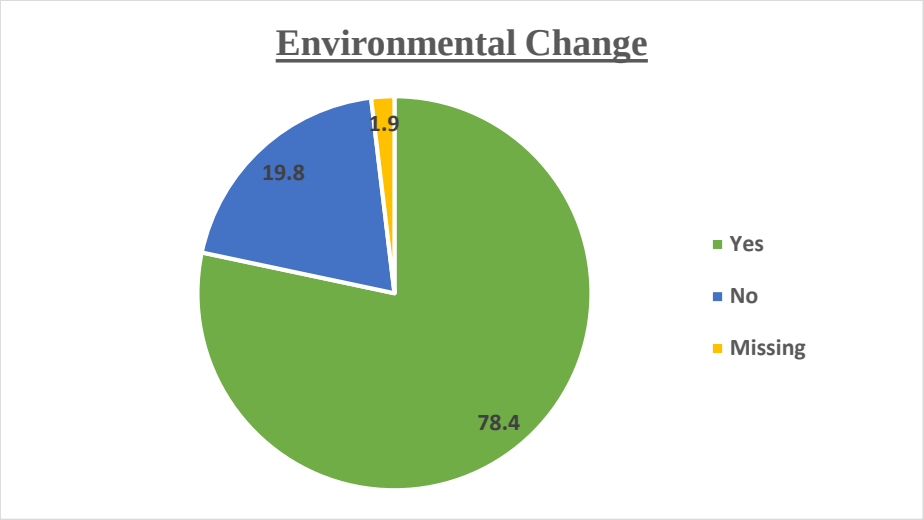


Fig 6.7: Environment Change in Mandra (Source: Field Survey 2021)

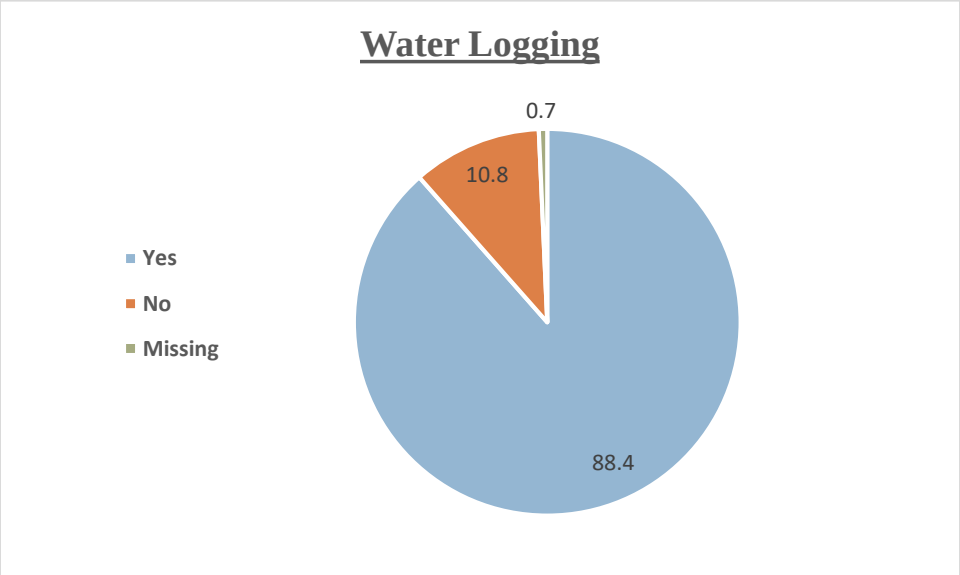


Fig 6.8: Water logging in Mandra (Source: Field Survey 2021)

6.7 Conclusion

Bangladesh is experiencing an increasing rate of land use change as a result of population dynamics, economic development, climate change, improved accessibility and technological developments in agriculture. Cultivated lands are converted into urban fabric hampering agricultural production and increasing food security issues.

Chapter 7

Summary Findings, Recommendations and Conclusion

7.1 Introduction

The field study at Mandra Mouza has been completed in a befitting manner. On the study of land use and socio-economic condition of this region, some practical knowledge and fallouts have been identified from the study. By questionnaire survey, we know the household characteristics, economic, agriculture and environmental characteristics. And from field survey, we know about geomorphic feature, soil characteristics, salinity, drought, settlement pattern, cropping intensity, source of irrigation water etc. of land use.

7.2 Summary Findings

Summary findings are very important for land use survey report. It is the easiest way to know about the whole findings of survey by summary findings of the land use survey report. Summary findings of land use survey and socio-economic conditions of Mandra Mouza are given below:

- There is an increasing rate of population in the study area.
- Build-up area is increasing, whereas agricultural land is decreasing. Lack of agricultural practice.
- Literacy rate is not very satisfactory at the Mandra mauza
- Most of the people born in this area. They are owned land from their father
- In low land areas, there is serious problem of water logging due to the elevation differences and the flood water can’t go out. This is causing soil degradation in the low land areas. This is causing huge loss of production.
- Diversification of economic activities is low in the area.
- Urbanization is increasing is taking away area covered by agricultural land and water bodies.
- High inequality is present in terms of level of education.
- Due to loss of production, some people are shifting from crop cultivation to dairy or poultry farming because of increase in salinity level and high profit rate in compared to other crop cultivations.

- Remittance flow from both internal and international is present in really small amount.
- The Businesses are centred along the highway.
- The Hat, hospital, administrative offices and school are all situated near the Highway and therefore, the people living further from the highway are deprived.
- The level of satisfaction and security is good.
- Road network is in not that much poor condition in terms of connectivity.
- Environmental degradation and pollution are increasing day by day rapidly due to lack of awareness of the people
- Recreational facilities are very poor.

7.3 Recommendation

Though it is too early to give any comments or recommendations for me as a learner of field research, based on the above description and statistics and from my point of view some useful recommendations are given below.

The following recommendations should be considered for betterment of lives in Mandra mauza-

- Overall road network should be repaired and improved.
- In order to expand education more school and college should be built
- The supply of rural electricity is not adequate and it should be improved
- Government should take proper steps to reserve the agricultural land
- The existing health facilities should be expanded for the inhabitants.
- Create awareness among people about the misuse of land
- Provide modern technologies in agriculture
- Irrigation system should be improved for better crops cultivation
- Stop conversion of farmland into settlement
- Awareness about environmental pollution must be increased for overall development of the area
- Different agricultural training should have to arrange to make trained farmer
- The wetland should be used properly so that it can facilitate to earn more currency
- Recreational facilities should be expanded
- As industrial activities are expanding area, so proper industrial policy should be established

- Provide proper land zoning plans and drainage systems to avoid mismanagement of lands.
- Strengthen enforcement of laws are required for industries to reduce the environmental problem (deforestation, hill cutting, air pollution, water quality deterioration etc.)

7.4 Conclusion

The natural land feature is usually used by man to meet their basics demand and it is changed and modified by human practices. So, it is important to explore the dynamics and spatial pattern of land use changes for a micro level study. There were some difficulties and limitation in our research, for instances, for plot-to-plot surveying plot identification was a challenge for the surveyors from the Google earth map due to existing unparalleled changes of land. Another limitation of this study is that taking of some physical features characteristics during the survey was difficult due to physical barriers of the environment. However, the output of the current research will be helpful in planning and policy development in a specific region of Bangladesh.

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