

## Changing Pattern of Biotic Habitat: A Case Study of Habla Tenguria Para Mouza, Basail, Tangail

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*Abstract— In every time there is a large change in human habitat. This type of change occurs for different natural and man-made factors. The motto of the research is to establish the types, factors and changing pattern of a biotic habitat and to provide some solutions to its consequences on the environment with spatial changes. The research is designed to investigate causes and extent of physical changes and component of environment [1]. To fulfill the objectives, this study has chosen broad methodology to include agricultural & household land use. For this research Habla Tenguria Para Mouza, Basail, Tangail has been selected and evaluated on the basis of 1912 and 2007 years' data. Maps are generated by using ArcViewGIS3.3 software. Its aim is to mitigate rural land use problems; especially agricultural field, household building, taking care of vegetation covered area, constructing road and educational institutions (etc.).*

**Key words:** *Changing pattern, inundation level, temporal change, GIS.*

### 1. Introduction

In Bangladesh and Pakistan, a mouza or mauza is a type of administrative district, corresponding to a specific land area within which there may be one or more settlements [2]. In other words a revenue village with a list of jurisdiction numbers and defined area is called *Mouza* [3]. *Mouza* map developed on the basis of each and every plot over the country which helped the landlord control their ind order. To identify the types, factors, and changing pattern of the habitat, it is very important to ensure collecting data from all ecological sectors of any particular area. Each and every plot of the *mouza* is the unit of the research. Biotic habitat is the combination of all organisms to their environment. These are not only complex and dynamic but also interdependent. On the other hand, the term biotic habitat is the relation of organisms within the family and society in the aggregate and in the community. In the present study, past and present land use data have been found out changing landforms and other demographic characteristics. Nature of the problems in the area is:

- a. Many canals dry up for regular siltation and are replaced by new agricultural land. Agricultural land has formed after the river bed

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having dried. But due to lack of sufficient water, agricultural land is not performing properly.

- b. Little water enters in the rainy season; so all shallow areas lose their regular characteristics. In previous time those areas were selected for *boro*, *aman* (low land crop) rice production which are now decreasing day by day.
- c. The Establishment of deep tube-well has eased the irrigation system. So people produce profitable rice in their field. Thus crop variation decreases in the agricultural field.
- d. Old big canopy vegetation is also decreasing.
- e. The socio economic quality also changes in terms of education, sanitation etc. sectors. Many sufferings exist in this section also.
- f. Many species of vegetation are becoming extinct.

Different data have been collected here related to land use types, their changing pattern; including different factors like human, vegetation, land, river etc. according to every plot of the *mouza* map of study area for analyzing changing pattern of biotic habitat.

### **2. Material and Methods**

Data were collected from the primary and secondary sources. Primary data were collected from field survey at the study area which provides adequate checking of the quality and reliability of data. For the study of agricultural land use *mouza* map was used and for completing the study of socio-economic situation household surveys were conducted. Secondary data were collected from:

- Published and unpublished reports and documents of government and non-government organizations.
- Survey of Bangladesh.
- Local Government Engineering Department (LGED).
- Department of Geography and Environment of Jahangirnagar University.
- Statistics Office of Tangail.
- Land Office, Tejgaon, Dhaka.
- Land Office of Tangail and
- Union Parishod Office, Basail Upazila, Tangail.

### ***Field Work***

479 Plots have been selected for sample survey for analyzing physical changes. Mouza map was counted on plots from 1912 through 2007 to provide an index

of changes in abundance on the study plots. All data were collected from the map of 1912 (figure-2) since updated map is lacking. To analyze the present condition all data had been newly collected on 2007 and input those on the *mouza* map (figure-2). A questionnaire survey was conducted among 20 participants for collecting plot-wise data and participants' age range was 75-80 years old. Those people explained the previous condition of the study area. Another questionnaire survey was conducted among 20 participants for collecting recent information about the plots and that time participants' age range was 25-30 years old. Each site was visited minimum two times for identifying the seasonal effects. To find out the land inundation level visually, every plot was visited for several times. To identify the change with time every plot has been visited and all data have been taken from crop distribution, vegetation coverage and any other resources of distribution. One was held between June & July while another one between December & January. Both times the questionnaire surveys were conducted. So, each and every data is very much authentic. As a result, some Land-Use-Pattern figures (Figure 2) are produced to explain the situation of the study area in 1912 and 2007. This area was visited to find out-

- Crop distribution
- Drainage pattern
- Flooding condition
- Vegetation type (Maintain vegetation survey to visit every household and find out the age of household area by approximant age of oldest tree. )
- Land use pattern
- Dominant vegetation &
- Natural and human resources.

Identifying the changing pattern of the total biotic habitat following data was collected-

- Transforming Natural habitat to agricultural land
- Settlement Distribution
- Pollution
- Commercialization
- Road construction

All of these data were collected for indicating the establishment of road construction and development of new settlement.

#### ***Data Analysis***

Discriminant function and correlation analyses of random samples among strata were used to reduce number of habitats based on variables. Densities of different size classes of the same plant species showed strong positive correlation between strata and study sites. Methodology adopted here to detect land cover changes is



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based on the comparison of these two years. The data of 1912 and 2007 were collected from primary sources. This data was used to assess the land use/land cover change dynamics in the study area. At first *mouza* maps' scan format takes in AutoCAD software to make its digitized format. Then by using arcviewGIS3.3 software all plot of the *mouza* map were identified on that digitized format (Figure-2) [4]. All collected data were input into the dataset and different types of maps were made to express the changing pattern of studied biotic habitat.

### **3. Study Site**

Study site covers the middle part of Bangladesh. Habla Tenguria Para Mouza includes Basail Upazila, Tangail District (Figure 1). This site is situated two kilometers away from Dhaka Tangail National Highway. The site is under tropical monsoon climate. Out of six seasons (summer, rainy, fall, autumn, winter and spring) of Bangladesh, Three seasons strongly focus on this area. In the rainy season 85 percent rainfall occurs over the site. Average rainfall is 70 ml. In winter season average temperature is 20 degree Celsius. In May, it may be 43 degree Celsius. Vaporization amount is low at dry season. Agricultural Land use fulfilled by cultivated land, fellow land, single crop land, double crop and triple crop land is controlled by the peasants. Main crops are paddy, wheat, potato, sugarcane, sweet potato, onion, garlic, ladies finger etc. Many old settlements exist there. Some new settlements are also built due to increasing population. River is situated at the nearest distance of this *mouza*. For this reason, this area is affected by flood frequently in rainy season for overflowing characteristics of river. So, soils contain silt. Soil texture becomes mixed near the river side area. Sugarcane, potato, sweet potato etc. crops grow in this sandy soil. Maximum land is utilized as agricultural purposes. But 30% of that is utilized as settlement area. (Field study 2007)

Total population 838; male 473, female 365, Muslim and Hindu families (about 120 families) are mixed there (Field study 2007). Main occupations are agriculture, service, teaching, business and others. All transport activities occur on *katcha* road and in rainy season sometimes boat is used for transportation. The rate of education is much better than that of the other area. Child education becomes 100% right now. (Field study 2007)



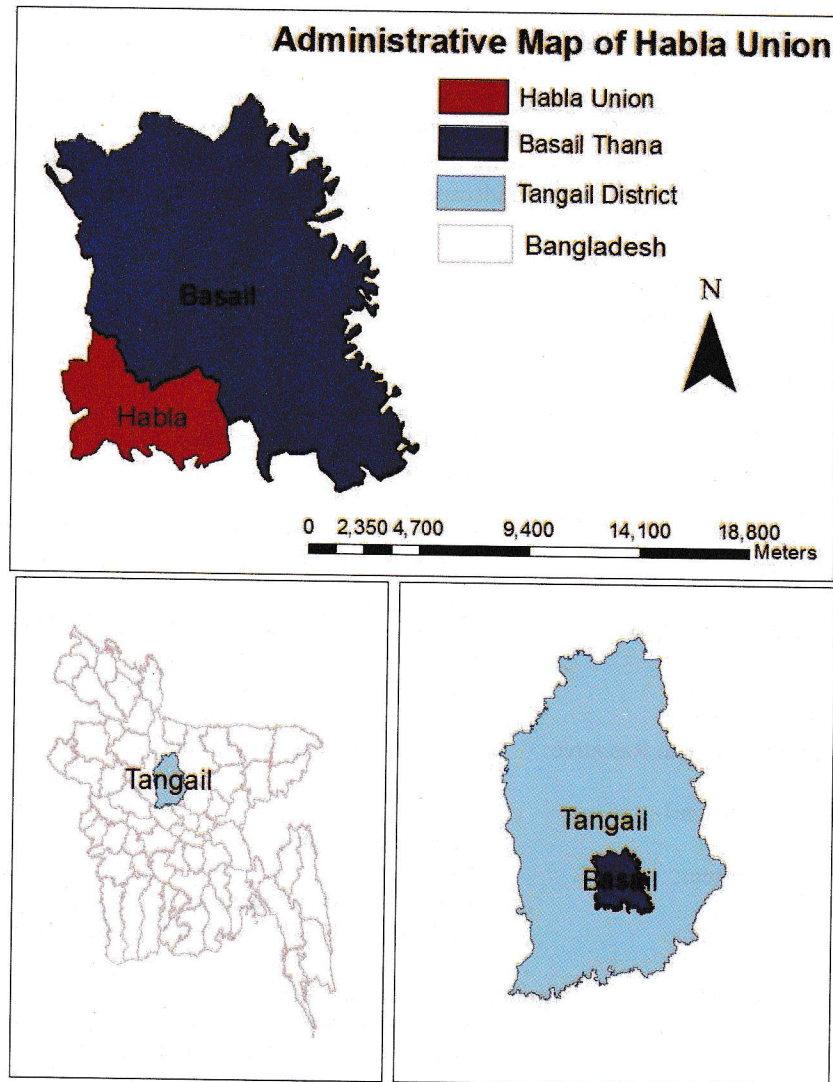


Figure 1: Location Map of Study Site.

Source: Compiled by author

***Physiographic Characteristics of the Study site***

Land inundation level source of the study area is divided by 4 categories- 0-30cm, 30-90cm, 90-180cm & 180-300cm. These levels help us to measure the land type and land use pattern. For example any area contains 0-30cm inundation level, which means high land exists there. On the other hand, 180-300cm inundation level explains about low land type pattern of any area. In this way, this paper finds the overall land type in perspective of the study area.

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According to inundation level when 180-300cm lowering area over is flowed by 5 feet deep water after that 90-180cm lowering area has started to over-flow. To identify the land use system of the study area we found the types of human habitat and other bio-diversities. So, from the plot-wise collected data we can compare the past land use and present land use systems. From this sense this piece compares 1912 and 2007 years data of the study area. Total plot number of this mouza is 479 (Figure 01). Landscape based on inundation level (on the basis of local name and Height) are:

- a) *Chala* (0-30 cm)
- b) *Kanda* (30-90 cm)
- c) *Beel* (90-180 cm)
- d) *Nama* (180-300 cm)

*Chala* (0-30 cm)

Slope: 1st & last parts are sloppy.  
Middle part is almost plain.

Drainage system: Very good

Flood: Flood free area

Vegetation type: Homestead+ Agricultural

Land use: Settlement, Road, Agricultural land- Double crop land, Triple crop land, Pond

Dominant Vegetation: Homestead: Mango, Jackfruit, Coconut, Guava, Lemon, Mehogoni etc.  
Agricultural: Sugarcane, Potato, Sweet potato, Wheat etc.

Natural and human Resource: Wooden tree, Tube well, Pond

*Kanda* (30-90 cm)

Slope: This area is sloppy

Drainage system: Good

Flood: Flood occurred frequently.  
In 1988 & 1998 this area was affected by flood

Vegetation type: Agricultural + Wooden tree

Land use: Settlement (very few), Road, Agricultural land- Double crop land, Single crop land

Dominant Vegetation: Homestead: Banana, Mango, Jackfruit, Bamboo, Guava etc.

Natural and human Resource: Agricultural: Jute, Rice etc.  
Deep tube well *Beel* (90-180 cm)

Slope: Sloppy area & middle part is little much low.

Drainage system: Medium

Flood: This area all-time going under water at rainy season.

Vegetation type: Agricultural

Land use: Agricultural land (Single crop), Pond (water body)

Dominant Vegetation: Agricultural: Jute, Rice etc.  
 Natural and human Resource: Deep tube well, Pond.

*Nama (180-300 cm)*

Slope: This area is also sloppy and in the middle it is shallow.

Drainage system: Very bad

Flood: Very flooded area from rainy season to winter. Almost 2 or 3 months water stored here after rainy season.

Vegetation type: Agricultural

Land use: Agricultural land (Single crop-*Buru, Aman*),

Fallow land

Dominant Vegetation: Agricultural: Rice.

Natural and human Resource: No specific resource.

Source: Field data 2007



#### 4. Habitat Types Identification

Identifying the land use system of study area is easy to find out ecological situation by discovering the animal's and vegetation's habitats. There is a comparison of 2 times land use system according to plot wise-data. In 1912 agricultural land was distributed on 375 plots and in 2007 agricultural land was distributed 338 plots (Table 1). On the other hand, in 1912 settlement distributed



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on 104 plots and in 2007 this amount increased to 141 plots. That means land use profile has become changed. Human activities, population increase and development activities of human being are the main reasons of these types of change. (Field survey 2007)

Agricultural land, House, Pond, Vegetation, Mosque, School, Road etc. features are similar somewhere. But in 1912, there were *Char, Doba, Khal*. In 2007, these three features were not found in 2007 map (Table 2). At this time, there is another new feature generate, that is Shallow land area. That means *char, doba, khal* have diverted to settlement, agricultural land and shallow land area. The main land uses include agriculture, human settlement, fishing etc. (Table 3).

**Table 1:** Temporal change at the study area in agricultural land sector (plot wise)

Types of components	1912 (Number of plot)	2007 (Number of plot)	Comments
1. <i>Char</i>	05	0	In previous time river side area was very sandy. That area was more unfertile land. Crops such as nut and watermelon have been grown there. But there is no <i>char</i> area in 2007 as a plot. Because the river has become almost dry. Very slow current and very low depth contain at this time (2007). <i>Char</i> and river bank erosion has disappeared. The <i>char</i> area is usually replaced by regular agricultural land and road.
2. Agricultural land	375	338	Agricultural land decreases because land use pattern changes. Population increases and new settlement builds.
3. Deep tube well	0	07	In 1912, river & rain water were the only ways for irrigation.  In 2007, seven deep tube wells were set up for increasing irrigation facilities to 338 plots of agricultural land.
4. Triple crop land	236	170	Most of the triple crop land is situated on the <i>chala</i> (high land) area. But in 2007, maximum plot of <i>chala</i> area fulfilled by settlement. 37 settlements developed in the middle 90 years. Some plots contained house side wood garden, some were used as a vegetable garden,

			and some became useless for the shade of household trees. So, in this situation triple crop land area has decreased.
5.Double crop land	103	45	Double crop land also decreases. This crop category normally produced in the <i>kanda</i> area. New born settlement is also situated there. Some plots are filled by soil for sedimentation process. Sometimes crops are grown here in rainy season. But unexpected rain water stores here for some months for low drainage system. So, these areas become fallow for that time.
6.Single crop land	36	87	Single crop land area has increased. Because triple and double crop land turned to single crop land. This crop land was normally <i>Beel</i> or <i>Nama</i> area. But in 2007, some plots of <i>Chala</i> & <i>Kanda</i> also produced single crop in one year.
7. <i>Aman</i> and <i>Boro</i> rice cultivation	30	10	<i>Boro</i> and <i>Aman</i> cultivation always occurred in <i>Nama</i> area. Because this was the lowest landform category of the study area. But for very bad drainage system, unexpected water logs here also. So, day by day this area is decreasing its sufficient depth to grow <i>Boro</i> and <i>Aman</i> rice. For this reason, rice cultivation is decreasing.

Source: Field data 2007.

Table-2: Temporal change at the study area in Water body sector (plot wise)

Types of components	1912 (Number of plot)	2007 (Number of plot)	Comments
1.Pond	12	22	Most of the <i>dobas</i> were transferred to ponds. Human being was conscious about the visual sight of their dwelling place. So, they are making many <i>dobas</i> as beautiful

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			ponds and fishing start there for economic solvency.  On the other hand, a good number of non-fertile agricultural lands were also transferred to ponds because of fish culture. In this way, village people lead a progressive life.
2.Doba	30	11	The number of <i>dobas</i> has decreased. People fill those <i>doba</i> and make agricultural land, settlements, ponds etc.
3.Nama	15	07	<i>Nama</i> area is normally situated in the old <i>khal</i> . <i>Khal</i> was filled by sediment and any other wastes. Then it turns to be <i>Nama</i> land. And these <i>Nama</i> land areas were decreasing because of sediment and waste has been fixed there time to time again.
4.Beel	45	25	<i>Beel</i> area also decreases for the same reason of <i>Nama</i> .

Source: Field data 2007.

**Table-3:** Temporal change at the study area in Socio economic sector (plot wise)

Types of components	1912 (Number of plot)	2007 (Number of plot)	Comments
1.Settlement	104	141	Settlement increases for the increase of population.
2.Well	10	03	Well decreases for tube well. People use tube well water for their daily use.
3. Tube well	0	125	In 1912 there was no tube well. This technology was very rare in that time. But in 2007, it was very popular for regular use of water.
4.Road	15	30	Many new roads developed in the study area. Some of them are linked to the new settlements.



			<p>Some others were developed by the government issues.</p> <p>In 1912, all roads were <i>katcha</i> road. In 2007, one <i>pacca</i> road was established there for the concern of government.</p>
5.School	02	08	<p>In 1912, two primary schools were being established for the 104 settlements. In 2007, six primary and two high schools were established in the study area (Field data 2007). This is the symbol of improved education system in the study area.</p>
6.Mosque	06	15	<p>With the developing process of human livelihood, many new infrastructures also developed. New mosque buildings are the symbols of development.</p>
7.Garden of wood & fruit tree	0	08	<p>This type of land use is very new in village. But nowadays this is very popular. This purpose uses more than eight plots. Most of the land is full of <i>Mehogoni</i>, Guava, Banana and Mango trees.</p> <p>Village people use such land as contains household vegetation shadow and does not suit agricultural activities. So, they have used those lands as gardens.</p>

Source: Field data 2007.

### 5. Changing Process

With increasing population, demand of food, cloth, fuel & any other important things increased as well. So, to meet up these demands many problems occurred in human habitats [5].

*Transforming Natural habitat to agricultural land:* For increase of population, people exploit natural habitat as agricultural land by cutting down bush or any other herb & shrub and make fruit garden or crop garden for their daily use [6].

*Settlement Distribution:* More population means more settlement. That is why agricultural land and natural habitat is destroyed. In course of time many

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settlement built up on the *chala, kanda* type's landscape to cover out the agricultural land. Settlement Distribution of the Study area at 1912 was in 5.32% and in 2007 it was 22.87% (analyzed by field data 2007). From this statistics, the study find that in 2007 settlement pattern increased one third or double amount than 1912 [7].

*Pollution:* From the same land people want to get more crops in every year. That is why more chemical fertilizer and insecticides applied for better improvement of crop cultivation. But these chemicals flow to the water body with irrigation water or rain drops or flood. Watery vegetation and animals are suffering from these types of water pollution. IRRI is the most cultivable crop of this area. *Amon & Aush* rice cultivation have decreased due to less inundation of land. So, same crop is cultivated in same land year after year. Using rate of chemical fertilizer is increasing day by day. Suppose in 1912 per *bigha* cultivation of *amon & aush* fertilizer was used 7-12 kg. In this place 30-50kg fertilizer used for per *bigha* IRRI cultivation in 2007 (Field study 2007) [6]. Rate of nitrogen decreases for these types' of fertilizer & land, water, vegetation's, animals etc. each and every habitat is destroyed for this reason.

*Road construction:* In 1912 there was only 1.90km 10feet wide *katcha* road (in total). People used pathway. In 2007 there was a huge development on road constructions. 15 feet wide 2.50km long *pacca* road was constructed there. And 6.75km long 10 feet *katcha* road (in total) have been constructed there also. There are many other small pathways situated in the study area (Table 4).

**Table-4:** Changing Pattern of Road types in study area

Types of Road	Year 1912(km)	Year 2007 (km)
<i>Pacca</i> Road 1(15 feet)	There was no 15 feet wide <i>pacca</i> road	2.50
<i>Katcha</i> Road 1(10 feet)	0.80	1.50
<i>Katcha</i> Road 1(10 feet)	1.10	2.00
<i>Katcha</i> Road1 (10 feet)	There was no 10 feet wide <i>katcha</i> road	3.25

**Source:** Road Survey 2007.

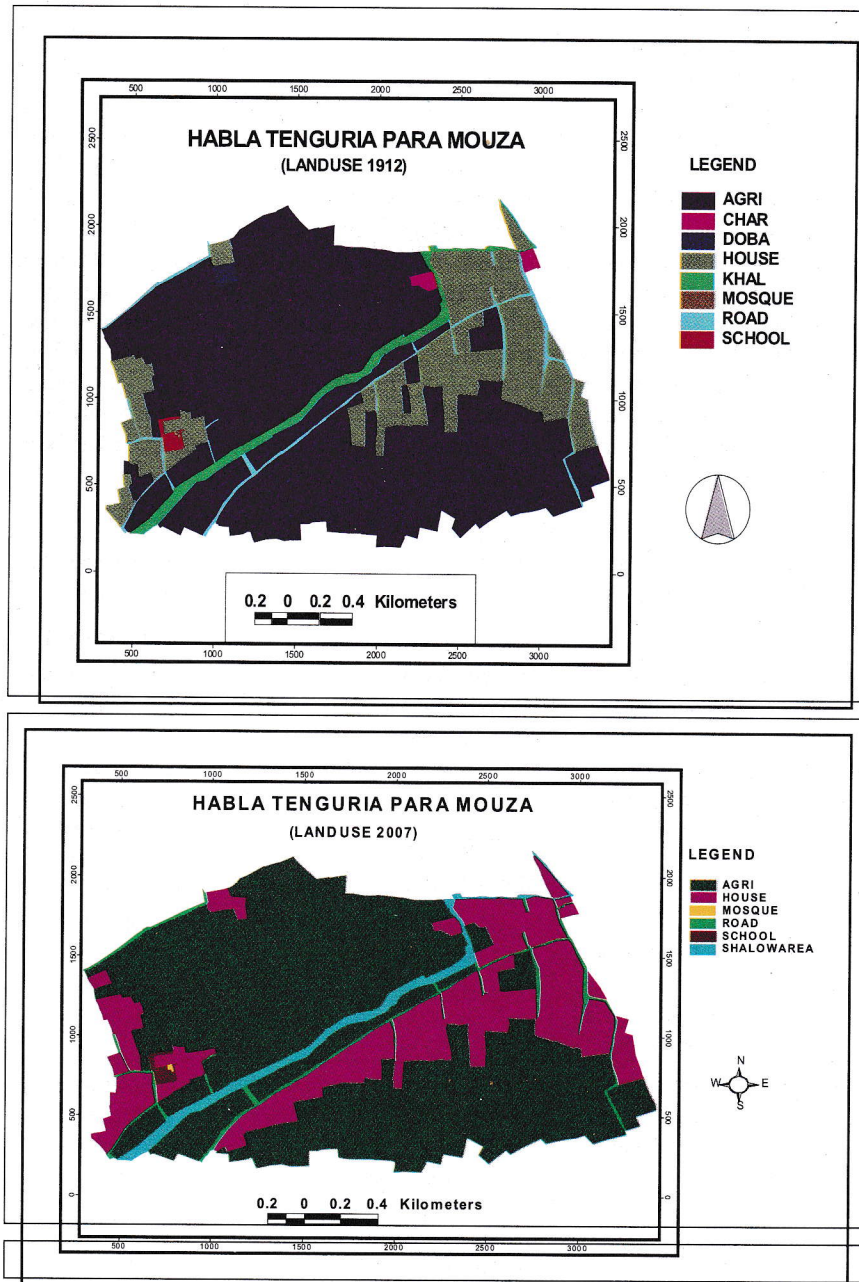


Figure 2: Land Use Pattern of the Study Area along with 1912 and 2007

Source: Compiled by author



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**6. Change of Habitat**

With the increase of population new settlement has been build up and homestead many species of biotic habitat disappeared. For increasing population more food items are being needed over the area. To meet up this challenge monoculture food production has started [8]. And this process is also cost effective. Lacking of surface water it is very easy to install a deep tube well for irrigation. It is sign of technologies development. Developments of road network and electricity connections ensure to use all of those technologies. Monoculture production of vegetation also started with wood gardening to remove home side bush area. And for cultivating same crop in the land year after year, land fertility has been lost. So, more chemical fertilizers are being used in the field. Land, water and air have also been polluted in this way also. Thus the changing matter of climatic condition starts deforestation, creates less vegetation covered area etc. has been made a big natural hazards. This way many species & genus population has been decreased (Table-5).

**Table-5: Factors, Types of factors, changing pattern & Changes**

Factors	Types of Factors	Changing Pattern	Vegetation & animals habitat & change of species life	
			First step	Second step
Population	By increasing population	Transformation of Natural habitat to agricultural land	Problems on habitat	Many species & genus is lost
Development	Development of agriculture	Pollution	Maximization & minimization of habitat	Increase & decrease of species & genus population
		Being commercialize		
		Monoculture		
	Development of Communication system	Road construction		
		Connect electricity		
Climate	Increase & Decrease of temperature	Natural hazard (Deforestation, Create less vegetation covered area, Cutting old big tree's because of forming new households)	Deviation of habitat	Entering new species
	Rate of Rainfall	No change		

Source: Field Data 2007.

### 7. Conclusion

Rural areas are developing very slowly. As the intensity of land has increased, it is imperative that the practice should be performed on the most suitable land [9]. The lifestyle of the people in the study area is changing time to time. In course of time, the number of population & settlements is equally increasing. In times many development activities increased and much vegetation decreased over the area (Field study 2007). All of the ecological components have fallen in much mismanagement. Most of those are human created. In this case, if Government and People work together to mitigate this mismanagement, then all types, factors and changing pattern of this biotic habitat can get positive directions to positive progress. It is hoped that, the methodology adopted for the study, could be extended more across the region [10].

### 8. Recommendations

Based on the above lessons and consequences of new database of the study area, this research arrives at some recommendations about finding the changing pattern of any biotic habitat. These are as follows:

- Due to time limitation all data have been collected from the initial stage. So for future study one can use more data from multi- sources.
- The present study will be helpful for future study and it could be taken as a methodology to analyze the changing pattern of biotic habitat.
- Socio-economic condition may be discussed as a broader way.
- This research may be studied broadly all over the Union or Thana or District in future.
- Law and order is an important tool for keeping peace and stable environment. So, they could be the keys to sustainable development.

### 9. Acknowledge ment

Land Use and Land Cover Manual; Survey of Bangladesh; Dept. of Geography and Environment of JU; LGED; Land Office, Tegaon, Dhaka; Statistical Office of Tangail; Land Office of Tangail & Union Parishod of Basail Upazila, Tangail.

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