

Habitat Based Ecological Analysis Of Urban Industrial Environment: An Appraisal For The Haldia Town, West Bengal

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Abstract: The urban ecological landscape of Haldia industrial town represents a semi-natural and altered cultural habitat which can be considered as a manifestation of human interaction with semi-natural environment in the face of industrialization and rapid urbanization. Manmade activities for urban development have brought about several changes in the form of land use alternation, high pollution level, fragmentation of natural habitat. Which are gradually affecting the habitat character by modifying the semi-natural habitats and also by introducing some man-made habitats. In my present work an attempt has been made to identify and assess each of the urban habitat types in ecological terms and also to evaluate the impact of urbanization on the remnant semi-natural habitats of Haldia industrial town. In this paper open source Google image was mainly utilized to analyze the habitat characteristics in site based case study in Haldia town. The finding is very significant to make decision to create eco-friendly situation in spite of the urban development of urban industrial site.

Keywords: Urbanization, industrialization, land use, fragmentation, habitat, decision, spite

1. INTRODUCTION

Urban habitat are semi-natural in their physical characteristics on urban land, but sometimes total alternation are not common in case of urban habitat however an amazing range of habitats are found with their associated plants and animals with on fringe of a town or a city. Semi-natural habitats of urban land include woodland, parkland, arable land, play ground, buildings, wall, sewage, and temple; exemplify the man-made or cultural habitat. With the advancement of human civilization more and more area comes under urbanization process and this process examined its spatial dimension not only to the physical suitable places of living but also to the harsh environmental conditions. Thus urbanization bring more areas under urban umbrella and the sometime it influences existing habitat urban centre. Urban landscape is characterized by development of buildings (both residential and residential) transport lines, railway and canal etc. Along with open lands for parking and dumping of waste product, green patches in different form (Garden, park, play ground), Govt. Centre, road. Demand for land in the C.B.D. is usually high for this region. The green cover is negligible in that area and distance increasing from centre the land is becomes more open in character. Urban area are not static, they are constantly expanding around the urban centre become degenerated. Sometime abandoned for a period of time while the others are being redeveloped. This dynamic process continuously shape and reshape urban habitat. Urban habitats face the problems of pollution, disturbance and fragmentation which finally affect the plant and animal community.

Along with the semi-natural urban habitat totally altered man-made artificial habitats are also found in urban areas. Due to diversified nature of urban landscape a variety of habitats are found in the urban area. Patchiness and fragmentation of urban habitat is one of the major causes of species richness in urban habitat. Migration through anthropogenic medium and introduction of exotic species in urban park, garden, and zoo also increases the biodiversity urban habitat along with the native indigenous species. Thus the species both plants and animals from interact association in urban environment. This is the unique characteristic of each urban area. Haldia is one of the most rapidly growing urban centres in West Bengal. Before (1970) developing centre its location advantages carry well habitat characteristics of different flora and fauna species. It is located at 50 km upstream from Bay of Bengal at the confluence of Hooghly and Haldi river, coastal belt advantage, morphologically plain surface, climatologically tropical savanna characteristics is well site for genesis of the species. But after (1970) development of urbanization and industrialization their habitat characteristics are changed rapidly. Now in Haldia town urban landscapes is characterized by development of building (both residential and residential), infrastructure development, parking, waste product, garden, park, school, playground, administered building, along with open land. That is the causes of natural habitats are totally altered semi-natural and artificial habitats. Due to diversified nature of Haldia landscape a variety of habitats are found in the urban area. There day to day species association and diversification and decreased due to patchiness and fragmentation of Haldia urban habitat.

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2 STUDY AREAS

Haldia means the land beside the Haldi river in the local Bengali language. But now it's important industrial centres in Eastern India and Gateway to South East Asia. The town Haldia with an existing industrial base is located 77 km downstream of legendary port Kolkata. The Gateway of Eastern India in the southern tip of Purba Medinipur District which forms the southernmost district of Medinipur Division

in West Bengal. Haldia town located in the estuarine reaches of the river Bhagirathi and confluence of river Hooghly and river Haldi. It is situated between 22°03'43.93" to 22°04'53"North latitude and 88°07'53.15" to 88°09'03.61"East longitude. The total geographical area of Haldia town is 109sq.km. Hooghly River bound detailed study area in East. Haldi River demarcates the South boundary, Brajlalchak and Sutahata also demarcates the Western and Northern boundary of the study area.

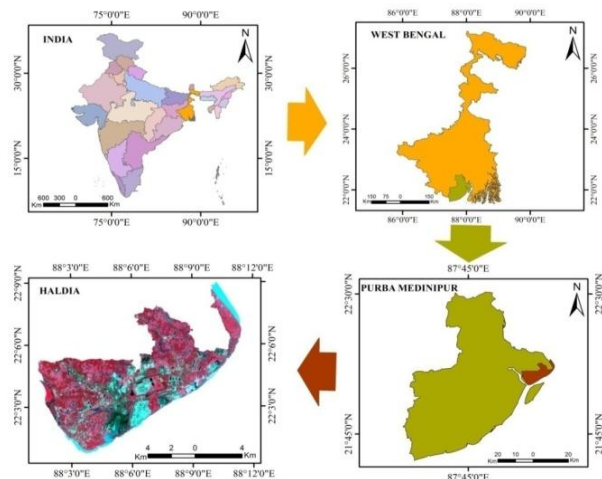


Figure 1: Location of the study area

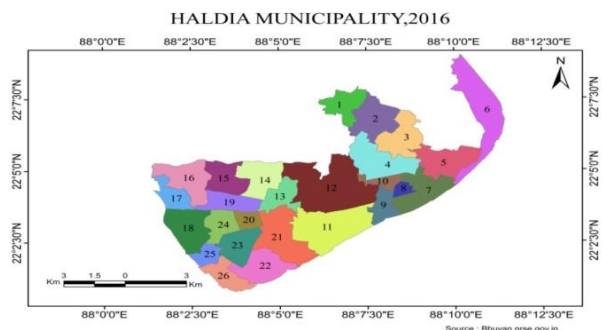


Figure 2: Municipal Wards, Haldia Town, West Bengal

3 METHODOLOGY

Open source satellite image have been used to identify habitat characteristics and species association on landscape. Urban information is collected from Govt. offices and Non-Govt. sources. Specimen herbarium and soil samples have been collected during field survey to get the ecological character of each patch. The habitats of homogeneous character are delineated on the hard copy of open source satellite images. Natural, semi natural and cultural habitats are considered for analysis. Field survey has been conducted in each type of habitats for identification and characterization. Soil samples and herbarium specimens have been collected and analysed for identification and classification to get the ecological character i.e. species association, niche, ecotone, composition and spacing of those species in specific habitat which characterize the habitat at micro level and ecosystem at large. Through case studies special emphasis has been given to assess the stress of urbanization and

industrialization in the form of pollution, degradation, fragmentation and conversion etc.

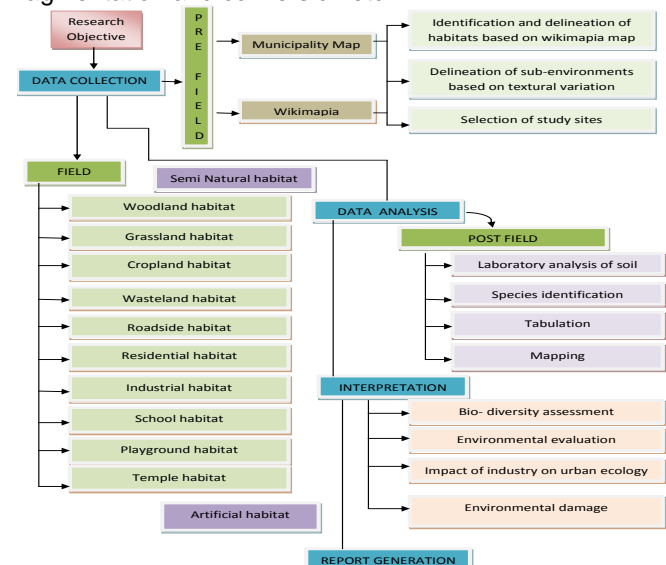


Figure 3: Schematic Diagram Showing Methods Followed

4 RESULTS AND DISCUSSION

Physiographically, the land of Haldia town is almost flat and the ground level is almost 7 to 13 feet above mean sea level. Broadly viewing point Haldia town is coastal plain of West Bengal and Bangladesh. Hence its geological history is very important. It lies on the 'South Bengal Basin' is now covered by recent to sub-recent alluvium of very thick Tertiary sediments. The basement of Bengal Basin is the part of the eastern edge of the Indian plate which is being subducted beneath the 'Eurasian' or 'China' plate along the 'Sunda Subduction Zone' and 'Naga – Lusai orogenic Belt'. The entire area situated lies on the combined deltaic plain of Damodar and Kasai river. Therefore, in Haldia town there are viewing no many morphometric features on the surface topography without natural levee, Abandan Chanel and Channel bar. The levee is small in length and occurred scattered. Some of the levees remain as an embankment upon which the old settlements are found otherwise the surface is absolutely flat so that filling of the ground is general nature for building of the industries and town estates. Being near to the sea Haldia town enjoys both temperate and hot humid climate. According to Koppen's Climate Classification Scheme this region come under Tropical Savannah. The temperate climate may be observed from November to March and the hot humid climate prevails on April, May and June followed by monsoon till October. The maximum temperature throughout the season except three months remains within the range of 33°C to 36.8°C while the minimum temperature seldom goes below 12°C. Normally in the last part of June month monsoon arrives in the region and extend up to August. The intensity of rainfall during monsoon is even more than 90%. The average annual rainfall is 1700 mm. The relative humidity is highest in the month of July and August and lowest in the month of January. The wind direction is generally from south and south-west with average 0.8km/hour to 7.3km/hour wind speed. The entire town is flanked by the two rivers Hooghly in the East and North side, Haldi in the south side small creeks and channels from the main stream intersect the region. Above

this type of facilities of this region is favourable for both living as well for species diversity. Haldia town having a population of 2,00,827 shows a distinct pattern in demographic features. The male and female population is 1,04,841 and 95,986 (2011) respectively and the ratio is 916. The age structure indicates more active people in the demographic people. The literacy rate is 78.86%. It has grown rapidly in the last two decades in terms of population and industrial activities with the setting up of Haldia Dock Complex in the 70's; an industrial township has been developed in its immediate hinterland. The port town, today, the only prominent urban centre of the Purba Medinipur district and the south part of the West Bengal. Speedy urbanization promotes transforming the landscape of the urban centre. Landscape alternation and modification has been carried out in Haldia town. Strong demand for the industrialization and urban facility converts to the natural landscape into cultural landscape. As a popular and biggest part and industrial town of the Eastern India in the southern tip it needs place for industries centre, construction and expansion of offices, buildings, hotels, markets for urban flourishing.

TRANSFORMATION OF LANDUSE
(HALDIA TOWN, WEST BENGAL)

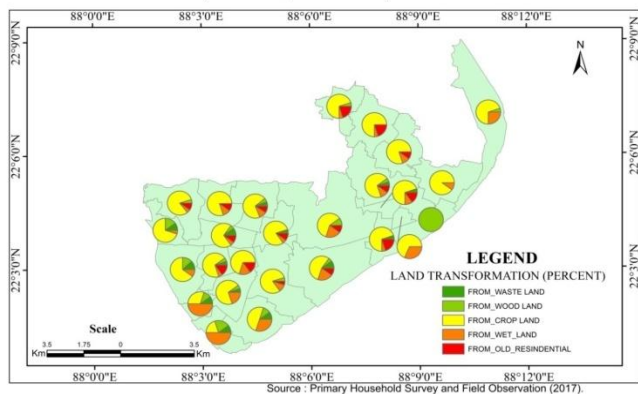


Figure 4: The ward wise variation of transformation of land use in Haldia town, 2017

Creation of urban parkland, garden, lakes for recreation, fresh environment promotes and better health of urban dwellers. Road, railway development for good transport system and increasing accessibility. Water pipeline, electricity, education centre and hospital establishment for better standard life of urban peoples. Population comes from rural area due to best opportunity of Haldia town in inward migration. These all are important factors for alternation of landscape and modified the natural landscape into cultural landscape. Field study (Fig.4) shows the percentage of different types of land transformation for the expansion of urban area in different wards of Haldia Municipality. All types of natural and semi-natural landscape, ecological stability get affected by toxic effects of litters, industrial wastes, plastic bottles, and wrappers disposed off by the urban dwellers. Habitats are thus being modified and fragmented making the environment vulnerable.

Ecological characterization of habitat types

The major habitat types identified in the study area as follows:

a. Residential habitat, b. Industrial habitat, c. Woodland habitat, d. Cropland habitat, e. Wasteland habitat, f. Roadside habitat, g. Ecology of the slum, h. Habitat of the tourist spots

a. Residential habitats

Residential habitats of the study area are found on river bank, fringed with agricultural land, beside connectivity networks and industrial area, developed re-habitation colony, housing complex area. Migration of working people from the rural belt and development of the industrial sector are the prime causes of increasing population pressure Haldia. The field study in residential habitats shows that there is strong in income disparity due to job opportunity in Haldia industrial town. Choice of areas for residential purpose is controlled by income profile. High and middle income group prefer Township, Hatiberia, Durgachalk, Khudiramnagar, Gandhinagar areas where lower income group compelled to live in the fringe areas like Ranichalk, Chirinijbpur etc. which are ecologically vulnerable nature. But day to day increasing population pressure and providing facilities to the dwellers of sustainable ecological lands have been used for urban purposes without considering ecological issues.

ECOLOGICAL ENVIRONMENT
(HALDIA TOWN, WEST BENGAL)

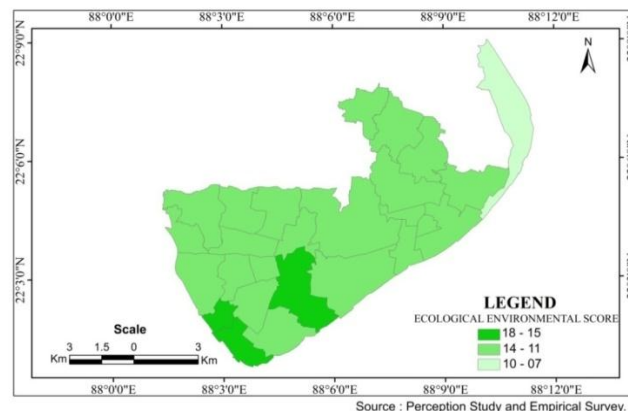


Figure 5: The ward wise variation of ecological environment in Haldia town.

To assess the ecological environment of the residential area, parameters like water supply, electricity supply, communication system, type and built environment status have been considered. Weighted ranks for each parameter have been assigned to each of the municipal wards. According to the total score obtained by each ward they are categorized three groups like areas with sustainable ecological environment, moderately sustainable ecological environment and deteriorated ecological environment. Residential areas wards of 21, 25 and 26 have received a high environment score with good public amenities and facilities; wards no. 1 to 20 and 22, 23, 24 area have moderate environmental score for their disrupted ecological condition and wards no. 6 area have less environment friendly (Fig. 5)

b. Industrial habitat

Industries of Haldia town are mainly the chemical industries. Port based functions initiated the development of chemical industries because it's requires huge chemical and also exports of chemical products in different countries. In Haldia town industries are fast growing. Most of the industries are situated in the along the river Hooghly as well as in the middle part of the Haldia municipal

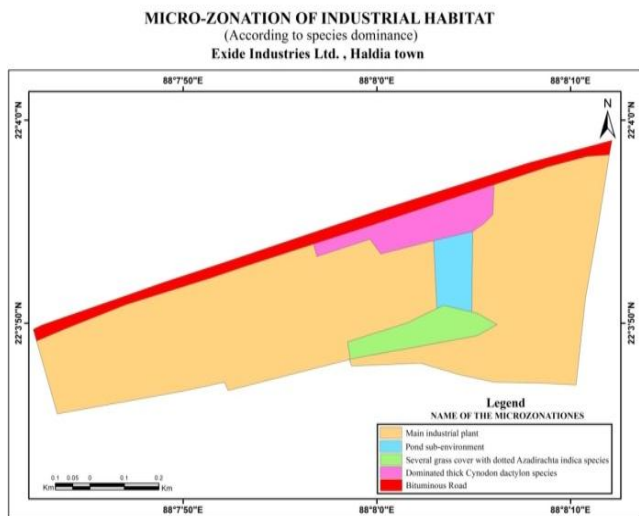


Figure 6: Species based microzonation of Exide Industrial habitat in Haldia town, 2017

area near vicinity of the residential areas. Products of the industries and not taken the action to protect the environment produced industrial waste impact of urban economic evolution on ecological system. Industrial habitat plant species are sensitive to micro-climatic variation and their association preference is controlled by variation in sunshine, soil moisture condition etc. Field study (Fig. 6) of Exide Industrial Ltd. reveals that Pistia stratiotes sp. are fund in pond sub environment, Cynodon dactylon, Azadirachta indica and Alstonia scholaries sp. are found ecologically deteriorated side. In the front side of industries some thick patches of Cynodon dactylon sp. are dominated.

c. Woodland habitat

Woodlands of the study area primarily located on canal banks and river embankments in small size which are utilized by human being in any way. Plant species and their ecological characteristics are determined by location, topography, edaphic condition and micro climatic type. This habitat are important in urban environment because of their role and function as screening air pollution and noise

pollution, supporting wild life and for aesthetic purposes. There is a tendency of some species to grow in association to maintain their ecological relation and a result co-existence of species is seen. In Haldia woodlands are mainly associated with in top lay Acacia nilotica, Casuarina equisetifolia, Shorea robusta, Swietenia macrophylla, Heritiera littoralis, etc. in floor lay of woodland habitat Argemone maxicana, Cissus quadran, Cuscuta reflexa, Croton bonplandianum, Opuntia monocantha, Opuntia stricta, Brachiaria mutica, Cynodon dactylon, etc. species are found. In case study (Fig: 7) urban woodland habitat and several micro-zones have been identified on the basis of above mentioned parameters and table (Table: 1) shows that hydro geomorphic characteristics of selected land assort. Due to human impact the areal coverage of woodland species decrease due to de-forestation. Establishment of alien plant species these are rapidly destroying the indigenous species. Die colouration and loss of needless and leaves. Epiphytes are largely affected by air pollution as a whole human intervention transformed natural woodland into semi natural woodland habitat.

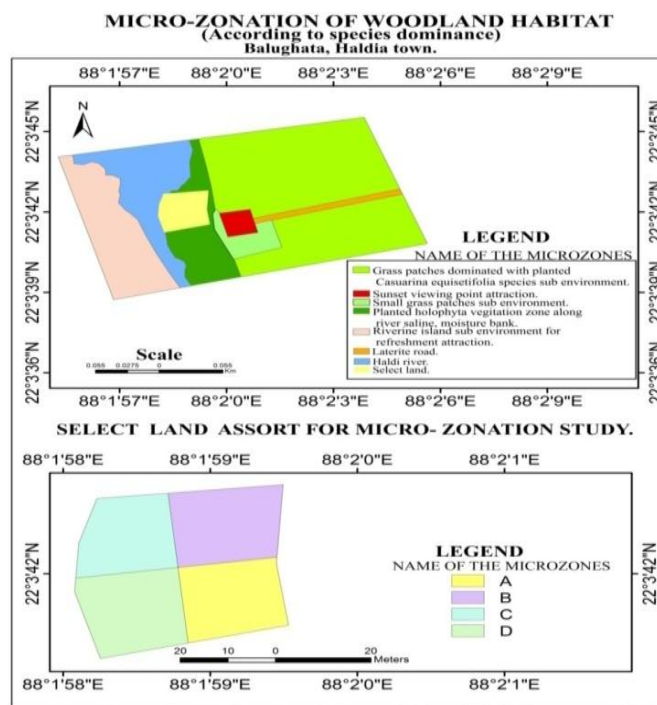


Figure 7: Species based microzonation of Balughata Woodland habitat in Haldia town, 2017

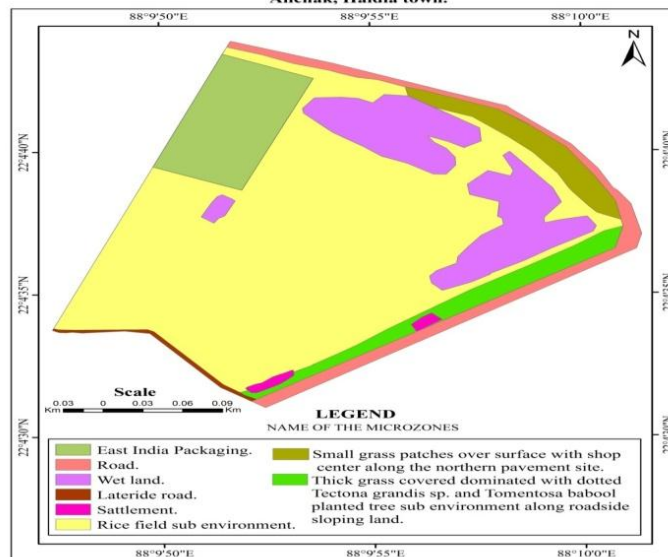
Table 1 : Hydro Geomorphic Characteristics of Selected Land Assort for Micro - zonation of Balughata Woodland Habitat

Zone	Area in sq. Metre	Soil Education			Drainage Percolating rate	Debris	Org anic matt er	PH	Name of Major Plant Species	Number of Plant species	Number of Major Fauna species	
		Soil Depth (cm)	Exposure (%)	Textur e							Avifauna	Insect
A	392.85	>20	5	clay	05ml/30'	Very High	<0.5	7.5	Bruguiera gymnorhiza	28	9	5
B	426.9	>20	5	clay	05ml/30'	High	<0.5	8.5	Bruguiera gymnorhiza	61	9	6
									Heritiera littoralis	49		

									Acanthus ilicifolius	56		
C	371.99	>20	5	clay	05ml/30'	Low	<0.5	6.5	Bruguiera gymnorrhiza	1	9	5
									Heritiera littoralis	56		
									Acanthus ilicifolius	67		
D	425.4	>20	5	clay	05ml/30'	Medium	<0.5	8.5	Bruguiera gymnorrhiza	2	9	5
									Heritiera littoralis	54		
									Acanthus ilicifolius	12		

Source: Prepared by author from field data, 2017

MICRO-ZONATION OF URBAN CROPLAND HABITAT (According to species dominance) Alichak, Haldia town.

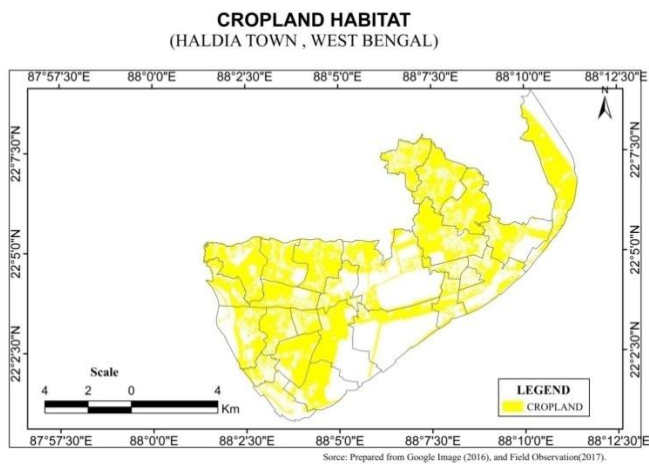


Source: Prepared from Google Image (2016) and Field Observation (2017).

Figure 9: Species based microzonation of Alichak cropland habitat (Case Study)

d. Cropland habitat

Haldia town as well known as industrial town so, herein found maximum land use in industries or built up area. During time at Haldia town 15% to 20% area covered isolated patches have following of crop lands (Fig: 8). Maximum croplands covered by paddy field. But in adjoining area of residential there founding different types of vegetables like Alocasia indica, Amaranthus viridis, Enhydra fluctuans, Ipomoea aquatic, Musa paradisiacal, Tectona grandis, Capsicum frutescens, Abelmoschus esculentus, Momordica charantica, Trichosanthes dioica, Kupusnjaca prodaja, Basella alba species etc. cropland are found to play very significant roles in maintaining the ecological balance of the urban area.



Source: Prepared from Google Image (2016), and Field Observation(2017).

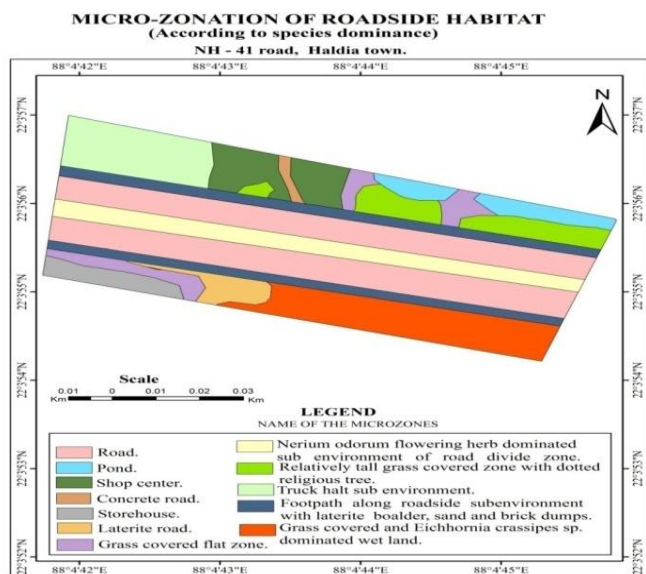
Figure 8: Distribution of Croplands Habitats over the landscape

e. wasteland habitat

Wastelands of Haldia are categorized into derelict land, neglected land and operational land. Wasteland habitat plant species are sensitive to micro-climatic variation and their association preference is controlled by variation in sunshine, soil moisture condition etc. According to species dominance case study (Fig 9) three micro ecological zones have been identified at Alichak. Wasteland species are playing very significant roles in maintaining the ecological balance of the study area.

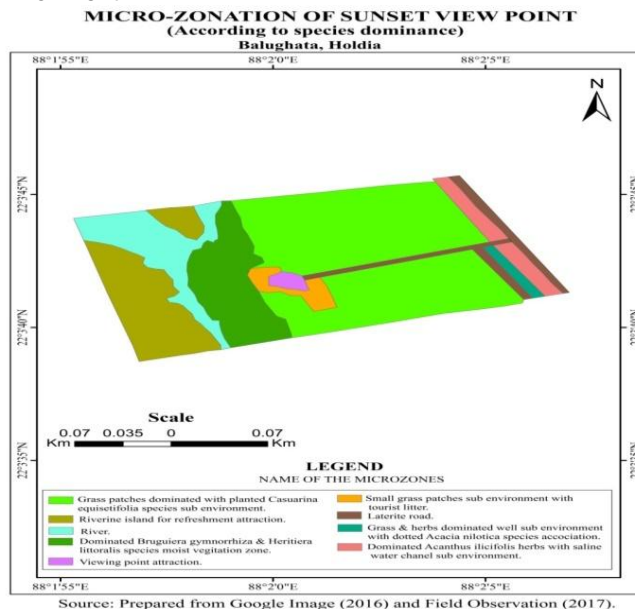
f. Roadside habitat

Roadways in the urban centre are responsible for fragmentation of habitat and on other hand carbon monoxide released from the transport sector causes harmful effects on road side plant species. Roadside habitats run parallel to the roads and are fragmented in nature due to human intervention. In this type of habitats indigenous species are found along with introduced alien species of decorative plants. Roadside grass cover is also affected by the pedestrians. A direct relation between distance from road and species number has been observed.



Source: Prepared from Google Image (2016) and Field Observation (2017).
Figure 10: Ecological Sub-environments in a Roadside Habitat (Case Study)

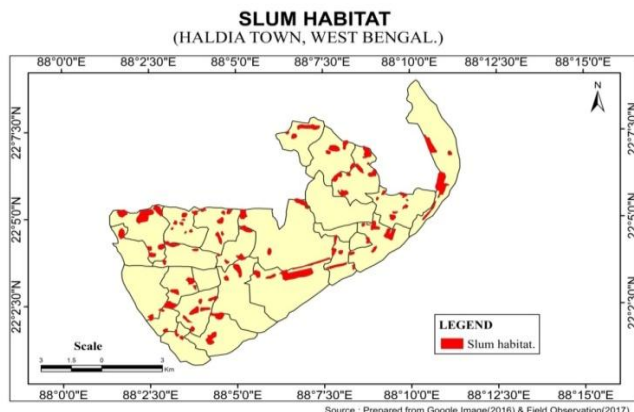
tourist spot attract the tourist by their charming environment.



Source: Prepared from Google Image (2016) and Field Observation (2017).
Figure 12: Micro-environmental Zones in a tourist spot (Case study in Balughata)

g. Ecology of the slum

Slum habitats of the study area are found to physically and culturally vulnerable zones mainly Haldi river bank, near the wasteland, beside road and rail network, sewage system, beside industries wall without any govt. recognition.



Source: Prepared from Google Image(2016) & Field Observation(2017)
Figure 11: Distribution of Slum Habitats over the landscape

Social status of the slum inhabitants represents poor economic condition. Most of the slum dwellers are either daily labourers or drivers engaged in industries. Housing environment of the slum area has been measured by some parameters like housing condition, level of privacy, having or not having garden, space between building blocks. The assessment reveals a poor environmental condition in the slum. Apart from that, noise pollution and poor level of social environment also characterize the slum areas near to Ranichak and Chirinjibpur.

h. Habitat of the tourist spots

The quality of the environment both natural and manmade is essential to tourism. However, the relationship of tourism with the environment is complex. It involves many activities that can have adverse environmental effects. The tourism has a great impact in his immediate environment. Various

That's why a large number of people come from different corner of country to make enjoy in the tourist spot. These different types of activity damage the environment quality of this particular tourist spot.

5 CONCLUSIONS

The present study focus upon the species association in the different urban habitat. Ecological analysis in Haldia town play negative role on urban dwellers health. Day to day landform changes from semi natural to cultural land enhancement environmental problem. It is true that above the landform changes increases economical development of a society but environmentally that have caused environmental damaged. Actual scene of the engineering construction and human intervention have intensified land alternation, as result more and more species damaged which is effect on urban ecology as well as environment. So it is the crucial time to take necessary step and strategies against such vulnerable environment of Haldia urban area, otherwise inhabitants of there have to pay the penalty of government and urban dwellers negligence management of urban ecology problems is as way in which urban potentiality is well saved and effect as well as the urban infrastructure and all of the facilities will be defined in a positive way along with the reduction and mitigation of urban problems. The micro level species management planning, always transformation of land should be developed at least fifty percent greenery development, threshold species should be conservation of the natural habitats and the environmental impact assessment has to be done before development planning. Above mention the importance strategies may be taken up for sustainable growth of Haldia industrial town.

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