

Q3: Tourism Survey – Hotel Survey

1. Date

2. What is the name of the Hotel?

3. What is the sex of Hotel Owner?  Male  Female

4. What is your Household Size (M & F)?

5. Age Group of Hotel Owner  0-14  15-29  30-44  45-59  >=60

6. What is your educational level?  Illiterate  Pre  1-5  5-8  9-10  11-12  Graduation  Above

7. What is the distance of your house from the hotel?

Next Door		< 1	1-2	2-3	3-4
4-5	5-10	10-15	15-20	20-25	

8. When was your hotel established?

9. Please provide the details of type and number of rooms and their rent.

No. of Floors	Type of Bed	No. of Rooms	Type of Room AC/ non-AC	Daily Rent
	Special Rooms			
	Single Bed			
	Double Bed			
	Dormitories			

10. What are the facilities available in the rooms?

	TV	AC	Geyser in Bathroom	Food Served in Rooms	Internet	Power Backup
No. of Rooms with the Facility						

11. What are the services offered in the hotel?

Restaurant	Number of Hours of Water Supply	Meal Hours	No. of Hours of Power Supply	Internet	Car Parking	Recreational	Emergency Services	Other Information

12. Please provide details of Tourists

Local	Tourists Primarily From			Nature of Tourists		
	Within State	Outside State	Foreign	Family	Organised Tour Parties	Others

13. In which time of year do tourists mainly come?

Months	Peak Season

Income	< 1500	1500-3000	3000-5000	5000-7500	7500-100000	>100000	
Expenditure	< 1500	1500-3000	3000-5000	5000-7500	7500-100000	>100000	
Profit	< 1500	1500-3000	3000-5000	5000-7500	7500-100000	>100000	

14. What is your monthly income and expenditure?

	Maintenance	Food	Power	Labour	Land Rent	Machinery	Other
Rank in order of importance							

16. Are any family members engaged in the same occupation?

Yes	No
-----	----

17. Do you hire any labour in your hotel? If yes, number...

Yes	No	No. Female	No. Male

18. Do you face any problem in the work?  Yes  No

Financial	Transport	Infrastructural	Power	Administrative	Labour	Water	Competition	Customer Related	Other

19. Do you have any suggestions for improving?

## BIBLIOGRAPHY & WEBLIOGRAPHY

Bhuiyan K.N and Sahu B. (2014), Assessment of water quality Index in Subarnarekha River Basin in and around Jharkhand area. TOSR Journal of Environmental Science, 8(II), 39-45.

Government of India (2013). Groundwater Information Booklet: East Singhbhum District, Jharkhand. Central Groundwater Board, Ministry of Water Resources, State Union Office Ranchi.  
([http://cgwb.gov.in/District profile/Jharkhand/East%20Singhbhum.pdf](http://cgwb.gov.in/District_profile/Jharkhand/East%20Singhbhum.pdf) accessed on 09.09.2022)

Government of India. Report on National Aquifer Mapping and Management of Groundwater Resources. East Singhbhum, Central Groundwater Board, State Unit Office, Ranchi

Government of Jharkhand (undated). Assessment and Mapping of Some Important Soil parameters including Soil Acidity for The State of Jharkhand (1:50,000 Scale) Towards Rational Land use plan: East Singhbhum District. National Bureau of Soil Survey and Land Use planning. Department of Soil Science & Agricultural chemistry. BAU, Ranchi, Jharkhand. Department of Agriculture and Cane Development. ([https://agni.jharkhand.gov.in/resources/Soil\\_Inventory/East%20Singhbhum\\_Soil\\_Analysis.pdf](https://agni.jharkhand.gov.in/resources/Soil_Inventory/East%20Singhbhum_Soil_Analysis.pdf) accessed on 24.12.2022).

Government of Jharkhand (undated). District Statistical Handbook 2021: East Singhbhum. Jharkhand. Department of planning & Development, District Statistics office, East Singhbhum. (<https://desjharkhand.nic.in/files/District%20Statistical%20Hand%20Book%20EAST%20SINGHBHUM.pdf> accessed on 24.12.2022).

IN-RIMT (undated). Report on Slope, Aspect and Altitude of East Singhbhum District, Jharkhand State. Jharkhand Space Application Centre, Department of Information Technology, Government of Jharkhand, Ranchi. ([https://jsac.jharkhand.gov.in/Report\\_PDF/Slope/Slope%20East%20Singhbhum.pdf](https://jsac.jharkhand.gov.in/Report_PDF/Slope/Slope%20East%20Singhbhum.pdf) accessed on 09.09.2022)

IN-RIMT (undated). Report on Soil Resources Map of East Singhbhum District. Department of Information Technology Government of Jharkhand, Ranchi.  
([https://jsac.jharkhand.gov.in/Report\\_PDF/New\\_Soil\\_Report/Soil\\_e-Singhbhum.pdf](https://jsac.jharkhand.gov.in/Report_PDF/New_Soil_Report/Soil_e-Singhbhum.pdf) accessed on 20.12.2022)

Jharkhand Space Application Centre (undated). East Singhbhum District profile. (<https://jsac.jharkhand.gov.in/district-profile/ESB.pdf> accessed on 09.09.2022)

Oxford University press (2010). Oxford School Atlas. New Delhi

Sarkar, A (2001). Practical Geography: A Systematic Approach. Orient Blackswan, Kolkata

Singh, R.L (1971). India: A Regional Geography. National Geographical Society of India, Varanasi

Soil Testing kit (2018) Handbook : Soil Testing kit , as recommended by I.A.R.I. Kolkata

<https://censusindia.gov.in/census.website/>

<http://en.wikipedia.org/wiki/>

✓ 20.11.2023  
02/12/23

Examination  
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S.P.T.B.S. College for Science  
Kolkata



**UNIVERSITY OF CALCUTTA**

**B.A. SEMESTER V GEOGRAPHY HONOURS**

**PRACTICAL EXAMINATION, 2022**

**PAPER: GEO-A-CC-5-11-P**

**GEOGRAPHY PRACTICAL NOTEBOOK**

**REGISTRATION NO:**

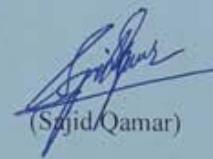
**561-1211-0165-20**

**ROLL NO: 202561-11-0086**

This is to certify that Roll No. **202561-41-0086**, , an examinee of the B.A. / B.Sc. Semester V Honours Examination (CBCS), 2022 of the University of Calcutta has visited the field area of study **VILLAGE CHORINDA, GHATSHILA BLOCK and its Surrounding Areas** in the month of **AUGUST 2022**. She/ He has completed the field report within the assigned time, under the guidance of Dr. Swati Sachdev, Mr. Sajid Qamar and Ms. Sumana Das, who accompanied the Semester V Geography Honours students of Budge Budge College.

The field report partly completes Paper GEO-A-CC-5-11-P of the Three-Year-Six-Semester Geography Honours Course.

  
(Swati Sachdev)

  
(Sajid Qamar)

  
(Sumana Das)



**DEVELOPMENT & ACCESS TO INFRASTRUCTURAL  
FACILITIES IN VILLAGE CHORINDA  
FOCUS ON HYDROLOGY AND ACCESS TO WATER**



## **ACKNOWLEDGEMENT**

I am greatful to the prinipal of collage Dr. Debjani Dutta for providing me the opportunity and support to undertake the field study and prepare the field report. I am also thankful to the collage authorities for assisting in preparing the field report. I am also thankful to Budge Budge College Geography Department H.O.D. Dr. Swati Sachdev along with Ms. Sajid Saman, Ms. Sumana Das and Staff members Subnata Karmakan for their guidance.

We are thankful for the cooperation of different offices and officials in kolkata and Ghatshila and village Choninda who helped us and provided us with relevant data and information e.g. main block office Ghatshila, Panchyat office Choninda, Aayshman Bhanat health center Choninda etc.

I am greatfull to my fellow classmates for their help and assistance in field report preparation.

## PREFACE

Village Chorinda is located in Ghatshila Block in East Singhbhum District of Jharkhand. It is located on the bank of the Subarnarekha river, and it is situated in a forested area and the average height of the region is 103 metens. The nearest railway station is at Ghatshila, at a distance of approximately 10 kilometers. The panoramic location among rivers, forest, hilly rugged tracts and valley influences both the demographic profile and livelihood of the people of the region.

A Field Survey was conducted by Geography Honours Students of Semester 5 in Village Chorinda and adjacent areas to study the nature of relationship between physical and cultural factors and their influence on the development levels in the region. In addition, focus was there on exploring the access to infrastructural facilities especially water. A number of surveys were conducted by the students to analyse the developmental level in general and the access to infrastructural facilities like water of the people in that region and assess the problems faced by them. The objective was to indicate suitable measures for enhancing access to infrastructural amenities and facilities in the region that might promote sustainable development of inhabitants of the region.

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01

HOUSEHOLD SURVEY

02

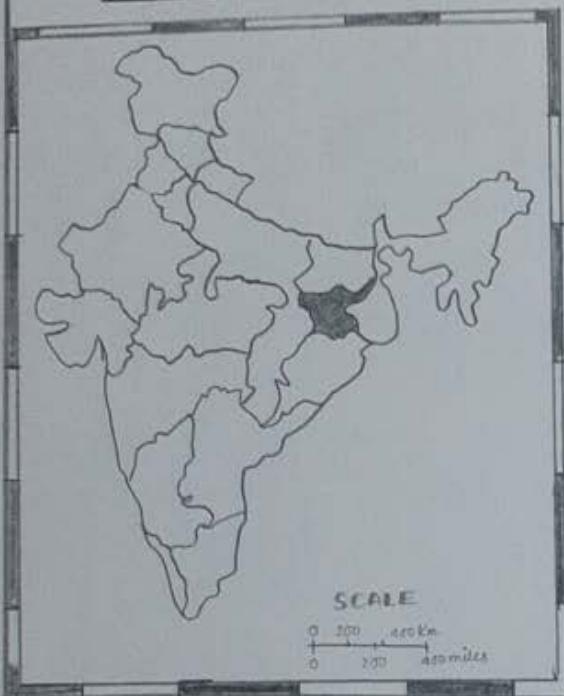
MARKET SURVEY

03

HOTEL SURVEY

## LOCATION OF STUDY AREA CHORINDA AND SURROUNDING PARTS

INDIA



SOURCE: NATMO

JHARKHAND



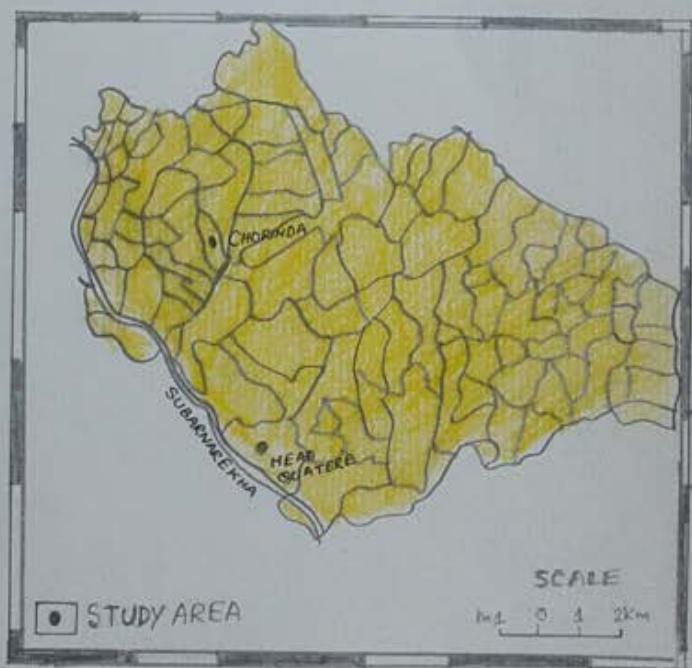
SOURCE: NATMO

PURBI SINGBHUM



SCALE  
0 5km  
0 5 miles

GHATSHILA C.D. BLOCK



SCALE  
0 1 2 km  
STUDY AREA  
SOURCE: Directorate of Census operations,  
Census of India, 2011

Chorinda  
02.01.23

## **INTRODUCTION**

Ghatshila is a developmental block in East Singhbhum district of Jharkhand. It is located on the bank of the Subarnarekha River, and it is situated in a hilly area and the average height of the region is 103 meters. The panoramic location among rivers, forest, rugged upland tract and valley influences both the developmental level of the people of the region and their access to infrastructural facilities.

Ghatshila comprise a population of 129905 and nearly 69 percent of its population is rural. Hence, the study area of Village Chorinda was selected in Ghatshila Block in East Singhbhum District in Jharkhand at a distance of 10km from the block headquarters at Ghatshila. It is located at an average elevation of 103 meters and on the outskirts of Chhotanagpur plateau. This influences the climate, soil, density of forests, access to water resources, livelihood and developmental level of the people of the region.

As mentioned, 69 percent of the population of the block is rural. Hence a village was selected for the purpose of conducting a socio-economic survey. Accordingly, a rural socio-economic household Survey was conducted by the sem 5 Geography Honours students at Village Chorinda to ascertain the developmental levels and the problems in access to infrastructural facilities mainly water faced by the inhabitants of the village and ascertain its relationship to physical environment.

S. D. S.  
20/10/2022

## OBJECTIVE AND RESEARCH PROBLEM

The objective was to study the nature of relationship between physical and cultural factors and their influence on the developmental levels in the region. In addition, focus was there on exploring the access to infrastructural facilities especially water.

The research problem thus was to examine the above issues of developmental level in general and indicate suitable measures for enhancing access to infrastructural amenities and facilities in the region that might promote sustainable development of inhabitants of the region.

A number of surveys were conducted by the students to analyse the developmental level in general and the access to infrastructural facilities like water of the people in that region and assess the problems faced by them.

A land use survey of the village was also undertaken to access the assemblage of landuse. In addition to get an approximate idea of the relative slope into the village a long profile was done along the contours approaching the village. In addition, in order to estimate the conditions favourable to agriculture an assessment of soil characteristics and availability of major nutrients (NPK) was attempted for which soil sample was collected from areas of different land use in the region.

These were combined with a market survey from where the population of the village fulfilled their needs. This survey sought to examine the various goods sold at the market and their problems. A landuse survey of the market (market morphology) was also undertaken to determine the diversity of goods sold and the grouping of shops.

Thus, fieldwork was conducted in the Choninda Village on the above-mentioned aspects bearing in mind the agrarian economy of the region. An attempt was made to examine the linkages of the physiography and ecology with socio-economic life and its impact on livelihood, developmental levels and accessibility to infrastructure.

Suresh  
20/11/2022

## LITERATURE REVIEW

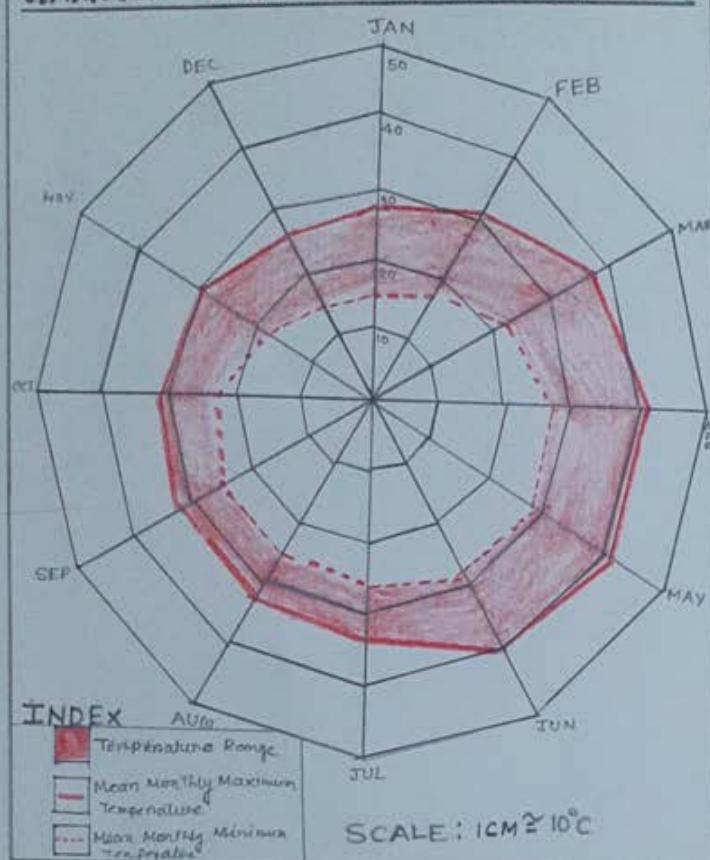
East Singhbhum district is situated at the extreme southeast of Jharkhand. It has an area of 3533 Sq. Km and a population of 2293019 persons (census of India, 2011). The district comprise two subdivision (Dhalbhum and Ghatshila) and nine development blocks. The study area is located in the Ghatshila block of the district with an area of 340.12 Sq. km and population of 129905 persons.

It is surrounded by forested hills, undulating ranges and valleys dotted with villages. It has great importance from industrial and mining standpoint. The rich cultural heritage of the block steeped in history has also resulted in high potential for tourism. The physical and cultural landscape and its location at the bank of Subarnarekha River influences the climate and mode of living of the people of the area.

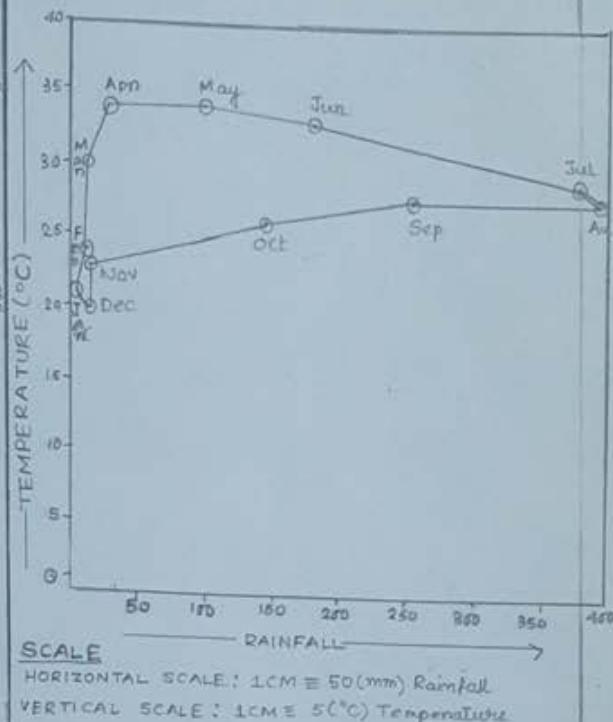
**GEOLOGY:** The district has large variation in slope and has remarkably unique geological history. From Behanagora in the South East up to East of Jamshedpur a major thrust zone is present which further extends into Sanakela Kharsawan district. This shear zone separates two Precambrian Provinces of the Indian Shield: an older province in the south which stabilized after the Iron age orogenie cycle closed about 2900 million years ago and a younger province in the north that underwent the Singhbhum orogenie cycle closing at about 850 million years ago (Government of India, 2013). The area is comprised of gneisses, gneiss and schist. Formation of igneous, sedimentary, and metamorphic rocks of the Dharawadian period are found in places.

# CLIMATIC SCENARIO AROUND GHATSILA 2021

## MAXIMUM MINIMUM TEMPERATURE

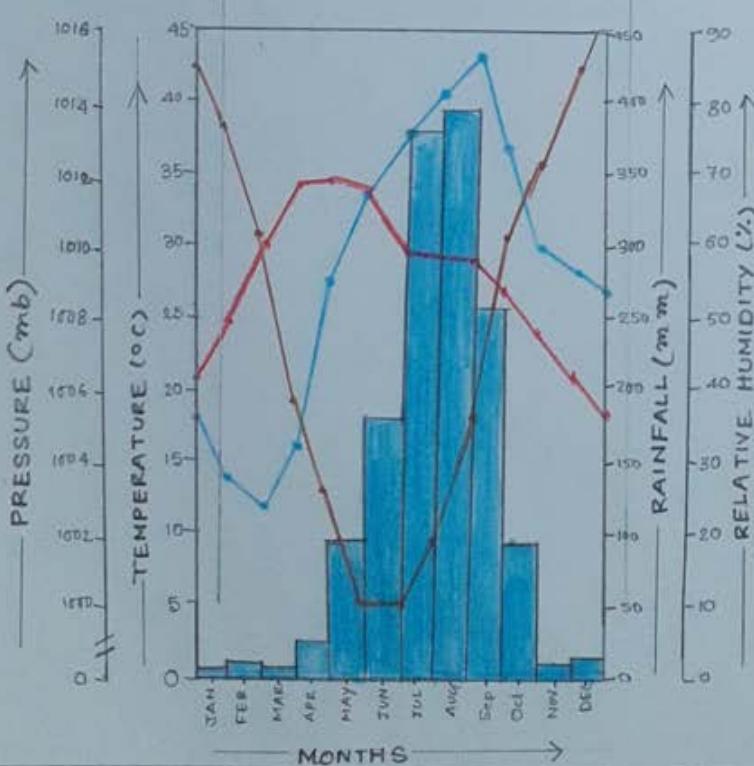


## HYTHERGRAPH



## CLIMATIC CHART

SHOWING  
RELATIONSHIP BETWEEN WEATHER ELEMENTS



✓ Verified  
24/09/2022

**■ PHYSIOGRAPHY:** The district has varied landforms like high hill ranges, eroded valleys, and undulating land. The Balma and Dhalbum are the main hill ranges and are covered by dense forests. The lower area that lies between hill ranges is known as the Dhalbum plain and is mainly created by river Subarnarekha and its tributaries. About 53 percent of the total area of the district is covered by residual mountains and hills. The relief is high in the southern and northern western portions of the district. Generally, the height of the district is 213 m to 945 m above the sea level. East Singhbhum district has large variation in slope. The study area Ghatshila has a slope range of 80 to 150 m/km (Government of India 2013).

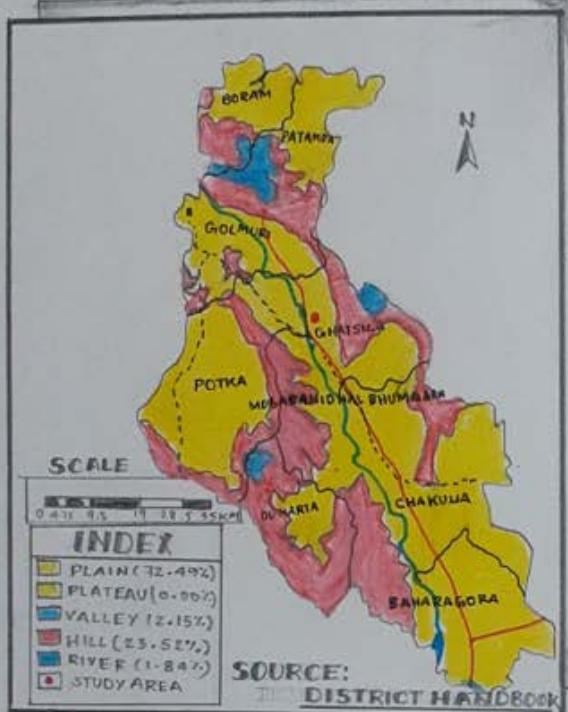
**■ CLIMATE:** Ghatshila has three distinct seasons - Summer, monsoon and Winter. Summers are tropical and hot. Monsoons are very moderate and generally start from June and continue till September. The average annual rainfall of the area is about 839 mm. Winters are quite chilly with temperature 10 to 15 degree Celsius during this period.

An analysis of the climate of the region through a thermograph (for 2021) reveals that at Ghatshila, the maximum temperature ranges from 36°C in May to 17°C in December. Minimum temperature ranges from 28°C in May to 13°C in December. The average annual temperature in a year indicate that the summer month range from March-May. There is a sharp dip in temperatures indicating the onset of winter season post September. The air pressure is very high in December-January.

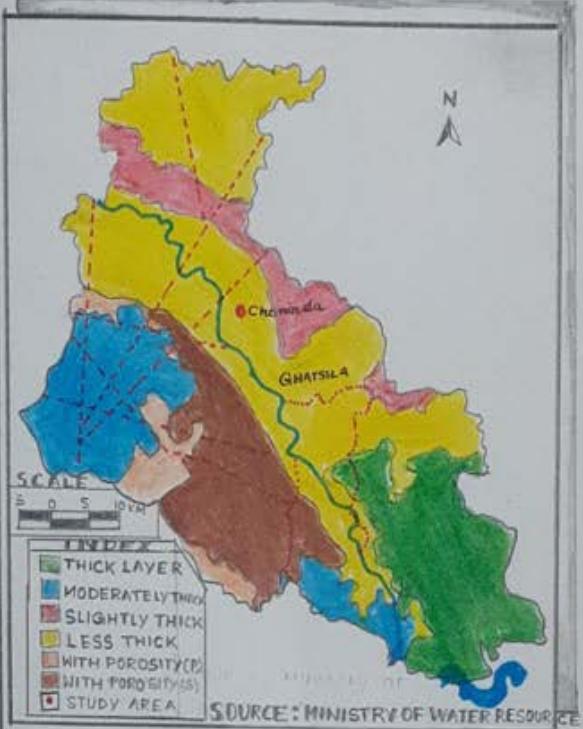
Rainfall however is variable and occurs from June to September with a peak in August in 2021. Thus the monsoon season begins in June and extends well into September. The temperature rainfall graph reveals that the relative humidity is also very high in these months. The region has very low

# HYDROGEOLOGICAL FEATURES

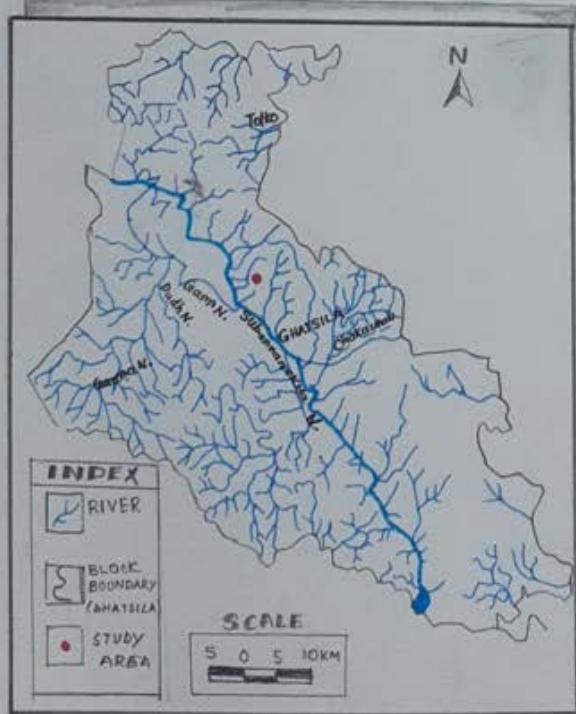
TOPOGRAPHICAL MAP



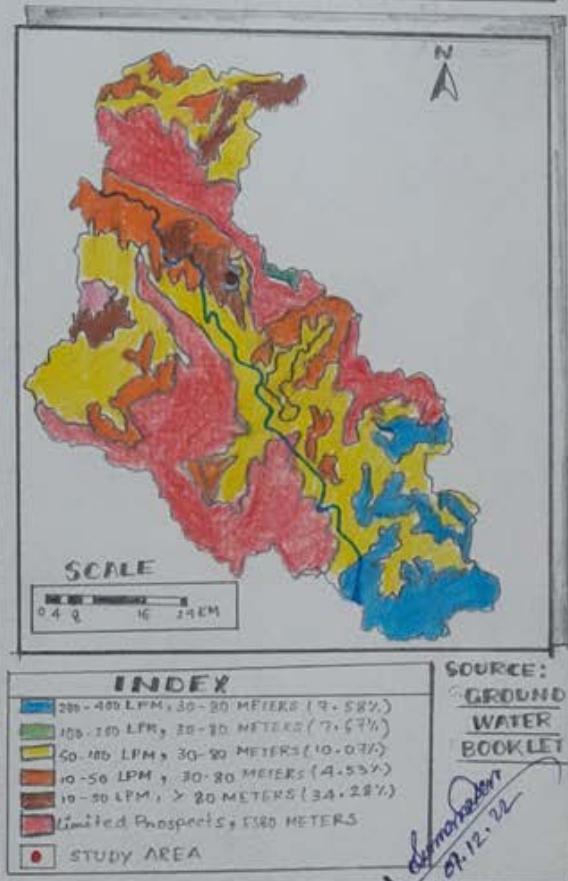
HYDROLOGICAL MAP



DRAINAGE MAP



GROUND WATER PROSPECT MAP



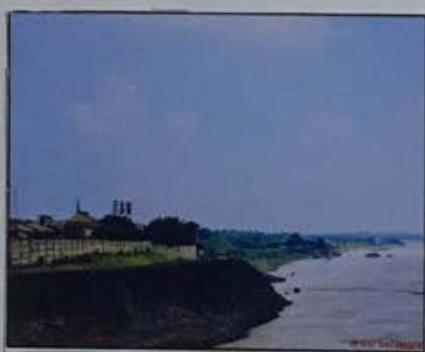
relative humidity only in February and March, else humidity is conspicuous.

Hypsograph reveals the moderately high temperature and thus evaporation and high rainfall prevails. The study region thus basically falls under hot humid climate with varying monthly rainfall.

**DRAINAGE:** The major rivers in the district are Subarnarekha and Khankai. The Subarnarekha River flows from west southern direction. All the tributaries of this area meet with the river. The drainage pattern is dendritic in nature. Drainage of Patamda blocks do not meet in Subarnarekha River.

Khankai River meets the river at Sonari near Jamshedpur. Major tributaries which meet at River from west to east at Sapananddi, Gramanadi, Duhnadi, Chakdahanadi (Government of India 2013).

**HYDROGEOLOGY:** The groundwater occurrence and movement are controlled by the prevailing morphology and intensity of structural discontinuities over the area. Rainfall is the main source of groundwater recharge in the area. The inconsistency between fracture zone is complicated in nature hence groundwater moves slowly and finds its way through the features and open joints. The area is underlain by unconsolidated to semi-consolidate sediments of the Tertiary age which are made up of coarse sand, gravel, fine to medium sand and clay. In hard rock areas, groundwater occurs within the weathered zone (1025 m thickness) and it underlying fractures/joints. The groundwater occurs both under unconfined conditions and semiconfined to confined conditions. The unconfined conditions exists in the weathered mantle portion of the rocks. The depth of the weathered mantle varies from 1534 m in general (Government of India 2013).

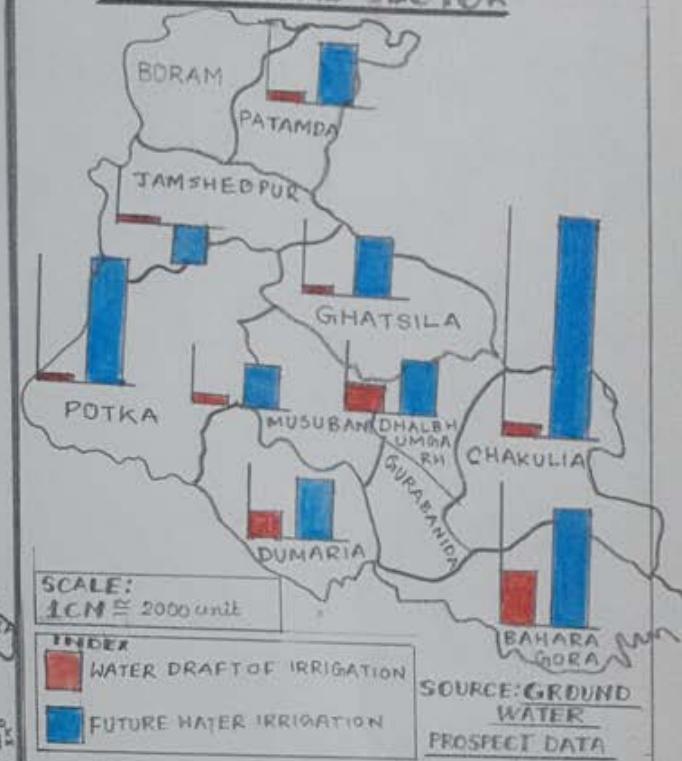


# GROUND WATER QUALITY

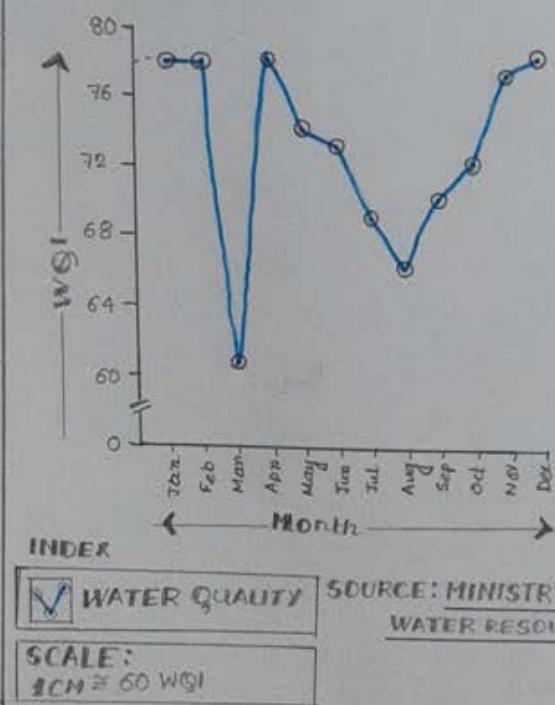
## STAGES OF GROUND WATER DEVELOPMENT



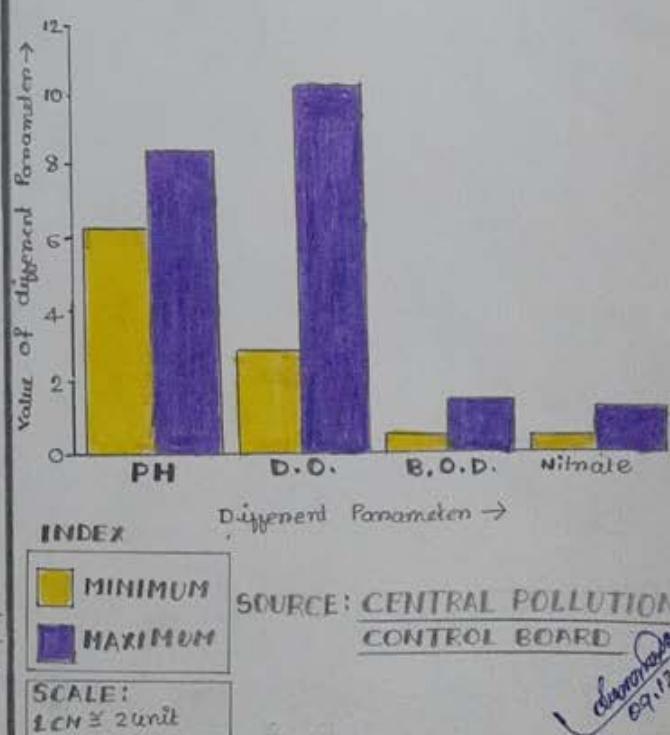
## STAGES OF GROUND WATER IN AGRICULTURAL SECTOR



## MONTHLY VARIATION OF WATER QUALITY



## WATER QUALITY PARAMETER



The hydrological map represents the ground water condition and depth of an aquifer in Ghatshila and its surroundings parts. The area is divided into six categories based on the nature of aquifer. Most of the people of this part district lies in a less thick aquifer zone, Chhindwa is also situated in this zone. The southern western parts of this district have moderately thick aquifer with high to medium porosity.

**■ GROUNDWATER:** Central Groundwater Board has a network of observation wells and groundwater management study and field data collected have examined to behaviour, quantity and quality of groundwater level in the district periodically.

**■ GROUNDWATER DEVELOPMENT AND PROSPECT:** Dug wells and shallow to medium depth (upto 50m) bore wells are the main groundwater extraction structures in the area to meet the increasing demand for domestic water supply. The overall groundwater development stage of the district is 20.74 percent only. Thus, there is scope for further development of groundwater. The ground water development varies in different places depending on the availability of favourable locations (local and regional hydrogeological conditions). Assessment of block wise ground water resources indicate the following:

Gross groundwater draft (all uses)	5633 ha.m
Net annual groundwater availability (all uses)	27155 ha.m
Net annual groundwater availability (irrigation development)	19843.85 ha.m

Ghatshila, the study area has 'Safe' level of groundwater exploitation and the stage of ground water development in the block varies from 6.84 percent to 131.39 percent (1997). The block still has immense potential for developing and tapping groundwater for utilisation.

Many wells have been dug in East Singhbhum district under Rajiv Gandhi National Drinking Water Mission Project. The depth range of the wells varies from 10 to 80 meters. In most

points of this district, the depth of the well is 30 to 80 meters. The flow rates of water in different categories of well are 50 to 200 l/minute. In Chorinda depth of groundwater is less than 30 meters with a flow rate of 10 to 50 l/minutes.

**■ WATER QUALITY PARAMETER:** Water Quality depends on different parameters i.e. dissolved oxygen, pH, Biological Oxygen Demand (BOD) and nitrate. pH range of groundwater in the region is 6 to 8, which represents natural water. The range of BOD and Nitrate is between 1 to 2, range of Dissolved Oxygen is 3 to 10. Monthly variation of Water Quality Index or WQI of the region depicts the aggregate water quality scenario and reveals that the water quality is bad in the month of March and is good for the rest of the months throughout the year.

**■ GROUNDWATER MANAGEMENT STRATEGY:** Thrust on development of groundwater resources to meet increasing demand, implies focussing on water conservation and artificial recharge to augment the depleting ground water resources and to improve groundwater quality by dilution. As nearly 58.58 percent of the wells show declining trend for pre monsoon and the same share for post monsoon period and about 41.67 percent wells show decline trend for entire period, hence all the blocks required for artificial recharge through check dam, percolation tank, nala bandhana, contour bunding and trenching.

**■ GROUNDWATER RELATED PROBLEMS:** The study area experiences varied levels of groundwater development. In the north eastern part of the area the groundwater resources are over utilized whereas in western and sections of central region ground water resources is underutilized. Ground water related issues and problems have not been the focus of scientific research to the same extent as surface water in the region. However, they used urgent attention e.g. compulsory rainwater harvesting laws, separate pricing policy for bulk consumers of ground water to mention of few so that the rural

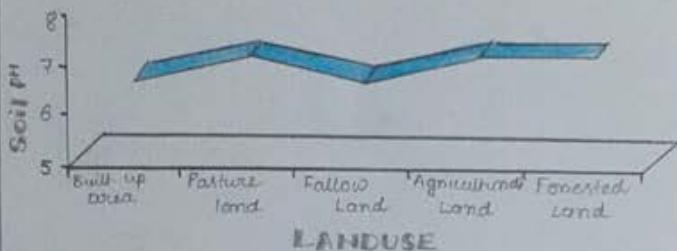
# SOIL CHARACTERISTICS AND ITS VARIATION ACROSS DIFFERENT LANDUSE

## IN VILLAGE CHORINDA

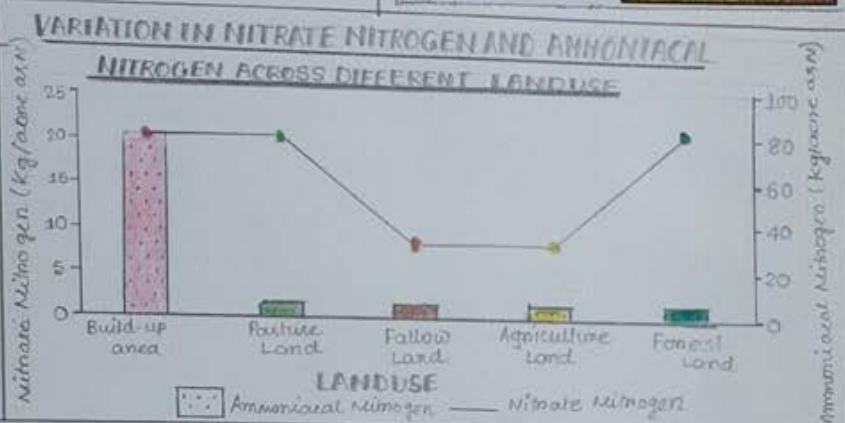
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Surveyed By: Semester 5 Geography Honours Students

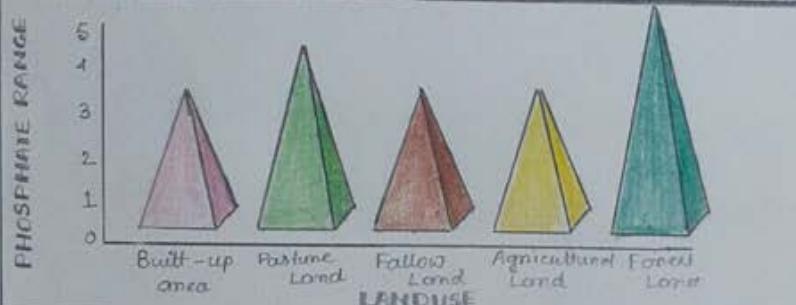
### VARIATION IN SOIL pH ACROSS DIFFERENT LANDUSE



### VARIATION IN NITRATE NITROGEN AND AMMONIACAL NITROGEN ACROSS DIFFERENT LANDUSE



### VARIATION IN SOIL PHOSPHATE ACROSS DIFFERENT LANDUSE



Agricultural Land

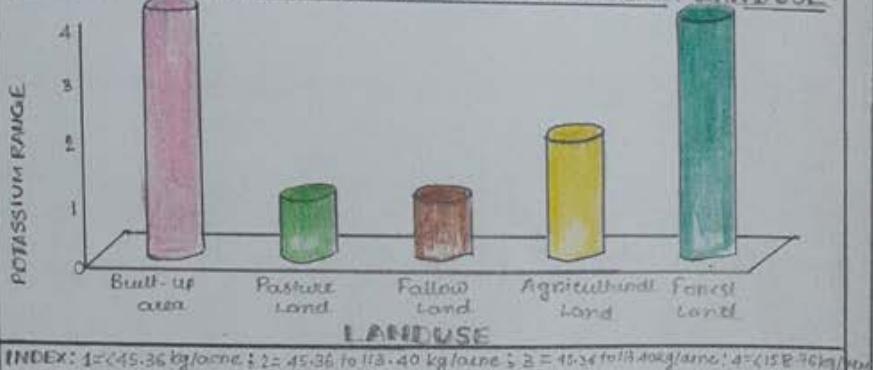


INDEX - 1 = 0; 2 = 0.07; 3 = 0.07 to 22.68; 4 = 22.68 to 29.49; 5 = > 29.49 (kg/ha/year ± 0.05)

Forest Land



### VARIATION IN SOIL POTASSIUM ACROSS DIFFERENT LANDUSE



INDEX: 1 = < 45.36 kg/ha; 2 = 45.36 to 113.40 kg/ha; 3 = 153.46 to 174.00 kg/ha; 4 = > 174.00 kg/ha

SOURCE NOTE: Based on Sample Collected in the Village on 25.08.2022 and Tested in Laboratory Setting in Budge Budge, Kolkata on 16th, 19th, 20th and 22nd December, 2022.

Geetika  
07/12/23

agranian population may also have access to them share of groundwater for agricultural and domestic use.

■ Soil: The major soil of the district are Alfisols (71 percent) which comprise of both mixed red & Black soil and red gravelly & Sandy Soils. These soils have light to medium texture and are moderately acidic. Besides these are district also has Entisols and Inceptisols. There are in all five soil types in the district: red gravelly red Sandy, red loamy, red & yellow and latosolic soil (Government of Jharkhand undated).

In order to examine the soil characteristics and its variation across landuse types in the study area of village Choninda, soil samples were collected from the five major landuse of the region- cultivated area, fallow lands, forested land, Pasture land and built-up area. The soil samples were dried in hot air oven and processed and analysed. Analysis reveals that the soil in the region is slightly acidic and there is not variation in the pH of soil in the region. The slight acidic nature of soil is conducive to growth of several crops.

However, an examination was also made into the availability of macro-nutrients for plant and agricultural growth, namely NPK (Soil Testing Kit 2018). The availability of nitrogen varies from high in built-up area with 80 Kg/acre of ammoniacal nitrogen to very low in other areas. However, nitrate nitrogen is high in built-up area, pasture land and forest area at 20 Kg/acre. The share of ammoniacal and Nitrate nitrogen in built-up area may be due the presence of poultry and livestock. The high share of nitrate nitrogen in the pasture land may be attributed to similar causes. The high share of nitrate nitrogen in the forest area however may be due to the accumulate of humus. The other important nutrient Phosphorous is also high in pasture and forest land with more than 22.68 Kg/acre of phosphate is soluble from. This may be on account of presence of livestock excreta and humans. The other regions also have moderate amount of phosphorous. As regards Potassium, it is very high in

forest area probably due to the same reason as phosphate. However, its high share in built-up area may be due to presence of poultry and its waste.

The agricultural land has low ammoniacal and nitrate nitrogen but low phosphorous and moderate potassium. The low nitrogen in the soil probably due to overuse and in its current stage is not conducive for growth of cereal crops but requires application of nitrogen fertilizer/manure on crop rotation before continuing growth of cereal crops. The low soluble phosphate implies that cereal crops cannot grow well. Excessive growing of crops in fields results in depletion of phosphorous which needs regular replenishment. The growth of rice crops over years have probably resulted in the low share of phosphate and there is a need to add phosphate fertilizer/manure regularly to improve productivity of cereal crops. The moderate potassium amount in the cultivated area is conducive to the growth of crops especially in these slightly acidic soils. In order to cultivate root crops in the region although some potassium salt or manure needs to be used to enrich the soil. Thus, in terms of agricultural, the soil in the region has adequate potassium, but it needs replenishment of nitrogen and phosphorous as it probably has been depleted through overuse. Crop rotation is also probably required in the region and growth of leguminous plants must be encouraged as well.

### **FLORA:**



Due to varied landscapes, the forest cover is found in different proportions in different areas. Plains associated with the Subarnarekha basin record considerable deforestation but Dantoli and Dhanjoli highland areas are under thick forest cover. Sal trees are dominant in this area. Other trees are Mango, Jamun, Jackfruit, Kananj, Palas etc. The region has witnessed deforestation due to need to expand agricultural land and most forests like in study area are hence Open Mixed forests.

**■ POPULATION AND ECONOMY:** East Singhbhum district comprise of 2 sub-divisions Dhalbhum and Ghatshila. Ghatshila has 8 development blocks one of which is Ghatshila CD Block. The total population of East Singhbhum district was 2293919 with a population density of 651 persons per sq km and a rural population of 372 persons per sq km. and rural population of 69 per cent (Government of Jharkhand undated). Hence a village Choninda adjacent to Ghatshila was undertaken for field work. The total population of village Choninda was 1035 over an area of 242 hectares. The forested area in the village is facing deforestation due to extension of agricultural and pasture land to accommodate the expanding population.

The level of literacy in the district was 66 per cent and in the block 62 per cent and in the village 75 per cent. As expected, the male female discrepancy is significant at district, block and village level. though it is more conspicuous at village level.

The per cent of workers in Ghatshila was 61 per cent and in Village Choninda only 40 per cent. However, male and female discrepancies prevail. While male workforce participation rate is around 60 per cent; for females it is barely 20 per cent in the village. The distribution across industry categories reveals that higher per cent are employed in non-agricultural activities in the district and as cultivators in the village. This indicates the reliance of the villagers on agriculture for their sustenance.

The infrastructure facilities of the region are not up to the mark. The physical infrastructure, namely transport is not well developed and there are two approach roads into the village from the main metalled road. The rest of the village has only cart-tracks or park tracts. Economic infrastructure facilities like bank are absent from the village and nearest bank is at a distance of approximately 5-10 kms from the village. Social infrastructure is only marginally better and the village has a primary and middle school; though the nearest Secondary and Senior Secondary School is only at Ghatshila Chaladh and Ghatshila respectively. Health infrastructure too is dismal and the village didn't have any PHC or sub center as per Census 2011.

Inspite of relying on agricultural, the village has only well, hand pumps, tube wells and one lone tap to supply water. There are no canals for irrigation though local tanks or ponds are present and these are the limited sources of irrigation.

Thus, the above discussion and review of literature provides an insight into the Ghatshila region of Purbi Singhbhum district, the focus on field work. Based on this snowball sample survey was undertaken of households in Village Choninda to assess the developmental level and assess its infrastructure facilities mainly water resources as agriculture is the mainstay of their livelihood even in contemporary times.

✓  
02-01-23

## METHODOLOGY

The students of Semester 5 Geography Honours of the collage conducted their field work in Ghatsila block in East Singhbhum district of Jharkhand. The survey analyses the developmental and socio-economic levels of living of people of the area and focussed on examining the hydrology and access to water of people in the study area. The entire field work can be categorised into - Pre-field Work, Work during Field Trip and Post Field Work.

**Pre-field Work:** After deciding to go to Ghatsila, the initial task was to collect information pertaining to various geographical aspects of the area, for which purpose, a number of books, government documents and websites were consulted on the history, geology, hydrology, population, economy, etc of the region. In addition, census data pertaining to various villages in Ghatsila block were examined to select the village for the purpose of survey. Finally, after deciding on the village Choninda, the location map was prepared using the Census District Primary Census Abstract and Village and town Directory and Census Atlas, 2011. Several online articles and website were referred to analyse the physiography, drainage, geohydrology and climate of the region with data obtained from the RMC Alipore, Kolkata. In addition, more detailed data regarding the population, occupational structure and village profile was collected on the selected block and village.

**During Field Work:** In course of the field work, stress was laid on collecting primary data by conducting a number of survey. A rural household survey was conducted in the village Choninda to obtain a picture of the socio-economic development scenario (demographic, literacy, occupation, standard of living) and access to amenities like water of population in the region.

A landsuse Survey was also conducted in the region to ascertain the amalgam of landsuse. Examination of soil of the study area was also conducted as it is the main source of livelihood. A detailed assessment of hydrology of the region, the various water sources, quality, access and problems of water resources in the region were examined.

A longitudinal profile Survey coupled with changing landuse along the approach road to the village which connects it to Ghatshila was undertaken to ascertain the variations in micro-nlife.

A market survey was also conducted to determine the type of goods sold, characteristics of shop and shopkeepers and problems. A landuse survey of the market morphology was also undertaken to find out the prominence of various types of shops.

In addition, a hotel survey was also conducted around Ghatshila to examine the nexus of tourist economy of the region with the agrarian economy.



Besides, Secondary data and maps were obtained from the Land records office, block office and PHCs regarding the various programs undertaken for the development of the region.

**Post Field Work:** After returning from the field based on the primary and secondary data and maps, the field report was prepared. In order to obtain a proper visualization of the data obtained from field work, several maps, cartograms, graphs, etc. were prepared. The various techniques used for this purpose and its analysis the field data are discussed as follows.

The map depicting the location was prepared using Census Administrative Atlas. Articles and research papers were used for studying the Geography of the region.

The climatee data was prepared by plotting histograms for rainfall and line graphs for temperature, pressure and relative humidity. Similarly, the variation of maximum and minimum temperature was depicted using star/ radar diagrams. The overall climate of the region was examined using hythengraph.

Soil testing kit was used to analyse the soil samples collected from the field. The objective was to assess the varying nature of soil ~~p~~ physical and chemical characteristic under different landuse types and to assess the suitability of crops of different soil in the region.

The landuse map was prepared after conducting a primary survey and with the help of locals. The data provided by the Land and Land reforms officers assisted the process. A long profile was prepared from the data collected by observing heights through dumpy level and bearings through prismatic compass in the field.

Using the primary data that was collected through household survey in Village Chorinda, an analysis of the demographic and developmental scenario and access to infrastructural amenities and facilities was undertaken and represented through age-sexpyramids and different chart and graphs like bargraphs, pie graphs, and stare diagram.

In additions, both secondary and primary data sources and research articles were referred to in order to analyse the nature of hydrogeology, drainage and water quality of the region. The problem of access to water was also examined using primary data. Maps and graphs have been prepared from selected data regarding these dimensions.

Data obtained through market survey was used to represent type of goods sold, nature and characteristics of shops and shopkeepers and their problems through bar graphs, pie-graphs, etc. Using pacing method landuse of market areas was assessed and represented through a landuse map / market morphology map.

Thus, Various statistical and cartographic methods were used to diagrammatically represent the primary and secondary

data obtained through the field work on varied aspects of the region, which have enhanced the visualisation and assisted in drawing conclusions regarding the correlation between physical and cultural attributes of the region and the development scenario in general and access to water resources in particular.

✓  
Santosh  
20/12/2022

## **RESULTS AND DISCUSSIONS**

The main purpose of the field trip was to examine the development level of the people of the study area and to assess its infrastructure mainly water resources. In order to understand these and the correlation between physical and cultural factors, a number of primary surveys were conducted. In addition, analysis was undertaken from data obtained from various secondary sources. On the basis of the analysis of primary and secondary data, the following results emerged.

### **Landuse**

The landuse of any region is dependent both on the physical and cultural attributes of a place. The region is part of the southern fringe of the Chhotanagpur plateau and is a rugged upland tract near river Subarnarekha. The landuse needs to be carefully managed in such area to maintain the quality of environment.

Village Choninda which was the focus of the fieldwork is essentially an agrarian economy nestled in the midst of the forested upland tract. This village was selected for survey purpose as the objective was to examine the assess to infrastructure especially water in an agrarian economy and examine their developmental level.

The village has an area of 242 hectares. Out of this 36 percent is net sown area. The land use map reveals that there is limited diversity of land use in the region. The prominent land use in the village is agricultural land use, fallow land and forested area. Mainly paddy cultivation is carried out, especially towards the southern, central and north eastern part of the region from south to north. The paddy fields are interspersed by settlements especially along roads or water bodies on edges of fields. Open mixed forests also are present adjoining the road in the west and in north and south west extremities as well as in the patch within the village center. pasture land is evident in patches scattered near the fallow land in the south east, south west and a small tract in the center of the village.

# LAND USE MAP OF CHORINDA VILLAGE



INDEX	
Cultivated	
Waste Land	
Fallow Land	
Ramer Garden	
Pasture	
Forest	
Horse Garden	
River	
Pond/Tank	
Defilement	
Road/Path	
Temple	
School	
Mudde/Calyut Bank	
Shed/Shop	

The village is bounded on the east by a 'Nala' of Subannanekha River and in the west by a metalled road. Three prominent unmetalled road (Cont tracks) branch off into the village and another path track is visible towards the centre traversing from north west to south east of the village. There are some small water bodies scattered throughout the village. Yet because of the absence of canals the irrigated area is minimal only 1.21 hectares. There is an almost continuous belt of uncultivable wasteland bordering the 'Nala' in the west as it is not clean water and is sandy.

There is a presence of a temple at the entrance to the village towards the left of the approach road. The primary school is also present near the main approach road to the village, slightly offshoot to the east sheltered by open mixed forests.

Thus, the region depicts a typically dispersed settlement pattern on account of the forested upland terrain wherein the forests have been cut down and transformed into cultivated tracts. Thus, it is clear from the Mawa and landuse map that most of the region is under agricultural land use - cultivation of rice being the mainstay of most people. In addition, the settlement of the region is influenced by the physical feature of the region as there is prominence of fallow land and forests.

Thus, developmental planning must take into account (i) the high share of agricultural in the village and provide for more irrigation facilities and building of more canals, etc (ii) managing the common property resources like the waste and fallow land where there is livestock grazing.

Landuse monitoring and management is needed to enable best utilisation of available land and reduce harmful environmental effects and increase access to irrigation facilities in the village.

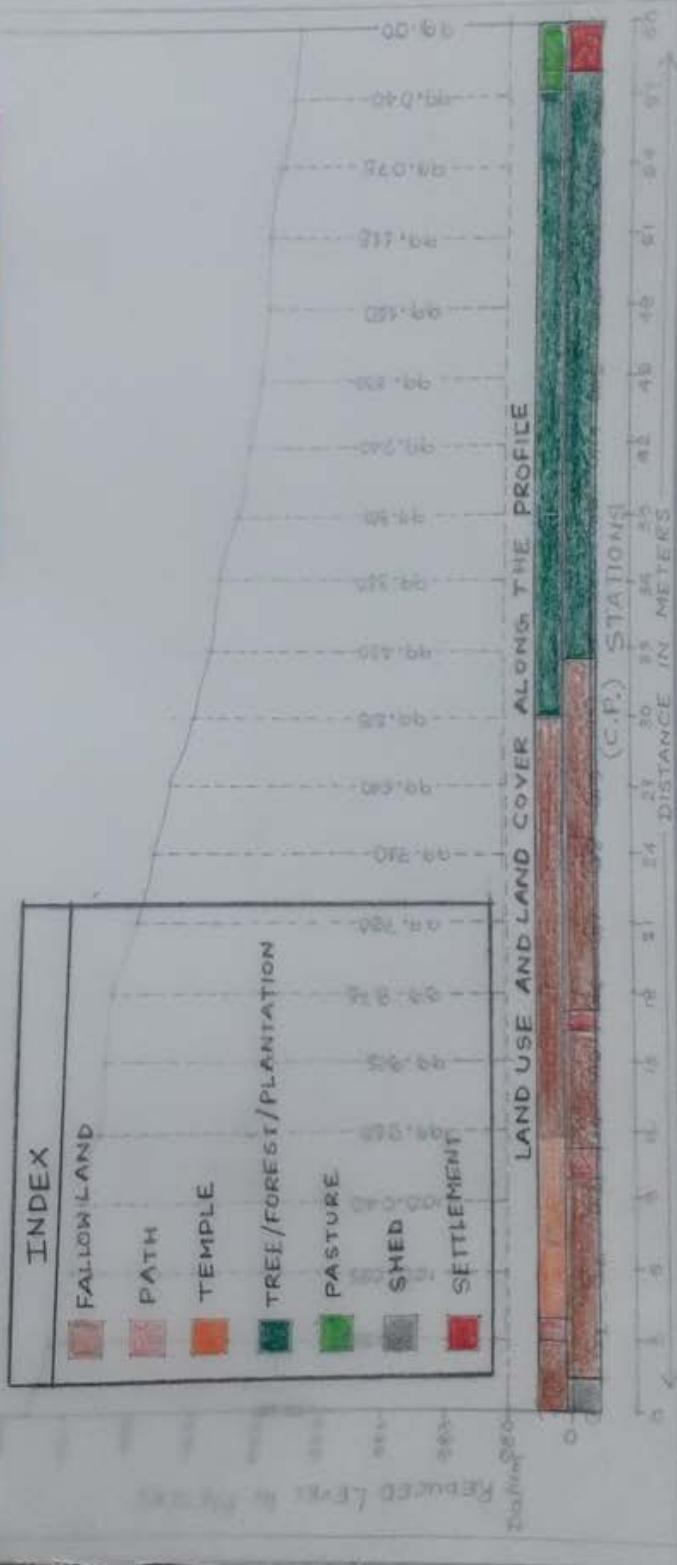
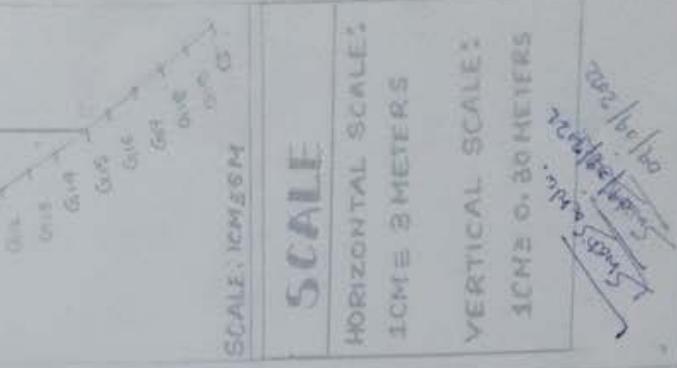
Yashwant  
22/10/2022

# FIELD BOOK: DUMP/LIVE-LONG PROFILE

INST. NO. 6  
DATE: 11/11/2013  
START STATION: 1  
END STATION: 1  
STUDENTS END: 1



INDEX	
	FALLOWLAND
	PATH
	TEMPLE
	TREE/FOREST/PLANTATION
	PASTURE
	SHED
	SETTLEMENT



# FIELD BOOK: DUMPY LEVEL - LONG PROFILE

**INSTRUMENT NO:**

**DUMPY LEVEL: DL 4**

**PRISMATIC COMPASS: PC 1**

**SURVEYED - 5<sup>TH</sup> SEM GEOA STUDENTS**

**PLACE: APPROX ROAD TO CHOWRUNDIA  
VILL**

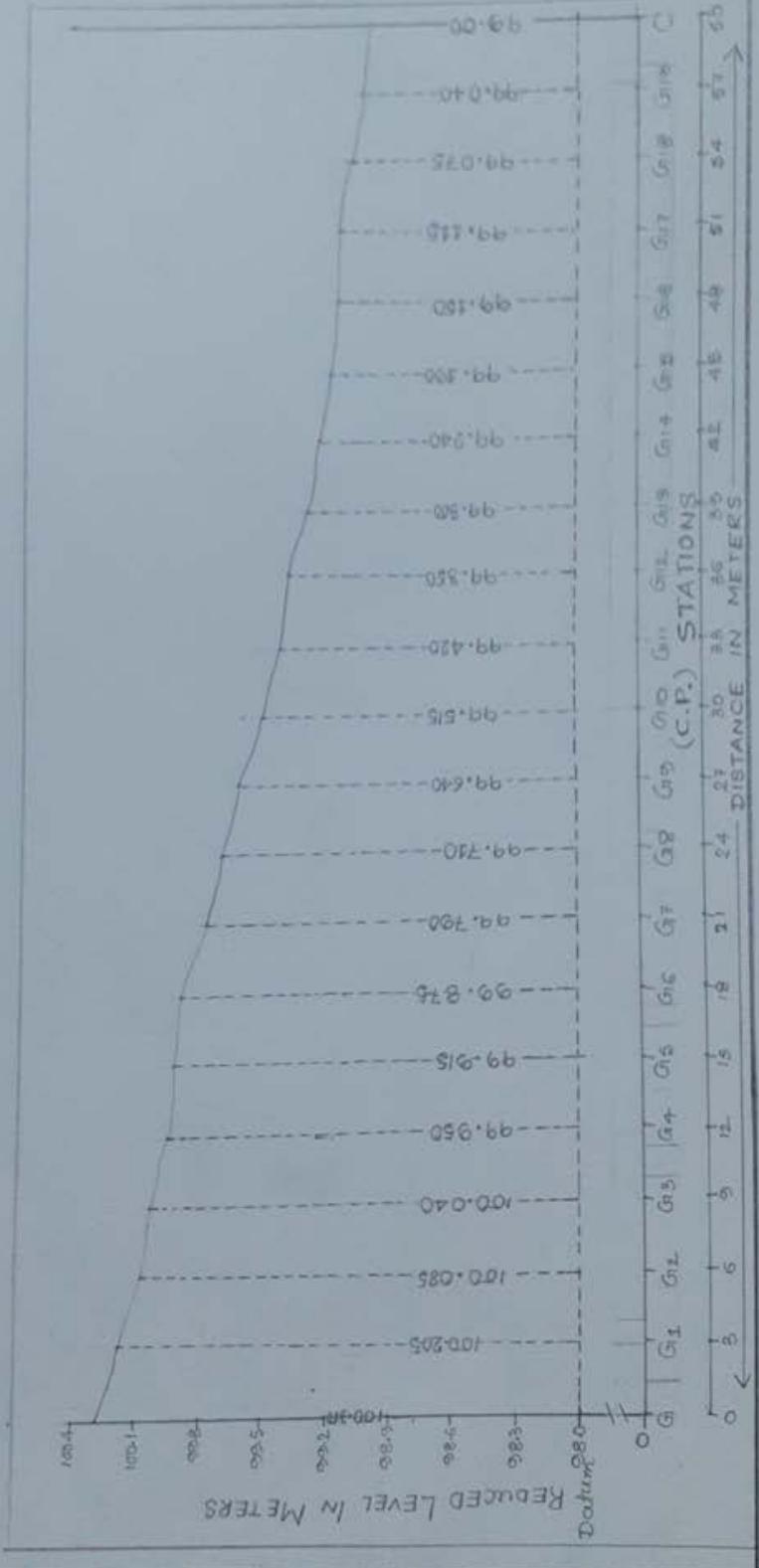
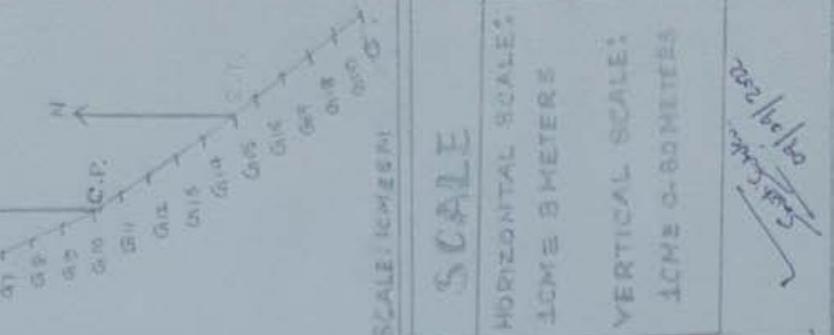
**DATE: 25/8/22**

**START TIME: 12:05 PM**

**END TIME: 12:55 PM**

## GROUND PLAN

## GROUND PLAN



## LONGITUDINAL PROFILE ALONG APPROACH ROAD TO VILLAGE

A long profile and prismatic Survey was undertaken along the cant track/unmetalled road approaching the village in order to assess the nature of profile and curvature of the path and examine the changing land use along the path.

The ground slope decreases from the main road as one moves inwards the village. This clearly indicates that most of the cultivated and residential area have developed in the relatively lower and less steep section of the village. The undulating and curvature nature of the long profile towards the east reveals the existence of undulating upland terrain very distinctly. The average elevation of the region is 100.30 meters.

There is changing pattern of land use along the approach road to the village. There is a presence of a temple at the entrance to the village towards the left of the approach road. Either side of the approach road is bordered mainly by fallow land and forested tract. The gentle slope into the village encourages growth of pasture land over the common property resources and upspring of settlements.

Thus, the longitudinal profile reveals that the approach road into the village is downward sloping and that lower relatively level land promotes livelihood options and growth of settlements.

Satya  
22/12/2012

# Household Survey

## Demographic And Social Characteristics

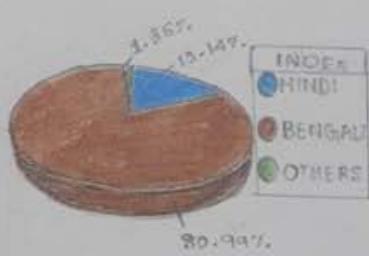
PLACE: CHORINDA

TIME: 10AM TO 12PM

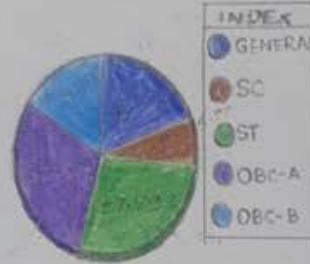
SURVEYED ON: 25/8/22

SURVEYED BY 4<sup>TH</sup> Sem Geography / Honour STUDENTS

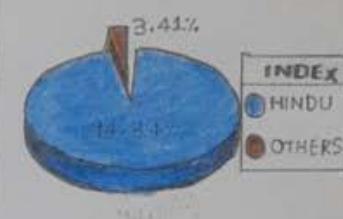
### LINGUISTIC COMPOSITION



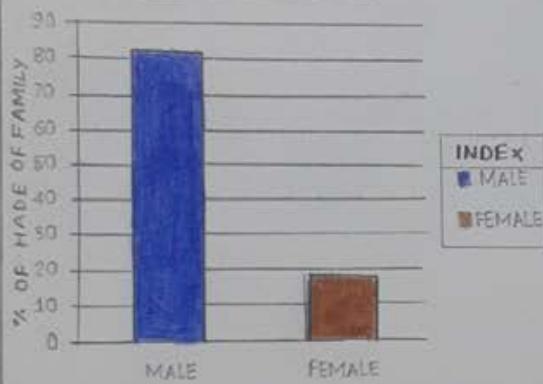
### SOCIAL GROUP



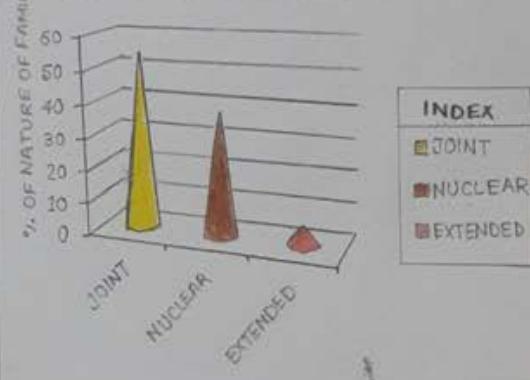
### RELIGIOUS COMPOSITION



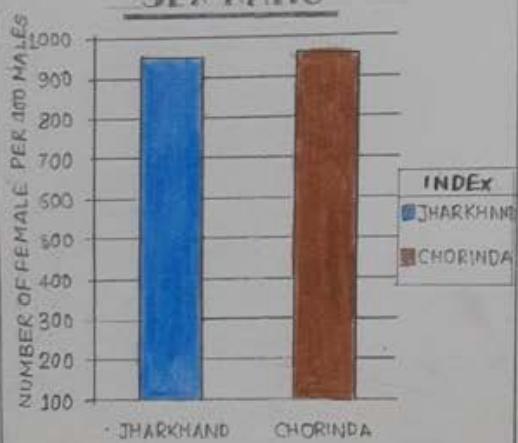
### HEAD OF FAMILY



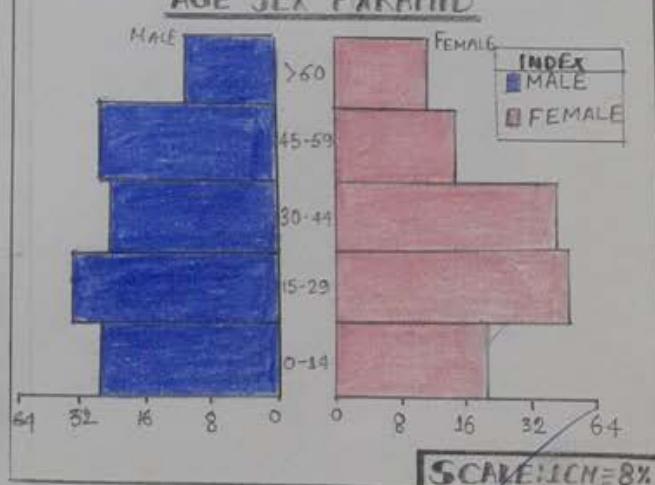
### NATURE OF FAMILY



### SEX RATIO



### AGE SEX PYRAMID



SOURCE: PRIMARY SURVEY

Scale: 1inch = 8km

*Rajesh  
Gupta  
Chorinda*

# HOUSEHOLD SURVEY OF CHORINDA VILLAGE IN GHATSHILA:

## DEMOGRAPHIC AND SOCIO-ECONOMIC SURVEY

A field Survey - household - demographic and socio-economic Survey was conducted by the 5<sup>th</sup> semester Geography (Hons.) students of the collage at Chorinda Village in Ghatshila Subdivision of Purbi Singhbhum district in Jharkhand, in Aug 2022, to analyze the level of development of people.

### DEMOGRAPHIC AND SOCIAL COMPOSITION OF POPULATION

• RELIGION, SOCIAL GROUP AND LANGUAGE: A social composition of the 147 households surveyed reveal that Hindus (96.59%) comprise of the majority of the population, other share is 3.4%.

However, the share of SC, ST, OBC and General population depict predominance of OBC-A 30.61%, ST (27.89%) and OBC-B 16.32%. This is because Jharkhand is home to a large number of tribal population. General population also comprise of a large share of the population i.e. 18.36% indicating diversity in the social profile of the population. Most of the people have Bengali as their mother tongue. Thus the social composition of the region is on one hand diverse comprising of people of various social groups but with a predominance on reflection of Bengali ancestry of people of the region. Thus in terms of social composition there is a heterogeneity within homogeneity.

In spite of the high share of STs in the population only 17.68% of households are female headed households, which shows predominance a patriarchal society prevalent in the study area. There is a tendency towards joint family nearly 56.46% of the

# HOUSEHOLD SURVEY

## EDUCATION AND ECONOMIC CHARACTERISTICS

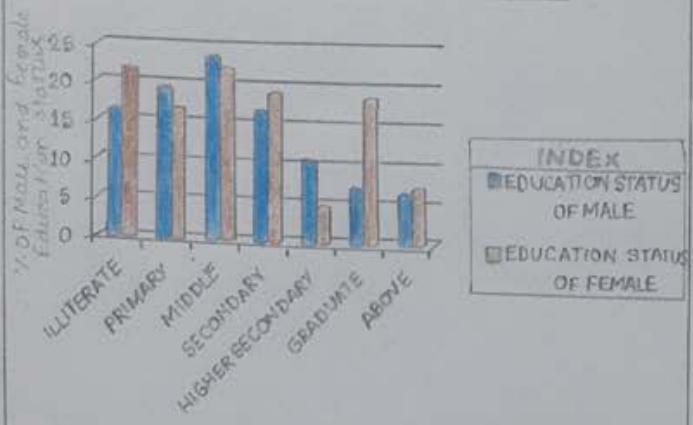
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TIME : 10AM TO 12PM

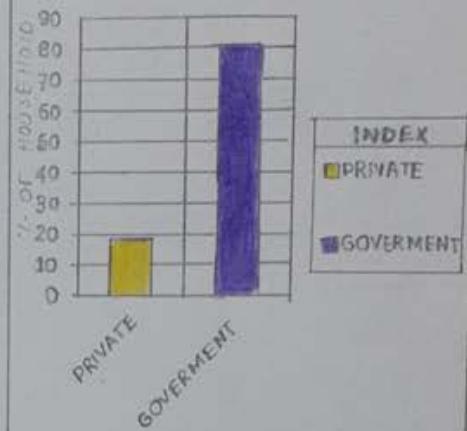
SURVEYED ON: 25/8/22

SURVEYED BY: 5<sup>TH</sup> SEM Geography Honours STUDENTS

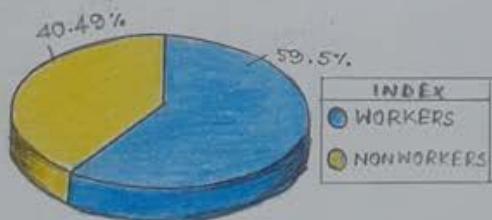
### EDUCATION STATUS OF POPULATION



### CHILDREN GOING TO SCHOOL



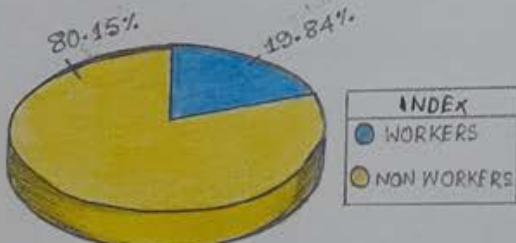
### EMPLOYMENT STATUS MALE



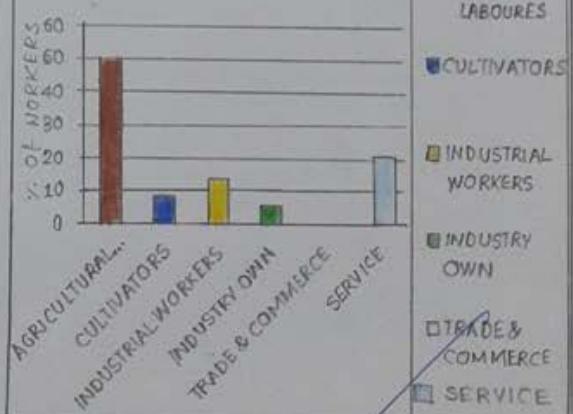
### OCCUPATION STRUCTURE MALE



### EMPLOYMENT STATUS FEMALE



### OCCUPATION STRUCTURE FEMALE



*Jitendra  
Jain*

households are joint households. A large share of household one of Nuclear family (38.09%), whereas extended family constitute 5.44%.

• **Demography:** The demographic profile of the people is examined through the Age Sex pyramid household type. The age sex pyramid reveals a tapering apex and a broad middle section and a moderate yet narrow base; hinting towards a gradually section population structure was the children have a slightly lower share as compared to Middle section. However, the very low share of old age persons both among men and women are probably indicative of low life expectancy and poor access to health infrastructure or higher morbidity.

The sex ratio of Chhindwa is 953 female per 1000 males which is more than the sex Ratio of Jharkhand i.e. 948. It is more than an indication of gender equality though this may indicate male out migration for employment purpose as employment prospects in the region are limited.

• **Education:** Around 80% Children go to Government Schools. Due to low level of earnings majority of households are unable to send their child to a private educational institution. More than 75% of male and females are literate in the study area. The level of literacy is nearly same for both men and women, indicating that there is generally equality in society. Thus the education levels in the region are moderate with share of female population having graduation degree is greater than their male counterpart, indicating lack of gender discrimination and higher status of women in the society. In the Higher education Male population is left behind their female counterpart due to which the job opportunities are limited.

# ECONOMY AND INFRASTRUCTURE



## OTHER OCCUPATIONS



## LIVESTOCK FARMING



## AGRICULTURE



## SCHOOL

## HEALTH CENTER

## PACK TRACK

# HOUSEHOLD SURVEY

## HOUSING AND FACILITIES

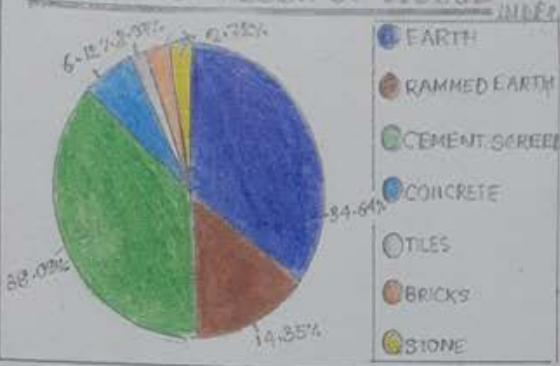
PLACE: CHORINDA

TIME: 10 AM TO 12 PM

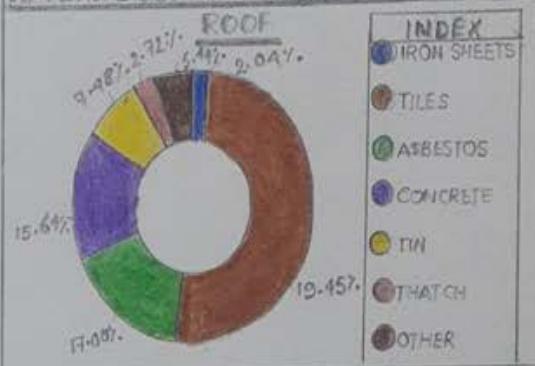
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SURVEYED BY: 5<sup>TH</sup> SEM Geography [HONS STUDENT]

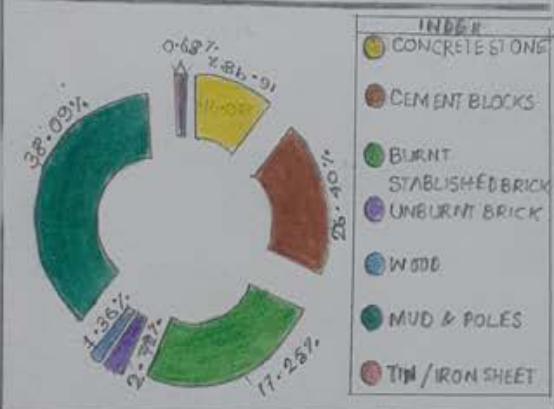
### NATURE OF FLOOR OF HOUSE



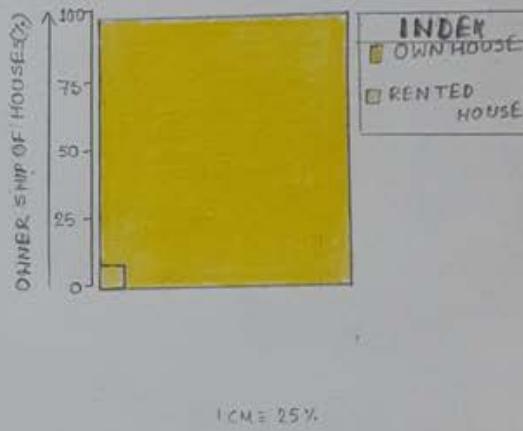
### MATERIAL USED IN CONSTRUCTION OF ROOF



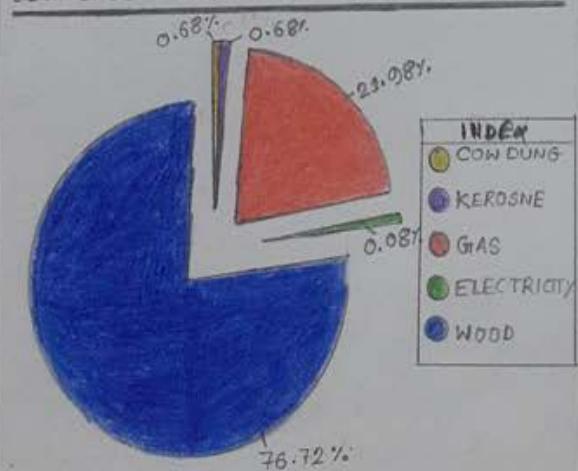
### MATERIAL USED FOR CONSTRUCTION OF WALL



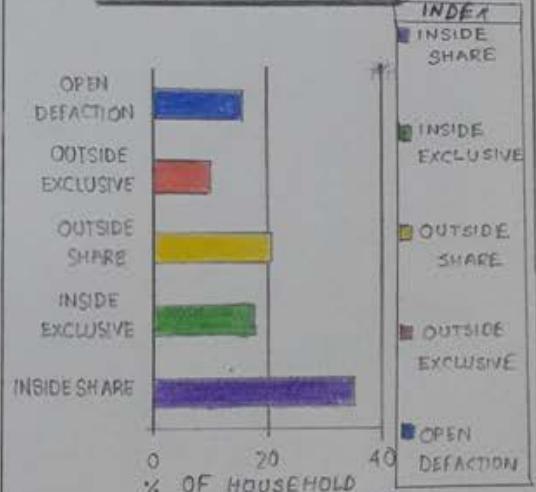
### OWNERSHIP OF HOUSES



### TYPES OF FUEL USED BY HOUSEHOLD



### TOILET FACILITY



SOURCE: PRIMARY SURVEY

R. J. Dinesh  
J. S. Singh

● **ECONOMY:** Workers and Occupation among men and women are strikingly different there is a marked discrepancy in the share of the workers between men and women while 59.5% of men are workers, only about 19.84% of women are workers thus women nearly go out to work as they are expected to do households chores.

The occupational pattern reveals that the share of men and women both are highest in Agriculture sector followed by Service and allied activities for both men and women, although the concentration of women in service sector is marginally higher than men, in trade the women participation is negligible. This indicates the reliance of the region on agriculture. Industry is not an important source of employment only 14.53% of male and 13.88% women are employed as industrial labourers.

This reflects the gender bias that does prevail even in the society as women are confined more to agriculture there is higher share of men in trade as industrial labours. Thus the Occupational structure indicates the dominance of Agriculture and service sector.

● **HOUSE TYPE:** The standard of living of the most of the people is up to the mark. Thus majority of households (99.3%) own their houses. Which reflect the relatively better scenario of the households in spite of a substantial segment owning a BPL card.

In addition majority of households have floor made of Cemented Screed (37.41%), Earth (34.68%), and Rammed earth (14.28%). Majority of Roofs are made of tiles (49.65%) yet substantial portion of households have roof of asbestos (17%), concrete (15.64%) or tin (7.48%). Most of the households have wall made of muds and poles (38.09%), Burnt established Bricks (25.17%) and Cement Blocks (20.4%).

# HOUSEHOLD SURVEY

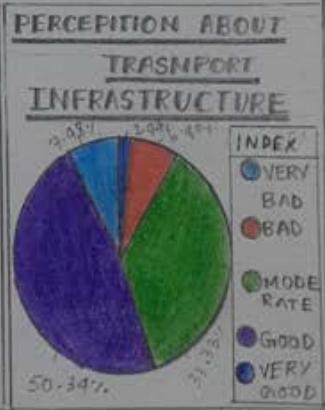
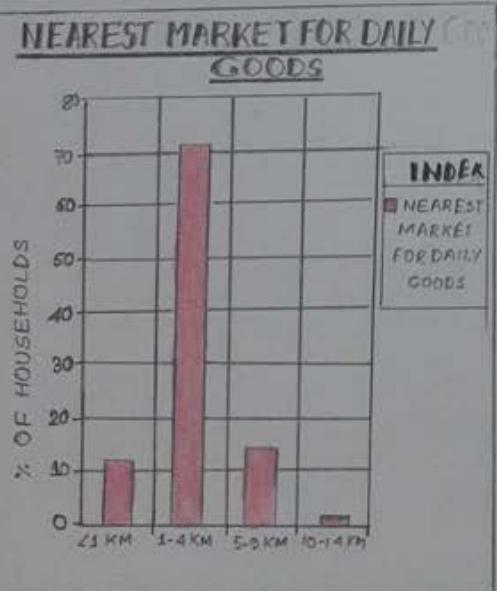
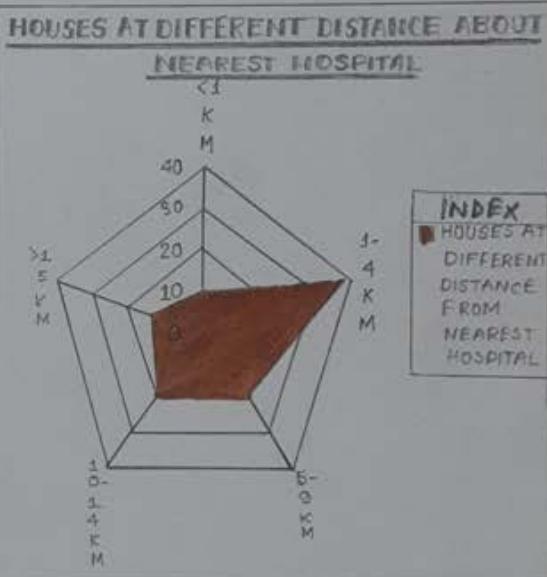
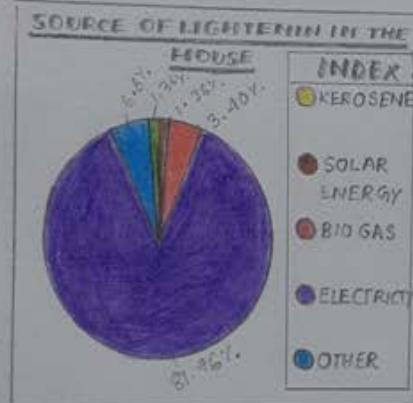
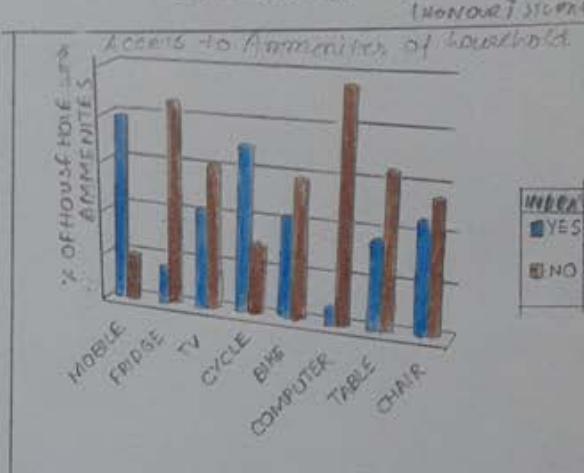
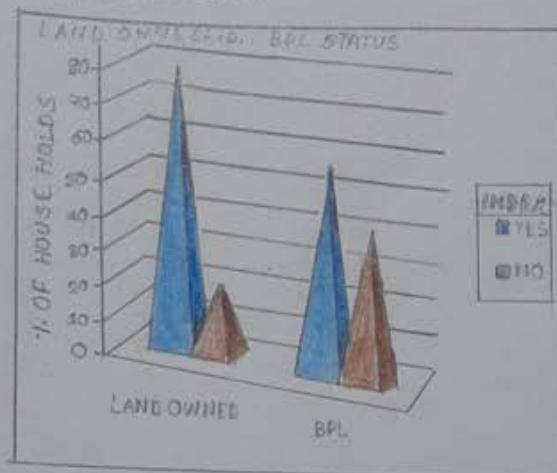
## AMENITIES AND PERCEPTION

PLACE: CHORINDA

STIMES: 10 AM TO 12 PM

SURVEYED ON: 25/08/22

SURVEYED BY: 5<sup>TH</sup> SEM GEOGRAPHY  
(HONOUR STUDENTS)



SOURCE - PRIMARY SURVEY

*Signature*  
16/11/2022

The village mostly depends on wood as major source of fuel for cooking, nearly 76.87% of the household was using wood as means of cooking and around 21.08% uses gas as a source of fuel, which can create serious health issues among women and pollute the environment.

- **FACILITIES:** The access to facilities is well up to the mark as regards to public facilities like electricity and drinking water. All the residents have electricity and majority of household use tap as the source of drinking water.

In terms of toilet 84% of households have access to toilet and only 16% of household practice open defecation. 18% have their inside exclusive toilets within their premises which they do not need to share with other households but a considerable share still do not have their own toilets, 35% have Inside Share, 21% have outside share while Outside exclusive constitute only 10%.

- **AMENITIES:** Access and ownership of amenities is an indicator of the standard of living, the survey reveals that majority of households have at least electricity and one set of basic furniture like bed, chair and tables even with respect to electronic gadgets however like T.V. or mobile. Only 40.13% have T.V. and 78.91% household have access to mobiles but only 15.64% have fridger and only 5.44% household possess a computer. It is interesting to note the penetration of mobiles into the lives of these household today. Around 70% of household have cycle as the means of commutation whereas, access to two wheelers is around 42.18%. Electricity is the main source of lightening in the majority of households, while a minute proportion of household uses Bio gas, Kerosene and solar energy.

Majority of the households have basic amenities like bed

Chair and own houses and access to electricity and even advance electronic gadgets however a significant population lack access to own vehicles although the house structure of half of the houses are stable yet some of them have mud floors and has need to be focus of developmental programmes such as PM Awas Yojana (Gramveen), in terms of access to facilities although access to safe drinking water is not so much a concern but there is a dearth of adequate sanitation facility.

It is evident that the standard of living of majority of households is far from satisfactory level as nearly 58.5% of the households have BPL card. The share of such people is big being to high, it indicates lack of penetration of the benefits of economic development to the people of surrounding areas however the redeeming factor is that more than 70.55% of households have their own land and hence have a better livelihood prospects as a large segment of population not directly linked with industries and depends upon agriculture.

Around 36% of households have a hospital within a distance of 1-4 km, while majority of households have to cover more than 5km to reach the nearest hospital. In times of emergency health situation it might become a matter of great concern.

**• MARKET:** Majority of households have access to nearest market within distance of 4 km. Local market enable small farmers and their families to increase their income by enabling them to sell their product more effectively, thereby reducing their dependence on social transfers and subsidies. Local Markets generate local jobs and the potential for new employment opportunities. Market Mobilities professionally local residents, encouraging them to undertake innovative economic and social initiatives locally in the field of production, processing and distribution of locally produced food.

# HOUSEHOLD SURVEY

## PROBLEM RELATED TO WATER

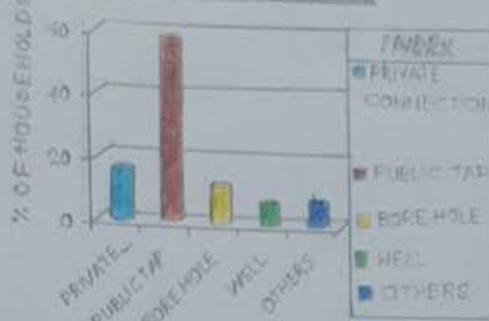
PLACE: CHORINDA

TIME: 10AM TO 12PM

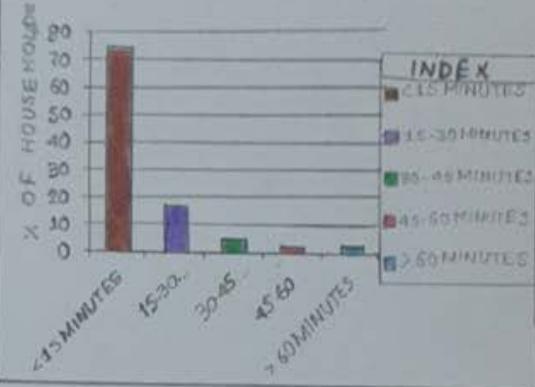
SURVEYED ON: 25/08/22

SURVEYED BY: 5<sup>TH</sup> SEM. Orography  
(HONOURS STUDENTS)

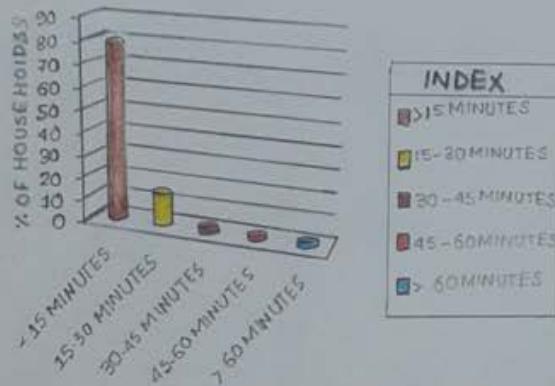
### DRINKING WATER



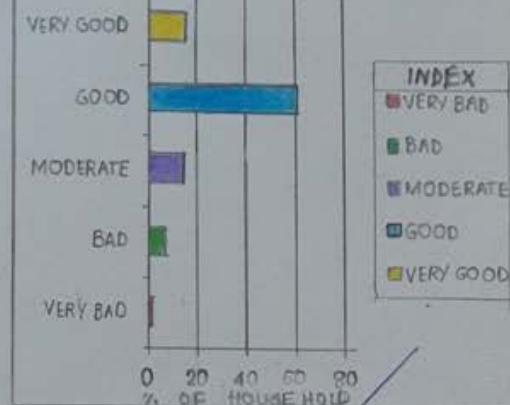
### TIME TAKEN TO REACH THE WATER SOURCES



### TIME TAKEN IN QUEUE TO FETCH WATER



### PERCEPTION ABOUT QUALITY OF DRINKING WATER



*[Handwritten signature]*  
[Signature] 16/10/22

**• PERCEPTION:** The living condition of the study area is quite satisfactory more than 80% of the population rated the living condition between moderate to good. Perception about the transport infrastructure is quite satisfactory, majority of population are happy with the available transport facilities.

**• PROBLEM RELATED TO WATER:** Only 16.32% of the households in the region have private connection of drinking water while 57.82% households are dependent upon public tap. The other source of drinking water includes bore hole (12.24%), well (6.8%), and others (6.8%).

Majority of households don't have access to personal connection of drinking water due to which they are forced to stand in queue for at least 15-20 minutes. As most of the public drinking water source are situated at some distance from their houses, so it takes them around 15 minutes to bring it to their home. On a day to day basis it is very tedious job to do so it becomes one of the primary matter of concern which needs to be addressed on an urgent basis.

Majority of households have perception about quality of drinking water ranging between moderate to good.

**• PLANNING FOR FUTURE:** The basic needs of the households needs to be tackled at first, there is a need to create awareness about various government schemes for the Rural areas like Pradhan Mantri Gramin awas Yojana, Pradhan Mantri Gram Sadak Yojana.

There is need to work more for improving sanitation in the locality, health and education must be given adequate focus. Door step water connection is one of the most important concern. The developmental works must happen without hampering the environment.

# ACCESS TO WATER



DATE: 26/08/25

SURVEYED BY: Sem. 5 Geography honours  
Student

TIME: 3 to 2 PM

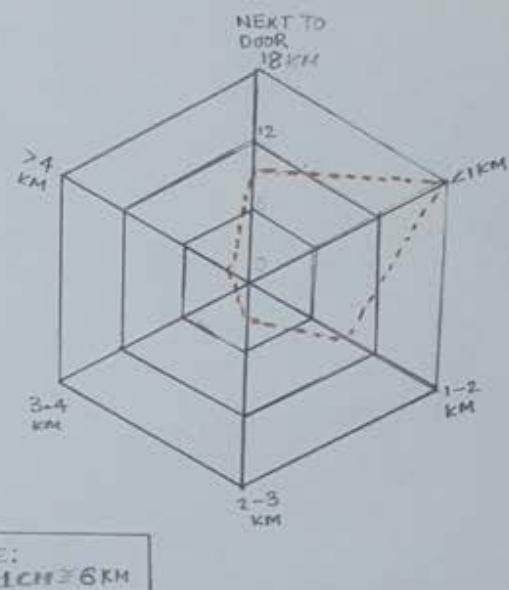
# MARKET SURVEY

PLACE: GHATSHILA

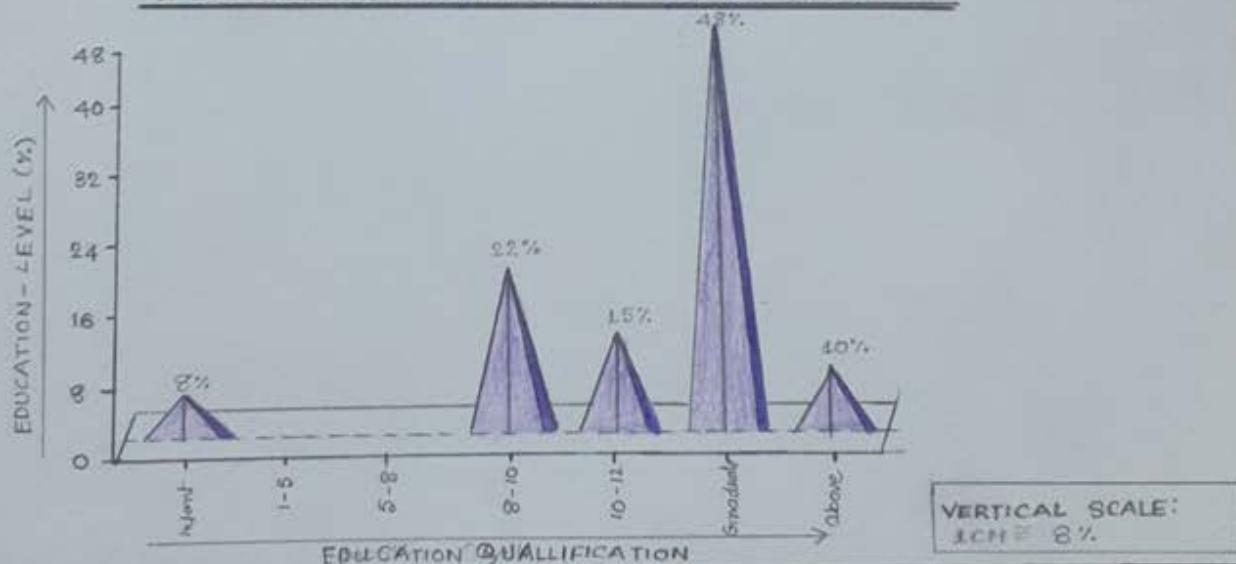
## DENSITY OF SHOP



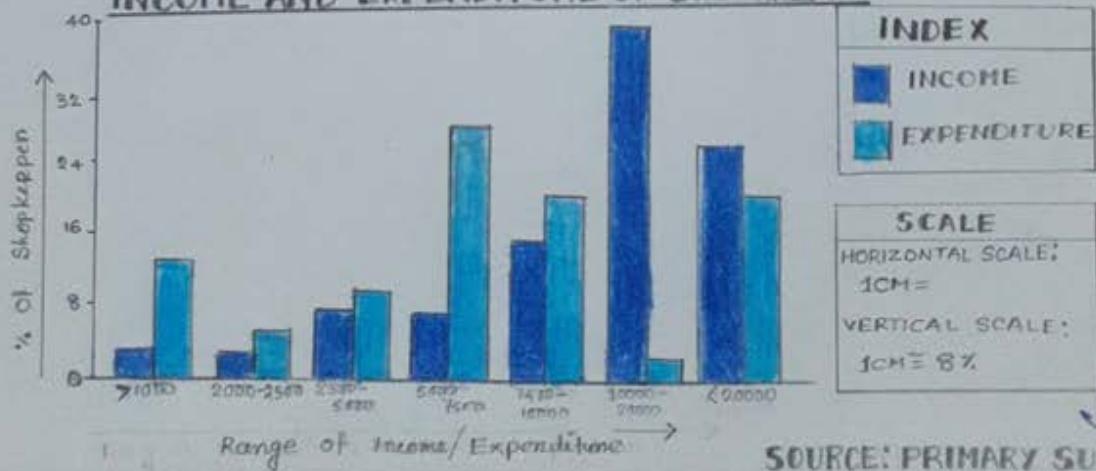
## DISTANCE OF SHOP FROM HOUSE



## EDUCATION LEVEL OF SHOPKEEPER



## INCOME AND EXPENDITURE OF SHOPKEEPER



SOURCE: PRIMARY SURVEY

## **MARKET SURVEY**

A Survey was conducted at Ghatshila market, which is the prime source area of articles of daily use for the villagers in surrounding villages. The objectives of this survey are to analyze the various types of goods sold, source area of different goods, education level, income and expenditure level of shopkeepers and their problems. Most of the customers of this market are locals who purchase their daily goods from this market.

■ **PROFILE OF SHOPS:** In this market, there is a diversity of products sold. Among the various types of goods, some categories were vegetables, fruits, grocery, garments, watch, shoe, medicine, ladies cosmetics, mobile and electronics gadget, etc. Among the shops, about 25 to 30% are clothes shops, and another 8 to 10% each are grocery, medicine, tiles and marbles, electronics and cosmetics. About 10 to 15% are food shops, including fruit and vegetables shops.

The second diagram shows the distance between the shop and the house of the shopkeepers. Around 20% of the shops are adjacent to the house (within 1 km). Almost 10 to 12% of shops are located near the door of shopkeepers. Less than 2% of shops are located between 3-4 km distance from the house of the shopkeepers.

■ **PROFILE OF SHOPKEEPERS:** Almost 90% of shopkeepers are male whereas only 5-10% are female.

There is a variation among the shopkeepers based on their educational qualifications. Around 40% of shopkeepers are graduates, nearly 5 percent are higher educated, and very few are illiterate (less than 5%). Thus, the educational level of shopkeepers is diverse, which means people from all kinds of background come here to sell their goods.

An analysis of the income level of the shopkeepers indicates the variation in the income of shopkeepers. Around 30 to 40% of shopkeepers have an income between 10 to 20,000 rupees per month. Another 30 percent of shopkeepers have an income of more than 20,000 rupees per month. Most of the shopkeepers' income ranges are between 7 to 10,000 per month. There is also variation in the case of expenditure of shopkeepers. Most of the shopkeepers have expenditure of nearly 10,000 per month. Shopkeepers with low-income face loss as their expenditures are higher than income.



**DIFFERENT PROBLEMS:** Most of the shopkeepers have reported that the main problems are waterlogging in the rainy season, power cut problems, and poor infrastructure.

*[Signature]*  
02/01/23

## MARKET MORPHOLOGY ANALYSIS ALONG GHATSBHIA STATION ROAD

PLACE : Ghatshila  
TIME : 11:00 am to 12 noon

DATE : 2020-06-26  
STUDY FIELD : Ghatshila  
FACILITY : GHATSBHIA STATION ROAD



PIE  
DENSITY OF SHOP TYPE %



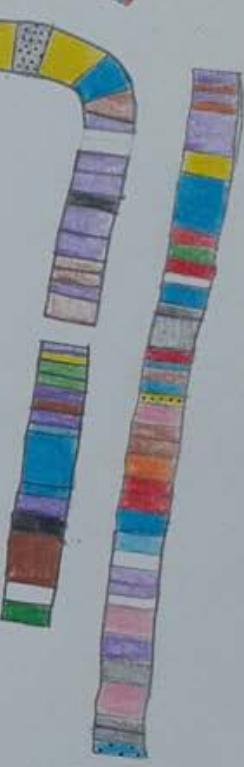
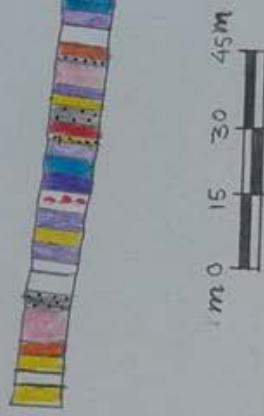
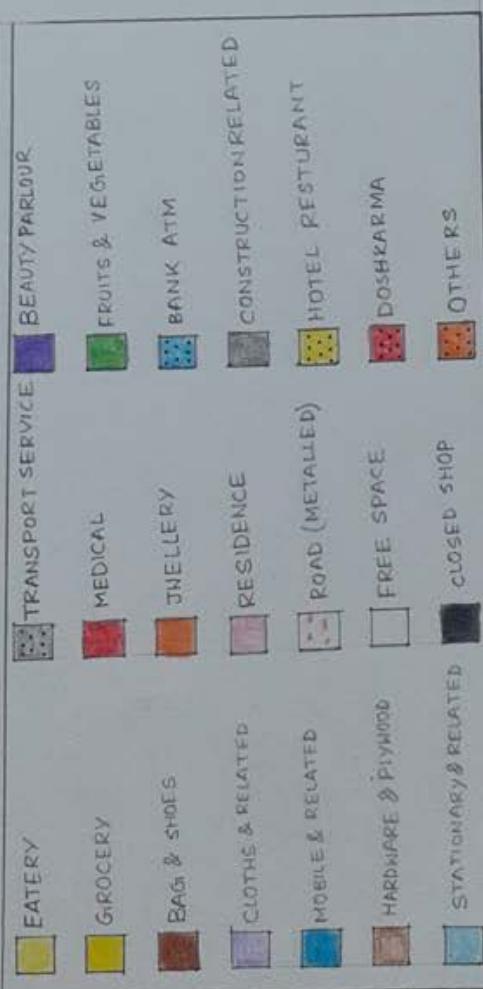
10 15 20 25 30 35

# MARKET MORPHOLOGY ANALYSIS ALONG GHATSWALA STATION ROAD

PLACE : GHATSWALA  
TIME : 11:00 am to 12 noon

SURVEYED ON - 26 / 8 / 22  
SURVEYED BY - 5<sup>th</sup> SEM Geography  
Honours Students

21-2/21/22  
Rishabh



21-2/21/22  
Rishabh

## LAND USE ALONG MARKET (MARKET MORPHOLOGY)- CHATSHILA STATION

### ROAD

A land use survey was undertaken of the main market in front of the station, where residents of all neighbouring villages come for marketing and where the local village commutes shop as they go to and from work. The survey was undertaken on both sides of the road by paching method to assess the pattern of distribution of various shops within a market and the diversity of goods available in the market.

Land use of this market reveals that there is a clustering of similar goods being sold in adjacent of road other e.g. grocery Shops, eatenies, medical shops, clothes shops. In addition, the segment of road nearest to the station are primarily Eateneis of different kinds from biscuit Shops, snack Shops to tea Shops and restaurants. This is because these spots are most lucrative as commutes need these refreshments for their long journeys. Plots/ shops farther away are often left vacant as shopkeepers feel that sale is very poor in the inner most sections as most customers don't reach so far because of other shops near the entrance selling the same produce.

Among the shops the most prominent are those pertaining to clothes/ garments, eatenies and groceries, fruits and vegetables and mobile and recharge shops - i.e. goods of daily necessities. In addition, there are several shops pertaining to shops, bags, medical and diagnostic centers. There is a great diversity of shops in the market as the commutes from neighbouring towns and villages often purchase their goods for their various needs to and fro from their workplace to residence. This indicates that the changing lifestyle reflected in the diversity of shops in the market.

There is an aggregation of the same type of shops adjacent to each other, probably in order to attract maximum customers and to cater to different portions of the market. Thus the land use reflects that there is clustering of same type of shops and there is diversity of shops selling different goods.

✓ Srinivas  
22/2/2022

# HOTEL SURVEY

DATE: 25.02.2022

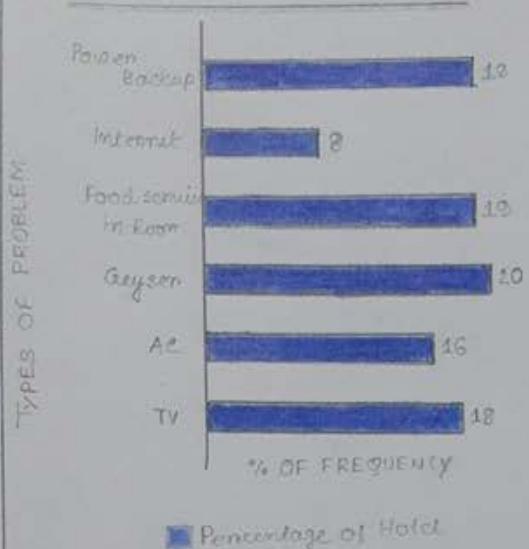
TIME: 3:00 - 5:00PM

SURVEYED BY - Semester 5  
Geography Honours

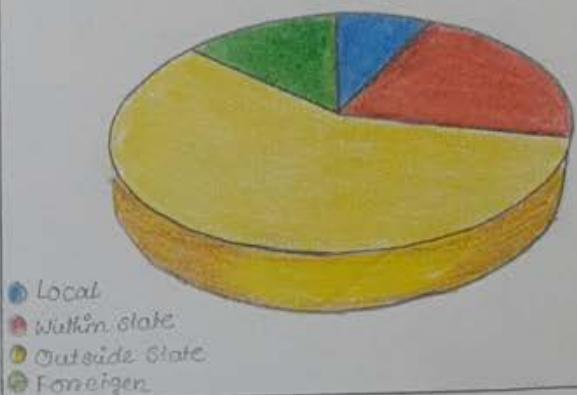
Students

PLACE - GHATSHILA

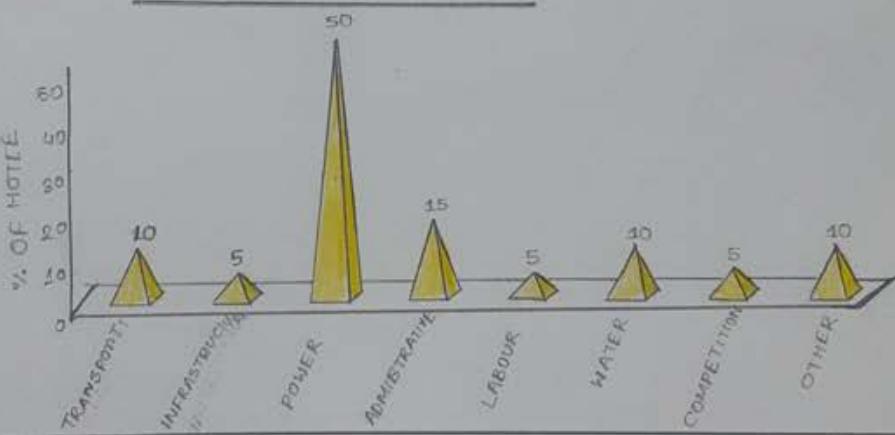
## FACILITIES AVAILABLE



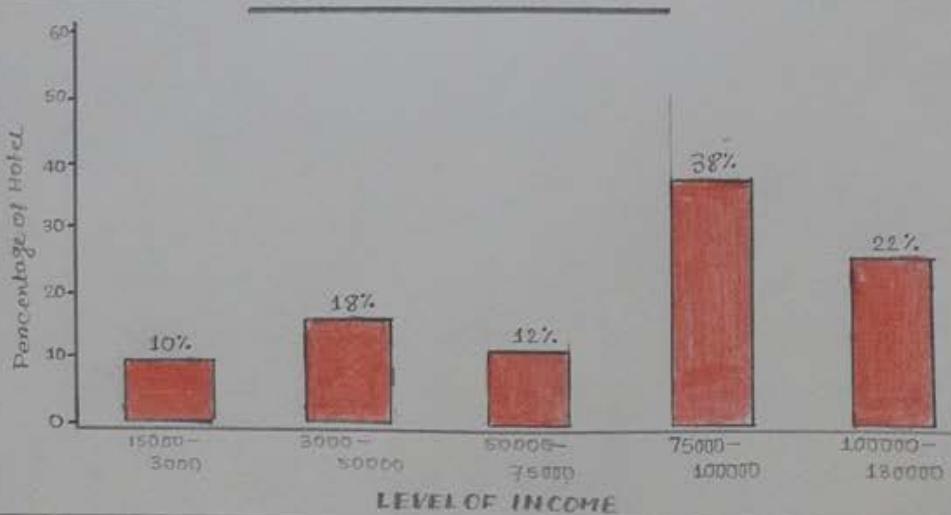
## DETAILS OF TOURIST



## PROBLEMS OF HOTEL



## LEVEL OF INCOME



Surveied by  
82-01-23

## HOTEL SURVEY

Ghatshila is a well-known tourist spot in Jharkhand. Surrounded by the lush greenery of thick forests, Ghatshila is one of Jharkhand's most beautiful places. This site is relatively popular among tourists from eastern India. People from West Bengal, Bihar, and Jharkhand adore the spot and often visit Ghatshila during weekends. The town's climate and scenic views attract many people.

One of the most famous Bengali authors Bibhutibhushan Bandopadhyay was from Ghatshila. He was the author of the coveted novel, "Pather Panchali." Bengalis are often visit Ghatshila to see the author's residence. This city is located in the East Singhbhum district of the state and is situated by the gorgeous Suwannekhwa River bank. Throughout the town, you will see many waterfalls and creeks. As hills surround the city, the scenic view is quite breathtakingly beautiful.

The prominent destination for tourists is Phuldungni Hill, Rankini Kali temple, Birudih Dam, Dhanagiri waterfalls, and Ratnophona.

Various resorts and hotels are present all around the region. A survey was conducted of the hotels to assess their characteristics and the linkage of the tourism economy with the surrounding villages.

The survey indicates that most of the hotel owners are well-educated and reside adjacent to their hotel.

Most of the tourists (near about 60%) are from outside of the state, mainly they come from West Bengal, Odisha, and Bihar. Around 20% of tourists come from within the state and only 10% come from outside of the country.

These tourists have access to a different facilities. These hotels have adequate facilities of AC, geysers, room service for

Food, T.V. and generators. Among different hotels, only less than 30 percent hotels provide internet facilities, where most of the hotels have power backup facilities, food service in the room, geysers, and tv. Most of the hotels are small having upto 10 room, nearly 70 percent of the hotels have double bed rooms, only 30 percent of hotels have single room.

There is a large variation among the owners based on income level. Most of the hotels have a medium range of income of 50,000 to 75,000 rupees per month.



Most of the hotel owners reported that they have faced many problems i.e. transport problems, lack of infrastructure, power cut problems, competition and administrative problems. About 50% of hotels reported that they suffered due to power cut problems and 30% of hotel owners said that due to lack of infrastructure they faced many problems.

Ghatshila is one of the important tourist spots in Jharkhand and tourism is an important economic activity. So, the problems need to be addressed for improving the condition of tourism.

I checked  
02-07-20

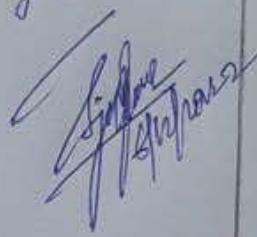
## CONCLUSION

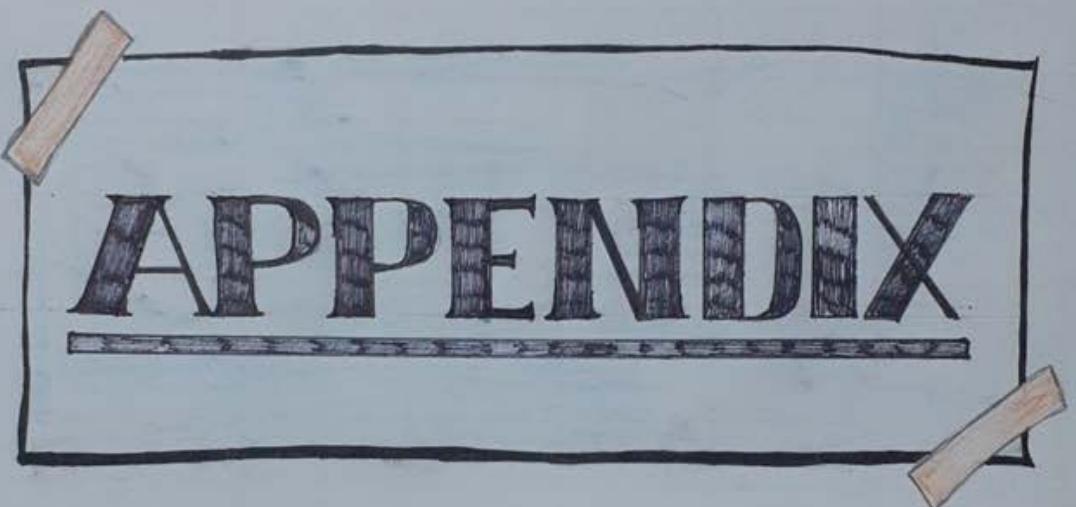
The village has majority of Hindus. Main Social group of the area consist of OBC, and ST. Most of the people live in joint households. Majority of population are literate, in higher education the share of women is greater than men, indicating lack of gender dissemination and higher status of women in the society. Majority of the population is engaged in agriculture. Male workers are more in share than female workers and occupational structure among men and women strikingly different there is a marked discrepancy in the share of workers between men and women, women are mostly engaged in agricultural sector. Women rarely go out to work as they are expected to do household chores.

Majority of household possess own house and land. At the same time large number of household possessed a BPL card which means the living condition is not so satisfactory. Majority of houses have roof made of Tiles, wall made of mud & Poles and Burnt established Bricks and floors made cemented screed. Majority of household have cycle as the means of commutation whereas, Access to two wheels is also available to a substantial share of population. Electricity is the main source of lightening in the majority of households, while a while proportion of household uses Bio gas, kerosene and Solar energy.

Access to basic facilities furniture and modern means of communication like mobile is present with most of the households yet some household still reserve to wood for cooking and use Tap water as the source of drinking water. the share of house with toilet facility within their premises is very low drinking water and health infrastructure is a serious concern for considerable segment of household of the village as they have to commute to access these facilities. This needs to be solved in order to raise the standard of living of the people and reduce inequality, although the Gram

Panchayat has taken steps to meet these problems yet a lot needs to be done to address their problems and improving their living condition.





A1

# CLIMATIC SCENARIO AROUND GHATSILA, 2021

Month	Mean Monthly Temperature (°C)			Rainfall (mm)	Pressure (mb)	Relative Humidity (%)
	Maximum	Minimum	Average			
January	27	15	21.0	5.6	1015.4	37
February	31	18	24.5	12.4	1013.5	28
March	37	23	30.0	11.6	1010.3	24
April	41	27	34.0	25.7	1006.6	32
May	41	28	34.5	93.9	1003.3	55
June	39	28	33.5	178.2	1000.4	67
July	33	26	29.5	378.4	1000.4	76
August	32	25	28.5	394.8	1002.1	81
September	32	25	28.5	256.0	1005.3	86
October	31	22	26.5	144.6	1010.1	73
November	29	18	23.5	12.0	1013.5	59
December	26	15	20.5	14.3	1015.1	56

SOURCE: <https://www.worldweatheronline.com/ghatsila-Weather/Jharkhand/in.aspx>

✓ Sunita Sarker  
21/09/2021

## Soil Characteristics In Village Chorinda

**Table No.: Variation in soil pH in Village Chorinda across different Land use**

Sample No.	Latitude	Longitude	Landuse	Date	Time	pH	Interpretation
Sample NO.1	22.67387°N	86.42986°E	Built-up Area	25.08.2022	10:10 am	6.5	Very Slightly Acidic
Sample NO.2	22.67437°N	86.43009°E	Pasture Land	25.08.2022	10:18 am	7.0	Neutral
Sample NO.3	22.67440°N	86.43034°E	Fallow Land	25.08.2022	10:24 am	6.5	Very Slightly Acidic
Sample NO.4	22.68481°N	86.43344°E	Agricultural Land	25.08.2022	10:34 am	7.0	Neutral
Sample NO.5	22.68484°N	86.43344°E	Forest Land	25.08.2022	10:57 am	7.0	Neutral

**Table No.: Variation in Soil Phosphate and Potassium in Village Chorinda across different Land use**

Sample No.	Latitude	Longitude	Landuses	Date	Time	Phosphate Lbs/acre as P <sub>2</sub> O <sub>5</sub> )	Potassium kg/acre as K <sub>2</sub> O)	Value	Potassium Value	Interpretation
Sample NO.1	22.67387°N	86.42986°E	Built-up area	25.08.2022	10:10 am	20-60 Medium	9.07 to 22.68	Above 350 lbs/acre (as K <sub>2</sub> O)	On 158-48 kg/acre	Very High
Sample NO.2	22.67437°N	86.43009°E	Pasture Land	25.08.2022	10:18 am	50-65 High	22.68 to 29.48	Below 100 lbs/acre (as K <sub>2</sub> O)	On 45-36 kg/acre	Low
Sample NO.3	22.67440°N	86.43034°E	Fallow Land	25.08.2022	10:21 am	20-50 Medium	9.07 to 22.68	Below 100 lbs/acre (as K <sub>2</sub> O)	On 45-36 kg/acre	Low
Sample NO.4	22.68481°N	86.43344°E	Agricultural Land	25.08.2022	10:34 am	20-50 Medium	9.07 to 250 (lbs/acre (as K <sub>2</sub> O))	100 to 250 lbs/acre (as K <sub>2</sub> O)	On 45-36 to 113-40 kg/acre	Medium
Sample NO.5	22.68484°N	86.43344°E	Forest Land	25.08.2022	10:57 am	>65 Very High	Above 28.48	Above 350 lbs/acre (as K <sub>2</sub> O)	On 158-36 kg/acre	Very High

**Table No.: Variation in Nitrate Nitrogen and Ammoniacal Nitrogen in Village Chorinda across different Landuse**

Sample No.	Latitude	Longitude	Landuse	Date	Time	Nitrate Nitrogen Lbs/acre as N	Ammoniacal Nitrogen Lbs/acre as N	Nitrate Nitrogen Lbs/area as N	Ammoniacal Nitrogen Lbs/area as N
Sample NO.1	22.67387°N	86.42986°E	Built-up Area	25.08.2022	10:10 am	45 High	20-44	180	84-64
Sample NO.2	22.67437°N	86.43009°E	Pasture Land	25.08.2022	10:18 am	45 High	20-44	13	5-89
Sample NO.3	22.67440°N	86.43034°E	Fallow Land	25.08.2022	10:21 am	18 Medium	8.16	13	5-89
Sample NO.4	22.68481°N	86.43344°E	Agricultural Land	25.08.2022	10:34 am	18 Medium	8.16	43	5-89
Sample NO.5	22.68484°N	86.43344°E	Forest Land	25.08.2022	10:57 am	45 High	20-44	13	5-89

Source Note: Based on Sample collected in the village on 25.08.2022 and tested in laboratory setting in Budge Budge, kolkata  
on 16<sup>th</sup>, 10<sup>th</sup>, 20<sup>th</sup> and 22<sup>nd</sup> December, 2022.

A<sub>3</sub>**FIELD BOOK : DUMPPY LEVEL - LONG PROFILE****INSTRUMENT NO:****DUMPPY LEVEL: DLA****PRISMATIC COMPASS: PC1****SURVED BY : 5<sup>TH</sup> SEM GEOA STUDENTS****PLACE: APPROACH ROAD TO CHOWRINDA VILL.****DATE : 25/8/22****START TIME : 12:05 PM****END TIME : 12:55 PM**

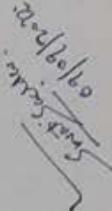
<b>LINE</b>	<b>MAGNETIC BEARING</b>	<b>STATIONS</b>	<b>DISTANCE (m)</b>	<b>STAFF READING (m)</b>		<b>COLLIMATION LEVEL (m)</b>	<b>REDUCED LEVEL (m)</b>	<b>REMARKS</b>
				<b>BS</b>	<b>FS</b>			
↑		G <sub>1</sub>	0	1.195		101.495	100.360	B.M = 100.360 (at G)
↑		G <sub>2</sub>	3	1	1.290		100.205	
		G <sub>3</sub>	6	2	1.440		100.085	
		G <sub>4</sub>	9	3	1.455		100.040	
		G <sub>5</sub>	12	4	1.545		99.950	
G <sub>1</sub> -G <sub>10</sub>	157°	G <sub>6</sub>	15	5	1.580		99.945	
		G <sub>7</sub>	18	6	1.620		99.875	
		G <sub>8</sub>	21	7	1.765		99.790	
		G <sub>9</sub>	24	8	1.780		99.710	
		G <sub>10</sub>	27	9	1.785	✓	99.640	
↓		G <sub>11</sub>	30	10	1.795	1.030	101.495	CHANGE POINT
↓		G <sub>12</sub>	33	11	1.890		101.310	99.545
		G <sub>13</sub>	36	12	1.960		99.420	
G <sub>10</sub> -G <sub>15</sub>	147° 30'	G <sub>14</sub>	39	13	2.040		99.300	
		G <sub>15</sub>	42	14	2.070		99.240	
		G <sub>16</sub>	45	15	2.120		99.190	
		G <sub>17</sub>	48	16	2.160		99.150	
		G <sub>18</sub>	51	17	2.195		99.115	
G <sub>15</sub> -C	142°	G <sub>19</sub>	54	18	2.235		99.075	
		C	57	19	2.270	✓	99.040	
		C	60	20	2.310	101.340	99.000	

**CHECKING:**  $\Sigma BS - \Sigma FS = RL \text{ of Last Point} - RL \text{ of First Point}$ 

$$(4.195 + 4.795) - (4.980 + 2.940) = (99.900 - 100.300)$$

$$2.000 - 4.290 = -4.300$$

$-4.300 = -4.300$  (PROVED)



A4

### HOUSEHOLD SURVEY DEMOCRATIC AND SOCIAL CHARACTERISTICS

LINGUISTIC COMPOSITION (%)						SOCIAL GROUP (%)						RELIGIOUS COMPOSITION (%)						MADE OF FAMILY (%)						SEX RATIO (%)						AGE SEX PYRAMID (%)					
Hindi	Bengali	Others	SC	ST	OBC-A	OBC-B	Hindu	Others	Male	Female	Joint	Nuclear	Extended	Other	DA	Chand	Chand	DA	0+	15	30	45	12+	29	44	35	760								
15.64	82.99	1.36	18.36	6.8	21.89	30.64	16.32	96.59	3.4	82.34	17.68	56.46	38.01	5.49	9.48	16.3	21.26	21.26	14	29	44	35	760	11	20	20	11	11	11	11	11	11	11		

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### HOUSEHOLD SURVEY EDUCATION AND ECONOMIC CHARACTERISTICS

EDUCATION STATUS OF POPULATION (%)	CHILDREN GOING TO SCHOOL (%)	EMPLOYMENT STATUS MALE (%)	OCCUPATIONAL STRUCTURE MALE (%)	EMPLOYMENT STATUS FEMALE (%)	OCCUPATIONAL STRUCTURE FEMALE (%)	OCCUPATIONAL STATUS		OCCUPATIONAL STRUCTURE		FEMALE (%)	
						WORKERS	NON WORKERS	CULTIVATOR	INDUSTRY WORKERS	OUTSIDE WORKERS	INSIDE WORKERS
1.36	18.36	16.32	17.68	14.64	14.64	16.64	33.49	14.35	13.55	13.55	13.55
2.32	21.89	21.89	21.89	19.84	19.84	18.62	84.37	40.44	59.55	50	50
2.32	30.64	30.64	30.64	29.06	29.06	29.06	66.67	33.33	33.33	33.33	33.33
2.32	16.32	16.32	16.32	15.76	15.76	15.76	66.67	33.33	33.33	33.33	33.33
2.32	11.20	11.20	11.20	10.64	10.64	10.64	66.67	33.33	33.33	33.33	33.33
2.32	1.36	1.36	1.36	1.36	1.36	1.36	66.67	33.33	33.33	33.33	33.33
1.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

### HOUSEHOLD SURVEY HOUSING AND FACILITIES

NATURE OF FLOOR OF HOUSE (%)	MATERIAL USED IN CONSTRUCTION OF ROOF (%)	MATERIAL USED IN CONSTRUCTION OF ROOF (%)	OWNERSHIP OF HOUSE (%)	TYPE OF FLOOR USED BY House Hold (%)	TOILET FACILITY (%)	OPEN		CLOSED		INSIDE		OUTSIDE		GAPS		KEROSENE		ELECTRICITY		SHRE		WEED		76.87	
						Own	Rented	Own	Rented	Own	Rented	Own	Rented	Own	Rented	Own	Rented	Own	Rented	Own	Rented	Own	Rented	Own	Rented
34.69	EARTH	PRIMRY	MIDDLE	LITTLE	15.64	1.36	0.00	18.62	84.37	40.44	59.55	50	50	19.84	80.15	50	8.33	13.88	5.55	0	22.22	10	10	16	16
14.28	RAMMED EARTH	SC REED	CEMENT	TILES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
37.41	CONCRETE	BRICKS	BRICKS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
6.12	CONCRETE	TILES	BRICKS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
17.67	ASBESTOS	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
15.64	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
7.48	TIN	THATCH	OTHER	PRIMRY	5.49	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
7.48	ASBESTOS	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
15.64	CONCRETE	BRICKS	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.78	TIN	THATCH	OTHER	PRIMRY	5.49	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.78	ASBESTOS	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
1.48	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
1.48	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	
2.04	CONCRETE	TILES	IRON SHEETS	STONES	2.32	1.36	0.00	1.36	1.36	1.36	1.36</														

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### Household Survey Amenities And Perception

LAND MEMBERSHIP BPL STATUS(%)	ACCESS TO AMENITIES TO HOUSE HOLD (%)	SOURCE OF LIGHTING IN THE HOUSE (%)	ACRPTION ABOUT LIVING CONDITION (%)	PERCEPTION ABOUT NEAREST MARKET DISTANCE(%)	
				GOOD	VERY GOOD
YES	NO	MOBILE	FRIEG	1.36	4.48
41.49	58.60	78.91	15.68	6.80	2.04
				3.32	6.80
				50.34	7.48
				43.56	13.46
				13.60	1.36
				1.36	4.36

### House At Different Distance From Nearest Hospital

< 1 Km	1-4 Km	5-9 Km	10-14 Km	> 15 Km
10.20	36.73	24.48	19.04	13.06

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### Household Survey Problem Related Water

DRINKING WATER PRIME (%)	TIME TAKEN TO REACH THE WATER SOURCES MINUTE (%)	TIME TAKEN IN QUEUE TO FETCH WATER MINUTE (%)	PERCEPTION ABOUT QUALITY OF DRINKING WATER	
			GOOD	VERY GOOD
16.32	57.82	42.24	6.80	0
			74.14	16.32
				5.44
				4.36
				2.72
				80.27
				14.96
				2.04
				0.63
				1.36
				6.80
				14.28
				61.22
				16.32

Signature

## MARKET SURVEY

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**Table: DENSITY OF SHOP**

Type of Shop	Grocery	Clothes	Marble & Tiles	Cosmetics	Food	Mobile	Watch	Shoes	Medicine	Gift
Percentage	6	20	7	7	15	7	8	9	10	11

SOURCE: PRIMARY SURVEY

**Table: DISTANCE OF SHOP FROM HOME**

Distance	Next door	< 1 Km	1 to 2 Km	2 to 3 Km	3 to 4 Km	> 4 Km
% of shops	28	30	17	9	8	8

SOURCE: PRIMARY SURVEY

**Table: EDUCATIONAL LEVEL OF SHOP KEEPERS**

Educational Level	Illiterate	Primary	Upper Primary	Secondary	Higher Secondary	Graduate	Higher level
% of shop keepers	8			27	12	45	8

SOURCE: PRIMARY SURVEY

**Table: INCOME LEVEL OF SHOP KEEPERS**

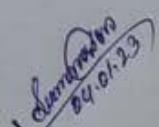
Income level	< 2000	2000 - 2500	2500 - 5000	5000 - 7000	7000 - 10,000	10 - 20,000	> 20,000
% of shops	5	5	10	10	16	30	24

SOURCE: PRIMARY SURVEY

**Table: EXPENDITURE LEVEL OF SHOPKEEPERS**

Expenditure level	> 2000	2000 - 2500	2500 - 5000	5000 - 7000	7000 - 10,000	10 - 20,000	> 20,000
% of shops	45	5	10	32	24	6	8

SOURCE: PRIMARY SURVEY

  
 Surveyor  
 24.01.23

**TABLE : MARKET MORPHOLOGY ANALYSIS ALONG THE GHATSILA  
STATION ROAD (RIGHT PAVEMENT), ON 26<sup>TH</sup> AUGUST 2022**  
**(11:00 AM TO 12:00 NOON)**

START PLACE	END PLACE	END PACE ACCORDING TO SCALE: 1cm ≈ 15 meters	SHOP TYPE
0	16	0.25	GROCERY
16	29	0.45	CLOSED SHOP
29	45	0.70	GROCERY
45	58	0.83	JEWELRY
58	59	0.92	CLOSED SHOP
59	88	1.38	RESIDENCE
88	102	1.60	AUTOMOBILE ACCESSORIES
102	121	1.89	CLOSED SHOP
121	133	2.08	CLOSED SHOP
133	146	2.29	GARMENTS
146	164	2.57	GROCERY
164	177	2.77	TEXTILES
177	198	3.04	UNMETALLED ROAD
198	210	3.29	BEAUTY PARLOUR
210	229	3.59	ELECTRONIC GOODS
229	240	3.76	GARMENTS
240	247	3.87	RESTURANT
247	261	4.09	MEDICAL
261	271	4.24	TYRES
271	282	4.42	FAST FOOD EATERY
282	293	4.58	GARMENT
293	301	4.71	RESIDENCE
301	312	4.89	MACHINERY PARTS
312	319	5.06	DIAGNOSTIC CENTER
319	330	5.17	CLOSED SHOP
330	347	5.43	GARMENTS
347	360	5.64	GRAPHIC DESIGNING
360	365	5.72	CYBAR CAFE
365	380	5.95	CYBAR CAFE
380	403	6.31	VEGETABLES
403	415	6.50	PAINT
415	429	6.72	MOBILE RECHARGE
429	448	7.02	STATIONARY

START PAGE	END PAGE	END PAGE ACCORDING TO SCALE: 1 CM = 15 Metres	SHOP TYPE
448	465	7.28	ATM
465	470	7.36	DOCTOR'S CHAMBAR
470	480	7.52	SHOES
480	487	7.63	FRUITS
487	511	8.00	VEGETABLES
511	525	8.22	SHOES
525	535	8.38	FRUITS
535	554	8.68	CLOSED SHOP
554	589	9.22	METALLED ROAD
589	638	9.99	BANK
638	651	10.20	CEMENT
651	665	10.41	CONSTRUCTION RELATED GOODS
665	675	10.57	RESIDENCE
675	704	11.03	TILES
704	733	11.48	SAREES
733	748	11.71	RESIDENCE
748	773	12.11	CLOSED SHOP
773	787	12.33	NEWS PAPER
787	797	12.48	GRAPHIC DESIGNING
797	810	12.69	MEDICAL
810	827	12.95	MEDICAL
827	844	13.22	JEWELLERY
844	863	13.52	HARDWARE
863	883	13.80	HARDWARE
883	896	14.03	RESIDENCE
896	915	14.33	JEWELLERY
915	930	14.57	HARDWARE
930	940	14.72	RESIDENCE
940	963	15.08	HOTEL
963	975	15.27	BOOKS
975	988	15.47	PLASTIC GOODS
988	998	15.63	STATIONARY
988	1003	15.71	DASHA KORMA
1003	1017	15.93	BUILDING MATERIALS
1017	1043	16.34	BUILDING MATERIALS
1043	1055	16.52	ELECTRONIC GOODS
1055	1068	16.73	CLOSED SHOP
1068	1081	16.93	DASHA KORMA

START PAGE	END PAGE	END PAGE ACCORDING TO SCALE: 1CM = 15metres	SHOP TYPE
1081	1097	17.18	VEGETABLES
1097	1114	17.45	RESIDENCE
1114	1126	17.64	MOBILE RECHARGE
1126	1146	17.89	SWEETS EATERY
1146	1180	18.48	GARMENTS
1180	1197	18.75	JEWLLERY
1197	1234	19.32	BAG
1234	1244	19.48	GARMENTS
1244	1252	19.61	SAREES
0 - 47		0.74	DISTANCE BETWEEN TWO SIDES OF ROAD
0	11	0.17	STATIONARY
14	20	0.31	TELLERY
20	35	0.55	BAG
35	53	0.83	GARMENTS
53	70	1.10	SHOES
70	95	1.49	HOTEL
95	106	1.66	GROCERY
106	111	1.74	COBBLER
111	121	1.89	CLOSED SHOP
121	131	2.05	CLOCK SHOP
131	142	2.22	MOBILE
142	152	2.38	CLOSED SHOP
152	160	2.51	CLOCK & WATCH
160	177	2.69	UNMETALLED ROAD
172	186	2.91	CLOSED SHOP
186	196	3.07	SALOON
196	217	3.40	GROCERY
217	230	3.60	GROCERY
230	240	3.76	EMPTY SPACE
240	250	3.91	PAN
250	259	4.06	EMPTY SPACE
259	269	4.18	BITSCUITS
269	280	4.38	EATERY
280	308	4.82	TEA SHOP
308	330	5.17	TEA SHOP
330	339	5.31	PAN SHOP
339	358	5.61	TEA SHOP

START PACE	END PACE	END PACE ACCORDING TO SCALE: 1CM = 15 meters	SHOP TYPE
358	370	5.79	EMPTY SPACE
370	386	6.04	TEA SHOP
386	397	6.22	EMPTY SPACE
397	406	6.36	PAN

**SOURCE:** Primary Survey By semester 5 Geography Honours students, 2022



**TABLE: MARKET MORPHOLOGY ANALYSIS ALONG THE GHATSILA  
STATION ROAD (LEFT PAVEMENT), ON 26<sup>TH</sup> AUGUST 2022  
(11:00 a.m. To 12:00 Noon)**

START PAGE	END PAGE	END PAGE ACCORDING TO SCALE:	SHOP TYPE
0	4	0.06	FRUITS
4	17	0.27	EMPTY SPACE
17	39	0.61	BAG
39	116	1.82	CLOSED SHOP
116	140	2.19	CLOTHES
140	153	2.40	MOBILE RECHARGE
153	162	2.54	MOBILE
162	181	2.83	PHOTOCOPY
181	193	3.02	CLOTHES
193	204	3.19	FRUITS
204	214	3.35	FRUITS
214	223	3.49	JUICE
223	235	3.68	HAND LOOM
235	246	3.85	EMPTY SPACE
246	257	4.02	HARDWARE
257	264	4.13	PLYWOOD
264	284	4.45	HARDWARE
284	306	4.79	PLYWOOD
306	318	4.98	CLOTHES
318	329	5.15	CLOTHES
329	341	5.34	CLOSED SHOP
341	362	5.67	CLOTHES
362	388	6.08	CLOTHES
388	394	6.17	EMPTY SPACE
394	416	6.51	CLOTHES
416	438	6.83	UTENSILS
438	448	7.02	MOBILE
448	459	7.19	GROCERY
459	490	7.67	CYCLE
490	532	8.33	GROCERY
532	552	8.64	MEDICAL
552	571	8.94	SWEETS EATERY
571	586	9.18	SHOES
586	595	9.32	CYCLE
595	605	9.48	GROCERY
605	624	9.77	SHOES
624	631	9.88	CLOSED SHOP
631	700	10.96	DIAGNOSTIC

**SOURCE:** Primary Survey by Semester 5 Students, 2022

Sheet 2/3  
Date 16/12/2022

## HOTEL SURVEY

**Table: FACILITIES AVAILABLE**

Facilities	Power Backup	Internet	Food service in Room	Ceysen	A.C.	T.V.
% of Hotels	49	8	49	20	16	18

SOURCE: PRIMARY SURVEY

**Table: DETAILS OF TOURIST**

Tourist Type	Local	Within state	Outside state	Foreign
Percentage	8	21	58	43

SOURCE: PRIMARY SURVEY

**Table: PROBLEMS OF HOTELS**

Different Problems	Transport infrastructure	Power	Administrative	Labour	Water	Competition	Others
% of Hotels	10	5	50	15	5	10	5

SOURCE: PRIMARY SURVEY

**Table: LEVEL OF INCOME**

Level of Income	15-30,000	30-50,000	50-70,000	70,000-1,50,000	above 1,50,000
% of Hotel	10	18	12	38	22

SOURCE: PRIMARY SURVEY

Submitted  
24-01-23

## Household Survey

1. Date:

2. Household Id.:

3. Sex of the Respondent: Male ( ) Female ( )

4. Sex of head of Household: Male ( ) Female ( )

5. Religion: Hindu ( ) Muslim ( ) Christian ( ) Buddhist ( ) Others(Specify):

6. Social Group: General ( ) OBCA ( ) OBCB ( ) SC ( ) ST ( )

7. Language: Hindi ( ) Bengali ( ) English ( ) Tribal Language ( ) Others(Specify):

8. How many members are there in the house: Male: Female:  
9. Age Sex Structure

Age Group	0-14	15-29	30-44	45-59	>=60
Female					
Male					

10. Marital Status

Gender	Married	Unmarried	Widow
Female			
Male			

11. Family Type: Joint ( ) Nuclear ( ) Extended ( )

12. Does your House has BPL Card: Yes ( ) No ( )

13. Educational Status of Family Member:

Gender	Illiterate	Primary	Middle	Secondary	Higher Secondary	Graduation	Above
Male							
Female							

14. Number of Children going to School: Private ( ) Govt. ( )

15. Number of Drop Out Candidates

Gender	Primary	Middle	Secondary	H. Secondary
Female				
Male				

16. Cause of School Dropout:

Financial Problem	Marriage	Health issues	Others(Specify)

17. Distance of the local educational facility

Primary	Middle	Secondary	H. Secondary	College

18. How many members in your household earn for living?

Adult Men	Adult women	Boy Child	Girl Child

19. Occupational Structure:

Gender	Agricultural Labourers	Cultivator	Industrial Worker	Industry Own	Trade & Commerce	Service
Male						
Female						

20. Nature of Employment

Gender	Self-employment	Regular Wage Employment	Casual Labour	No. of Months with Work
Male				
Female				

21. Monthly Income and Expenditure of Household:

Income	<1000	1000-2000	2000-3000	3000-4000	4000-5000	6000-7000	7000-10000	10000-15000	>15000
Expenditure	<1000	1000-2000	2000-3000	3000-4000	4000-5000	6000-7000	7000-10000	10000-15000	>15000

22. Do you have your own land? Yes ( ) No ( ) Amount:

23. What are the main crops grown?

24. Do you have your own house or it is Rented? Own ( ) Rented ( )

25. Nature of House

No. of Rooms	Kutcha House	Semi-Pucca	Pucca House
Earth	Rammed earth	Cement screed	Concrete

27. What type of material is mainly used for construction of the roof?

Iron sheets	Tiles	Asbestos	Concrete	Tin	Thatch	Other(Specify)

28. What type of material is mainly used for construction of the wall?

Concrete/Stones	Cement blocks	Burnt stabilised bricks	Unburnt bricks	Wood	Mud and poles	Tin/Iron sheets	Other(Specify)

29. How many livestock does your family own?

None	Cattle for farming	Cow	Goat	Poultry	Buffalo	Others(Specify)
------	--------------------	-----	------	---------	---------	-----------------

30. Do you have any of these Amenities?

Mobile	Fridge	TV	Cycle	Bike	Computer	Table	Chair	Others (Specify)
--------	--------	----	-------	------	----------	-------	-------	------------------

31. What is the main source of lighting in your house?

Kerosene	Firewood	Solar energy	Bio gas	Electricity	Others(Specify)
----------	----------	--------------	---------	-------------	-----------------

32. What type of fuel do you use for cooking?

Cow Dung	Kerosene	Gas	Electricity	Wood	Charcoal	Others (Specify)
----------	----------	-----	-------------	------	----------	------------------

33. Toilet Facility: Yes ( ) No ( ) (if Yes - select any one option from the following)

Inside shared	Inside exclusive	Outside shared	Outside exclusive	Open Defecation
---------------	------------------	----------------	-------------------	-----------------

34. What is the main source of water for drinking?

Private connection	Public Tap	Bore- hole	Well	River	Pond	Lake	Others(Specify)
--------------------	------------	------------	------	-------	------	------	-----------------

35. How long do you have to stand in the queue to fetch water?

< 15 minutes	15-30 minutes	30-45 minutes	45-60 minutes	>60 minutes
--------------	---------------	---------------	---------------	-------------

35. Any govt. Programme/Scheme for Development purpose: Yes ( ) No ( ) (If Yes Mention: )

36. What was the impact of Covid-19 Pandemic on your Financial Status?

Very bad	Bad	Moderate	No effect at all
----------	-----	----------	------------------

37. Did you receive any assistance during Pandemic? Yes ( ) No ( ) (If Yes Mention: )

38. Do you have any health insurance facility/scheme? Yes ( ) No ( ) (If Yes Mention: Govt. / Private)

39. How far is the PHC and hospital?

Distance	<1 km	1-4 km	5-9 km	10-14 km	>=15 km
PHC					
Hospital					

40. How long does it take to reach main water source from your house?

Less than 15 minutes	15-30 minutes	30-45 minutes	45-60 minutes	>60 minutes
----------------------	---------------	---------------	---------------	-------------

41. How far is the nearest market for daily goods?

Distance	<1 km	1-4 km	5-9 km	10-14 km	>=15 km
----------	-------	--------	--------	----------	---------

42. How do you dispose your household garbage?

Burry in the yard	Burn	Collection point in village	Throw into the River	Others (Specify)
-------------------	------	-----------------------------	----------------------	------------------

43. What is your Perception about Quality of Drinking Water?

Very Bad	Bad	Moderate	Good	Very Good
----------	-----	----------	------	-----------

44. What is your Perception about Air Quality in your area?

Very Bad	Bad	Moderate	Good	Very Good
----------	-----	----------	------	-----------

45. What is your Perception about Transport Infrastructure in your area?

Very Bad	Bad	Moderate	Good	Very Good
----------	-----	----------	------	-----------

46. What is your Perception about the Living condition in your area?

Very Bad	Bad	Moderate	Good	Very Good
----------	-----	----------	------	-----------

47. What kind of Problem do you face in your locality?

Power supply	Water	Health	Transport	Banking Facility	Recreational Facilities	Education	Agriculture (Specify)	Other (Specify)
--------------	-------	--------	-----------	------------------	-------------------------	-----------	-----------------------	-----------------

48. What are common diseases that affect People in the area? (Mention)

49. Do you have any Suggestion for improving your existing living condition.

### Q3: Market Survey

1. Date \_\_\_\_\_
2. Id No. \_\_\_\_\_
3. What is the name of the shop? \_\_\_\_\_
4. What is the gender of Shop Owner?  Male  Female
5. What is your educational level?  Illiterate  1-5  6-8  9-10  11-12  Graduation  Above
6. What is the distance of your house from the shop?  Next Door  < 1  1-2  2 - 3  3 - 4  4 - 5  5 - 10  > 10
7. How old is your shop? \_\_\_\_\_
8. Do you own the shop or is it rented?  Own  Rent
9. If it a temporary or permanent shop?  Temporary  Permanent
10. What is the nature of structure of the shop?  Kutchhi  Semi-Kutchhi  Pucca
11. What type of goods do you sell in your shop? \_\_\_\_\_
12. Where do you purchase your goods from? \_\_\_\_\_
13. What is the main mode of transportation of goods?  Cycle  Bike / Scooter  Van  Truck  Bus  Jeep  Others \_\_\_\_\_  
What? \_\_\_\_\_
14. What number of customers come to your shop daily? \_\_\_\_\_
15. What type of Customers comes to your shop?  Local  Nearby Villages/ Mandals  Outside State  Foreign \_\_\_\_\_
16. Do you hire any labour?  Yes  No
17. What are the number of hired labourers? \_\_\_\_\_
18. What is your monthly income and expenditure and daily sale?
- |             |       |             |             |             |              |          |             |  |
|-------------|-------|-------------|-------------|-------------|--------------|----------|-------------|--|
| Income      | <1000 | 2000 – 2500 | 2500 – 5000 | 5000 – 7500 | 7500 – 10000 | > 10000  | 7500-100000 |  |
| Expenditure | <1000 | 2000 – 2500 | 2500 – 5000 | 5000 – 7500 | 7500 – 10000 | > 10000  | 7500-100000 |  |
| Daily Sale  | <100  | 100-200     | 200-300     | 300-400     | 400-500      | 500-1000 | > 1000      |  |
19. Do you face any problems in your daily selling and trading?  Yes  No
20. What are the problems faced by you in market?  Credit  Purchase  Sale  Transport  Labour  Infrastructure  Others  
What? \_\_\_\_\_
21. Do you have to pay for the market land or anything else? \_\_\_\_\_
22. Have you received any help from anyone?  Yes  No
23. If yes, what kind of help do you get? \_\_\_\_\_
24. Do you have any suggestions for improving your trade? \_\_\_\_\_

Q3: Tourism Survey – Hotel Survey

1. Date

2. What is the name of the Hotel?

3. What is the sex of Hotel Owner?

Male	Female
------	--------

4. What is your Household Size (M & F)?

5. Age Group of Hotel Owner

0-14	15-29	30-44	45-59	>=60
------	-------	-------	-------	------

6. What is your educational level?

Illiterate	Pre	1-5	5-8	9-10	11-12	Graduation	Above
------------	-----	-----	-----	------	-------	------------	-------

7. What is the distance of your house from the hotel?

Next Door	< 1	1-2	2 - 3	3 - 4
4 - 5	5 - 10	10 - 15	15 - 20	20 - 25

8. When was your hotel established?

9. Please provide the details of type and number of rooms and their rent.

No. of Floors	Type of Bed	No. of Rooms	Type of Room AC/ non-AC	Daily Rent
	Special Rooms			
	Single Bed			
	Double Bed			
	Dormitories			

10. What are the facilities available in the rooms?

No. of Rooms with the Facility	TV	AC	Geyser in Bathroom	Food Served in Rooms	Internet	Power Backup

11. What are the services offered in the hotel?

Restaurant	Number of Hours of Water Supply	Meal Hours	No. of Hours of Power Supply	Internet	Car Parking	Recreational	Emergency Services	Other Information

12. Please provide details of Tourists

Tourists Primarily From				Nature of Tourists			
Local	Within State	Outside State	Foreign	Family	Organised Tour Parties	Others	

13. In which time of year do tourists mainly come?

Months	Peak Season

Income	< 1500	1500-3000	3000-5000	5000-7500	7500-100000	>100000	
Expenditure	< 1500	1500-3000	3000-5000	5000-7500	7500-100000	>100000	
Profit	< 1500	1500-3000	3000-5000	5000-7500	7500-100000	>100000	

14. What is your monthly income and expenditure?

Rank in order of Importance	Maintenance	Food	Power	Labour	Land Rent	Machinery	Other

16. Are any family members engaged in the same occupation?

Yes	No
-----	----

17. Do you hire any labour in your hotel? If yes, number...

Yes	No	No. Female	No. Male

18. Do you face any problem in the work?

Yes	No
-----	----

Financial	Transport	Infrastructural	Power	Administrative	Labour	Water	Competition	Customer Related	Other

19. Do you have any suggestions for improving?

## BIBLIOGRAPHY & WEBLIOGRAPHY

Bhuiyan, K.N. and Sahu, B.(2014), Assessment of Water Quality Index in Subarnarekha River Basin in and around Jharkhand area. IJER Journal of Environmental Science, 8(11), 39-45.

Government of India (2013). Groundwater Information Booklet: East Singhbhum District, Jharkhand, Central Ground water Board, Ministry of Water Resources, State Unit Office Ranchi, ([http://cgwb.gov.in/District\\_Profile/Jharkhand/East%20Singhbhum.pdf](http://cgwb.gov.in/District_Profile/Jharkhand/East%20Singhbhum.pdf) accessed on 09.09.2022)

Government of India. Report on National Aquifer Mapping and Management of Ground Water Resources. East Singhbhum, Central Ground Water Board, State unit Office. Ranchi.

Government of Jharkhand (undated). Assessment and Mapping of some Important Soil parameters including Soil Acidity for the State of Jharkhand (1:50,000 scale) Towards Rational Landuse Plan. East Singhbhum District. National Bureau of Soil Survey and Landuse Planning Department of Soil Science & Agricultural Chemistry, BAU, Ranchi, Jharkhand. Department of Agriculture and Cane Development. ([https://desjharkhand.nic.in/files/Districts/20\\_Statistical/20\\_Hand/20\\_Book/20\\_East/20\\_SINGHBHUM.pdf](https://desjharkhand.nic.in/files/Districts/20_Statistical/20_Hand/20_Book/20_East/20_SINGHBHUM.pdf) accessed on 24.12.22)

Government of Jharkhand (undated). District Statistical Handbook 2021: East Singhbhum. Jharkhand. Department of Planning & Development, District Statistical Office, East Singhbhum. ([https://desjharkhand.nic.in/files/District/20\\_Statistical/20\\_Hand/20\\_Book/20\\_East/20\\_SINGHBHUM.pdf](https://desjharkhand.nic.in/files/District/20_Statistical/20_Hand/20_Book/20_East/20_SINGHBHUM.pdf) accessed on 09.09.22)

IN-RIMT (undated). Report on Slope, Aspect and Altitude of East Singhbhum District, Jharkhand State. Jharkhand Space Application Center, Department of Information Technology, Government of Jharkhand, Ranchi. ([https://jsac.jharkhand.gov.in/Report\\_PDF/Slope/Slope/20\\_Singhbhum.pdf](https://jsac.jharkhand.gov.in/Report_PDF/Slope/Slope/20_Singhbhum.pdf) accessed on 09.09.22)

IN-RIMT (undated). Report on soil Resources Map of East Singhbhum District. Department of Information Technology, Government of Jharkhand, Ranchi ([https://jsac.jharkhand.gov.in/Report\\_PDF/New\\_Soil\\_Report/Soil\\_e-singhbhum.pdf](https://jsac.jharkhand.gov.in/Report_PDF/New_Soil_Report/Soil_e-singhbhum.pdf) accessed on 20.12.22)

Jharkhand Space Application Center (undated). East Singhbhum District profile. (<https://jsac.jharkhand.gov.in/district.profile/ESD.pdf> accessed on 03.09.21)

Oxford University Press (2016), Oxford School Atlas - New Delhi  
Sarkar, A. 2001. Practical Geography: A Systematic Approach, Orient  
Blackswan, Kolkata.

Singh, R.L. (1971) India: A regional Geography. National Geographic  
Society of India, Varanasi

Soil testing kit (2018) Handbook! Soil testing kit. as recommended  
by I.A.R.I. Kolkata

<https://censusindia.gov.in/censusweb.html>

<https://en.wikipedia.org/wiki/>

✓  
Santosh  
03/01/2023

**UNIVERSITY OF CALCUTTA**  
**B.A. HONOURS SEMESTER II PRACTICAL EXAMINATION**

**2023**

**GEOGRAPHY LABORTORY NOTEBOOK**

**SUBJECT : GEOGRAPHY**

**STREAM : HONOURS**

**PAPER : GEO-A-OC-6-14-P (HAZARD MANAGEMENT  
LAB)**

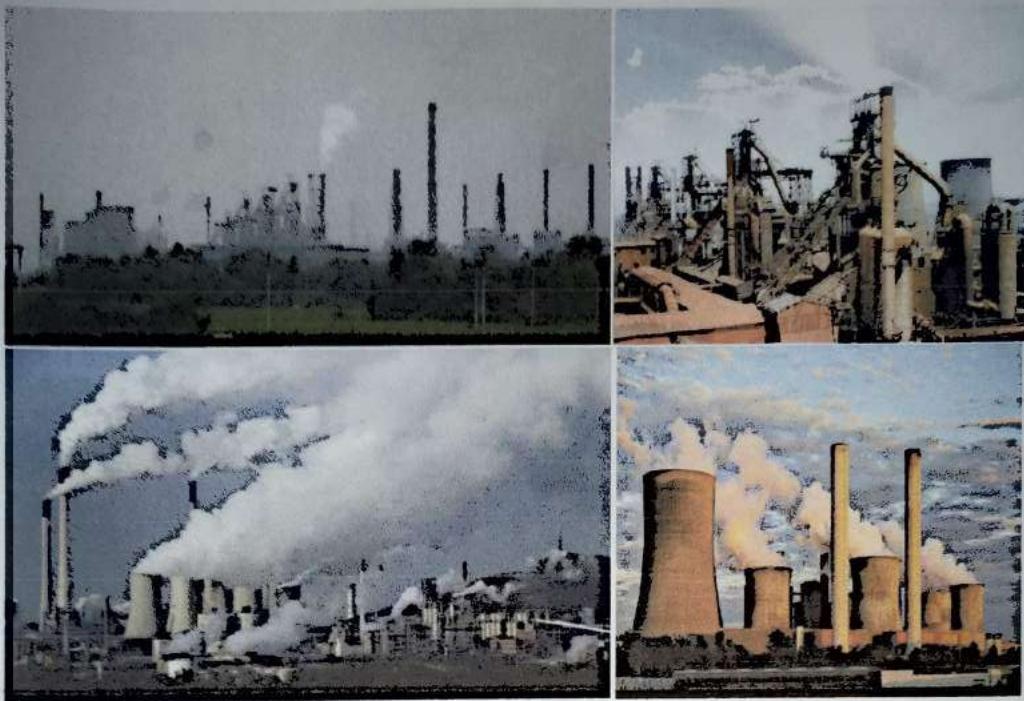
**HAZARD / DISASTER MANAGEMENT REPORT**

**UNIVERSITY REG. NO.: 561-1211-0167-20**

**UNIVERSITY ROLL NO.: 202561-11-0087**

**042 EXAMINED**





## DISASTER MANAGEMENT PROJECT

### AIR POLLUTION: A CASE STUDY OF DURGAPUR



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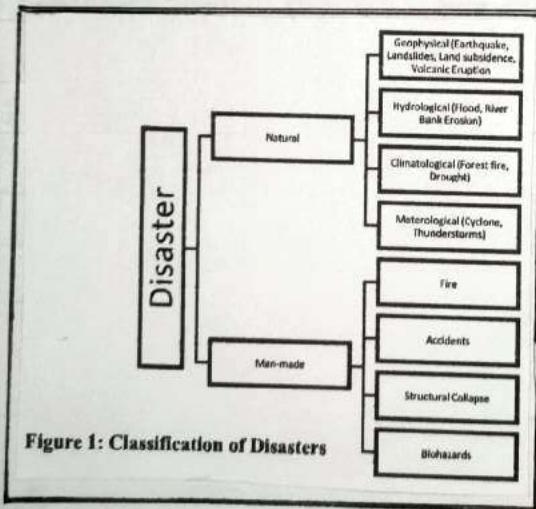
<u>SL. NO.</u>	<u>SUB - SECTION</u>
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# DISASTER MANAGEMENT PROJECT

## AIR POLLUTION : A CASE STUDY OF DURGAPUR

**INTRODUCTION :** Disaster as defined by the United Nations is "a serious disruption of the functioning of a community or society which have or involve widespread human, material, economic or environmental inputs that exceed the ability of the affected community or society to cope using its own resources." Disaster are seen as the effect of hazards on vulnerable population. Great damage, loss, destruction and devastation to life and property are the results of disasters. Disasters may be classified as provided below (Figure 1). Disaster may be due to natural or anthropogenic causes, but its intensity is accentuated due to human agency. Among man-made disasters, air pollution is one of the serious concerns of contemporary world. This disaster is the focus of this report.



**AIR POLLUTION :** Air Pollution is one of the most serious problems in the world. When dust, smoke, harmful gases introduced into the atmosphere and contaminate the environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere then air becomes

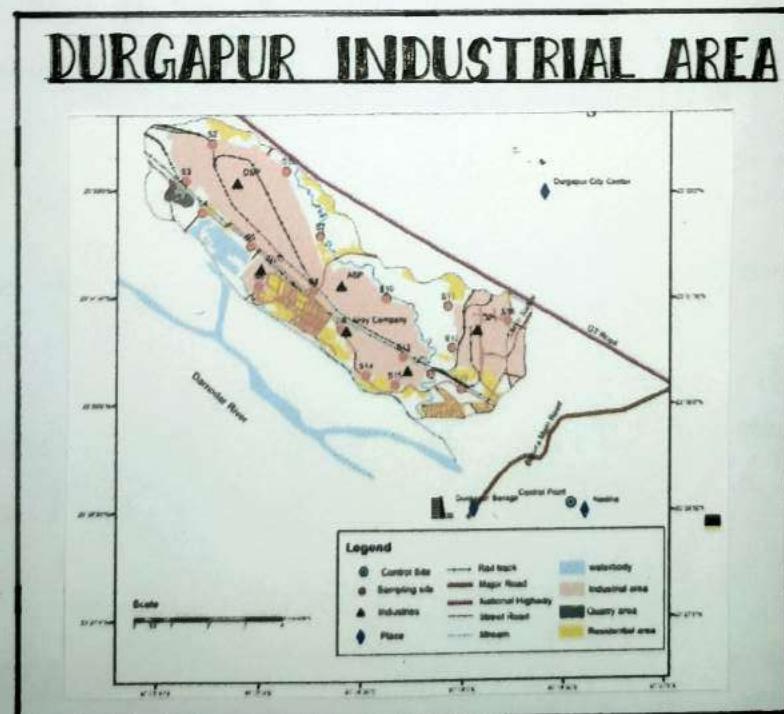
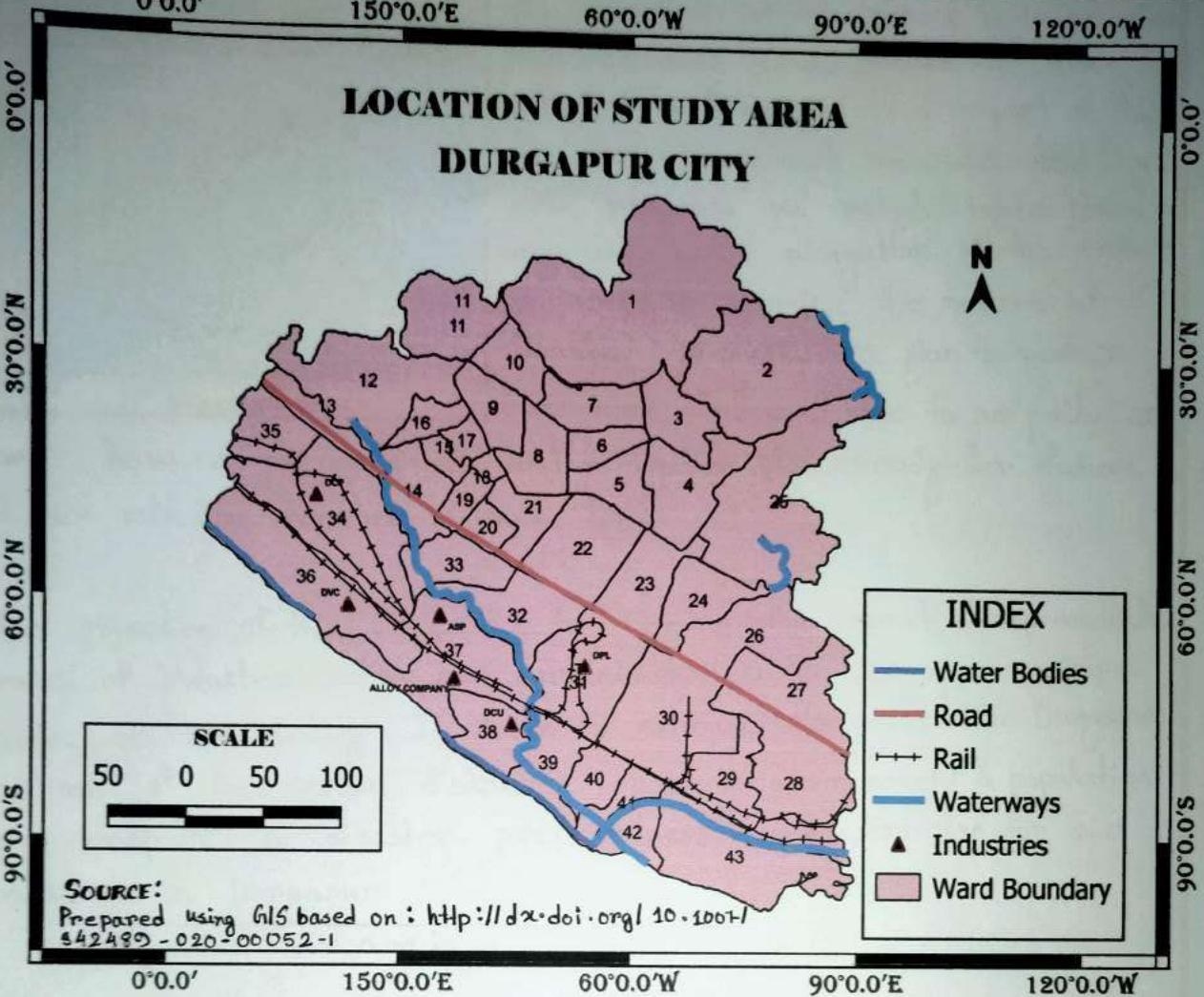
polluted for all living organisms. Air Pollution is a slow-paced disaster with effects that last longer. Household combustion devices, transport, industries, burning of fuel and forest fires are the main causes of air pollution. The six main pollutants are Carbon Monoxide ( $\text{CO}$ ), Nitrogen ( $\text{NO}_2$ ), Lead ( $\text{Pb}$ ),

Ground level Ozone ( $O_3$ ), particulate pollutant and Sulphur dioxide ( $SO_2$ ). Long term health effects from air pollution include heart diseases, lung cancer, respiratory problems. Air pollution can also cause long term damage to people's nerves, brain, kidney, liver, other organs and increase morbidity and mortality.

**STUDY AREA:** Durgapur is located in India's eastern part at  $23^{\circ}32'0.3840''N$  latitude and  $87^{\circ}19'18.9480''E$  longitude. Durgapur, a major industrial city in Paschim Bardhaman (West Bengal), is a part of Chhotanagpur Plateau and is bounded by the Ajay River in the north and the Damodar River in the south, with an average elevation of 65 meters. Durgapur is a gently sloping alluvial terrain comprised of lava flows with interbedded carbonaceous, silicious shales and clays. It relies on the Damodar Valley Cooperation and barrage and is rich in mineral and coal deposits and hence is termed as the 'Ruhr of West Bengal'. The city is located in the enriched Bituminous coal belt of the Damodar Valley region; hence many industries are set up here (Figure Set 2). It is a municipal corporation in West Bengal with unprecedented urbanization, industrialization and transportation development. Hence it is one of the most polluted cities in West Bengal with high level of particulate matter in the atmosphere, creating a major health hazard. West Bengal, in 2019, accounted for the second-highest number of deaths linked to air pollution in the country, 20.8 per cent of overall deaths.

**OBJECTIVES:** Disaster management refers to the programs, administrative actions and operations undertaken to address a disaster, preparedness, mitigation, response and recovery. It refers to how one prepares for, responds to and learns from effects of disaster. Steps taken to address varies for each specific disaster.

**FIGURE: 2**



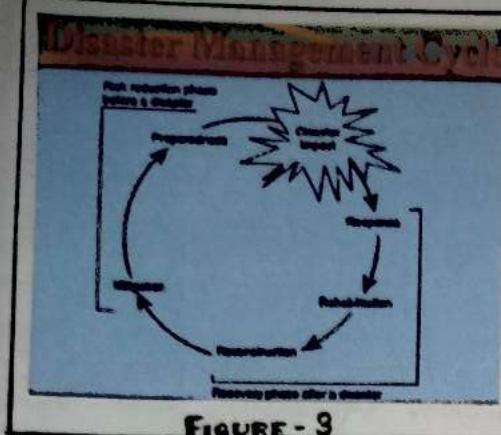


FIGURE - 3

The objective of this project is to examine the causes and nature of air pollution in Durgapur and impact of this disaster management measures and long-term response and rehabilitation planning undertaken for mitigation of the risk. It seeks to examine the nature of disaster preparedness plan to reduce the risk incurred due to air pollution.

and have a preparedness and mitigation plan ready for future if air pollution reaches serious levels.

The objective of this project is to examine the impact of unprecedented rates of industrialization and urbanization in the Durgapur municipal area on air quality. It seeks to examine air pollution in Durgapur as one of the serious disasters impacting environment & population and prepare a disaster preparedness - mitigation plan for air pollution in Durgapur.

The objectives thus are:

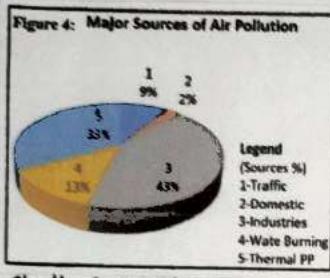
- To assess the status of urban environment in terms of air quality and examine its variation over a week in Durgapur.
- To analyse causes - sources - factors and level of air pollution.
- To examine the impact of chronic exposure to urban air pollution on health of the residents of Durgapur
- To suggest suitable measures to reduce the magnitude of air pollution and its adverse effects by providing a Disaster preparedness Plan.

**METHODOLOGY :** This hazard report took recourse to various reports of the West Bengal Pollution Control Board, various research articles and websites for obtaining data pertaining to air pollution in Durgapur. Recourse was also undertaken of the website

accweather for obtaining real time data for the week 17<sup>th</sup> April 2023 to 21<sup>st</sup> April 2023 at four time points. The data analysis was represented through graphs and cartograms for better visualization to interpretation.

## CAUSES OF AIR POLLUTION IN DURGAPUR:

Industries and heavy transport vehicles ownership continue to increase air



Chatterjee, 2021.

pollution in Durgapur. Combustion of fuel in the domestic sector is also a significant contributor. The steel plant, thermal power plant, mining areas, transport sector releases several pollutants such as particulate matter and fugitive dust. Significant sources of air pollution in Durgapur are industries (43%), thermal power plants (33%), waste burning (13%) and 9% from traffic (Chatterjee 2021). Among other factors and sources of air pollution are:

- Vehicular Emissions:
  - Abundance of poorly maintained vehicles
  - Explosive increase in personal vehicles - cars and two-wheelers.
  - Use of petrol fuel and dieselization of personal vehicle segment.
- Thermal and Hydel power plants: which release nitrogen oxides and result in formation of smog
- Combustion of fuel in domestic sector:
  - Cooking in living rooms in slums using Kerosene
  - Natural gas stoves in urban areas release carbon monoxide.
- Presence of versatile industries, e.g. steel plants, chemical industry, plastics, especially which use coal combustion
- Presence of small industries operating in the city contribute to the air pollution.
- Large-scale construction activities release fugitive dust and wind-blown dust due to removal of soil.

- Mining and transportation of coal and iron ore release dust and other pollutants.
- High and ever-increasing population density
- Stubble burning results in deteriorating the air quality.
- During Festivals like Durga Puja, Kali Puja, Diwali lot of fireworks and crackers are used and release pollutants like sulphur dioxide, carbon monoxide, suspended particles and iron dust.
- Seasonal impacts and change of climate from hot humid and windy to colder weather with less wind results in higher concentration of air pollutants in Durgapur during wintertime.
- Improper landuse planning in Durgapur city development.

Initially the industries were set up south of National Highway and the residential areas to the north with a green buffer in midst. Later industries were set up south of the National Highway and railway line, near Damodar River in conjunction with township. In contemporary years the development has become more unplanned as industries have been set up in the buffer zones and in vacant spots close to residential areas.

All these have increased the air pollution levels in Durgapur.

## DISASTER CHARACTERISTICS AND IMPACTS

**CHARACTERISTICS:** The analysis of different sources of air pollution in Durgapur depicts that the major air pollutants are particulate Matter, especially PM 2.5 which is 3.9 times above the recommended limit given by the WHO 24 hrs air quality guidelines value. (<https://www.aqi.in/in/dashboard/India/west-bengal/Durgapur>) Particulate Matter 10, Carbon dioxide (CO<sub>2</sub>), Carbon Monoxide (CO), and sulphur Dioxide (SO<sub>2</sub>), Nitrogen dioxide (NO<sub>2</sub>) are other significant contributors.

**PARTICULATE MATTER (PM 10 AND 2.5):** In Durgapur the concentration of SPM is much higher than the other pollutants. The main sources of these are incomplete combustion, automobile emissions, dust and cooking. SPM is too small to be filtered by the natural protective mechanisms of the human respiratory system. The effect of high SPM in the atmosphere are long term and short term. Short term effects result in nose and eye itching and irritation, headache, allergic reactions, nausea. Long-term and more serious impacts are lung cancer, heart disease, brain damage, kidney and liver damage. The annual average concentration of Suspended Particulate matter (SPM) and Respirable particulate matter (RPM) were  $243.4 \mu\text{g}/\text{m}^3$  and  $138.3 \mu\text{g}/\text{m}^3$ , well above health permissible standards (Molla 2018).

**NO<sub>2</sub>:** Annual concentration of NO<sub>2</sub> was  $59.9 \mu\text{g}/\text{m}^3$ , just about the maximum allowed concentration of 60 micrograms per cubic metre. NO<sub>2</sub> is created from automobile exhaust and industrial activity which causes allergic asthmatics by augmenting allergic responses. This also contributes to ozone pollution.

**SO<sub>2</sub>:** SO<sub>2</sub> levels are under control largely because of change in energy mix and is low at  $7.8 \mu\text{g}/\text{m}^3$ .

**CO:** CO is produced in the incomplete combustion of carbon-containing fuels. The largest anthropogenic source of CO is vehicle emissions. Breathing the high concentrations of CO leads to reduced oxygen transport by haemoglobin and has health effects that include headaches, heart diseases and impaired reaction timing.

The **AIR QUALITY INDEX** measures the quality of air. It shows the amount and types of gases dissolved in the air. There are 6 categories in this air quality index: good, satisfactory, moderate, poor and severe. The World Health Organization guidelines 2021 states that,

- PM 2.5 should not exceed  $15 \text{ ug/m}^3$  24-hour mean
- PM 10 should not exceed  $45 \text{ ug/m}^3$  24-hour mean (India  $60 \text{ ug/m}^3$ )
- Nitrogen dioxide ( $\text{NO}_2$ ) should not exceed  $25 \text{ ug/m}^3$  for a 24-hours mean (India  $40 \text{ ug/m}^3$ )
- Sulphur dioxide ( $\text{SO}_2$ ) concentrations should not exceed  $40 \text{ ug/m}^3$  24-hours mean (India  $50 \text{ ug/m}^3$ )
- Carbon monoxide concentrations should not exceed  $4 \text{ mg/m}^3$  24-hours mean
- AQI values at and below 100 are generally considered to be satisfactory

## AIR POLLUTION PATTERNS IN DURGAPUR:

There are four manual air quality monitoring stations and one real-time station in Durgapur.

Table 1: Durgapur—locations of the ambient air quality monitoring stations and the parameters monitored

Station name and location	Parameters monitored
<b>Automatic monitoring stations</b>	
Sidhu Kanhu Indoor Stadium, Durgapur	PM10, PM2.5, $\text{SO}_2$ , $\text{NO}_2$ , ozone, ammonia, CO, lead, nickel, arsenic, benzene, BaP
<b>Manual monitoring stations</b>	
DMC Water Works, Angadpur	PM10, $\text{SO}_2$ , $\text{NO}_2$
Kwality Hotel, Bhiringi More, Benachiti	PM10, $\text{SO}_2$ , $\text{NO}_2$
Bidhannagar, PCBL Club, Muchipara	PM10, PM2.5, $\text{SO}_2$ , $\text{NO}_2$ , ozone, ammonia, CO, lead, nickel, arsenic, benzene, BaP
Dew India Limited, PCBL More, Durgapur	PM10, $\text{SO}_2$ , $\text{NO}_2$

Source: As provided by the West Bengal Pollution Control Board and CPCB website for automatic monitoring stations

All the four stations have significantly higher than permissible standards of PM 10, e.g. where the PM 10 should not exceed  $45 \text{ ug/m}^3$  24-hour mean (India  $60 \text{ ug/m}^3$ ); in Durgapur the average is more than  $100 \text{ ug/m}^3$  at all locations.

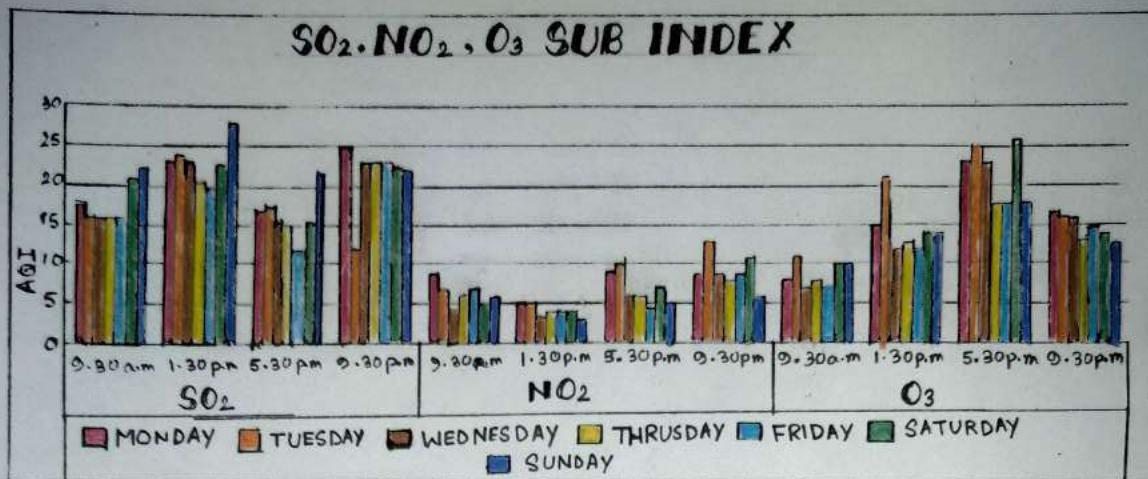
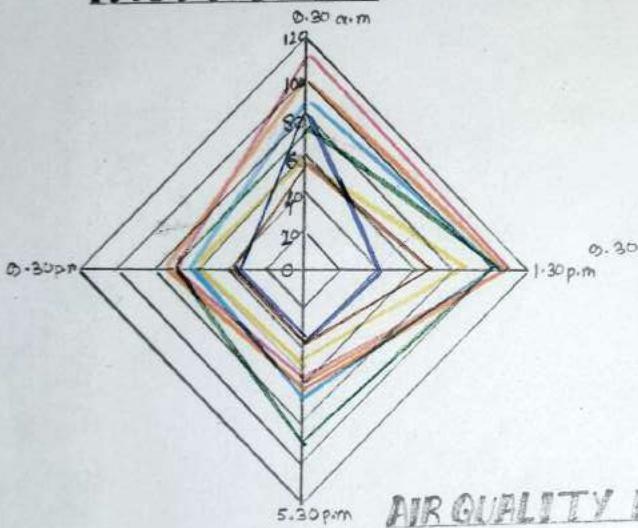
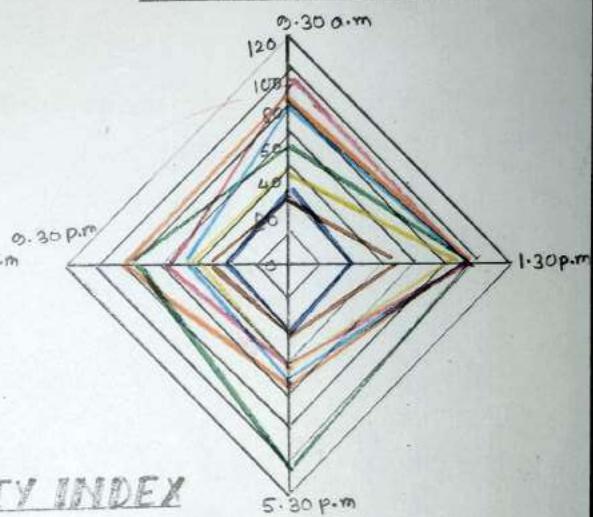
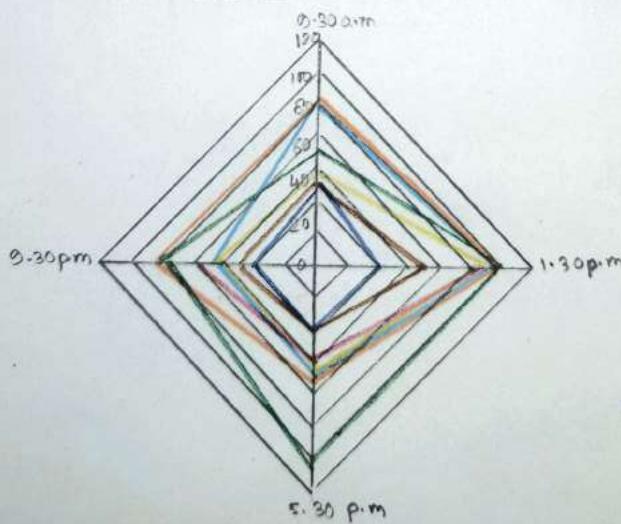
TABLE 2 : MANUAL MONITORING UNDER NATIONAL AMBIENT AIR QUALITY MONITORING PROGRAMME (IN  $\text{ug/m}^3$ ), 2020 (DURGAPUR)

LOCATION	MINIMUM (24 HOUR- LY AVER- AGE)	MAXIMUM (24 HOURLY AVERAGE)	ANNUAL AVERAGE	MINIMUM (24 HOURLY AVERAGE)	MAXIMUM (24 HOURLY AVERAGE)	ANNUAL AVERAGE	MINIMUM (24 HOUR- LY AVER- AGE)	MAXIMUM (24 HOURLY AVERAGE)	ANNUAL AVERAGE
	S02	NO2		PM 10 (PM 2.5)					
DMC Water Works, Angadpur	4	15	13	16	48	32	63	182	111
Kwality Hotel, Bhiringi More, Benachiti	6	17	13	23	47	32	67	184	116
Bidhannagar, PCBL Club, Muchipara	2	14	8	11	35	24	47(26)	146(92)	100(67)
Dew India Limited PCBL More, Durgapur	2	16	13	14	48	31	61	182	107

Source: <https://coch.nic.in/namp-data/>

FIGURE:15

# DIRUNAL VARIATION IN VARIOUS AIR POLLUTANT IN DURGAPUR 17.04.2023 TO 23.04.2023

**PM 2.5 SUB INDEX****PM 10 SUB INDEX****AIR QUALITY INDEX**

✓  
S. R. H.  
23/06/2013

Legend: Monday (Red), Tuesday (Orange), Wednesday (Brown), Thursday (Yellow), Friday (Blue), Saturday (Green), Sunday (Dark Blue)

**TABLE 3 : POLLUTANTS IN DURGAPUR : 2005, 2009**

YEAR	DURGAPUR		
	SPM	SO <sub>x</sub>	NO <sub>x</sub>
2005	211.1	8.4	42.9
2009	344.8	8.4	58.9

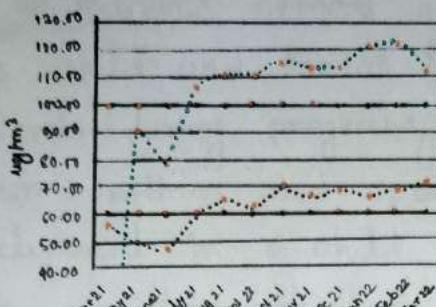
SOURCE: Shahin, F. SK. (2020)

Temporal study by a researcher has revealed that air pollution level have been rising between 2004-2005 to 2009 in Durgapur, especially SPM, which is at highly critical stage. Aggregate picture of Air Quality Index (AQI) reveals that air quality is poorer at morning peak and afternoon pre-lunch hours (Figure Set 5). This might be due to high vehicular traffic and higher intensity of work operations in mining, industrial and constructions sites in these areas. It is also interesting to note that pollution levels peak on Mondays and Tuesdays and Saturday evening probably when the commuters from neighbouring towns are going back home for the weekend or coming back to work for the week on Monday mornings. It is exceptionally low on Sundays on account of low level of traffic and absence of industrial and related economic activities.

**SEASONAL VARIATION OF AIR POLLUTION:** The chemical properties of the pollutants in the atmosphere depend upon temperature, wind direction, rainfall and relative humidity of a particular locations. Seasonal variation in the climate has a significant relation with the level of pollutants in the city. The increase in temperature results in an increase in the average mixing height thereby, increasing the volume of air circulation and reducing the concentration of pollutants. The increase in wind circulation, due to the proximity to rivers, reduces the concentration of the gaseous pollutants, with the aid of strong convection currents. An increase in the amount of precipitation results in the wash out of the pollutants in the form of wet deposition. Analysis of the cyclic pattern of the levels of the gaseous pollutants in Durgapur suggest that during winter the air mass is more stagnant compared to other

seasons as there is less atmospheric circulation and increase in atmospheric stability; this results in increased concentration of pollutants and poorer AQI.

### **PM10 AND PM2.5 PROFILE OF BIDHANNAGAR DURGAPUR DURING 2021-2022**



INDEX	
PM 2.5	.....
PM 2.5 std	—
PM 10	.......
PM10 std	—

**FIGURE - 6**

SOURCE : WBPCB - 2022

Pollution levels rise very rapidly in winter due to low wind speed, low temperature, inversion trap and low mixing height of air. Application of National Air Quality Standards show that November onwards the air quality deteriorates, especially the extent of particulate matter (PM10 and PM 2.5) increases significantly in all three stations November onwards till February.

**IMPACTS:** The continuous air pollution has wide ranged immediate and long-term impacts on various aspects ranging from those on life, property, economic, social and environment.

**TABLE 4 : CATEGORIES OF AIR POLLUTION LEVELS AND RELATED HEALTH IMPACTS**

AQI Category: Pollutants and Health Breakpoints									
AQI Category Range	PM <sub>10</sub> (24hr)	PM <sub>2.5</sub> (24hr)	NO <sub>x</sub> (24hr)	O <sub>3</sub> (8hr)	CO (8hr)	SO <sub>2</sub> (24hr)	NH <sub>3</sub> (24hr)		
Good (0-50)	< 50	< 35	< 40	< 40	< 8	< 25	< 10		
Satisfactory (51-100)	51-100	35-60	41-60	41-100	8-16	25-50	10-20		
Moderately polluted (101-200)	101-200	61-80	81-100	101-150	17-33	51-100	21-40		
Poor (201-300)	201-300	91-120	101-200	101-150	34-50	101-200	41-100		
Very Poor (301-400)	301-400	121-200	201-400	201-400	51-77	101-200	101-200		
Severe (401-500)	401-500	201-300	201-400	201-400	78-100	101-200	101-200		
Extremely Severe (501-500+)	501-500+	301-500+	201-500+	201-500+	101-200+	101-200+	101-200+		

AQI	Associated Health Impacts
Good (0-50)	Minimal Impact
Satisfactory (51-100)	May cause minor breathing discomfort to sensitive people.
Moderately polluted (101-200)	May cause breathing discomfort to people with lung disease such as asthma, and discomfort to people with heart disease, children and older adults.
Poor (201-300)	May cause breathing discomfort to people on prolonged inhaling, and problems to people with heart disease.
Very Poor (301-400)	May cause respiratory illness to the people on prolonged inhaling. Effect may be more severe in people who are living with lung and heart diseases.
Severe (401-500)	May cause respiratory impact even on healthy people, and serious health impacts on people with lung/heart disease. The health impacts may be experienced even during normal walk also.

**a) DEMOGRAPHIC IMPACTS ON HEALTH:** Air pollution results in several respiratory and heart conditions like asthma, chronic bronchitis, emphysema, heart attack, stroke. In addition, long term and critical illness like various kinds of cancer are caused. Several million are known to have died due to the direct or indirect effects of air pollution. Air pollution also impacts child and foetal health as exposure to high air pollution levels during pregnancy causes miscarriage, premature birth, autism, asthma and spectrum disorder, damage early brain development in a child and cause pneumonia that kills almost a million children below 5 years. Durgapur has a significantly higher share of PM 2.5 which are so small that it can penetrate in to the gas exchange regions of the lung migrating into other organs, including the brain.

**TABLE 5: DEATHS ATTRIBUTABLE TO AIR POLLUTION IN INDIA, 2019**

STATES OF INDIA	INDIA	WEST BENGAL
Percentage of total deaths attributable to air pollution	17.8 (15.8 - 19.5)	20.8 (18.3 - 22.8)
Percentage of total deaths attributable to ambient particulate matter pollution	10.4 (8.4 - 12.3)	11.9 (9.1 - 14.4)

SOURCE: DANBONA, L. 2021.

Major diseases found by an author in a study of Durgapur city attributable to air pollution are given in the Table. Skin diseases, Bronchitis, Heart problem, Lung infection, Asthma, and Cancer, has increased at the rate of 26.06%, 43.40%, 32.07%, 40.75%, 55.92% and 57.14% from 2010 to 2017. Other common diseases like dust allergy and breathing issues, Fatigue, breathing problems, anxiety, depression, etc also were found but their magnitude couldn't be determined but the author (Chatterjee 2021).

TABLE 6 : MAJOR DISEASES DUE TO AIR POLLUTION IN DURGAPUR (CHATTERJEE 2021)

MAJOR DISEASES	2005	2010	2017
Cardiovascular d.	172	704	1169
Lung infections	46	173	292
Asthma	57	342	776
Skin diseases	344	1688	2283
Bronchitis	78	442	781
Cancer	10	36	84
Pulmonary TB	7	16	23

b) Economic: Economic loss due to lost output from premature death and morbidity from air pollution was 1.4 per cent of the GDP in India in 2019. Economic loss due to air pollution as a percentage of the state GDP was higher in the Northern and Central Indian states. India should invest in state specific air pollution control strategies. Research suggests that air pollution reduces productivity in four critical ways.

- (i) Increased absenteeism due to pollution reduce working hours of adults
- (ii) Decreased individual employee productivity when workers are on the job
- (iii) Reduction in agricultural crop and commercial forest yields by billions of money each year.
- (iv) Loss of income due to increased visit to doctors and medical institutions, consequent financial and emotional loss due to premature deaths.



STATES OF INDIA	INDIA	WEST BENGAL
Economic loss (US\$ millions) attributable to ambient Particulate Matter pollution	Air Pollution 36,803.8 (27,368.6- 47,710.3)	2125.3 (1,622.8- 2676.6)
	Ambient Particulate Matter pollution 27,768.6 (15,936.6-30,710 4,6)	1204.0 (838.8-1,601.1)

**TABLE 8 : ECONOMIC LOSS AS A PERCENTAGE OF STATE GDP DUE TO VARIOUS SOURCES**

STATES OF INDIA	INDIA	WEST BENGAL
Air Pollution	1.36	1.26
Ambient particulate matter Pollution	0.84	0.71

SOURCE : DANDONA, L. 2021

c) **SOCIAL**: It is important to remember that pollution is a social issue because it is caused by human behaviour and it increases violent behaviour. It not only has a negative effect on the human physical health but also on mental faculties of an individual. Research is ongoing of the effects of air pollutant exposure on social decision-making and social behavioural patterns.

d) **ENVIRONMENT**: (i) Air pollution results in release of green houses gases, resultant global warming and consequent increase in sea levels due to melting of ice from colder regions (ii) various types of industrial processes release harmful gases like nitrogen and sulphur oxides, which produce acid when they react with and fall back as acid rain causing damage to humans, animals, fisheries and crops. (iii) Ecosystem is also severely affected as heavy metal pollutants travel in the atmosphere and are deposited into various ecosystems resulting in disruption of ecosystem services and its self-regulating mechanism (iv) Air pollution has also resulted in displacement and loss of habitat of several species, especially pattern of migratory birds in the city.

e) **OTHERS**: Air pollution also affects visibility. When fine particles are dispersed in the air as emission from industrial facilities and power plants, they cause haze and reduce the transparency of the atmosphere.

## **DISASTER RESPONSE AND MANAGEMENT:**

There is an emerging consciousness to reduce the risk of major air pollution event and reduce air pollution levels in general which is aggravating due to climate change. It is necessary to design a reliable emergency response system to tackle air pollution using new technology. An air pollution management system includes a knowledge database and inference mechanism and the interface with the user and another resource. Design of expert systems for air pollution emergency response includes identifying problem characteristics, decision structure regarding present knowledge, formulating and validating rules to organize knowledge for the future forecasting.

**COMPREHENSIVE CLEAN AIR POLLUTION (CAP)** has been initiated for six non-attainment cities in West Bengal including Durgapur which will submit these action plans to the Air Quality Monitoring committee for review and implementation. These are prepared within the broader framework of the National Clean Air Programme (NCAP) that has set a generic target of 20% - 30% reduction in particulate pollution by 2024.

Several policy measures have been introduced to curb air pollution. These range from industrial baseline measures, pollution control for critically polluted areas, stricter location policy for new industrial units, and restriction on setting up of red category industries in municipal area, ensure regulatory compliance for grossly polluting industries, mandatory use of clean fuels, incentivizing small and medium-scale units to improve and replace boilers and coal fired down draft kilns to incentivizing renewable energy practitioners with tax incentives to add to the long term cost effectiveness of solar energy (rooftop and community based solar devices).

## POST DISASTER MANAGEMENT, MITIGATION AND FUTURE PREPAREDNESS

There are several steps that need to be taken to curb air pollution from all sources including industry, trash burning construction dust, road dust among others to meet clean air target. But vehicles need special attention. Durgapur Municipality, West Bengal Pollution Control Board and other stakeholders have enacted several laws and taken several steps to control air pollution. Some of the steps that have been taken include:

### (i) INDUSTRY

- Identification of cumulative impact of industrial emissions, e.g. total load from a specified area
- Regulatory compliance for grossly polluting industries and stringent pollution control action for each type of industry
- Regulating fuel quality by enhancing use of oil or gas in place of coal as mandatory i.e. Clean fuel policy and incentives for clean fuels like gas and electricity
- Regular testing and CEMS enabled monitoring for compliance to existing standards for PM; emission standard of  $150 \text{ mg/Nm}^3$  for PM was enacted by the WBPCB for boilers and down-draft kilns.
- Minimizing fugitive emissions through the preparation of a check list for industrial zones and units, specific to each type of industry
- Stricter industrial siting policy: Enforce restrictions on operations of Brick kilns within urban airshed zones during high pollution periods, relocate hot mix plants to areas Durgapur boundaries, shut down small and mobile hot mix plants.

### (ii) CONSTRUCTION

- Control measures for fugitive emissions from material handling.

conveying and screening operations through water sprinkling, curtains, barriers and dust suppression units.

- No construction materials should be left uncovered at roadside
- Introduce steeper penalties for non-compliance

### (iii) TRANSPORT

- Reduce vehicular emissions by expansion to gaseous fuel program for vehicles e.g. moving auto rickshaws and local taxis to LPG / CNG and buses can run on CNG
- Upgrade in-use emission testing for petrol and diesel vehicles by using additional methods of screening such as remote sensing.
- Electric Vehicles: There is a need to increase reliance on zero emissions electric mobility through use of E-Rickshaws and E-Carts as the mode of transport for last mile connectivity.
- Streamlining efficiency of Auto Emission Testing Centres.

### (iv) TRANSPORT MANAGEMENT

- Traffic re-engineering, e.g. signal replaced with circular round about for removal of congestion from densely polluted / most frequented road stretches.
- Introduction of synchronized traffic signals (green channels) to ensure less waiting time for vehicles and reduce gas emission from vehicles.

### (v) URBAN GREEN

- Avenue planning along roads with more traffic
- Urban planning integrates urban green e.g. provide green roofs and vertical greens linked to infrastructure development
- Green walling with plantations around generators
- Dust barriers to be integrated with the urban forestry and forest policy
- Urban redevelopment projects set aside 15-20% area for urban green and tree cover.

## vii) OTHERS

- Open Burning : Enforce a complete ban on garbage burning in the entire region and impose stringent action against such activities.
- Cooking Fuel : A targeted program to be implemented for 100% coverage of households by distribution of LPG/CNG in all non-compliant cities. Deter use of solid fuels for cooking especially the use of coal and firewood in roadside eateries and residential sector and issue trade license accordingly.
- Renewable Energy : West Bengal has a solar energy policy. It is mandatory for all housing societies having a total contract demand of 500 KW to install solar rooftop systems to meet at least 1.5% of their total electrical load.
- Need for Public awareness and cooperation : Organizing deeper public engagement to address the problem of sustainable industrial development and urban mobility. In addition, enhance place public education and awareness and awareness among public health providers regarding air pollution related illness, its treatment and prevention.

## DISASTER PREPAREDNESS PLAN

The varied causes of air pollution in Durgapur necessitate recourse to myriad measures to combat the problem as well. Effective disaster preparedness plan seeks to both reduce physical and economic damages and prevent and minimize morbidity, mortality, increase access to relief measures. There are a number of measures which are undertaken for controlling air pollution from industry, domestic sector and transport sector.

### (i) Industrial Sector

- Enhancing use of oil or gas in place of coal as mandatory. Coal use restricted in industries and coal-fired boilers and ceramic kilns converted to oil-fired ones.
- Relocating highly polluting industries outside of Durgapur city.

- Enforce Compulsory retirement of old machines.

(ii) Thermal Power Plants Control: The major contributor in medium and large-scale category is from thermal power plants. Thus, there is a need for installation of electrostatic precipitation in all boilers in power plants.

### (iii) Transport Sector

- Phasing out vehicles: Currently, cities in West Bengal except Kolkata do not have age restriction on vehicles. After crossing 15 years registration time frame, these vehicles are re-registered for another five years. The non-attainment cities require a phase out plan through age restrictions supported by a scrappage policy.
- Emissions Standards: West Bengal has introduced Bharat Stage IV (BS VI) norms, where vehicles will be equipped with more advanced emissions control system, expected to reduce emissions from new vehicles by 80-90%.
- In-use Emission control: West Bengal has introduced In case of in use vehicles, CO and hydrocarbon concentrations, air to fuel ratio are measured in petrol and smoke density is measured in diesel vehicles while undertaking pollution testing and issuing PUC certificate. However, PUC centres are decentralized, need frequent inspections and robust audit programs linked with centralized data server.
- On road monitoring: Introduction of BS IV and BS VI vehicles with more advanced emissions control systems require advancement in emissions monitoring e.g. vehicles manufactured after 2013 equipped with on board Diagnostic system (OBD) should be checked for malfunctioning light on the dashboard of the vehicle when they come for PUC check; as OBD in vehicles has the capacity

to sense and record the emissions performance of the vehicles. In addition, on road smoky vehicles inspection is needed to identify visible pollution vehicles and ensure that vehicles do not emit more than they are designed to emit by introduction of on road remote sensing monitoring to check the emissions as the vehicles are passing.

- Regulating movement of heavy-duty vehicles: Several industries, mining result in heavy duty truck movement through city which contribute hugely to air pollution. Usually, truck movement is restricted during the day and allowed to pass through or do loading and unloading during night. However, explicit intervention is needed to design highway alignment in a way that they bypass the highly populated residential areas. Industrial areas will require focused freight movement plan and freight terminal and dust control measures to control re-suspension of dust. Long term solution will emerge in shift from road-based freight system to rail based freight movement and use of conveyor belt transport within industries or mining to industrial sites.

(vi) Traffic Management: Introduction of integrated automated network system or traffic light system through Siemens controller via GPRS network system and use of smart variable message signs (VMS).

(v) Technology Upgradation: Introduction of Google Traffic Pilot Project to integrate real time traffic situation with Google Traffic virtual condition reducing the halting time of vehicles and minimizing the air pollution.

(vi) Underpass and flyover construction at major crossings to reduce traffic congestion.

(vii) Upgrading PCU emission testing centers to improve in-use emission control and on road monitoring.

(viii) Enforcement of possession of valid PCU certificate in all vehicles and imposition of penalty for non-compliance.

(ix) Comprehensive Clean Air Plan to be combined with GRAP. Objective of Graded Response Action Plan (GRAP) is to prevent pollution from getting worse when adverse weather conditions trap and spike pollution and are a series of temporary measures that needed to be initiated at state, district, municipal corporations, transport department, citizen level.

However, inspite of the preparedness plans, due to lack of awareness of citizens regarding these measures and increasing population the problem is getting aggravated.

**CONCLUSION:** The West Bengal Pollution Control Board is focused on improving the 4'E' for better traffic management i.e. Education, Enforcement, Engineering & Emergency Response, by harnessing the use of modern technology to minimizing the effects of air pollution. The problem of air pollution is a disaster that acquires high magnitude seasonally, is a slow-paced disaster and results in qualitative changes in the total ecology of Durgapur city. The preparedness and mitigation measures for such a disaster are interlinked and move in conjunction with each other and can provide direction for action and be used as guidelines for strategy formulation for future urban planning.

✓  
Gopal  
23/06/2023

# DIURNAL VARIATION IN VARIOUS AIR POLLUTANTS

## IN DURGAPUR (17.04.2023-23.04.2023)

9:30 A.M.

DAY	PM 10	PM 2.5	SO <sub>2</sub>	NO <sub>2</sub>	O <sub>3</sub>	CO <sub>2</sub>	AQI
MONDAY	111 102 ug/m <sup>3</sup>	110 60 ug/m <sup>3</sup>	23 23 ug/m <sup>3</sup>	9 24 ug/m <sup>3</sup>	8 17 ug/m <sup>3</sup>	3 549 ug/m <sup>3</sup>	
TUESDAY	102 84 ug/m <sup>3</sup>	100 50 ug/m <sup>3</sup>	24 33 ug/m <sup>3</sup>	7 14 ug/m <sup>3</sup>	11 29 ug/m <sup>3</sup>	3 587 ug/m <sup>3</sup>	102
WEDNESDAY	42 42 ug/m <sup>3</sup>	53 26 ug/m <sup>3</sup>	23 32 ug/m <sup>3</sup>	4 9 ug/m <sup>3</sup>	7 19 ug/m <sup>3</sup>	3 586 ug/m <sup>3</sup>	53
THURSDAY	55 53 ug/m <sup>3</sup>	56 28 ug/m <sup>3</sup>	21 25 ug/m <sup>3</sup>	6 11 ug/m <sup>3</sup>	8 10 ug/m <sup>3</sup>	2 419 ug/m <sup>3</sup>	56
FRIDAY	96 77 ug/m <sup>3</sup>	88 44 ug/m <sup>3</sup>	20 21 ug/m <sup>3</sup>	7 14 ug/m <sup>3</sup>	18 18 ug/m <sup>3</sup>	3 237 ug/m <sup>3</sup>	
SATURDAY	71 63 ug/m <sup>3</sup>	71 35 ug/m <sup>3</sup>	23 31 ug/m <sup>3</sup>	5 10 ug/m <sup>3</sup>	16 24 ug/m <sup>3</sup>	2 380 ug/m <sup>3</sup>	
SUNDAY	45 45 ug/m <sup>3</sup>	49 24 ug/m <sup>3</sup>	28 47 ug/m <sup>3</sup>	6 12 ug/m <sup>3</sup>	10 24 ug/m <sup>3</sup>	2 389 ug/m <sup>3</sup>	49

1:30 P.M.

DAY	PM 10	PM 2.5	SO <sub>2</sub>	NO <sub>2</sub>	O <sub>3</sub>	CO <sub>2</sub>	AQI
MONDAY	114 102 ug/m <sup>3</sup>	108 58 ug/m <sup>3</sup>	18 18 ug/m <sup>3</sup>	5 9 ug/m <sup>3</sup>	15 39 ug/m <sup>3</sup>	1 230 ug/m <sup>3</sup>	114
TUESDAY	116 105 ug/m <sup>3</sup>	108 58 ug/m <sup>3</sup>	16 16 ug/m <sup>3</sup>	5 10 ug/m <sup>3</sup>	21 52 ug/m <sup>3</sup>	1 211 ug/m <sup>3</sup>	116
WEDNESDAY	69 62 ug/m <sup>3</sup>	68 24 ug/m <sup>3</sup>	16 16 ug/m <sup>3</sup>	3 6 ug/m <sup>3</sup>	12 30 ug/m <sup>3</sup>	1 101 ug/m <sup>3</sup>	69
THURSDAY	106 80 ug/m <sup>3</sup>	85 42 ug/m <sup>3</sup>	16 16 ug/m <sup>3</sup>	4 7 ug/m <sup>3</sup>	13 33 ug/m <sup>3</sup>	1 179 ug/m <sup>3</sup>	106
FRIDAY	112 90 ug/m <sup>3</sup>	102 52 ug/m <sup>3</sup>	16 16 ug/m <sup>3</sup>	4 9 ug/m <sup>3</sup>	12 30 ug/m <sup>3</sup>	1 190 ug/m <sup>3</sup>	112
SATURDAY	115 105 ug/m <sup>3</sup>	103 53 ug/m <sup>3</sup>	21 22 ug/m <sup>3</sup>	4 7 ug/m <sup>3</sup>	14 30 ug/m <sup>3</sup>	1 201 ug/m <sup>3</sup>	115
SUNDAY	42 42 ug/m <sup>3</sup>	40 20 ug/m <sup>3</sup>	22 25 ug/m <sup>3</sup>	3 6 ug/m <sup>3</sup>	14 35 ug/m <sup>3</sup>	1 243 ug/m <sup>3</sup>	42

5:30 P.M.

DAY	PM10	PM2.5	SO <sub>2</sub>	NO <sub>2</sub>	O <sub>3</sub>	CO <sub>2</sub>	AQI
MONDAY	63	56	17	9	23	1	63
	58 ug/m <sup>3</sup>	28 ug/m <sup>3</sup>	17 ug/m <sup>3</sup>	17 ug/m <sup>3</sup>	56 ug/m <sup>3</sup>	254 ug/m <sup>3</sup>	
TUESDAY	74	61	18	10	25	1	74
	64 ug/m <sup>3</sup>	31 ug/m <sup>3</sup>	18 ug/m <sup>3</sup>	20 ug/m <sup>3</sup>	58 ug/m <sup>3</sup>	284 ug/m <sup>3</sup>	
WEDNESDAY	43	38	16	6	23	1	42
	42 ug/m <sup>3</sup>	10 ug/m <sup>3</sup>	16 ug/m <sup>3</sup>	13 ug/m <sup>3</sup>	55 ug/m <sup>3</sup>	203 ug/m <sup>3</sup>	
THURSDAY	66	49	15	6	18	1	66
	60 ug/m <sup>3</sup>	25 ug/m <sup>3</sup>	15 ug/m <sup>3</sup>	13 ug/m <sup>3</sup>	45 ug/m <sup>3</sup>	198 ug/m <sup>3</sup>	
FRIDAY	70	66	12	4	18	1	70
	62 ug/m <sup>3</sup>	33 ug/m <sup>3</sup>	12 ug/m <sup>3</sup>	9 ug/m <sup>3</sup>	45 ug/m <sup>3</sup>	210 ug/m <sup>3</sup>	
SATURDAY	126	91	16	7	26	1	126
	121 ug/m <sup>3</sup>	45 ug/m <sup>3</sup>	16 ug/m <sup>3</sup>	14 ug/m <sup>3</sup>	59 ug/m <sup>3</sup>	196 ug/m <sup>3</sup>	
SUNDAY	39	37	22	5	18	1	39
	39 ug/m <sup>3</sup>	19 ug/m <sup>3</sup>	27 ug/m <sup>3</sup>	9 ug/m <sup>3</sup>	45 ug/m <sup>3</sup>	253 ug/m <sup>3</sup>	

9:30 P.M.

DAY	PM10	PM2.5	SO <sub>2</sub>	NO <sub>2</sub>	O <sub>3</sub>	CO <sub>2</sub>	AQI
MONDAY	79	71	25	9	17	3	79
	68 ug/m <sup>3</sup>	35 ug/m <sup>3</sup>	36 ug/m <sup>3</sup>	17 ug/m <sup>3</sup>	43 ug/m <sup>3</sup>	621 ug/m <sup>3</sup>	
TUESDAY	103	74	12	13	16	2	103
	84 ug/m <sup>3</sup>	37 ug/m <sup>3</sup>	12 ug/m <sup>3</sup>	26 ug/m <sup>3</sup>	39 ug/m <sup>3</sup>	320 ug/m <sup>3</sup>	
WEDNESDAY	48	39	23	9	16	3	48
	48 ug/m <sup>3</sup>	20 ug/m <sup>3</sup>	32 ug/m <sup>3</sup>	17 ug/m <sup>3</sup>	40 ug/m <sup>3</sup>	521 ug/m <sup>3</sup>	
THURSDAY	67	60	23	8	13	2	67
	60 ug/m <sup>3</sup>	30 ug/m <sup>3</sup>	31 ug/m <sup>3</sup>	17 ug/m <sup>3</sup>	33 ug/m <sup>3</sup>	410 ug/m <sup>3</sup>	
FRIDAY	66	64	23	9	15	2	66
	53 ug/m <sup>3</sup>	32 ug/m <sup>3</sup>	32 ug/m <sup>3</sup>	19 ug/m <sup>3</sup>	38 ug/m <sup>3</sup>	240 ug/m <sup>3</sup>	
SATURDAY	98	71	22	11	14	1	98
	73 ug/m <sup>3</sup>	36 ug/m <sup>3</sup>	27 ug/m <sup>3</sup>	23 ug/m <sup>3</sup>	35 ug/m <sup>3</sup>	267 ug/m <sup>3</sup>	
SUNDAY	40	36	22	6	13	2	40
	40 ug/m <sup>3</sup>	18 ug/m <sup>3</sup>	27 ug/m <sup>3</sup>	13 ug/m <sup>3</sup>	32 ug/m <sup>3</sup>	319 ug/m <sup>3</sup>	

SOURCE : [www.accuweather.com/in/in/durgapur/191572/airquality-index/191572](http://www.accuweather.com/in/in/durgapur/191572/airquality-index/191572)

## REFERENCES

- Central Pollution Control Board (2020). Ambient Air Quality Monitoring Data for the Year 2020 (<https://cpcb.nic.in/namp-data/>)
- Chatterjee, B. (2021). Recent Trend of Air Pollution and Associated Health Hazard A Study on Steel City Durgapur, India Journal of Emerging Technologies and Innovative Research (JETIR), 8(12), 353-362.
- Dandona, L. (2021). Health and economic impact of air pollution in the states of India : The Global Burden of Disease Study 2019. Lancet Planet Health 2020, Supplement to : India State - Level Diseases Burden Initiative Air Pollution Collaborators, 5(1), e25 - e38 ([http://dx.doi.org/10.1016/S2542-5196\(20\)30298-0](http://dx.doi.org/10.1016/S2542-5196(20)30298-0))
- Government of West Bengal. (2018). Comprehensive Air Quality Action Plan for Kolkata - Air Quality Monitoring Committee. (<https://cpcb.nic.in/Actionplan/Hatest%20Bengal.pdf>)
- Government of West Bengal. (2020). Clean Air Action Plan Durgapur - Environment Department (<https://www.wbpcb.gov.in/files/Mo-02-2020-02-45-04CAPY.20For%20Durgapur.pdf>).
- Haque, Md. Sennal and Singh, R.B (2017). Air Pollution and Human Health in Kolkata, India : A Case Study in Climate - Climate: Urban Climate - Air Pollution, and Public Health (5(1), 71, 1-16 (<https://doi.org/10.3390/ci15040077>)
- Molla, R (2018). A Preliminary Assessment of Recent Air Pollution Status of Bardhaman District in West Bengal : Especially Industrial Area. International Journal of Creative Research Thoughts (IJCRT), 6(1), 1609 - 1615.
- Shahin, F.S.K. Samim, S.K. Firdaus, Wasim, S.K. Md (2020). Air Pollution in Durgapur An Overview , Scholar's Press: Chapter 5 (<https://doeplayer.net/176722793-Air+pollution+-+in+-+durgapur+-+an+-+overview+.html>)
- West Bengal Pollution Control Board (2022). Annual Report, 2021-2022 (<https://www.wbpcb.gov.in/annual-reports>)
- <http://emis.wbpcb.gov.in/airquality/popupAqi.jsp?type=auto>

<https://app.cpcbeern.com/AQI-India/>

<https://en.wikipedia.org/wiki/Air-quality-guideline>

<https://www.aeauweather.com/en/in/durgapur/191572/air-quality-index/191572>

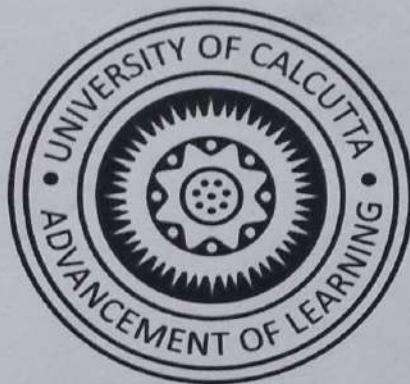
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S. S. S.  
23/06/2023

Examined By  
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23/06/2023  
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# **UNIVERSITY OF CALCUTTA**



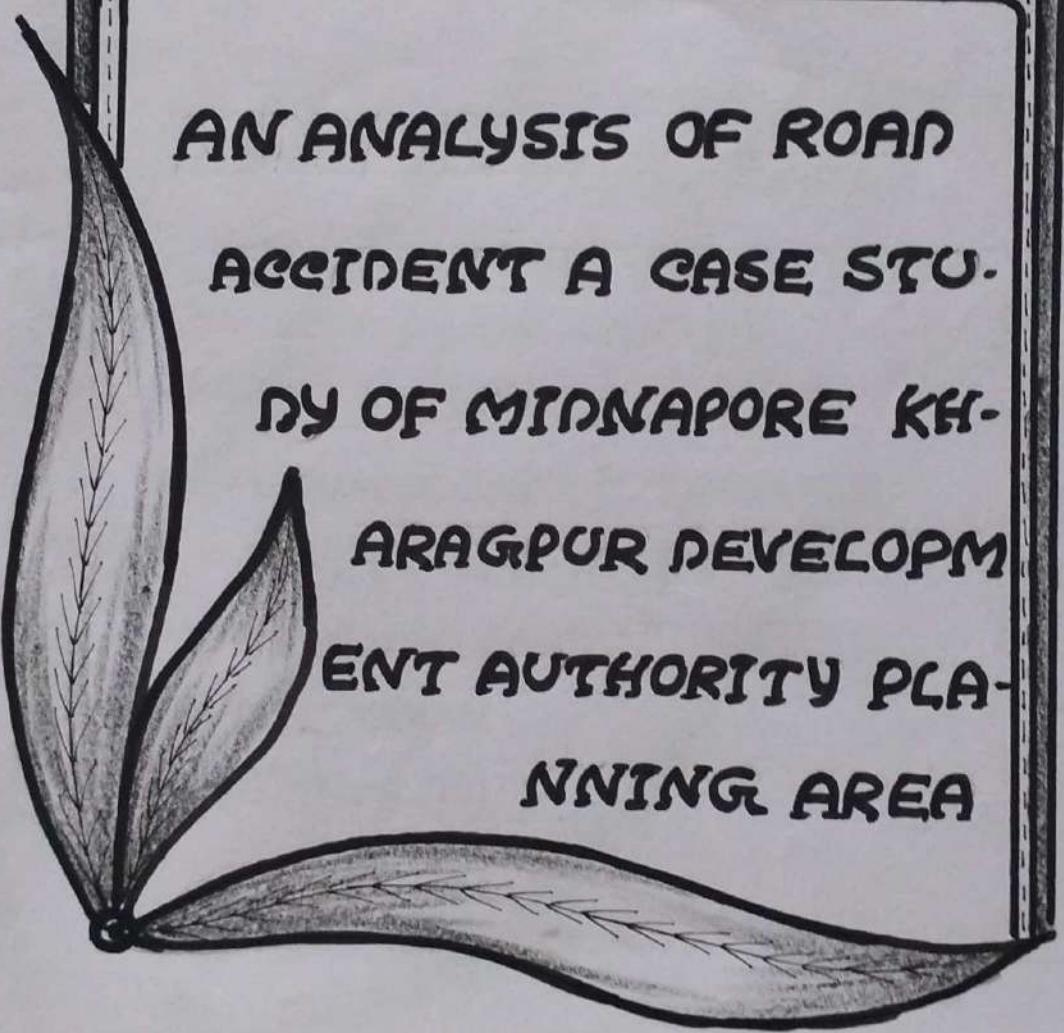
**B.SC - SEMESTER VI, GEOGRAPHY  
HONOURS PRACTICAL  
EXAMINATION 2023 CBCS  
A GROUP PROJECT REPORT ON**

**AN ANALYSIS OF ROAD ACCIDENT. A CASE  
STUDY OF MIDNAPORE KHARAGPUR  
DEVELOPMENT AUTHORITY PLANING AREA**

**PAPER: GEO- A-CC-6- 14-P**

**REG NO- 561-1211-0385-20**

**ROLL NO- : 203561-11-0019**



**AN ANALYSIS OF ROAD  
ACCIDENT A CASE STU-  
DY OF MYSORE KH-  
ARAGPUR DEVELOPM-  
ENT AUTHORITY PLA-  
NNING AREA**

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- STUDY AREA
- LITERATURE REVIEW
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- CONSEQUENCE & TRAUMA
- RESCUE AND RELIEF
- POST MANAGEMENT
- CONCLUSION
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## INTRODUCTION

The road traffic system is considered as the most complex and dangerous system with which people have to deal everyday. Road accidents are increasing day by day mainly because the place of development of transportation infrastructure is somewhat less than that of other sectors such as meal estables and industries road traffic injuries is the eighth leading causes of death of the global level. According to the WHO Global Level report on road safety 2018, India accounts for almost 11% of the accident related deaths in the world. According to the "Road Accident" in India 2015, the total number of road accident increased by 25% from 2014 to 2015. Road accident injuries have also increased by 1.4% from 2014 to 2015. According to "Road Accident" in India 2018, West Bengal ranked at 11th in the countries for total Road Accidents. Geographic Information System has made a noticeable impact in detecting road accident hot spots. Spatial attributes combined with statistical analysis presents a superior way to understand traffic accidents. In the results the reason of accident is vehicle over speed, faults of driven, climate condition, bad over talking and improper highway design. They define the black spot zone yearly, monthly, vehicle type and accident type wise. This study express the that proper traffic management is required for future.

## STUDY AREA

Midnapore and Kharagpur Development Authority has two major parts. One is Midnapore town and the other is Kharagpur town. The congestion is a common problem in this place of daily life. The infrastructure such as proper signaling, maintenance and enlargement of the road is a matter of concern compared to the growing population of this place. Besides, illegal stalls are rapidly growing up beside the road, which has made the daily transportation very complicated. In the same way, the number of automobiles that are primarily responsible for congestion is overgrowing here. In the Midnapore Kharagpur Development Authority planning area, there are many conjunction points of the different roads where the traffic signal is not available and sometimes it doesn't work correctly, on the other hand reckless driving and breaking traffic rules is a noticeable incident, which has made the accident prone road zone.

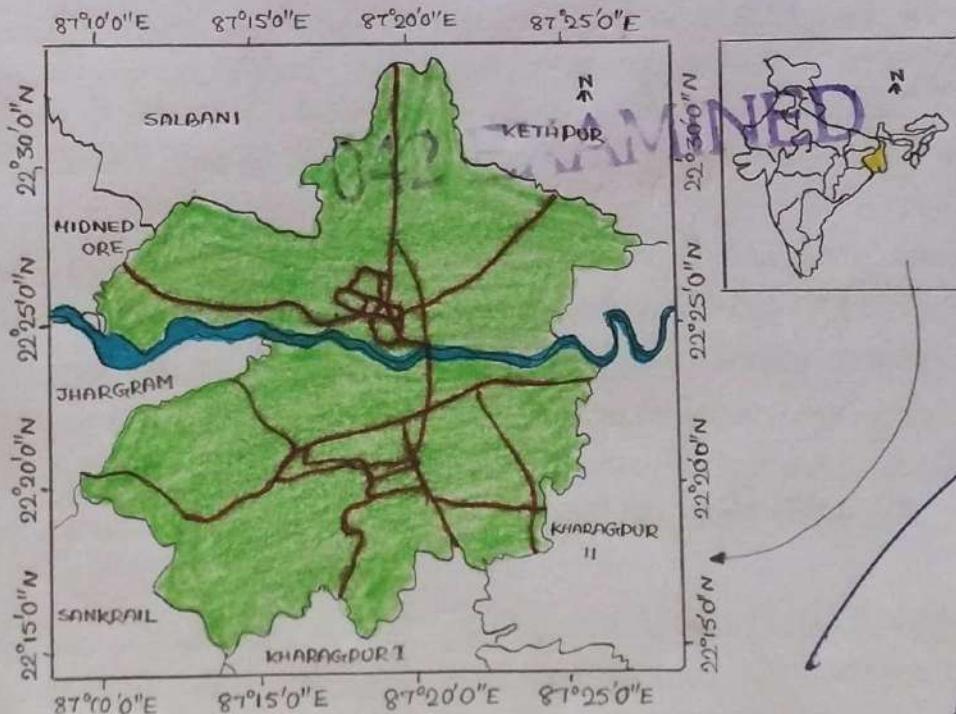


FIG.1 : LOCATION MAP OF THE STUDY AREA

## LITERATURE REVIEW

Yannis T.H (2014) was presented A Review of the Effect of Traffic and Weather characteristics on Road study. Despite the existence of generally mixed evidence on the effect of traffic parameters, a few patterns can be observed. For instance, traffic flow seems to have a non linear relationship with accident rates, even though some studies suggested linear relationship with accident. Regarding weather effects, the effect of precipitation is quite consistent and leads generally to increased accident frequency but does not seem to have consistent effect on severity. The impact of other weather parameters on safety, such as visibility, the increasing use of real time data not only make easier to identify the safety impact of traffic and weather characteristics. The more systematic use of real time data may address several of the research gaps identified in the research.

K. Meshram and El.S Goliya (2013) were presented an analysis of accidents on small portion NH3 from Dandia to Dhamrod. The data analysis is collected for the period of 2009 to September 2011. Only accident occurred in Manipur region by faulty road geometry. The trend of accidents occurring in urban portion is more than 35% to total accident in each year. This may due to high speed and more vehicular traffic in the present study area the frequency of total accident are 2 in a week and 6 for minor accident in a week, more number of accidents observe in 6 p.m to 8 p.m. At Rajendra Nagar from 2000 onwards the traffic is reduced due to the construction of by passes in that area.

R.R. Dince-A venmanagras (2011) was presented Random parameter models for accident prediction on two lane undivided highways in India based on three years of accident history, from nearly 200 km highway segment is used to calibrate and validate the models, motorized two wheelers and trucks in traffic. They have concluded with a discussion on modeling result and the limitation of the present study.

Rakesh Mehra and Pradeep Kumar Agarwal (2013) were highlighted the deficiencies in the present state of the art and also presents some basic concepts so that systematic Approach for formulation of a road safety improvement program in India can be developed.

The study presents basic concept to develop an accident record. It is expected that this study will provide a systematic approach for development of road safety improvement program in India and thus pave the way for improving safety on Indian roads.

Amit G. Ghods et.al (2012) differential speed strategies increased the number and rate of car-truck overtakes over the range of volumes considered in this analysis. This suggests a negative effect on safety resulting from differential speed strategy applied to two lane rural highways. On a positive side DSL and MSL strategies have reduced the number of car overtakes of different volumes hence increasing safety. No significant effect was observed concerning differential speed control strategies and both average TTC and P700. The effect on TTC was due to volume, highest TTC for cars and car-truck interactions of very low volumes, decreasing to a minimum in the range between 500 up to 800 VPH low volumes and increasing slightly thereafter. This indicator suggests the highest road on risk is experienced in the mid volume region. The average speed of traffic decreases in a monotonous fashion with volume with differential speed strategies indicating a downward shift in this relationship.

Michael Williamson and Huago Zhou (2012) were developing contribution factors for crash prediction models in the new highways safety manual for rural two lane roadways in Illinois. The crash prediction models so called Safety performance functions in the HSM were developed using data from multiple states therefore the models must be calibrated to account for local factors such as weather, road way conditions and drivers characteristics. It is recommended that local SPF be developed and compared to the HSM SPF when evaluating the safety of a road ways.

E.S. Park et al (2012) studies the safety effect of wider edge lines was examined by analyzing crash frequency data for road segment with and without wider edge lines. The

data from three states, Kansas, Michigan and Illinois have been analyzed. Because of different nature of data from each state a different statistical analysis approach was employed for each state: an empirical Bayes Before after analysis of Kansas data an interrupted time series design and generalized linear segmented regression analysis of Michigan data, and a cross sectional analysis of Illinois data. The consistent findings lend support to the positive safety effects of widened edge lines installed on rural, two lane highway ways. Although the magnitudes of crash reductions were somewhat different from state to state the results points in the same directions.

## WHEN HAPPENED

Road Accident data collected from Paschim Medinipur, Kotwali police Station from 2016 to 2019.

## CAUSES OF ROAD ACCIDENT

Road accident is most unwanted thing to happen to a road user though they happen quite often. The most unfortunate thing is that we don't learn from our mistakes on road. Most of the road users are quite well aware of the general rules and safety measures while using roads but it is only the laxity on part of road users, which cause accidents and crashes. Main cause of accidents and crashes are due to human errors. We are elaborating some of the common behaviours of humans which results in accident.

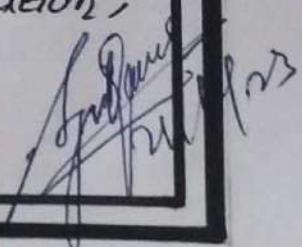
1. Over Speeding
2. Drunken driving
3. Distraction to Driver
4. Red light jumping
5. Avoiding Safety Goods like seat belt and helmets
6. Non adherence to law driving and overtaking in a wrong manner.

### OVER SPEEDING :

Most of the fatal accidents occur due to over speeding. It is a natural psyche of humans to excel if given to a chance man is seen to achieve inflity in speed. Increase in speed multiplies the risk of accident and severity of injury during accident. The ability to judge the forthcoming events also gets reduced while driving at faster speed which causes errors in judgement and finally a crash.

### DRUNKEN DRIVING :

Consumption of alcohol to celebrate any occasion is common. But when mixed with driving it turns celebration into a misfortune. All these factors while driving cause accidents and many a times it proves fatal. Apart from alcohol many drugs, medicines also effects the skills and concentration, the risk of accident doubles.



### DISTRACTION TO DRIVER :

Though distraction while driving could be minor but it can cause major accidents. Distraction could be outside or inside the vehicle. This division of brain hampers reaction time and ability of judgement. Some of the distractions on road are : 1. Adjusting mirrors while driving 2. Radio in vehicle 3. Animals on the road 4. Banners and billboards.

### RED LIGHT JUMPING :

It is a common sight at road intersections that vehicles cross without caring for the light. It has also been seen that the red light jumper crosses the intersection with greater speed to avoid crash and challan but it hampers his ability to judge the ongoing traffic and quite often crashes.

## CONSEQUENCES & TRAUMA

Road accidents can have devastating effects on individuals families and communities.

**Physical Injuries :** From minor cuts and bruises to severe injuries such as broken bones, spinal cord injuries, traumatic brain injuries and amputations. These injuries can impact a person's health and well-being leading to long term disabilities and reduced mobility.

**Loss of Life :** Losing a loved one in a road accident can profoundly impact family members friends and communities. The emotional and psychological toll can be significant and grieving can take a long time.

**Financial Burden :** Victims may face medical bills, property damage and lost wages which can add up quickly. In some cases victims may also face legal fees and other expenses related to their accident.

**Disability and Reduced Mobility :** Disabilities can be temporary or permanent and require ongoing medical treatment and rehabilitation. This can be costly, time consuming and impact a person's mental health and well-being.

**Social and Economic Impact :** Road accidents can also have a broader social and economic impact, affecting communities and entire countries. The cost of medical care, lost productivity, property damage can be staggering and the impact on families and individuals can lead to increased reliance on social services and support programs. Governments and communities need to invest in road safety initiatives.

## **TRAUMA**

Survivors may experience shock, anxiety, depression and post-traumatic stress disorder and struggle with guilt, anger and fear. It can also impact a person's relationships and social interactions, leading to isolation and further mental health problems.

## ROAD ACCIDENT OF MIRzapur RHRAGPUR DEVELOPMENT AUTHORITY PLANNING AREA

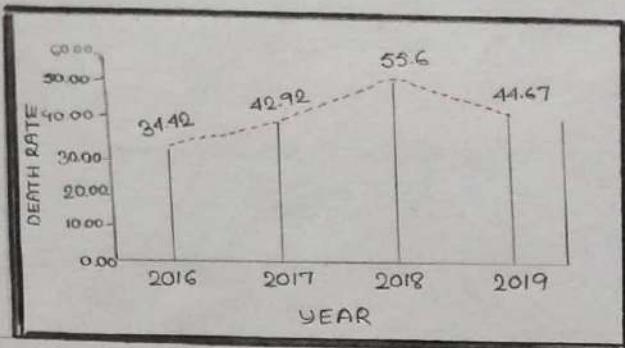


FIG 2 : DEATH RATE OF THE STUDY AREA

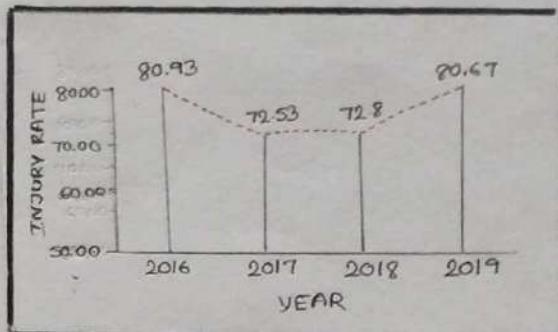


FIG 3 : INJURY RATE OF THE STUDY AREA

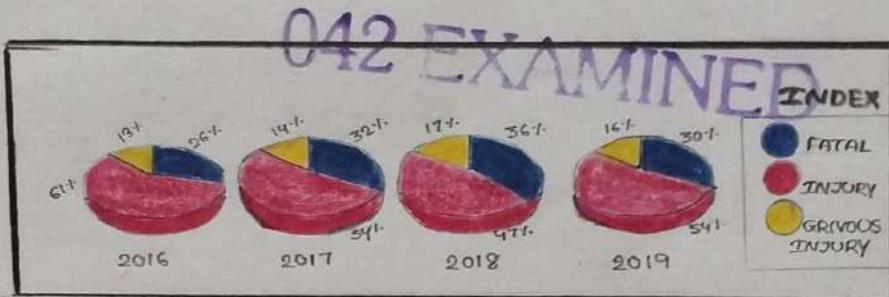


FIG 4 : ACCIDENT BASED IN VICTIMS CONDITIONS

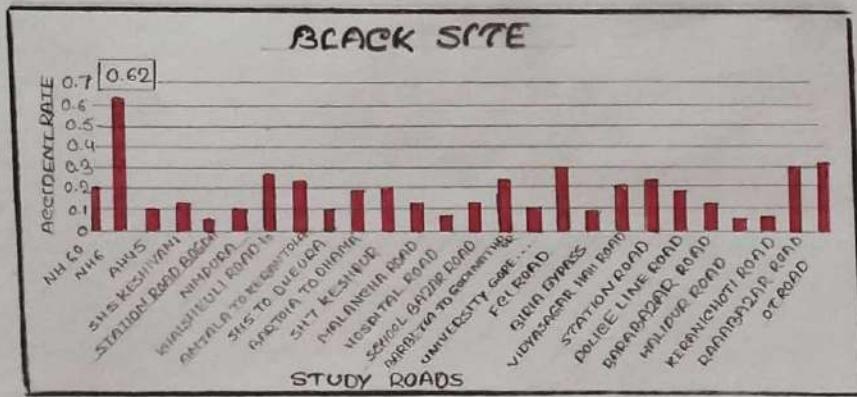


FIG 5 : BLACK SITE RATE OF THE STUDY ROADS

*Jitendra*  
2018/23

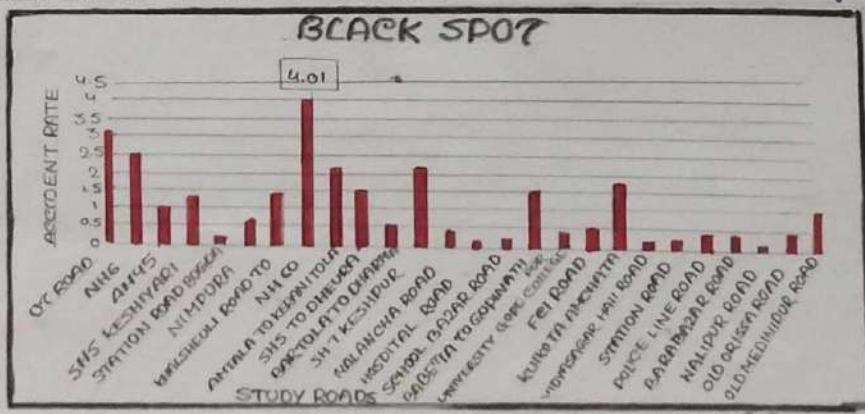


FIG 6 : BLACK SPOT RATE OF THE STUDY ROADS

## RESCUE AND RELIEF

Rescue and relief response is the second phase of disorders management where aim evacuation, transportation of survivors, search and rescue, emergency medical services and damage restoration of infrastructure is required. We are going to look at each of these life saving step that can help a road accident victim.

- Arriving at the accident scene

When you come across a road accident, the first thing you need to know is whether the scene is safe to enter and accessible before attempting to render first aid. This is to ensure your safety first before helping the car.

- Check for Injuries

If you have been injured in the accident check yourself first for any injuries or bleeding. If others are injured assess the extent of their injuries. Look for any bleeding in the head, neck, arms, legs, abdomen and other parts of the body.

- Call Ambulance Services

Immediately call for an emergency ambulance or emergency medical services to inform them about the incident ask their advice to resuscitate and rush the victim to the nearest medical facility.

- Check for obstructions in the mouth or throat

If the victim has stopped breathing check his mouth for any obstruction. Use your index and middle fingers to remove the obstruction and to clean the airway.

- Perform Life-saving techniques

If there is no pulse and the victim is unresponsive and not breathing perform CPR immediately.

ly. Place the victim's body in the recovery position keep the neck straight then proceed with CPR.

- **Treat bleeding wounds**

A clean cloth or soft Pad can stop bleeding by applying continuous pressure to the open wound. Press down with your palms and treat the fracture.

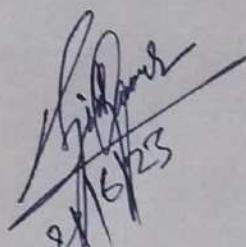
- **Dealing with spinal injuries** ~~Call 911~~ always suspect spinal injuries

Neck and spinal injuries are expected in a road accident. If the victim is unconscious or the neck is not normally placed, it's best not to move the victim unless there is immediate danger. Rough had handling or moving the victim with suspected neck and spinal injuries can cause more harm.

- **Keep the victim warm**

Victims feel excessive cold after the accident due to shock. Therefore, keeping them warm is crucial for their survival. Use a jacket, a pullover, or what ever is available on the scene.

To prevent the incident of road accidents in the country, we need to know how to deal with road traffic accidents. Attend a first aid course to learn the basis of first aid. Learn how to save lives with simple skills that you can learn in just a few hours.



A handwritten signature in black ink, appearing to read "Rishabh" followed by a date "21/6/23".

# ROAD ACCIDENT



BUS ACCIDENT



BUS ACCIDENT



RESCUE



ALCOHOL TESTING



CAR-TAXI ACCIDENT



TRUCK-BIKE ACCIDENT

## POST MANAGEMENT

Post management of road accident response should be enhanced and health and other agencies should be ensured to provide appropriate emergency treatment and long term rehabilitation accident victims.

1. Ensure pre hospital care produces, including removing the injured persons from the vehicle after an accident and calling the national emergency services telephone no 112 or calling and ambulance first observe and see where the person has pain - neck, head, legs, whether the physical condition of the person is worse, whether the person can breathe etc.

2. Quality of care should be ensured by improving hospital trauma care systems and implementing good practices on trauma care systems and quality assurance.

3. The united nation has announced a uniform formula of 5 pillars to prevent road accidents to world decide. The 5 pillars are - A) Road Safety Management B) Risk Free Vehicles C) Conscious Road-users D) Post Road accident Action and E) Ensuring appropriate driving Environment.

4. The importance of the "Golden Hour" in giving a adequate treatment to the accident victim in saving the injured should be highlighted to both the health personal and the community.

5. The road transport ministry will create a fund to provide immediate hospitalisation expenses to road crash victims to ensure no one is deprived of medical care for want of money or attendant.

## CONCLUSION

The study was an attempt to find out the most vulnerable accident locations in the Midnapore kharagpur Development Authority planning area using GIS techniques. A total of twenty six roads were selected for the study, in which national highway, state highway, and districts road are included. The Black spot analysis method was used to find the accident locations. Based on the analysis, national highway six (NH 6) and sixty (NH-60) were identified as the most vulnerable accident locations. From 2016 to 2019 out of a total of 848 accidents, 318 incidents have happened between the two roads. The highest black spot was found at National Highway sixty (NH-60), where 83 events happened at the same road parts in the period of 2016-2019. The black spot vulnerable value of this road is 4.01. The method is considered to be useful in identifying the black spots from sufficient secondary data. In addition to this study, we used kernel density to find out the accident density. From 2016 to 2019, highest density has been found in the western part of Midnapore town, where NH-60 passes through. In this study, we also found another high density where NH-6 passes, but from 2016 to 2019, this accident density decreasing slowly. The low density was found in the rest of the study area.



A handwritten signature in black ink, appearing to read "Biju" or "Biju Dey". Below the signature, the date "21/07/23" is written vertically.

# APPENDIX

TABLE 1 : The Number of traffic accidents within MKDA planning Area

YEAR	OCCUREN CES	VICTIMS (PERSONS)		
		FATAL	INJURY	GRIEVOUS INJURY
2016	215	74	174	38
2017	233	100	169	45
2018	250	139	182	63
2019	150	67	121	36

TABLE 2 : The Number of death Rate

YEAR	DEATH RATES
2016	34.42
2017	42.92
2018	55.6
2019	44.67

TABLE 4 : The number of accident rate (Black site)

PLACE	ACCIDENT RATE
NH60	0.2
NH6	0.62
AH45	0.1
SH5 Keshiyamri	0.12
station Road Bogda	0.05
Nimpurna	0.1
Khalsheuli Road to	0.25
Amatala to kenanilola	0.22
SH5 to Dheuna	0.1
Amatala to Dharmma	0.19
SH7 Keshpurn	0.9
Malancha Road	0.11
Hospital Road	0.08
School Bazar Road	0.12
Benbatia to Gopinathpur	0.22
University Gope	0.1
FCI Road	0.3
Binla bypass	0.9
Vidyasagar Hall Road	0.1
station Road	0.11
Police Line Road	0.9
Banabazar Road	0.11
Nalipur Road	0.05
kenanibhatt Road	0.07
Rajabazar Road	0.29
at Road	0.31

TABLE 3 : The number of Injury Rate

YEAR	INJURY RATES
2016	80.93
2017	72.53
2018	92.8
2019	80.67

TABLE 5 : The number of Accident Rate (Black spot)

PLACE	ACCIDENT RATE
OT Road	3.2
NH6	2.5
AH45	1
SH5 keshiyamri	1.3
station Road Mogda	0.2
Nimpurna	0.6
khalsheuli Road to	1.4
NH 60	4.01
Amatala to kenanilola	2.1
SH5 to Dheuna	1.5
Amatala to Dharmma	0.5
SH7 keshpurn	2.1
Malancha Road	0.4
Hospital Road	0.1
School Bazar Road	0.2
Benbatia to Gopinathpur	1.5
University Gope college	0.4
FCI Road	0.5
Kulikola Amchata	1.7
Vidyasagar Hall Road	0.2
station Road	0.3
Police Line Road	0.4
Banabazar Road	0.4
Nalipur Road	0.1
Old Omessa Road	0.4
old medium road	1.2

13  
13

## REFERENCE

1. Abd Kudus and Zaini 1998, Analisa kecelakaan Lalu lintas Di propinsi Riau (studi kasus pada Ruas Jalan Rimbo Ranjang Bangkiang) Unpublished report, pp. 7-12.
2. Chainey. S. Ratcliffe. J. 2013. GIS and crime mapping John wiley & Sons. USA. 442D.
3. Sun Y ; Chang .H ; Miao .Z .; Zhang .D.12 Solution method of overtopping risk model for earth dams, Safety Science 50(9): 1960 - 1972
4. Anderson, T. k 2009, kernel density estimation and K means clustering to profile road accident hotspots, Accident analysis & prevention 41(3) : 359-364
5. Sketch of kernel Density Method which is Employed in Gis processing for this research Source : (Bailey and Goadnell 1995).
6. K.D.J and Ganesh Kumar, B (2010) Identification of Accident Hot Spots : A Gis Implementation for Kannur District, Kerala (1) pp . 51-59.
7. Hombungen, Carsten. E.C. 1978 Introduction of Transportation, Engineering, Preston, publishing company Inc, Virginia, USA pp - 13-15.
8. Puslikat Penhubungan Darat 1998, Penhubungan Darat dalam Angka 2011, Land transportation in Figure, 2011, kementerian Penhubungan Direktorat Jendral Penhubungan Darat Jakarta, pp 10-1.
9. Fotheringham, A.s ; Brunswik C ; Charlton M. 2000 . Quantitative Geography: perspectives on spatial Data Analysis SAGE publications . England 267 p.
10. Anchan. S.S., Basaranaja. N.H and Rohit H.G. (2018) Identification and Analysis of Accident Black spots along the Selected stretches of NH 75 Using Remote Sensing & Gis Technology (October 2015).
11. <https://www.ignte.org/wp-content/uploads/Vgiz/B3B1079220.pdf>.

12. [https://www.academia.edu/33913945/Lite\\_nature\\_Review\\_on\\_Road\\_Accidents\\_Analysis\\_a\\_case\\_study\\_on\\_Dahod\\_to\\_Jhalod\\_Section\\_of\\_N.H-113](https://www.academia.edu/33913945/Lite_nature_Review_on_Road_Accidents_Analysis_a_case_study_on_Dahod_to_Jhalod_Section_of_N.H-113)

13. [https://Jhatnansport.gov.in/causes\\_of\\_road\\_accidents.html](https://Jhatnansport.gov.in/causes_of_road_accidents.html).

14. [https://www.hseblog.com/effects\\_of\\_road\\_accidents](https://www.hseblog.com/effects_of_road_accidents).

15. [https://brisbanefirstaidcourses.com.au/blog/first\\_aid\\_for\\_road-accident\\_victims](https://brisbanefirstaidcourses.com.au/blog/first_aid_for_road-accident_victims).

16. <https://Sokaler.alo.com/online-portal/news-show/926/8>

B. Dudge.

UNIVERSITY OF CALCUTTA



B.A / B.Sc. Semester VI  
Geography Honours Practical  
Examination, 2023 CBCS

A GROUP PROJECT REPORT

ON  
THE IMPACT OF CYCLONE  
AILA ON INDIAN SUNDARBAN

**PAPER : GEO-A-CC-6-14-P**

**REGISTRATION NO. : 561-1112-0392-20**

**ROLL NO. : 203561-21-0013**

THE IMPACT OF CYCLONE  
AILA ON  
INDIAN SUNDARBAN

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13.	Reference
14.	Appendix

INTRODUCTION : Natural disasters can happen at any place at any time. The disaster that hit various parts of the world depends on the climatic conditions of a place. Cyclone are one of the natural hazards that affect India almost every year causing large loss of lives and properties. Hazards associated with tropical cyclones are long duration rotatory high velocity winds, very heavy rain and storm tide. India has a coastline of about 7576 km of which 5400 km is along the mainland. The entire coast is affected by cyclones with varying frequency and intensity. Although the North India Ocean generates only about 7% of the total cyclone their impact is comparative high and devastating, especially when they strike the coasts bordering the North Bay of Bengal.

Four States (Tamil Nadu, Andhra Pradesh, Orissa and West Bengal) and one union territories Puducherry on the east coast and one state Gujarat on the west coast are more vulnerable to cyclone hazards. Among them Sundarbans in W.B is one of the hazard prone zones in India so, I have selected this zone on my study area.

The Indian Sundarbans has witnessed many major tropical cyclones that caused extensive damage to the area. Some of the more destructive of these occurred in 1833, 1864, 1942, 1976, 1988 and 2009.

The severe tropical cyclone Aila struck on 25 May 2009, causing most widespread inundation of the area in living memory. Aila made its landfall in the West Bengal coast at Sagar Island between 1:30 and 2:30 pm India Standard Time (IST).

OBJECTIVES : The objectives of this project are

- \* To find out piled affected zone in Indian Sundarbans.
- \* To analyse the impact of severe cyclone Aila in Sundarbans area.
- \* To identify highly effected areas.
- \* To focussed on disaster preparedness with emphasis on mitigation major measures.
- \* To Review the impact of this cyclone on the environment and socio-economic condition.

METHODOLOGY: The study is based on secondary data which has been collected from several publications in different journal and website. After collecting data, we analysed the data and represents by different maps and diagrams.

STUDY AREA: Aila is one of the important and vulnerable cyclones, which occurred on May 25, 2009 at around 12 noon. The storm badly affected four districts of West Bengal normally South 24 Parganas, North 24 Parganas, Howrah and Kolkata. Sundarbans were very badly affected by this cyclone, the main aim of this paper is to discuss the effect of Aila on Sundarbans. It is mangrove area in the delta formed by the confluence of the Ganges, Brahmaputra and Meghna rivers in the Bay of Bengal.



LITERATURE REVIEW: The Aila cyclone of 2009 was a severe tropical storm that struck the Indian states of West Bengal. Several studies have been conducted on the impact of the Aila cyclone in West Bengal, focusing on different aspects of the disaster. A literature review of some of the studies on the Aila cyclone in West Bengal is presented below.

\* "Assessment of post cyclone Aila agricultural damage in Sundarbans, West Bengal, India" by Biswas (2013) assessed the damage caused by the Aila cyclone to agricultural lands in the Sundarbans region of West Bengal.

\* "Cyclone Aila and its aftermath: a study of the Sundarbans" by Ghosh (2010) examined the impact of the Aila cyclone on the Sundarbans region of West Bengal, focusing on the social and

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economic implications of the disaster.

- \* "Cyclone Aila and the Sundarbans: from disaster to recovery" by Shaw and Mallick (2011) this study analysed the responses of the government and non-government organizations to the Aila cyclone in the Sundarbans region of West Bengal.
- \* "Aila cyclone and women's vulnerability in coastal West Bengal, India" by Datta (2010) focused on the gender-specific impact of the Aila cyclone on women in the coastal areas of West Bengal.
- \* "Cyclone Aila and its impact on the economy of the Sundarbans" by Dasgupta (2011) examined the impact of the Aila cyclone on the economy of the Sundarbans region of West Bengal.

**CASE STUDY:** Severe cyclone Aila hits the coastal part of West Bengal particularly Sundarbans at around 14 hours on 25 May, 2009. Cyclone Aila struck the Sagar Island, at around 12 noon, with wind reaching 120-140 km per hour accompanied by torrential rain of about 400 mm. The storm badly affected four districts of West Bengal, namely South 24 Parganas, North 24 Parganas, Howrah and Kolkata. Many blocks in Sundarbans were severely affected by Aila. The major rivers like Matla, Hoogly, Rupnarayan, Damodar, Haldi and Brahmaputra were flooded and about 500 km embankments on the village side were washed out and have caused large scale flooding, leaving lakhs of people marooned in the area. The field camps were under 12 to 15 feet of water for around 12 hours and waterlogging was for almost a week, resulting in soil erosion and huge damage to mud houses, particularly in the Matla river Bank.

Saltwater gushed in through breaches in the river dykes and inundated houses and lands. Almost 60% of the area in these

PATH OF CYCLONE AILA



SOURCE - IMD REPORT

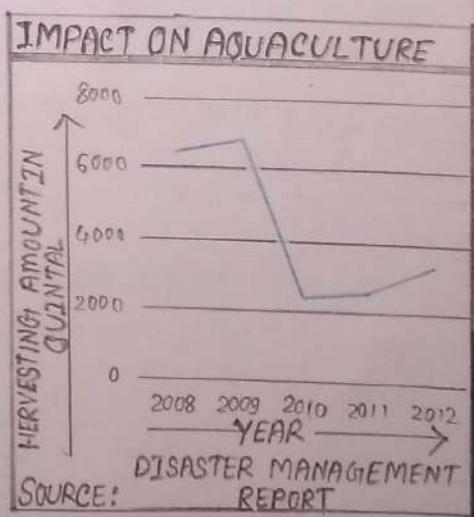
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2 districts has been rendered uncultivable and not suitable for making seedbed. It is caused a havoc in 5 Blocks (Sandeshkhali-I, II, minakhan, Hasnabad and Hingalganj) of North 24 Parganas. In Canning II about 1300 bighas of land was under saline water. In South 24 Parganas all the 13 Blocks were affected by the saline water. In Sandeshkhali I and II and Hingalganj blocks about 70-80 poultry farms got completely shattered.

Formed	May 25, 2009
Dissipated	May 27, 2009
Highest winds	3 minutes Sustained : 110 km/h (70 mph)
Lowest pressure	1 minutes Sustained : 120 km/h (75 mph) 968 hPa (mba); 28.59 in Hg

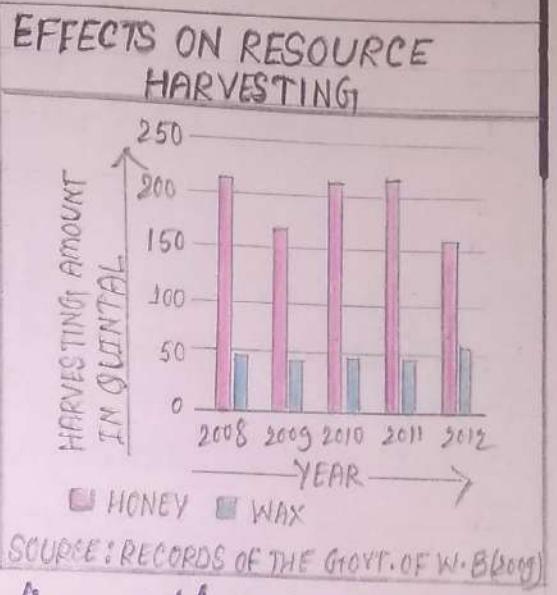
IMPACT : Cyclone Aila was a category 1 cyclone that struck the coastal regions of India on May 25, 2009. The impact of cyclone Aila was devastating and the region is still recovering from the damage caused by the storm.

IMPACT ON AQUACULTURE : Aquaculture is one of the important primary activities in Sundarbans. Most of the villagers in different blocks of Sundarbans are dependent on this aquaculture, which were drastically destroyed by Aila. It destroyed most of the aquaculture ponds in Sundarbans area. Change in fish collection in this area over time period 2005 to 2013. The total aquaculture area was 288 hectares in 1990 and 2163 hectares in 2005, it increases to 6471 hectares in 2008. But this aquaculture area was drastically reduced to 2312 hectares after Aila. (Draw Line Diagram)



## CHANGE IN RESOURCE HARVESTING: Sundarbans Forest ecosystem

owns huge natural resources. Livelihood of large number of people living surrounding the forest depends on this ecosystem of Sundarbans. According to forest resource harvesting inventory, main resource of Sundarbans are honey and wax. Cyclone Aila caused different impacts on different ecosystem services. The impact of Aila on honey and wax harvesting reduced day by day. Honey collection in Sundarbans found lowest in the sequence from 2008 to 2013. Deterioration of honey production might be due to super cyclone Aila. Honey harvesting increase again after 2013. (compound bar).



SOURCE: RECORDS OF THE GOVT. OF W. BENGAL

## TIMBER COLLECTION: Besides agriculture and aquaculture, timber collection is one of the important primary activities in Sundarbans. The villagers of this area collected the timber from the forest like Guran, Giura and Sundam. After the Aila the state government as well as local government strictly prohibited the cut down of trees specially Giura, which decrease the trends of timber collection of Giura after 2009.

## IMPACT ON AGRICULTURE: When Aila roared through Bengal in May 2009, agnaniyan communities in low-lying Sundarbans lost all standing crops, overnight, to the tropical cyclone. It has been a decade since cyclone Aila roared the Bay of Bengal. But paddy farmers Tapan mandaal is trying to grow legumes and watermelon in the still recovering soil of the Sundarbans. In the aftermath of Aila,

Agriculture fields in the Sundarbans clay marooned in salt water as flood waters had gushed in, breaching embankments. For the next few months, water stagnated in the low lying field, raising up salinity and rendering farms unproductive or the total agriculture land affected by Aila, 21.65% were effected in North 24 Parganas and 26.93% land were affected in South 24 Parganas, so 48.58% of the total affected agriculture land fall in the Sundarbans area.

### CHANGES IN WATER QUALITY:

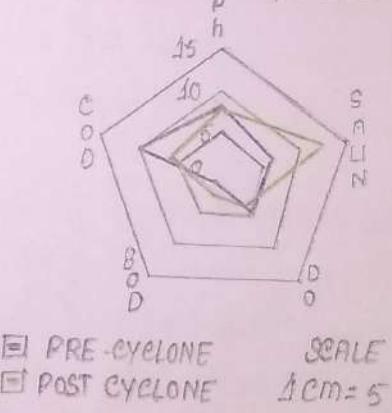
Aila induced water quality changes in Sundarbans. Post Aila period the different components in water became changed which affect the water quality. In pre & post period the main concentration of

nitrate was 22.68 microgram atom per litre which increases upto 28.52 microgram atom per litre during post Aila period. Increased the concentration of phosphate in water up to three times than the previous concentration.

During post Aila period like nitrate and phosphate the others component like pH, salinity, BOD, COD also changed. (star diagram) During the

cyclonic storm the major tidal rivers and Sundarbans had undergone a temporary phase of this equilibrium in terms of sediment accumulation and erosion process. The turbidity of water increase because of sudden impact of the tide associated with high wave.

CHANGES OF WATER QUALITY



■ PRE-CYCONE      SCALE  
■ POST CYCONE      1cm = 5

SOURCE: W.B.GOVT. REPORT

### IMPACT OF BIO-DIVERSITY:

The Sundarbans, a region which houses 265 of the endangered Bengal tigers, was inundated with 6.1m of water. Dozens of the tigers are feared to have drowned in Aila storm surge along with deer and crocodiles. As of 27 May 2009, one

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tiger has been found alive; it was found in a waterlogged cowshed following the cyclone's landfall. Additionally, the forest remains under an estimated 2.4 m of water. On 27 May, conservationists have begun a search for the tigers throughout the forest.

According to the 2011 tiger census, the Sundarbans have about 270 Royal Bengal tigers. The balance in the ecosystem is often disturbed due to the cyclones. Because of large water bodies on all sides covering about 1700 km the Sundarbans area is inundated by cyclones.

INCREASE SALINITY: About 500 km embankments on the village side were washed out and have caused large scale flooding, leaving lakhs of people marooned in the area. The field campas were under 12 to 15 feet of water for around 12 hours and waterlogging was for almost a week, resulting in soil erosion and huge damage to mud houses, particularly in the Mahla river bank.

Saline water gushed in through breaches in the river dykes and inundated houses and lands. Almost 60% of the area in these 2 districts has been rendered uncultivable and not suitable for making seedbed. It has caused a havoc in 5 blocks of North 24 Parganas. In Canning II about 1300 bighas of land was under saline water. In South 24 Parganas all the 13 blocks were affected by the saline water.

SOCIO-ECONOMIC IMPACT: Approximately 920 000 houses have been damaged, the majority of them in Sundarbans. (chart)

SL NO.	PARTICULARS	EXTENT OF DAMAGES
1.	Number of villages Affected	4249
2.	Size of Affected population	25,62,442
3.	Number of people missing	8000

## AFTERMATH OF CYCLONE AILA



Impact Aila



High Tide during Aila



House Collapsed



Going To Relief Centre



Aftermath of Aila

SL NO.	PARTICULARS	EXTENT OF DAMAGES
4.	Number of Death	70
5.	Length of embankment Breached	400 Kilometers
6.	Numbers of cattle Lost	212851
7.	Total area of Agriculture Land affected	125872 hectares
8.	Estimated Financial Loss in Agriculture	Rs. 337 crores
9.	Numbers of house Partially damaged	194701
10.	Total Loss	Rs. 1495.63 crores

SOURCE : Unpublished Records of the government of West Bengal (2009 - 2010).

TRAUMA : Trauma is an immediate after the event, shock and denial are typical. Longer term reactions include unpredictable emotions, strained relationships and even physical symptoms like headaches. Many farmers became traumatized to see the destroy of their cultivated crops. In a second, presently, to hearing a news of cyclone they become anxious about their crops. A 70 years old woman, became depressed watched hopelessly as the tides washed away her mud house and cattle. During cyclone management authorities have rescue the affected people an old woman decided to stay amid the ruins of what used to be her home, perhaps due to the trauma that is so evident on faces here. many of them became hopeless to show the devastating effects of Aila. After seeing this devastating cyclone many people became stressed and traumatized. Fisherman are always anxious in this may month for the devastating effects of cyclone.

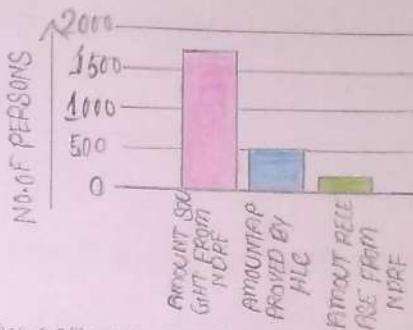
RESCUE AND RELIEF : The state government carried out rescue operations in South 24 Parganas district. chief minister Buddhadeb Bhattacharjee visited many of the affected island in the Sundarbans delta and help meetings with the District admission and Police officials at Jamnagar and nimith villages to chalk out plans

for the rescue operation.

The Sundarbans development authority has started rescue operation in different parts of the district. Komti Gionguly did the army had been called for carrying out rescue operations in different parts of Sundarbans Island.

Addressing hundreds of homeless villages at a temporary rescue camp, assured them to give compensation within next two days. Thousand of pouches of drinking water has been distributed among the cyclone victim and the state government has been distributed among the cyclone victim and the state government has also opened several community kitchens across Sundarbans region. Roughly 400 relief camps were established in West Bengal shortly after the storm passed. On 27 May, 400 forces from the national disaster response force were deployed to the state for relief operations.

### RELIEF FUND BY NDRF



SOURCE: DISASTER MANAGEMENT REPORTING

POST MANAGEMENT: Here are some of the post management were carried out in West Bengal following the cyclone -

\*RESCUE AND RELIEF OPERATIONS: The government of West Bengal launched a massive rescue and relief operation in the wake of the cyclone. The Indian Army, Navy and Air Force were deployed to assist in the rescue and relief efforts.

\*REHABILITATION EFFORTS: The government of West Bengal launched rehabilitation efforts to help the affected people rebuild their homes and livelihoods. The government provided financial assistance to the affected people to help them rebuild their homes and restart their businesses.

\*MEDICAL ASSISTANCE: The government of West Bengal also set up medical camps to provide medical assistance to the affect

ed people.

\* **DISTRIBUTION OF RELIEF MATERIALS** : The government of West Bengal distributed relief materials, such as blankets, clothes and food to the affected people.

\* **RECONSTRUCTION OF INFRASTRUCTURE** : The cyclone caused extensive damage to infrastructure, such as roads, bridges and buildings. The government of West Bengal launched reconstruction efforts to repair and rebuild the damaged infrastructure.

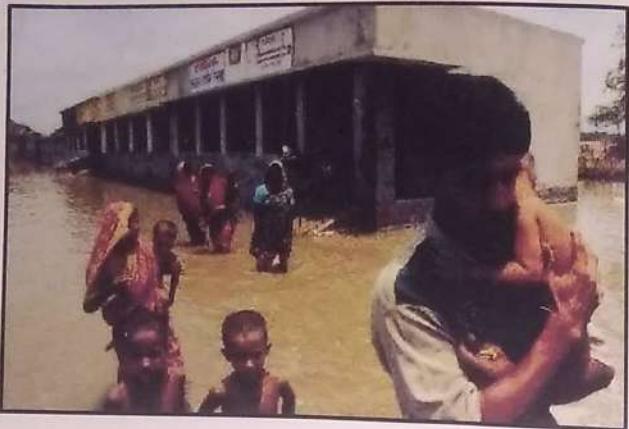
### PRE-AWARENESS :

\* **AWARENESS CAMPAIGNS** - The government of West Bengal launched awareness campaigns to educate people about the dangers of cyclones and the measures that can be taken to protect themselves. The campaigns included the dissemination of information about the cyclone through television, radio and print media.

\* **EARLY WARNING SYSTEMS** - The government of West Bengal established early warning systems to alert people about the impending cyclone. The government installed sirens in vulnerable areas to warn people about the approaching cyclone. The government also used mobile phone networks to send out alerts to people in affected areas.

\* **CAPACITY BUILDING** - The government of West Bengal also initiated efforts to build the capacity of government officials and other stakeholders to better prepare for and respond to disasters. Training programs were conducted to enhance the skills of government officials, emergency responders and other stakeholders.

# RESCUE OPERATION



Cyclone Relief Centre



Management Embankment



Satellite views of Sundarbans after Aila



Distribute essential Goods



Medical Camp

## CONCLUSION

The Aila cyclone provided several valuable lessons in disaster management, including the need for effective early warning systems, evacuation plans and emergency response mechanisms. Overall, the Aila cyclone was a tragic event, but it also provided an opportunity to learn valuable lessons and make important improvements in disaster management and response efforts. By working together, stakeholders can ensure that the people of West Bengal are better prepared and response equipped to withstand future natural disasters. The lessons learned from the Aila cyclone will be critical to building a more resilient and sustainable future for the people of West Bengal.

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## REFERENCES

1. Biswas, S. (2010). Coastal inundation due to the storm surge of tropical cyclone Aila in the southwestern coast of Bangladesh. *Natural Hazard*, 54(1), 79-92.
2. Dutta, D. (2012). Surviving the cyclone Aila: Locating Agency of Disaster Affected People in West Bengal. *Journal of Developing Societies*, 28(2), 175-198.
3. Mukherjee, S., Sengupta, K., and Das, S. (2011). The impact of Aila a study of health outcomes in the aftermath of the cyclone. *South East Asia Research*, 19(1), 73-79.
4. Das, D. (2011). Impacts of Aila on Agriculture in the India Sundarbans. *Journal of environment management*, 92(3), 648-653.
5. Dutta, A. (2010). Aila cyclone and women's vulnerability in coastal West Bengal, India. *Indian Journal of gender studies*, 17(3), 391-408.
6. Sankar, S., Chakraborty, A., and Bhattacharya, T. (2012). Aila cyclone and health consequences: experience of a medical relief team in Sundarbans Delta. *Indian Journal of community medicine*, 37(3), 201-205.
7. Dasgupta, R. (2011). Cyclone Aila and its impact on the economy management. 92(11), 2933-2939.

## APPENDIX

### 1. AQUACULTURE

YEAR	HARVESTING AMOUNT IN QUINTAL
2008	6471
2009	6842
2010	2312
2011	2545
2012	3272

### 2. RESOURCE HARVESTING

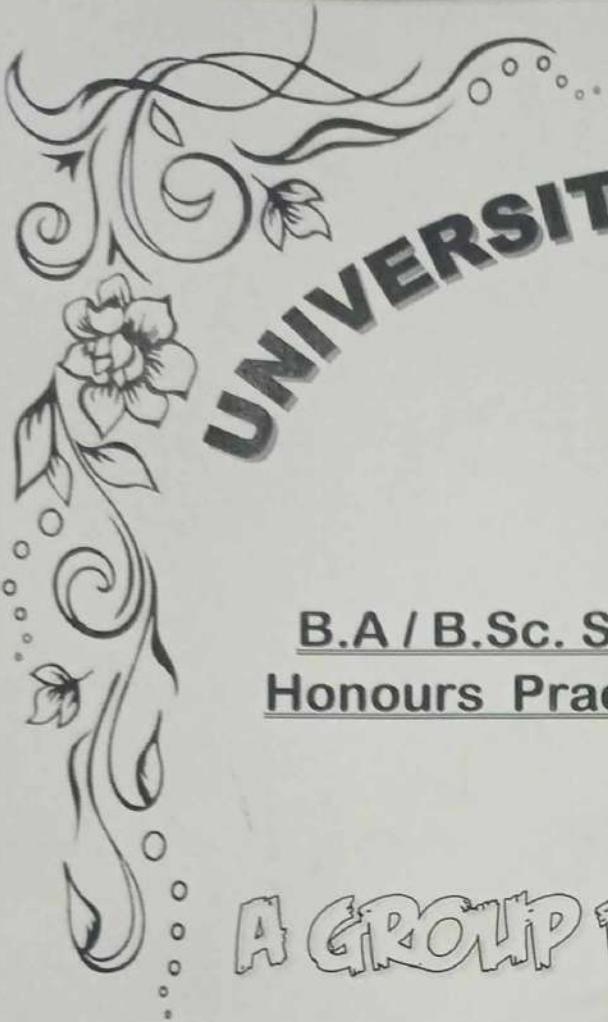
YEAR	HONEY	WAX
2008	213	50
2009	168	44
2010	213	51
2011	219	51
2012	163	63

### 3. CHANGES IN WATER QUALITY

	PH	SALINITY	DO	BOD	COD
PRE	8.3	6.6	5.6	1.1	10.4
POST	7.9	12.5	4.3	2.2	6.5

### 4. FOLLOWING CHART SHOWING THE FUND GIVEN BY DIFFERENT AUTHORITIES RS. IN CRORE

SL. NO.	STATE	AMOUNT SOUGHT FR- OM NCDF	AMOUNT APPRO- VED BY HIGH LEVEL COMMI- TTEE (HLC)	AMOUNT RELEASE FROM NCCF
1.	WEST BENGAL	1743.14	516.86	166.87



**UNIVERSITY OF CALCUTTA**



**B.A / B.Sc. Semester VI Geography  
Honours Practical Examination, 2023**  
**CBCS**

## **A GROUP PROJECT REPORT**

**ON**

**SOCIO-ECONOMIC IMPACT OF ARSENIC  
CONTAMINATION IN DIFFERENT BLOCKS OF  
MALDAH WEST BENGAL**

**PAPER : GEO-A-CC-6-14-P**

**REGISTRATION NO. : 561-1211-0383-20**  
**ROLL NO. : 203561-11-0017**



SOCIO-ECONOMIC IMPACT OF  
ARSENIC CONTAMINATION IN  
DIFFERENT BLOCKS OF MALDAH WESTBENGAL

# CONTENT

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3

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study area

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literature review

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case study

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Effect (Health effect, Economic impact,  
Environment impact, Socioimpact)

9

Trauma

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Mitigation

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Conclusion

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Reference

**Introduction** & Arsenic (As) is a ubiquitous metalloid element that ranks 20th in crustal abundance. It enters into the groundwater and food chain due to its association with rocks, sediments and soils as well as its discharge from industrial sources and the use of pesticides. It is a toxic substance with exceedingly diverse forms of poisoning. Different species of As affected well water in different degrees of toxicity of these As-3 causes the most damage (Mukherjee, A.B.). The world Health organization (WHO) ranked this calamity as "the largest poisoning of a population in history" (Smith, et. al, 2000). Arsenic contamination of groundwater is often due to naturally occurring high concentrations of arsenic in deeper levels of groundwater. It is a high-profile problem due to the use of deep tube wells for water supply in the Ganges Delta, causing serious arsenic poisoning to large numbers of people. Chronic toxicity due to drinking of arsenic contaminated groundwater is a major environmental health hazard throughout the world including India. In India occurrence of arsenic in groundwater has been reported from West Bengal, Bihar, Jharkhand, Chhattisgarh, Uttar Pradesh and Assam. Though many states have been identified with significant arsenic contamination in groundwater in India. The major affection was detected as early as 1983 in West Bengal. Significant effluent has been observed in the district of Malda, Burdwan and North and South 24th parganas. In the past several studies have been carried out in many arsenic affected districts of West Bengal but no such study has so far been done in Malda district. In this paper we have discussed about the seven arsenic affected blocks of Malda district in West Bengal.

### objectives of the study :-

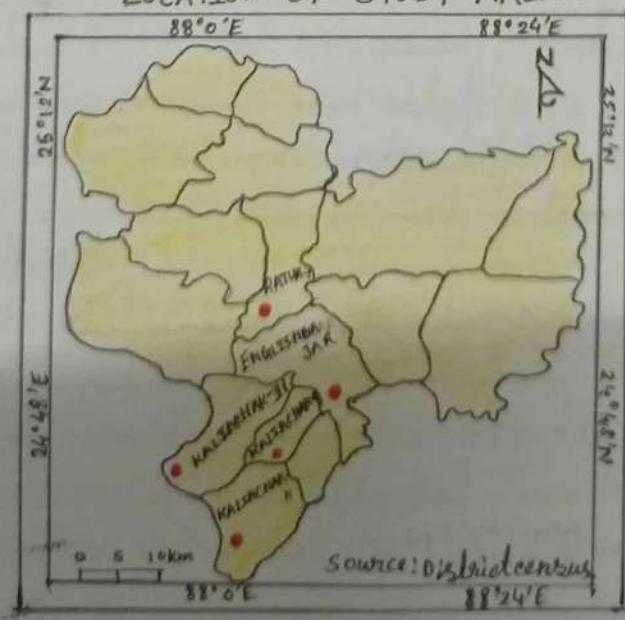
1. To Known the extent of problem in West Bengal with reference to Malda.
2. To indicate the major affected areas of Malda district.
3. To find out the causes of high incidence of arsenic in groundwater of Malda.
4. To study the extent of impact of arsenic contaminated water.
5. To focus on efforts made by the state government as well as local government to tackle the problems.
6. Lastly discuss about the people awareness and preparedness plan of arsenic contamination.

Materials and method: For preparation of this project the data have been collected from secondary sources, e.g. different Govt. Reports, Journals, Articles, Internet and West Bengal pollution control board. Factors responsible for As contaminations in water and their effects on human health have been discussed. The areas of highly contamination in groundwater in the course of the study.

Study area: Arsenic contamination of ground water in West Bengal was reported in the early eighties. Till date 1312 villages and 15 Non Municipal urban areas and urban backlogths in 65 blocks and 9 municipalities in 8 districts are reported as arsenic affected areas. These districts are Malda, Murshidabad, Nadia, North and South 24-Pargana, Howrah, Hugli and Burdwan (CPCB, 2002). In West Bengal this problem comes into focus during the mid of 1980's in few villages of North 24 Pargana, South 24-Pargana, Nadia, Murshidabad and Burdwan. By the end of 2006 this problem spreads from few villages to 3235 villages of 73 blocks of 8 districts. As contaminations is gradually spreading and the affected area are increasing.

out of 19 district in 8 district of West Bengal covering area of about 34000 sq. km with a population 30 million. According to WHO permissible limit of Arsenic in ground water is 1 mg/l. But from 2003 Bureau of India Standards (BISI) has also revised the limit of arsenic in drinking water from 0.05 to 1.0 mg/l. Above 8 districts are come into this limit. Malda is one of the major arsenic affected region in West Bengal. So we have selected this Malda district as our project study area.

LOCATION OF STUDY AREA



Literature Review : For this project we have reviewed the following literature related to arsenic contamination.

- Bidyut Kumar Santra started about the arsenic contamination of ground water in west Bengal with its impact on social and health condition of the people in his paper 'Arsenic contamination of ground water in west Bengal'.
- A.K. Sing analysed the causes and consequences of arsenic contamination in ganga Brahmaputra river basin in his paper 'Chemistry of arsenic in ground water of ganga Brahmaputra River Basin'.
- The report on Arsenic contamination statistics published of Ministry of Jalshakti. in Delhi (Dec, 2022).
- Debendranath guha and Aloka Kumar gosh have described the causes and scenario of arsenic contamination in Malda with its mitigation measures in there paper 'Arsenic contamination in Malda . WB'.

Case study :-

Major Arsenic affected area of malda District:-

The affected blocks 1. Kalichak -I : It is a high populated block of Malda district. Total 66 Mouza come under this block. 352,181 people live in 325 habitation.

2. Kaliachak -II :- 67 Mouzas are present under Kaliachak -II , 275,845 people are live in 146 villages. Kaliachak -II is highly affected by arsenic. 60% area of this zone are come under highly arsenic affected zone.

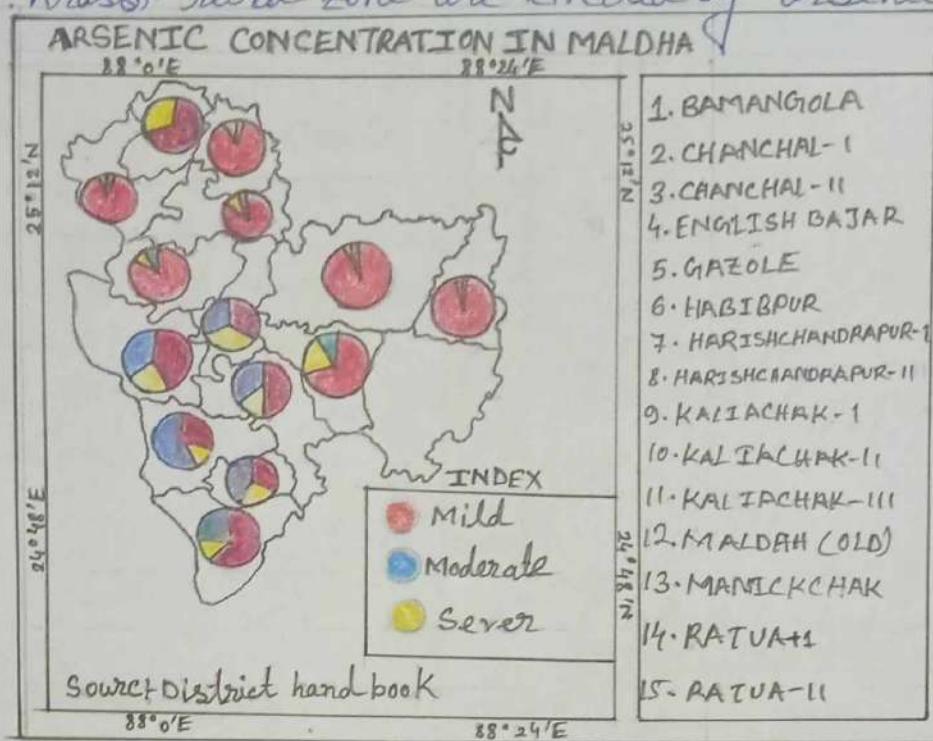
3. Kaliachak -III : 46 Mouzas are present under Kaliachak -III . 269,097 people are live in 88 villages.

4. Manikchak : Manikchak block holds a large number of area. Total 282,150 people are live in 250 villages in 91 mouzas.

5. English Bazar : In English Bazar 286,886 people are live in 252 villages in 135 mouzas. It is notified that there are urban populations under English Bazar block But among the urban areas there are no place found which is affected by

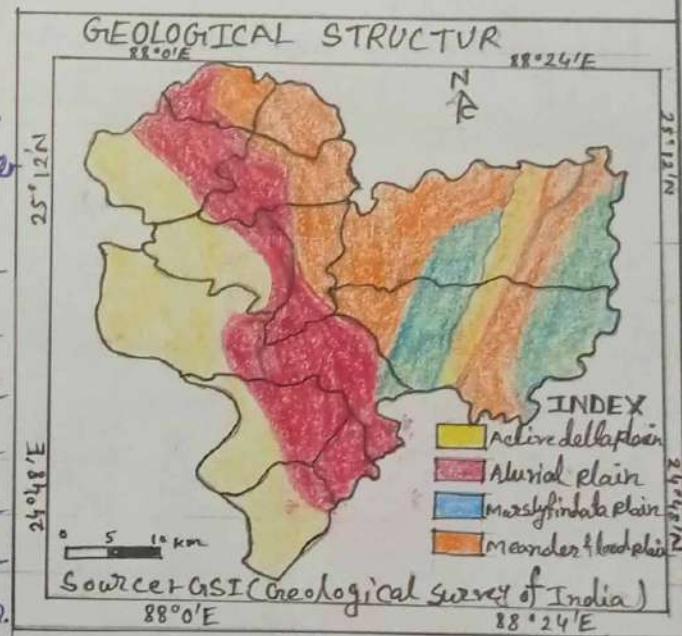
arsenic some areas of zone are affected by arsenic.

6. Redua:ii: Areas of rural zone are effected by arsenic.



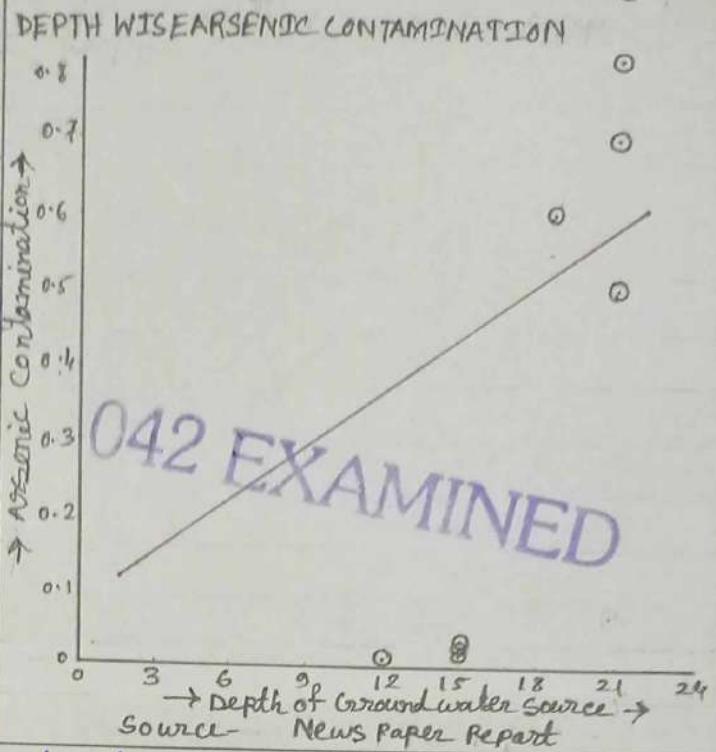
Cause : The causes of arsenic pollution in Malda district are multi dimensional and complex.

- Natural - 1) Hydrology and Geology + The district is located in the Ganges delta, which is characterized by a complex network of alluvial deposits and aquifers. The geological structure of the region combined with the high geological structure of the region with the high ground water extraction rates, has resulted in the mobilization and release of naturally occurring Arsenic from the sediment into the aquifer.
- Anthropogenic + 1) Agricultural practices - The use of Arsenic contaminated ground water for irrigation has led to the accumulation of arsenic in the soil and crops. The district



Summarization  
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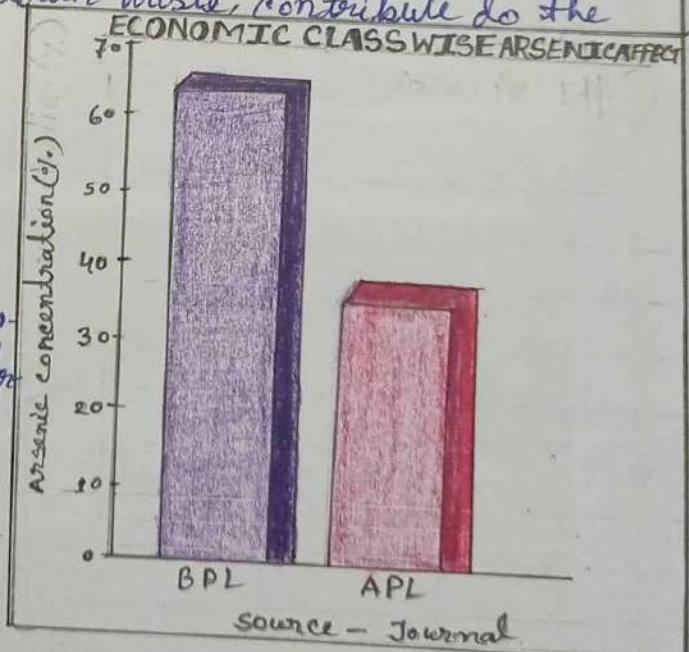
is largely agrarian, and farmers rely heavily on ground water for irrigation, making them vulnerable to the impacts of arsenic contamination due to commercialization of agro products lowered the ground water level (20-60) m the risk of arsenic contamination is found to very high.

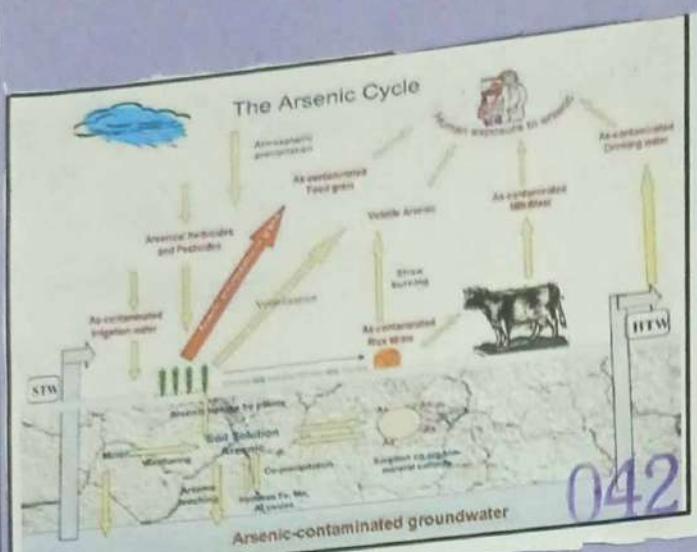


2) Industrial Activities - The district is home to several small scale industries, including dyeing and printing units, which discharge untreated effluent in to the environment, contaminating ground water and surface water sources.

3) Poor Sanitation - Poor sanitation practices, including open defecation and improper disposal of human waste, contribute to the contamination of surface water and groundwater sources. In this reason higher percentage of cases belonged to BPL category.

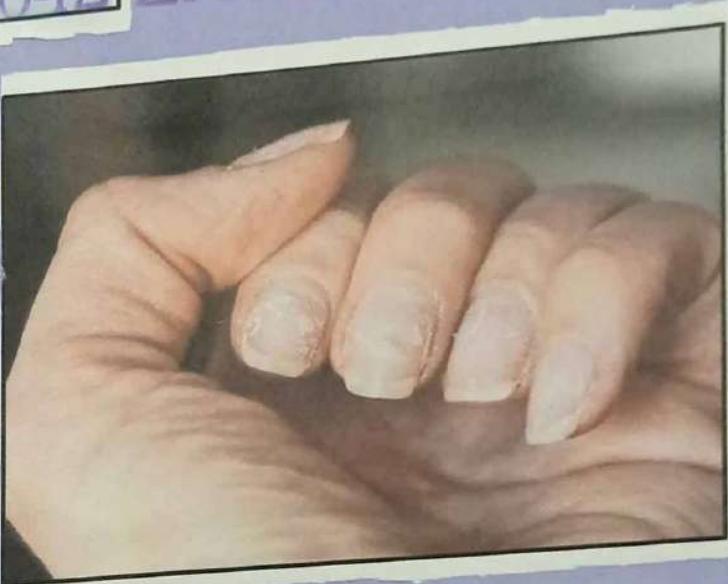
4) Climate Change - Climate change is exacerbating the problem of arsenic pollution in Malda district, as changing rainfall patterns and rising temperatures can alter the hydrology of the region and affect the mobilization of arsenic in the sediment. This climate change creates water scarcity which are the main cause of this contamination.



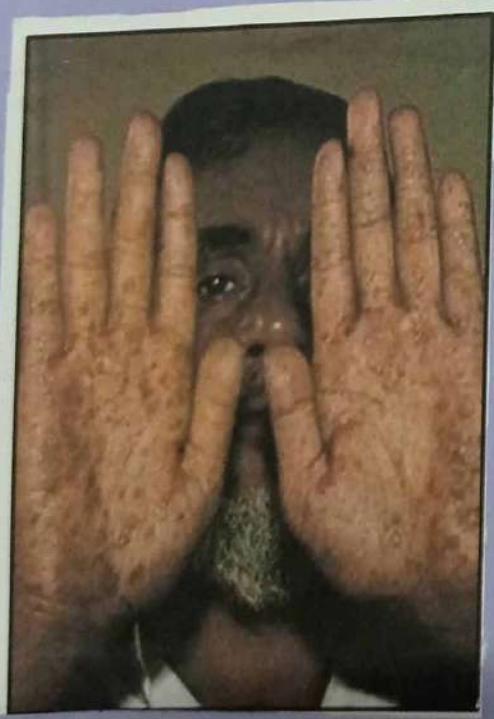


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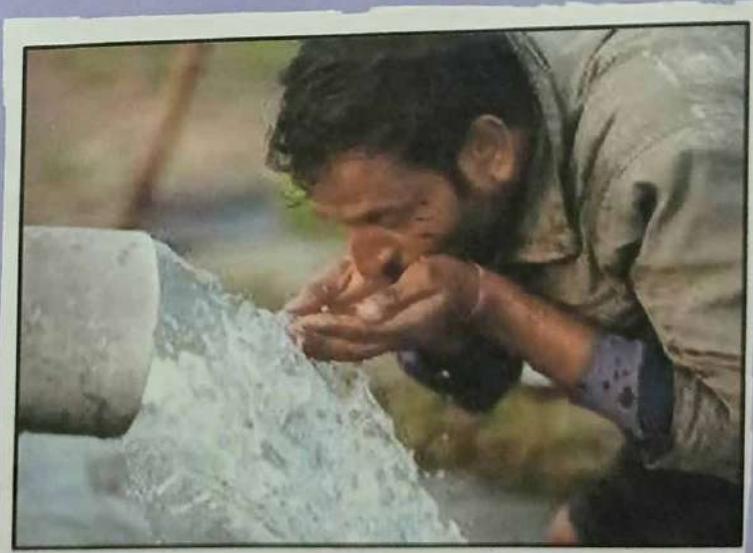
### ARSENIC CYCLE



ARSENIC AFFECTED NAIL



ARSENIC BLACKFOOT DISEASES



DRINKING ARSENIC CONCENTRATED WATER

5) Lack of Awareness & A lack of awareness among the local population regarding the health impacts of arsenic contamination and safe drinking water practices has contributed to the persistence of the problem.

6) Groundwater Depletion & The high rates of ground water extraction in the district have led to the depletion of ground water resources, which can exacerbate the problem of arsenic contamination of naturally occurring arsenic in the remaining ground water source. In a Gazde block most of the villages almost get safe drinking water during summer.

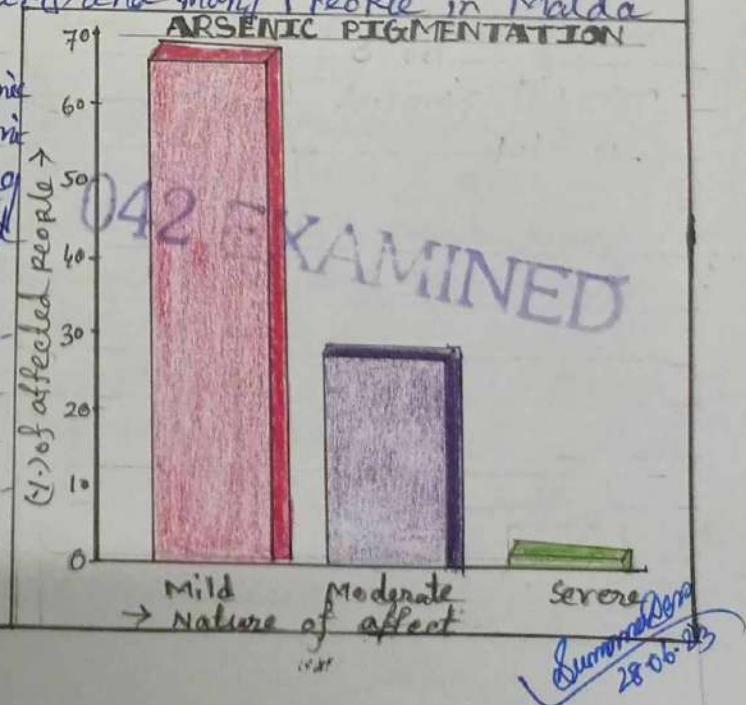
7) Lack of political will & Finally, a lack of political will to address the problem of arsenic pollution in the district has contributed to the persistence of the problem. This has been reflected in inadequate funding for initiatives to address the problem as well as a lack of political leadership to address the root causes of contamination.

Effect :- Arsenic contamination in Maldah district has a number of negative effects on human health, agriculture and the environment.

A) Health effects & Exposure to arsenic contaminated water over a period of time can cause a range of health problems, including skin lesions, cancer, and organ damage. Most of the villagers in Kaliachak I, II, III & English Bazar are affected by different health diseases.

1) Skin problems & Skin lesions are a common symptom of chronic arsenic poisoning and many people in Maldah district have reported experiencing skin problems as a result of arsenic contamination. Due to arsenic contamination the skin become dry, thick, leading to the formation of lesions, spots and pigmentation changes.

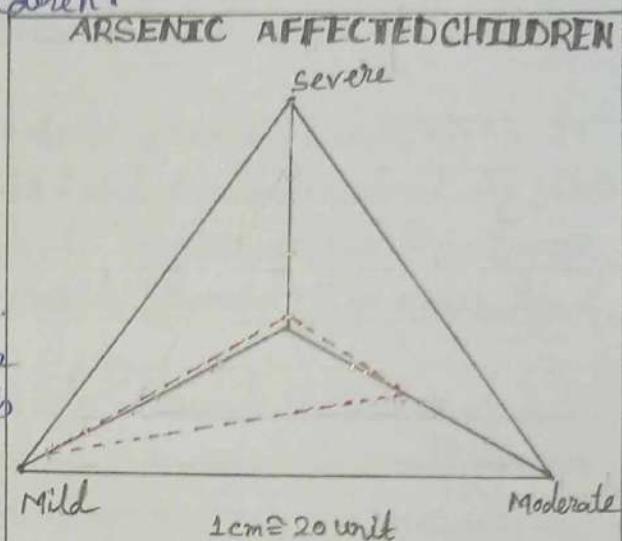
2) Increased cancer risk & Exposure to arsenic over a long period of time can increase the risk of certain types of cancer, including skin, bladder, and lungs cancer.



3) Reduced cognitive function & studies have shown that exposure to arsenic can lead to reduced cognitive function, affecting the ability to learn, remember, and concentrate. This is particularly problematic for children.

### B. Economic Impact :-

1) Agricultural impact & Arsenic contamination in Maldah district can also have a significant impact on agriculture as crops grown in arsenic contaminated soil can absorb the toxin, leading to reduced yields and quality.



### C. Environmental impact & Arsenic con. Source: District census report

Contamination in groundwater can have negative effects on the environment. Arsenic can enter the food chain through contaminated water, soil, and crops, leading to health problems in animals and wild life.

1) Increase treatment cost & The cost of treating arsenic-related health problems can be substantial, and the contamination can also affect the local economy.

D. Social impact & Arsenic contamination in Maldah district can also have social consequences. Many people in affected communities face stigma and discrimination due to their health problems, and there may be social isolation and exclusion. Children who are affected by arsenic exposure may face challenges in school and have limited opportunities in the future.

□ Trauma:- Arsenic contamination is one of the main types of water population. Besides socio-economic condition it also affects the mental health. After arsenic contaminated the people's faced many dermatological problems. Many illiterate people believe that this dermatological problem is contagious and avoid that arsenic affects people. Due to avoiding behaviour of surrounding people they segregate them and become unsocial. Many arsenic affected women are insulted by their in-laws family and their friends. Due to the insulting behaviour they become depressed. Some time this depression tends to commit suicide. For the clinical treatment many effected people become economically poor which increase their mental stress.

**Mitigation** To mitigate arsenic contamination in Maldah district, several measures can be taken. Arsenic contamination in groundwater is a significant issue in many parts of the world, including some regions of Maldah district. Here are some possible strategies to address the problem:

1. Public Awareness and Education Conduct awareness campaigns to educate the local population about the risks of arsenic contamination and its health effects. Emphasize the importance of using safe drinking water sources and provide information on water treatment methods.

2. Alternate water sources Identify and promote alternative sources of safe drinking water, such as rainwater harvesting, surface water bodies, and deep tube wells that are free from arsenic contamination. This could involve drilling new wells or rehabilitating existing ones in areas with low arsenic levels.

3. Water Testing and Monitoring Implement a regular water testing and monitoring program to identify the arsenic-affected areas accurately. This will help in determining the extent of contamination and guiding the selection of appropriate mitigation measures.

4. Water Treatment Implement suitable water treatment technologies to remove or reduce arsenic levels in contaminated water sources. Some effective treatment methods include activated alumina filtration, reverse osmosis, iron removal filters, and oxidation followed by sedimentation and filtration.

5. Community-based Interventions Encourage the formation of community-based organizations to collectively manage water sources, monitor arsenic levels, and promote safe water practices.

6. Agricultural practices Promote agricultural practices that minimize the uptake of arsenic by crops. This can include measures like using arsenic-safe irrigation water, adopting arsenic-tolerant crop varieties, and implementing proper wastewater management to prevent arsenic-contaminated water from seeping into the soil.

7. Health Awareness and Support Provide healthcare facilities, medical check-ups, and support services to individuals affected by arsenic contamination. Raise awareness about the symptoms of arsenic poisoning.

and encourage affected individuals to seek medical attention.

8. Long-term Solution:- Explore options for long-term solutions, such as identifying and implementing sustainable arsenic-free water sources or developing regional water treatment plants to serve affected communities. It's important to note that addressing arsenic contamination requires a multidisciplinary approach involving government agencies, a multidisciplinary approach involving researchers, and the local community. The implementation of these measures should be supported by sufficient funding, effective governance, and ongoing monitoring to ensure their success in mitigating arsenic contamination in Malda district.

□ Preparedness:- In terms of preparedness to address arsenic contamination in Malda district, several measures can be taken:

- Water Testing and monitoring of water:** Regular testing and monitoring of water sources are essential to identify areas with arsenic contamination. This involves establishing a systematic process of collecting water samples, conducting laboratory tests, and analyzing the results. Local authorities, along with relevant government agencies and NGOs, can collaborate to ensure regular monitoring and testing.

**Awareness and Education:** Raising awareness about the risks of arsenic contamination and its associated health effects is crucial. Public education campaigns can be conducted to inform the local population about the sources of arsenic contamination, its symptoms, and preventive measures. This can be achieved through community meetings, workshops, and the distribution of educational materials in local languages.

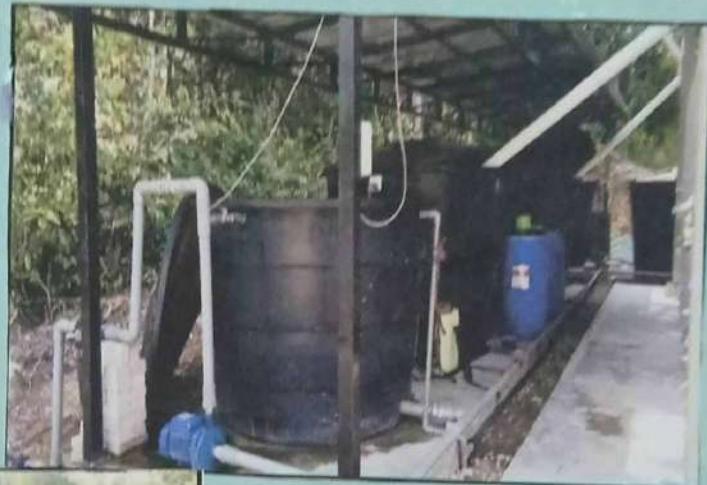
**Alternative safe water sources:** Providing alternative sources of safe drinking water is a priority. This can involve setting up community-level water treatment plants, installing deep tube wells, or implementing rainwater harvesting systems. Efforts should be made to ensure the availability of safe water sources in areas most affected by arsenic contamination.

**Health services and treatments:** Establishing adequate healthcare services to diagnose and treat arsenic-related health conditions is essential. This includes training healthcare professionals to identify symptoms and provide appropriate medical care. Regular health camps can be organized in affected areas to facilitate early detection and treatment.

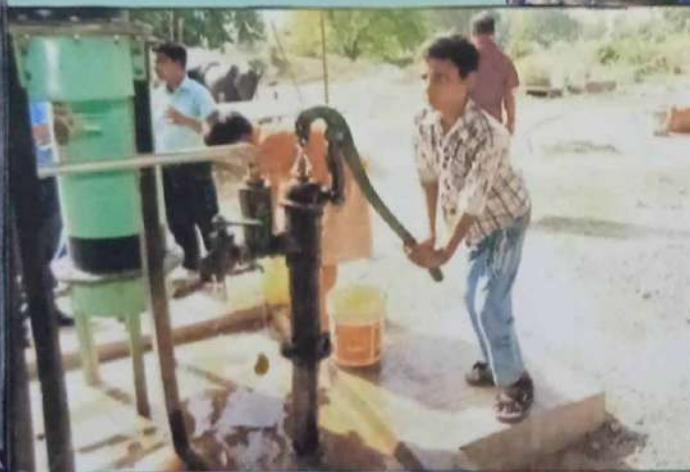
**Mitigation and Remediation:** Implementing mitigation and remediation measures is crucial to address the long-term issue of arsenic contamination. This can involve exploring technologies for arsenic removal from water sources, implementing water treatment plants, or considering alternative water supply options like piped water systems from non-contaminated sources.



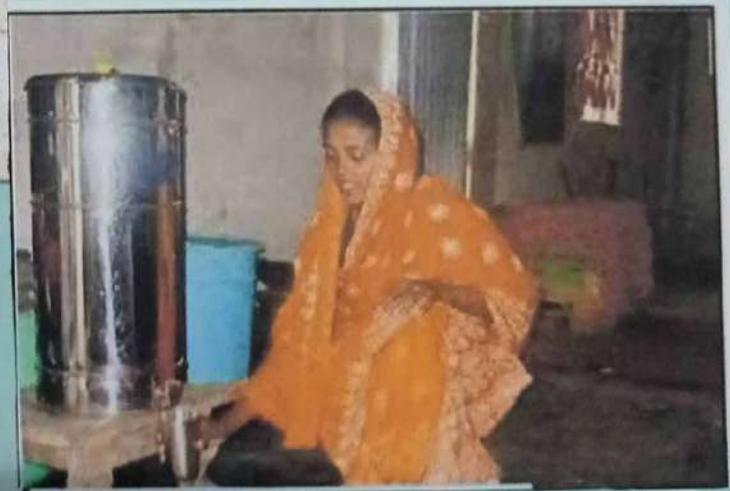
ARSENIC EFFECTED TUBEWELL



RAINFALL HARVESTING



WATER PURIFIER



ARSENIC PURIFICATION FILTER

**Collaboration and Government support:** Addressing arsenic contamination requires the collective effort of various stakeholders, including government bodies, local authorities, NGOs, and the community. Collaborative initiatives should be encouraged to coordinate actions, share resources and seek necessary financial support from the government and other funding agencies.

It is important to note that the above measures are general guidelines, and specific actions should be tailored to the local context and the severity of arsenic contamination in Malda district. Local authorities and experts should conduct a detailed assessment of the situation to develop a comprehensive preparedness plan and prioritize actions accordingly.

**Conclusion:** - In conclusion, arsenic contamination in Malda district poses a significant health and environmental risk. The presence of high levels of arsenic in the region, impacting the well-being of the local population. Arsenic, a highly toxic substance, can lead to various health issues, including skin lesions, respiratory problems, cardiovascular disease, and even cancer when ingested over an extended period. According to arsenic contamination in Malda district is a complex and challenging task that requires the combined efforts of the government, local community, and various stakeholders. Continued commitment and collaborative action are necessary to mitigate the adverse effects of arsenic contamination and safeguard the health and well-being of the residents in the district.

*Suman Das*  
28/06/23

□ References & some reference about arsenic contamination in Malda district

cl:

1. 'Arsenic contamination in west Bengal with reference to malda district' by md. Juet Rama (2013)
2. 'Ground water Arsenic contamination in malda west Bengal India: Epidemiology and Efficacy of mitigation measures' by International Journal of medicine and public Health (2014)
3. 'Ground water Arsenic contamination in malda, west Bengal India' by international journal of medicine and public health (2015).
4. IRAC. Some drinking water Disinfectants and contaminants, including Arsenic monographs on the Evaluation of carcinogenic risks to humans Lyon, France, WHO, 2004: 84: 61-86.
5. Garia R. Chakraborty AK Dey SB Saha KC. chronic arsenic poisoning from tubewell water Journal of the Indian medical Association 1984;82(1): 345.
6. Oruha majmber DN Aquae R. Orhosh N. De BK, Santra A. Chakraborty D. et. al. Arsenic levels in drinking water and the prevalence of skin lesions in west Bengal India Int J Epidemiol. 1998;27(5): 87-1-7.
7. Rahaman m. Sengupta m.k. Mukerjee Se. Puli s. Ahmed S. Lodh D. et. al mursidabad - one of the nine ground water Arsenic-Affected Districts of west Bengal India Part 1: magnitude of contamination and population at risk. Clinical Toxicology 2005; 43(7): 823-34.
8. Mitra S.R. Oruha Majumbar .D.N. Basu. A. Block. G. Haque. Rund Santra. S. 2004. "Nutritional factors and susceptibility to arsenic caused skin lesions in west Bengal" India Environ. Health pers. 112: 1104-1109.
9. Saha, A.K. Chakraborty .C. and De .S 1997. "Studies of genesis of arsenic in ground water in parts of west Bengal". Indian Soc. Earth Sci 24: 1-5.
10. Das D. samanta C. madal, B.K. chanda, C.R. and choudhury P.P. 1996 "Arsenic in groundwater in six districts of west Bengal." India Environ. Geochen Health. 18: 5- 15.
11. choudhury U.K. Rahaman. M.M. mandal. B.K. Paul. K. Lodh D. and Bishay S.K. 2001. "Groundwater arsenic contamination and sufferings in west Bengal India and Bangladesh". Environ. sci 8: 393:415.

## APPENDIX

### 1. Depth wise Arsenic contamination

depth of ground water source (cm)	Amount of detected arsenic in tested sample (mg/l)
15	0.01
20	0.7
20	0.5
20	0.5
15	0.02
12	0.01
20	0.5
20	0.5
15	0.02
18	0.6
20	0.8
20	1.0

### 2. Effects on children

Nature	%
Mild	2.98
Moderate	23.50
Serere	73.52

### 3. Economic class wise Arsenic concentration

Poverty level	%
APL	63
BPL	35

### 4. Arsenic Pigmentation problems

Nature	%
Mild	66.8
Moderat	27.27
Serer	0.6

# UNIVERSITY OF CALCUTTA



## B.A. SEMESTER VI GEOGRAPHY HONOURS PRACTICAL EXAMINATION (CBCS-2023)

PAPER: GEO-A-CC-6-14-P

GEOGRAPHY PRACTICAL NOTEBOOK

REG. NO.: 561-1211-0190-20

ROLL NO.: 202561-11-0097

042 EXAMINED

THE IMPACT OF LANDSLIDE AND  
MANAGEMENT OF LANDSLIDE IN  
KURSEONG DARJEELING :

A CASE STUDY OF LIMBUGAON LANDSLIDE

## CONTENTS

- ① Introduction
- ② Study Area
- ③ Objective
- ④ Methodology
- ⑤ Literature Review
- ⑥ When
- ⑦ Cause -
  - ⓐ The Torrential Rainfall
  - ⓑ The location of the village
  - ⓒ The Fragile Topography of the village
- ⑧ Impact -
  - ⓐ Demographic Impact
  - ⓑ Social Impact
  - ⓒ Environmental Impact
  - ⓓ Economic Impact
  - ⓔ Vegetation Depletion
  - ⓕ Other Impact
- ⑨ Trauma
- ⑩ Rescue and Relief -
  - ⓐ Roll of the local Government
  - ⓑ Roll of Local Communities
- ⑪ Post Management
- ⑫ Conclusion
- ⑬ Reference

042 EXAMINED

## INTRODUCTION

A Landslide is defined as the movement of a mass of rock, debris, or earth down a slope. Landslides are a type of "mass wasting" which denotes any down-slope movement of soil and rock under the direct influence of gravity. The term "Landslide" encompasses five modes of slope movement: falls, topples, slides, spreads and flows. These are further subdivided by the type of geologic material (bedrock, debris or earth). Debris flows (commonly referred to as mudflows or mudslides) and rock falls are examples of common landslide types. Hills slopes become unstable due to groundwater pressure, earthquakes, erosions and volcanic eruptions, which causes landslides.

The landslides are a common feature in Himalaya, western Ghats, and in river valleys. The state of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, and all the seven states of northeast India, is most vulnerable to landslides. In Southern India Maharashtra, Karnataka, Tamil Nadu, and Kerala bear the brunt of landslides.

## OBJECTIVES

The objectives of this project will orient under the following heading:

- The first objective of this project is to investigate about the landslide that occurred in Limbagaon on 1<sup>st</sup> July 2015.
- The other objectives is to find out the approaches adopted by the community and the local government for the management of the landslide.

## ABOUT STUDY AREA

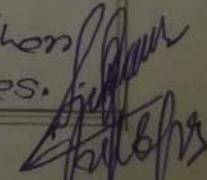
Limbugaon is a small village located in Tingling Tea Estate of Kurseong. The name of the village is derived from 'Limbu' a tribe of Darjeeling Hills and Nepal and 'Gaon' meaning village. The village is located under Someni I Gram panchayat which comes under Minik Teshsil of Darjeeling district, West Bengal. The headquarters for both police station and block office for the village is Minik.

The approximate elevation of the village is 4431 ft. and the approximate latitude and longitude of the region is  $28.5158^{\circ}$  N and  $88.1146^{\circ}$  E. The village is surrounded by different tea gardens such as Tingling Tea Estate, Paschim Phuguri Tea Garden and Pumba Phuguri Tea Garden.

According to one of the respondents the village consisted of 35 to 40 houses but in the year 2015 when a landslide destroyed the village half of the village was relocated or was rehabilitated to a nearby area.

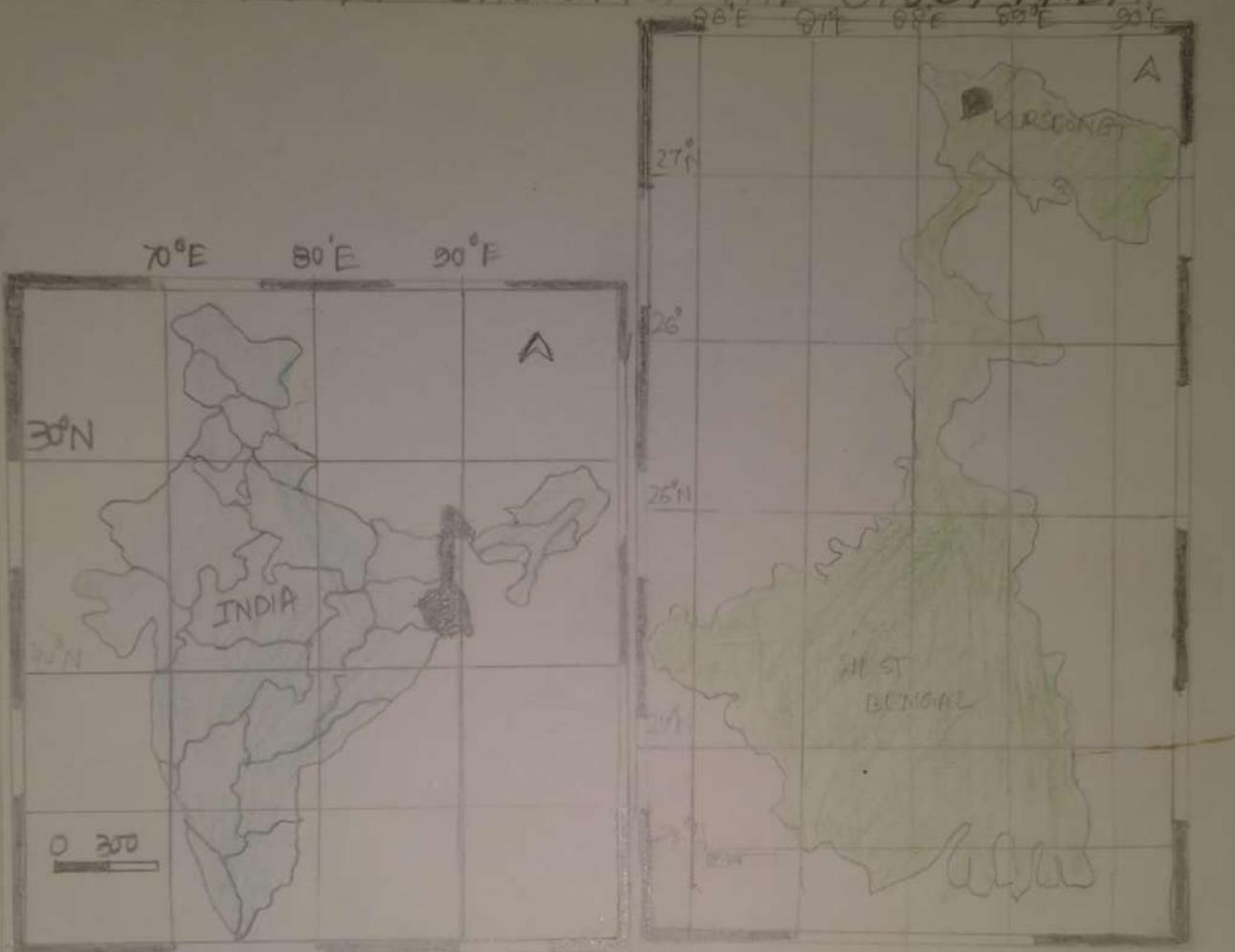
The people of the village are dependent on Tingling Tea Garden for their source of income. Most of the population is engaged as laborers in the tea garden. Few of the villagers also practice agriculture and animal husbandry to earn their income.

About the educational status of the men here are no schools in the village though only a few kilometers away there is one government primary school and one private school. To acquire their higher education the students travel to the a school named Rabindranath High School located in Someni Bazar which is around 4 kms. from the village. For the college education the students have to travel to Minik College which is located in Minik around 9 kms. away from the village. For medical purpose there are no health centres in the villages. The villagers have to either travel to Someni town or Minik for medical emergencies.



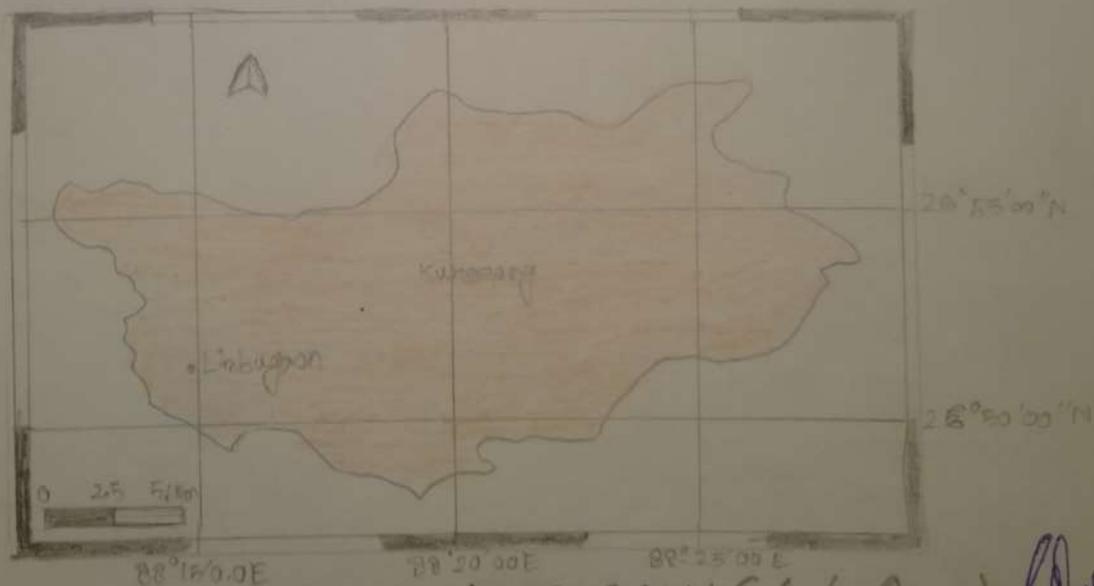
# ABOUT STUDY AREA

## LOCATION MAP SHOWING THE STUDY AREA



Map SHOWING THE STATE  
OF WEST BENGAL

MAP SHOWING THE KURSEONG  
SUBDIVISION



MAP SHOWING THE LIMBUGAON (Study Area)

*Jitendra  
Gelopan*

## METHODOLOGY

The study is based on secondary data which has been collected from several publication in different journal and website. After collecting data we analysed the data and represent by different maps and diagrams.

## LITERATURE REVIEW

The investigation of landslide danger and their management has become a critical subject matter of sociology.

Ghosh, In this work calls attention to the landslip's issue of the Darjeeling Himalaya.

Again Shankar (1972) clarifies in his work about the job of calamitous precipitation in the forming of the lower Himalaya. Ambalagan et al. (2012), the quantitative methodology have built up based on major causative variables of Indravati firmness.

The study an instance of Landslide Risk Zonation in the Maharashtra region, utilizing Landslide Potential assessment factor (CLHEF) rating plan. In this strategy joined major inalienable causative variable of Indravati insecurity and embraced a straightforward, economical viable and powerful methodology.

A Sengupta et.al (2010), The authors have studied the geological and geotechnical parameters of the major trouble spots in the eastern Himalaya along national highway NH-31A and NH-44 to understand the factors affecting the landslides in the region. The main factors triggering landslides in this region has been confirmed such as the regional geology or rock type, structure of the bed rocks, excessive rainfall and human interference and diversion of streams.

Macdonald (2003), the author has made a step towards providing a general understanding of the principal types of disasters and in particular, how they can affect the buildings. The stress is given on the effect of good design and planning which can reduce the impact of disasters on the built environment. Legislation for good standards of construction reduces vulnerability only if implemented properly.

A.F Shaik et.al (2015), the landslide, which hit on 30<sup>th</sup> July 2014, early in the morning was believed to have been caused by a burst of heavy rainfall. The other causes identified and categorized as natural such as Heavy rainfall, environmental destruction, sudden changes in water table and artificial causes such as deforestation, construction activities without environmental consequences. These had effected the region with huge loss of property, assets and people's moral.

Ghosh, et al, in his work features the provincial dissemination of disasters in west Bengal. Most important the data assembled from the National Disaster Management Authority, Ministry of Home Affairs and Government of India

### Articles

"LANDSLIDE AND MANAGEMENT OF LANDSLIDE IN KURSEONG, DARJEELING A CASE STUDY OF LIMBU GAON LANDSLIDE" International Journal of Engineering Technologies on Innovative Research ([www.jetrn.org](http://www.jetrn.org)). ISSN-2349-5162

<http://www.jetrn.org/popen/JETIR1904T59.pdf>

When On 1st July, 2015 at around 3.A.M village of Limbugaon Tining te estate had to face the tremendous worth of landslide this landslide swept a major portion of the village thus affecting the area and the villagers.

Cause:- The Causes of the landslide can be several; some of which are mentioned below:

#### The Torrential Rainfall :-

The first major cause of the landslide is due to the torrential rainfall that was taking place in the region since last few days but on the night of 1st July, 2015 the rainfall increased tremendously due to cloud burst thus the disaster took place

#### The location of the village:-

The second cause is the location of the village as mentioned above is located below the main road that connects Siliguri with Darjeeling via Mirk. The road condition is proper but the drainage condition of the road is very poor. So, since it was raining for last three days before the landslide took place so due to the lack of proper drainage facility the overplaced water was pouring down the village. Due to the reason the overplaced water was pouring mixed with the torrential rainfall was making the already fragile area more fragile. Thus, the cloud be also a major reason behind the landslide that occurred in the village.

#### The Fragile Topography of the village:-

The other major cause is the fragile topography of the village. Since the whole of Darjeeling hills is situated in a very fragile geological condition because of its composition of rocks and minerals like shale, quartzite, mica, chist and sandstone the village is also no exception.

Apart from this the village is located in a very steep slope with no protection wall. So the fragile topography combined with the location of the area is also one of the major reasons behind the landslide.

### IMPACT:-

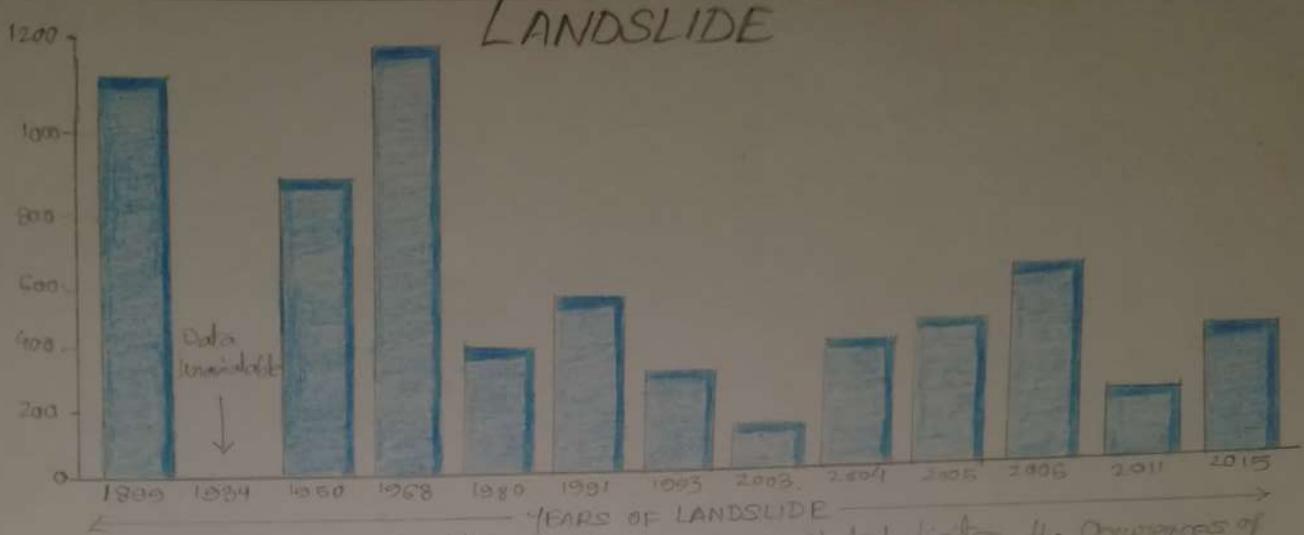
Landslide is a common natural phenomenon seen in mountain territory of Darjeeling Himalaya.

1) Demographic Impact:- In 2015, Darjeeling had population of 1,846,823 of which male and female were 937,259 and 909,564 respectively. The main effected area is Tingling. The total death toll reached upto 19 and several people were misplaced. The toll in Landslide battered Birbogaon in Tingling has risen to up even as 40 people still missing said Thomas Thapa, the president of the Victims Committee, an apolitical organisation.

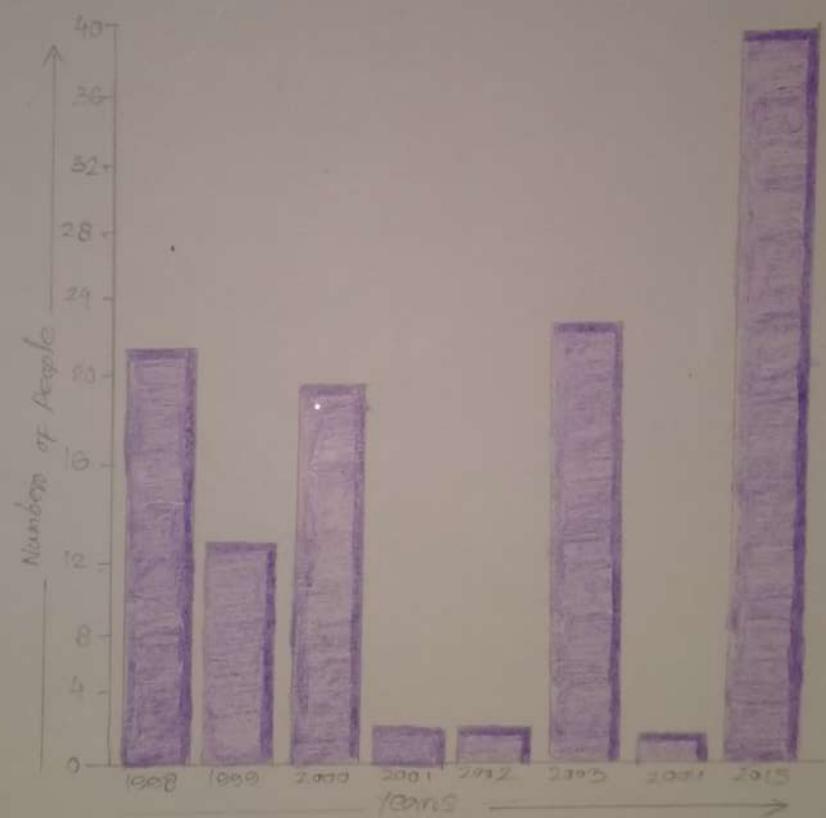
2) Social Impact:- Like any other disasters landslide disasters also effected the Community or Society in a number of ways such as physiological trauma, family disruption, lowering a1 quality of life, disruption of Community etc.

- Disruption of Community and Social life, due to loss or interruption of Cultural heritage, religious/rituals functions and performances.

- Marked decrease in the mobility of affected people due to loss of transportation network.
- Loss of livelihood due to loss of agricultural farm Landslide and Crops, non functioning of govt. offices.
- Hunger and starvation due to loss of grains Crops, income dysfunction of prod Supply chain, drinking water scarcity
- Reduced opportunities of education to children due to damage or destruction of educational institutions and injuries or death of teachers, employees



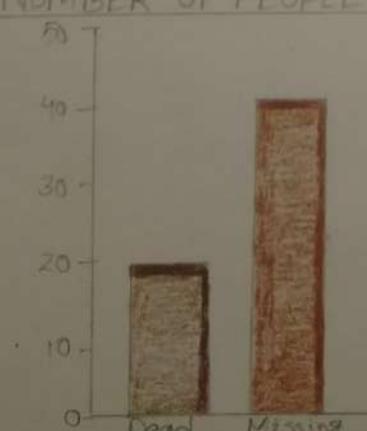
(Simultaneous Occurrences of Landslide and heavy rainfall that Indicates the Occurrences of Landslide due to heavy rainfall)



~~Report  
Ranjan  
2017/23~~

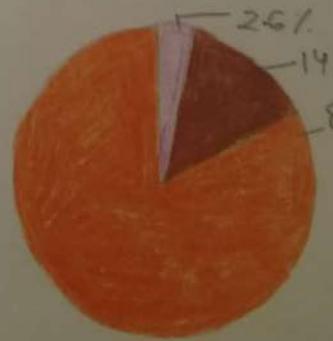
1cm = 4 unit Numbers of people died in Landslide in Darjeeling

#### NUMBER OF PEOPLE DIED IN LANDSLIDE



Number of people died in Landslide in Limbugaon (2015)

#### NUMBER OF HOUSES DAMAGED IN LANDSLIDE IN LIMBUGAON



#### INDEX

- Completely Washed
- Fully Damaged
- Partially Damaged

## Environmental Impact :-

The impact of Landslides disaster on physical environment comprising abiotic and biotic environment include the following

- Creation of mounds due to piling of enormous volume of debris and mud.
- Flattening of high ground.
- Formation of temporary / semi-permanent lakes due to drowning of rivers by debris deposit.
- Hill slopes are steepened but valleys are filled with debris.

## Economic Impact :-

Economic Impact include adverse as enumerated above on people their names and properties, agricultural lands and crops, timber, life lines, such as roads, highways, communication system, water supplies, education institutions etc.

- Reduction of real estate properties due to high risk factor.
- Reassessment of landslide hazard risks.
- Loss of human and animal productivity because of death injuries and psychological problems.
- provision for additional money for temporary housing or long-term shelter for displaced people by landslide disaster.

## Vegetation Depletion :-

- ① Areas where wildfires or human modification of the land have destroyed vegetation.

Others Impact :- steps that have been altered for construction of buildings and changing the course of the river for landslide.

## TRAUMA:

post traumatic stress Disaster is a disorder that develops in some people who have experienced a shocking, scary and dangerous event. It is natural to feel afraid during and after a traumatic situation (landslide). It widely occurs among victim or witness of disasters. There are literature suggesting that people emerging from their struggle with such tragedies as bereavement.

Positive personal gain often adverse life events and trauma is known as post-Traumatic Growth (PTG). Although Traumatic or distressing events can cause long-lasting psychological symptoms. A person who undergoes a traumatic experiences haunt victim that hit by landslide, often their dreams impacts their lives and changed their perceptions of reality.

Psychological impacts of trauma in three categories as follows:-

- ① PTSD symptoms (re-experiencing, avoidance, diminished interest, detachment from others etc)
- ② Change in obj internalized objects and self (helplessness and entrapped dependency, projective identification and splitting, regression to 'primitivized' object relations, imposing as a 'false self', loss of self-cohesion.)

## RESCUE AND RELIEF

- ① Apart from Tingling primary school relief camps were also set up at the tea garden's hospital, creche, tea garden office, assistant manager's bungalow and also at Sounari Community Hall not only for the villagers of the Limbugaon village but also the Seine the people of other villages located near Limbugaon.

# LANDSLIDE



(ii) Apart from local government and SSB: various other agencies such as National Disaster Response Force (NDRF), District Magistrate (DM) office and various Non-Governmental Organization (NGOs) like distributed relief such as tarpaulin, food, medicines, drinking waters to the victims of the landslides and the people who were temporarily rehabilitated to the rescue camps.

(iii) Prime Minister Shri Narendra Modi had announced a Compensation of ~~Rs~~ 2 lakh Rupees for the family members of the death and also the then chief Executive of Gorkha Territorial Administration (GTA) and autonomous district Council for the Darjeeling and Kalimpong area of the west Bengal state in India. Shri Bimal Gurung announced Compensation of 2 lakh Rupees for the kin of those who was killed and Rs 50,000 to those injured (Gazmen, 2015)

### LOCAL COMMUNITIES-

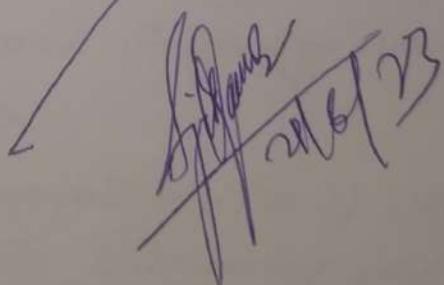
- Role - (i) The local communities helped the rescue personals from the local DM office, the SSB and the NDRF during the search and rescue operations.
- (ii) Till the relief arrived in the rescue camps food, water and medicines were provided by the community from the village as well as communities from the village as communities from neighboring villages too.
- (iii) Apart from village communities relief materials were also provided by different organizations such as universities, colleges, clubs etc.
- (iv) The villagers also transported the identified victims to a safe and secure spot and provided the best possible medications.

## POST MANAGEMENT

- Stay away from the slide area. There may be dangers of additional slides.
- Listen to local radio or television stations for the latest emergency information.
- Watch for flooding, which may occur after a landslide or debris flow. Floods sometimes follow landslides and debris flows because they may both be started by the same event.
- Check for injured and trapped persons near the slide, without entering the direct slide area. Direct movements to their locations.
- Help a neighbour who may require special assistance infants, elderly people and people with disabilities. Elderly people and people with disabilities may require additional assistance. People who care for them or who have large families may need additional assistance in emergency situations.
- Look for and report broken utility lines and damaged roadways and railroads to appropriate authorities. Reporting potential hazards will get the utilities turned off as quickly as possible, preventing further hazard and injury.
- Replant damaged ground as soon as possible since erosion caused by loss of ground cover can lead to flood, flooding and additional landslides in the near future.
- Seek advice from a geotechnical expert for evaluating landslide hazards on designing. Connective techniques to reduce landslide risk. A professional will be able to advise you of the best ways to prevent or reduce landslide risk, without creating further hazard.

## CONCLUSION

The Darjeeling Himalaya region is the most vulnerable to a landslide as well as avalanche fall stamp disaster. The primary effects of the June, July landslide disaster are the disconnection of the roads, loss of lives the breaking of bridges etc. The people have lost their home and suspended home lessly and took shelters that one provided by state government. Thus, the landslide disasters of 2015 triggers severely the natural environment of the Darjeeling Himalayas. It is caused by the natural phenomena viz heavy torrential rainfall but the intensity and magnitude are enhanced by the anthropogenic activities. A recent geological Survey conducted for the Darjeeling landslide. However, on the basis of historical record it can be said that intense rainfall is the key factor for the June July 2015 landslide. As the developmental activity is increased in the mountainous region, thereby the land use management is significant to reduce the vulnerability of the landslides.



A handwritten signature in blue ink, followed by the date "20/6/13".

042 EXAMINED

## REFERENCES:

- Subha Aditya (April 2019). Landslide and management of Land slide in Kunseong. Drijeeling : A Case study of Limbu Gaoon landslide
- Grazmen, D (July 2, 2015), Heavy rainfall in Darjeeling triggers landslides - 36 killed. The Times of India
- Nod, C (2015) Landslide Hazard Management of Darjeeling Hill-A Critical Need for Inhabited. International Journal of Humanities and Social Science Invention.
- Naidu, B.R (2013) Disaster Mitigation Measures for Cyclone Prone Areas of Andhra pradesh. In P.sahni, A hanjra, S U Medury, Disasters Mitigation: Experiences and Reflections PHI learning Private Limited; Delhi
- Prasad, N.N (1995). Landslides-Cause, K, mitigation Kerala Centre for water Resources Development and Management.
- Singh, S (1991) Environmental Geography, Allahabad; pustak Bhawan, Allahabad.
- Singh R.L (1971) India; A Regional Geography, varanasi; National geographical Society of India.
- Rai R, Biswas SS, Mondal B, Pramanik MK (2016) Landslides and Floods in the Tista Basin (Darjeeling and Jalpaiguri Districts): Historical Evidence, Causes and Consequences

## LINKS

- ① [www.jetin.org](http://www.jetin.org)
- ② <https://www.telegraphindia.com/west-Bengal/landslide-victims-call-strike-in-mirik/cid/1524473>
- ③ <https://www.readyt.gov.in/landslides...>
- ④ <http://s.hoch.inflibnet.ac.in:8080/jspui/bitstream/123456789/8484/5/05-Literature%20review.pdf>

# APPENDIX

# HEAVY RAINFALL THAT INDICATES THE OCCURANCES OF LANDSLIDE DUE TO HEAVY RAINFALL

Year	Rainfall (in MM)
1899	1040
1934	Data Unavailable
1950	760
1968	1120
1980	340
1991	460
1993	260
2003	120
2004	340
2005	360
2006	520
2011	180
2015	340

## NUMBER OF PEOPLE DIED IN LANDSLIDE IN DARJEELING

Year	Number of people Died
1998	22
1999	12
2000	21
2001	2
2002	2
2003	23
2004	1
2015	39

## NUMBER OF HOUSE EFFECTED DUE TO LANDSLIDE

Damaged house in landslide	Number of house Damaged
Completely	4
Fully Damaged	22
Partially Damaged	130

Reg-EGI-1211-0190-20  
Roll-2025G1-11-0097

## Number of people effected

	Number of People effected
Dead	19
Missing	40

*Signature over numbers*





06/07/2023 03:32 pm

22° 29' 18.67452" N 88° 11' 21.0642" E





06/07/2023 03:25 pm

22° 29' 18.67452" N 88° 11' 21.0642" E





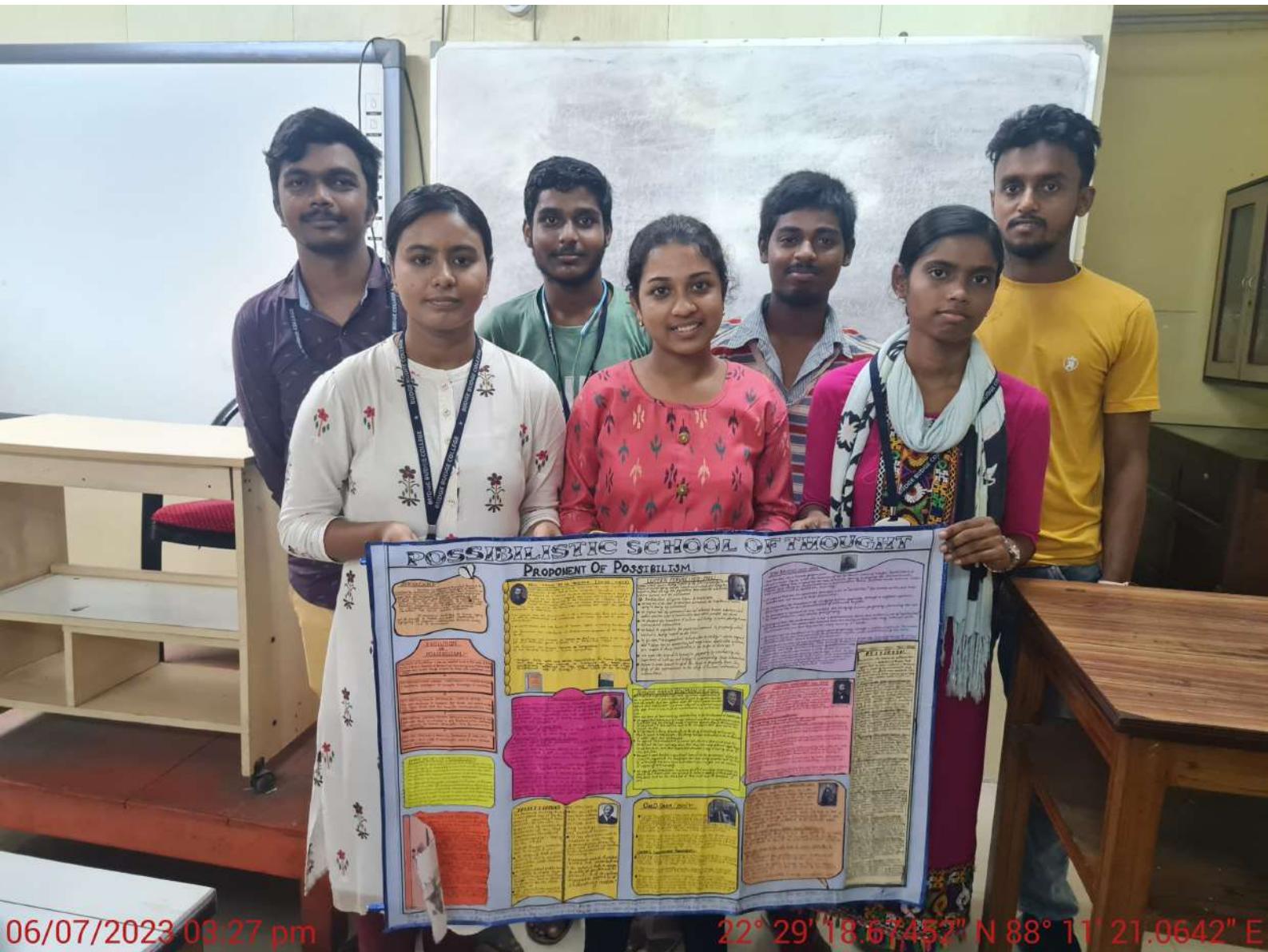
06/07/2023 03:30 pm

22° 29' 18.67452" N 88° 11' 21.0642" E









06/07/2023 03:27 pm

22° 29' 18.57452" N 88° 11' 21.0642" E

## **B.A. History Honours**



## UNIVERSITY OF CALCUTTA

### Notification No. CSR/ 12 /18

It is notified for information of all concerned that the Syndicate in its meeting held on 28.05.2018 (vide Item No.14) approved the Syllabi of different subjects in Undergraduate Honours / General / Major courses of studies (CBCS) under this University, as laid down in the accompanying pamphlet:

#### List of the subjects

<u>Sl. No.</u>	<u>Subject</u>	<u>Sl. No.</u>	<u>Subject</u>
1	Anthropology (Honours / General)	29	Mathematics (Honours / General)
2	Arabic (Honours / General)	30	Microbiology (Honours / General)
3	Persian (Honours / General)	31	Mol. Biology (General)
4	Bengali (Honours / General /LCC2/AECC1)	32	Philosophy (Honours / General)
5	Bio-Chemistry (Honours / General)	33	Physical Education (General)
6	Botany (Honours / General)	34	Physics (Honours / General)
7	Chemistry (Honours / General)	35	Physiology (Honours / General)
8	Computer Science (Honours / General)	36	Political Science (Honours / General)
9	Defence Studies (General)	37	Psychology (Honours / General)
10	Economics (Honours / General)	38	Sanskrit (Honours / General)
11	Education (Honours / General)	39	Social Science (General)
12	Electronics (Honours / General)	40	Sociology (Honours / General)
13	English ((Honours / General/ LCC1/ LCC2/AECC1))	41	Statistics (Honours / General)
14	Environmental Science (Honours / General)	42	Urdu (Honours / General /LCC2 /AECC1)
15	Environmental Studies (AECC2)	43	Women Studies (General)
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17	Food Nutrition (Honours / General)	45	Industrial Fish and Fisheries – IFFV (Major)
18	French (General)	46	Sericulture – SRTV (Major)
19	Geography (Honours / General)	47	Computer Applications – CMAV (Major)
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21	Hindi (Honours / General /LCC2 /AECC1)	49	Advertising Sales Promotion and Sales Management –ASPV (Major)
22	History (Honours / General)	50	Communicative English –CMEV (Major)
23	Islamic History Culture (Honours / General)	51	Clinical Nutrition and Dietetics CNDV (Major)
24	Home Science Extension Education (General)	52	Bachelor of Business Administration (BBA) (Honours)
25	House Hold Art (General)	53	Bachelor of Fashion and Apparel Design – (B.F.A.D.) (Honours)
26	Human Development (Honours / General)	54	Bachelor of Fine Art (B.F.A.) (Honours)
27	Human Rights (General)	55	B. Music (Honours / General) and Music (General)
28	Journalism and Mass Communication (Honours / General)		

The above shall be effective from the academic session 2018-2019.

SENATE HOUSE  
KOLKATA-700073  
The 4<sup>th</sup> June, 2018

  
 (Dr. Santanu Paul)  
 Deputy Registrar

4/6/18

**CBCS SYLLABUS  
IN  
HISTORY (HONOURS)**

**CALCUTTA UNIVERSITY  
2018**

## **Structure of B.A (Hons. ) History Course under CBCS** **HIS-A-CC-1-14- TH & TU**

Paper 1 **SEM -1**: History of India (From the Earliest times to C 300 BCE)

Paper 2 **SEM-1**: Social Formations and Cultural Patterns of the Ancient World other than India

Paper 3 **SEM-2**: History of India (c 300 BCE to c.750 CE)

Paper 4 **SEM-2**: Social Formations and Cultural Patterns of the Medieval World other than India

Paper 5 **SEM-3**: History of India (c.750 – 1206)

Paper 6 **SEM-3**: Rise of the Modern West –I

Paper 7 **SEM-3**: History of India (c.1206 – 1526)

Paper 8 **SEM-4**: Rise of the Modern West – II

Paper 9 **SEM-4**: History of India (c.1526-1605)

Paper 10 **SEM-4** History of India (c.1605 – 1750s)

Paper 11 **SEM-5**: History of Modern Europe (c.1780-1939)

Paper 12 **SEM-5**: History of India (c.1750s– 1857)

Paper 13 **SEM-6**: History of India (c. 1857 – 1964)

Paper 14 **SEM-6** : History of World Politics: (1945-1994)

## **HIS-A- DSE TH & TU**

**Discipline Specific Elective DSE (Any Four) Choosing any one paper in Semester -5 and another in Semester 6 taking one from Group –A and the other from Group –B**

Paper 1 **DSE-A-1 SEM -5**: History of Bengal (c.1757-1905)

Paper 2 **DSE-A-3 SEM -6**: History of Bengal (c.1905-1947)

Paper 3 **DSE-B-2 SEM -5**: History of Southeast Asia – The 19<sup>th</sup> Century

Paper 4 **DSE-B-4 SEM -6**: History of Southeast Asia – The 20<sup>th</sup> Century

Paper 5 **DSE-B-1 SEM -5**: History of Modern East Asia – I China (c.1840 – 1949)

Paper 6 **DSE-B-3 SEM -6**: History of Modern East Asia – II Japan (c.1868 – 1945)

Paper 7 **DSE-A-2 SEM -5**: History of United States of America – I (c.1776 – 1945)

Paper 8 **DSE-A-4 SEM -6**: History of United States of America – II (c.1776-1945)

**Skill Enhancement Courses SEC –A & B (Any Two) Choosing one from group-A and one from group-B) in Semester 3 and 4**

**SEC -A 1: SEM-3 Archives and museums**

**SEC -B 1: SEM-4 Understanding Popular Culture**

**SEC-A 2: SEM-3 Understanding Heritage**

**SEC-B 2: SEM-4 Art Appreciation: an Introduction to Indian Art**

**\*Generic Elective Courses (GE) - Same as Core courses (cc) offered in the BA General Syllabus.**

## **Skill Enhancement Courses (SEC –A & B) Credits,-2 each**

### **SEC –A (1): Archives and museums**

This course introduces students to the institutions that house and maintain documentary, visual and material remains of the past. Museums and archives are among the most important such repositories and this course explains their significance and how they work. Students will be encouraged to undertake collection, documentation and exhibition of such materials in their localities and colleges. Visit to National Archives and National Museum are an integral part of the course.

#### **I. Definition and history of development (with special reference to India)**

**II. Types of archives and museums:** Understanding the traditions of preservation in India Collection policies, ethics and procedures Collection: field exploration, excavation, purchase, gift and bequests, loans and deposits, exchanges, treasure trove confiscation and others. Documentation: accessioning, indexing, cataloguing, digital documentation and de-accessioning Preservation: curatorial care, preventive conservation, chemical preservation and restoration

#### **III. Museum Presentation and Exhibition:**

#### **IV. IV. Museums, Archives and Society:** (Education and communication Outreach activities

#### **Essential Readings:**

Agrawal, O.P., Essentials of Conservation and Museology, Sundeep Prakashan, New *Delhi*, India, 2007.

Choudhary, R.D. Museums of India and their maladies. Calcutta: Agam Kala Prakashan, New Delhi, 1998 (In Bengali).

Guha, Thakurta, Tapati, Monuments, Objects, Histories: Institution of Art in Colonial Post Colonial India, New York, 2004

Kathpalia, Y. P. Conservation and Restoration of Archive Materials. UNESCO, 1973

Mathur Saloni, India by Design: Colonial History and Cultural Display, University of California, 2007

Nair, S.M. Bio-Deterioration of Museum Materials. 2011

Roychowdhury, Madhuparna. Displaying India's Heritage : Archaeology and the Museum Movement in Colonial India. Delhi: Orient Blackswan 2015

Sengupta, S. Experiencing History Through Archives. Delhi: Munshiram Manoharlal. 2004.

Agrawal, O.P., Essentials of Conservation and Museology, Delhi, 2006

Chainani, S. 2007. Heritage and Environment. Mumbai: Urban Design Research Institute, 2007

## **SEC –B (2): Art Appreciation: an Introduction to Indian Art**

The purpose of this course is to introduce students to Indian art, from ancient to contemporary times, in order to understand and appreciate its diversity and its aesthetic richness. The course will equip students with the abilities to understand art as a medium of cultural expression. It will give students direct exposure to Indian art through visuals, and visits to sites and museums.

**I. Prehistoric and protohistoric art:** Rock art; Harappan arts and crafts

**II. Indian art (c. 600 BCE – 600 CE):**

World Heritage Site Managers, UNESCO World Heritage Manuals  
[Can be downloaded/ accessed at [www.unesco.org](http://www.unesco.org)]

Notions of art and craft Canons of Indian paintings Major developments in stupa, cave, and temple art and architecture Early Indian sculpture: style and iconography Numismatic art

**III. Indian Art (c. 600 CE – 1200 CE) :** Temple forms and their architectural features Early illustrated manuscripts and mural painting traditions Early medieval sculpture: style and iconography Indian bronzes or metal icons

**IV. Indian art and architecture (c. 1200 CE – 1800 CE) :**

Sultanate and Mughal architecture Miniature painting traditions: Mughal, Rajasthani, Pahari  
Introduction to fort, palace and haveli architecture

**V. Modern and Contemporary Indian art and Architecture:**

The Colonial Period Art movements: Bengal School of Art, Progressive Artists Group, etc.  
Major artists and their artworks Popular art forms (folk art traditions)

### **Essential Readings**

Neumayer, Erwin, Lines of Stone: The pre-historic rock-art of India,  
South Asia Books, 1993

Goswamy, B.N., Essence of Indian Art, Asian Art Museum of San  
Francisco, 1986

Huntington, Susan, The Art of Ancient India: Hindu, Buddhist, Jain, Weatherhill, 1985  
Guha-Thakurta, Tapati, The making of a new modern Indian art: Aesthetics and nationalism in  
Bengal, 1850-1920, Cambridge University Press, 1992

### **Suggested Readings:**

Mitter, Partha, Indian Art, Oxford History of Art series, Oxford University Press, 2001

Dhar, Parul Pandya, ed., 2011, Indian Art History Changing Perspectives, New Delhi: D.K.  
Printworld and National Museum Institute (Introduction).

Beach, M.C., The New Cambridge History of India I: 3, Mughal and Rajput Painting, Cambridge  
University Press, 1992.

Ray, Nihar Ranjan, An Approach to Indian Art, Calcutta, 1970

Date : 12.12.2022

To  
The Principal  
Budge Budge College  
Kolkata - 700137



Sub:-Prayer to conduct field trip to Murshidabad between 19.12.2022

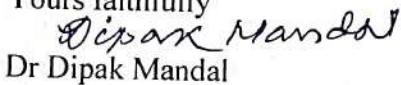
to 23.12.2022

Respected Madam,

I will be highly obliged if you kindly allow the Department of History to conduct a field trip to Murshidabad between 19.12.2022 to 23.12.2022. Murshidabad is a historically significant place. The students of first and third semester will participate in the field trip.

Thanking you

Yours faithfully



Dr Dipak Mandal

Associate Professor and H.O.D (Dept of History)



# Budge Budge College

Estd. 1971

NAAC Accredited B+ & UGC 12B, 2(f)

Affiliated to the University of Calcutta

Ref. No.....

Date .....

**BUDGE BUDGE COLLEGE**  
**LIST OF PARTICIPANTS' OF THE FIELD STUDY IN HISTORY – 2022**  
**Department of History**  
**19/12/2022 – 22/12/2022**

SI. No	NAME	GENDER	AGE	DESIGNATION
1.	DR. DEBJANI DATTA	F	59	PRINCIPAL
2.	DR. DIPAK MANDAL	M	47	ASST. PROF. & HEAD
3.	DR. SWETA DUTTA	F	43	ASST. PROF.
4.	MS.CHUMKI SARKAR	F	48	SACT
5.	MR. SUMIT SANTRA	M	31	SACT
6.	MR. TAPAS SHOW	M	37	LAB ATTENDANT
7.	KUYASA KANTHAL	F	17	STUDENT
8.	DIPANNITA ADAK	F	17	STUDENT
9.	SOHINI PARAMANICK	F	18	STUDENT
10.	TINA GHOSH	F	17	STUDENT
11.	TANIYA KHATUN	F	17	STUDENT
12.	RENUA KHATUN	F	18	STUDENT
13.	RIMI ADHIKARY	F	17	STUDENT
14.	SUROJIT MONDAL	M	19	STUDENT
15.	ESHA PAUL	F	18	STUDENT
16.	JASMIN KHATUN	F	19	STUDENT
17.	TISTA BISWAS	F	19	STUDENT
18.	RITE ADHIKARY	F	17	STUDENT
19.	SAMRIDDHA JANA	M	20	STUDENT
20.	NILAY MALIK	M	18	STUDENT
21.	RIYA SARDAR	F	19	STUDENT
22.	SUMAN JATI	M	19	STUDENT
23.	SNEHA DAS	F	19	STUDENT
24.	ANKAN DAS ADHIKARY	M	19	STUDENT
25.	RANIT ADHIKARY	M	18	STUDENT
26.	SOUMEN NASKAR	M	18	STUDENT
27.	AVIJIT KAYAL	M	21	STUDENT
28.	SAYANI KHAN	F	19	STUDENT
29.	SUBRATA MONDAL	M	21	STUDENT
30.	UPASANA CHAKRABORTY	F	18	STUDENT
31.	BAISHALI DAS	F	18	STUDENT
32.	SUMONA PARVIN	F	19	STUDENT
33.	NASRIN KHATON	F	19	STUDENT
34.	SAYON PYNE	M	18	STUDENT

*Debjani Datta*  
DR. DEBJANI DATTA  
Budge Budge College  
19/12/2022

# Budge Budge College

Estd. 1971

NAAC Accredited B+ & UGC 12B, 2(f)

Affiliated to the University of Calcutta

Ref. No.....

Date .....

Sl. No	NAME	GENDER	AGE	DESIGNATION
35.	PRITI DALUI	F	18	STUDENT
36.	SANCHITA MONDAL	F	19	STUDENT
37.	SUSMITA GHOSH	F	19	STUDENT
38.	SK HASANUR	M	19	STUDENT
39.	KRISHNA BAR	F	19	STUDENT
40.	PRITHA MONDAL	F	19	STUDENT
41.	SAKINA KHATOON	F	20	STUDENT
42.	MEHNAZ KHAN	F	20	STUDENT
43.	ABHRANIL SARKAR	M	22	STUDENT
44.	SUCHISMITA RAY	F	20	STUDENT
45.	RANADIPA DALUI	F	20	STUDENT
46.	KHADIJA KHATUN	F	19	STUDENT
47.	FATEMA KHATUN	F	20	STUDENT
48.	MONISHA KHATUN	F	21	STUDENT
49.	SUPRITI KAYAL	F	20	STUDENT
50.	ANISHA BARUA	F	19	STUDENT
51.	RESHMI KHATUN	F	20	STUDENT
52.	PRITHA BERA	F	21	STUDENT
53.	NISHA GOURI	F	20	STUDENT
54.	PARINITA NASKAR	F	21	STUDENT

Debjani Datta

DR. DEBJANI DATTA

Principal 2022

Budge Budge College

**I. Department of History: Field Visit – Hazarduari, Murshidabad**





**BUDGE BUDGE COLLEGE****Academic Session: 2022-2023****Department of History**

**1.3.2 Percentage of students undertaking project work/field work/ internships (Data for the latest completed academic year)**

**History Honours****SEC –A (1): Archives and museums &****SEC –B (2): Art Appreciation: An Introduction to Indian Art****19/12/2022 to 22/12/2022**

<b>Serial Number</b>	<b>Roll No.</b>	<b>Registration No.</b>	<b>Name</b>
1	202561-21-0041	561-1112-0191-20	Abhranil Sarkar
2	212561-21-0048	561-1112-0201-21	Anakan Das Adhikary
3	212561-11-0091	561-1211-0170-21	Anisha Barua
4	212561-21-0045	561-1112-0180-21	Avijit Kayal
5	212561-21-0021	561-1111-0193-21	Baishali Das
6	222561-11-0090	561-1211-0188-22	Dipannita Adak
7	222561-11-0072	561-1211-0140-22	Esha Paul
8	202561-11-0288	561-1215-0204-20	Fatema Khatun
9	222561-11-0008	561-1211-0016-22	Jasmin Khatun
10	202561-11-0289	561-1215-0208-20	Khadija Khatun
11	202561-11-0236	561-1212-0209-20	Krishna Bar
12	222561-11-0083	561-1211-0169-22	Kuyasa Kanthal
13	202561-11-0109	561-1211-0213-20	Mehnaz Khan
14	202561-11-0302	561-1211-1254-20	Monisha Khatun
15	212561-11-0098	561-1211-0183-21	Nasrin Khatun
16	212561-21-0017	561-1111-0169-21	Nilay Malik
17	212561-11-0178	561-1212-0194-21	Riya Sardar
18	202561-11-0298	023-1212-0071-19	Nisha Ghorui
19	202561-11-0239	561-1212-0220-20	Parinita Naskar
20	212561-11-0115	561-1211-0220-21	Pritha Bera
21	202561-11-0116	561-1211-0223-20	Pritha Mondal
22	212561-11-0175	561-1212-0186-21	Priti Dalui
23	202561-11-0240	561-1212-0225-20	Ranadipa Dalui
24	212561-21-0024	561-1111-0214-21	Ranit Adhikary
25	222561-11-0074	561-1211-0143-22	Renua Khatun
26	212561-11-0089	561-1211-0167-21	Reshma Khatun
27	222561-11-0131	561-1211-1156-22	Rimi Adhikary
28	222561-11-0075	561-1211-0144-22	Ritu Adhikary
29	202561-11-0122	561-1211-0232-20	Sakina Khatoon
30	212561-21-0016	561-1111-0165-21	Samriddha Jana
31	212561-11-0179	561-1212-0195-21	Sanchita Mondal
32	212561-11-0201	561-1214-0221-21	Sayani Khan
33	212561-21-0023	561-1111-0212-21	Sayon Pyne
34	212561-21-0034	561-1111-0284-21	Sk Hasanur
35	212561-11-0094	561-1211-0173-21	Sneha Das
36	222561-11-0005	561-1211-0012-22	Sohini Paramanick
37	212561-21-0046	561-1112-0181-21	Soumen Naskar
38	212561-21-0066	561-1112-1239-21	Subrata Mondal
39	202561-11-0128	561-1211-0245-20	Suchismita Ray
40	212561-21-0025	561-1111-0217-21	Suman Jati

<b>Serial Number</b>	<b>Roll No.</b>	<b>Registration No.</b>	<b>Name</b>
41	212561-11-0220	561-1215-0197-21	Sumona Parvin
42	202561-11-0130	561-1211-0248-20	Supriti Kayal
43	222561-21-0059	561-1112-1157-22	Surojit Mondal
44	212561-11-0092	561-1211-0171-21	Susmita Ghosh
45	222561-11-0088	561-1211-0183-22	Taniya Khatun
46	222561-11-0091	561-1211-0189-22	Tina Ghosh
47	222561-11-0087	561-1211-0181-22	Tista Biswas
48	212561-11-0101	561-1211-0190-21	Upasana Chakraborty

## **History Field Trip Report**

The Department of History conducted a field trip to Murshidabad from 19.12.2022 to 23.12.2022. The students from Semester 1, 3 and 5 participated in the trip. The department visited various places like the Katra Mosque, Kat Golap er Bagan Bari, Hazar Duari Palace and museum, Jagat Seth's house, Siraj-ud-daula's grave and Moti Jheel. Murshidabad is a very historically significant place.

**Objective:** Battle of Plassey, its causes, consequence and significance is an integral part of the syllabus. Hence, the objective was to provide additional exposure to the students regarding these aspects and historical events by visiting the historical sites in Murshidabad.

**Outcome:** The students were immensely benefitted by this trip. The visit to Hazar Duari museum was helpful to the students because History of Archives and Museums is also an important part of the syllabus and they visited an archive for the first time and examined old records.

# **B.Sc. Zoology Honours**



# UNIVERSITY OF CALCUTTA

## Notification No. CSR/ 12 /18

It is notified for information of all concerned that the Syndicate in its meeting held on 28.05.2018 (vide Item No.14) approved the Syllabi of different subjects in Undergraduate Honours / General / Major courses of studies (CBCS) under this University, as laid down in the accompanying pamphlet:

### List of the subjects

<u>Sl. No.</u>	<u>Subject</u>	<u>Sl. No.</u>	<u>Subject</u>
1	Anthropology (Honours / General)	29	Mathematics (Honours / General)
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3	Persian (Honours / General)	31	Mol. Biology (General)
4	Bengali (Honours / General /LCC2 /AECC1)	32	Philosophy (Honours / General)
5	Bio-Chemistry (Honours / General)	33	Physical Education (General)
6	Botany (Honours / General)	34	Physics (Honours / General)
7	Chemistry (Honours / General)	35	Physiology (Honours / General)
8	Computer Science (Honours / General)	36	Political Science (Honours / General)
9	Defence Studies (General)	37	Psychology (Honours / General)
10	Economics (Honours / General)	38	Sanskrit (Honours / General)
11	Education (Honours / General)	39	Social Science (General)
12	Electronics (Honours / General)	40	Sociology (Honours / General)
13	English ((Honours / General/ LCCI/ LCC2/AECC1))	41	Statistics (Honours / General)
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21	Hindi (Honours / General /LCC2 /AECC1)	49	Advertising Sales Promotion and Sales Management –ASPV (Major)
22	History (Honours / General)	50	Communicative English –CMEV (Major)
23	Islamic History Culture (Honours / General)	51	Clinical Nutrition and Dietetics CNDV (Major)
24	Home Science Extension Education (General)	52	Bachelor of Business Administration (BBA) (Honours)
25	House Hold Art (General)	53	Bachelor of Fashion and Apparel Design – (B.F.A.D.) (Honours)
26	Human Development (Honours / General)	54	Bachelor of Fine Art (B.F.A.) (Honours)
27	Human Rights (General)	55	B. Music (Honours / General) and Music (General)
28	Journalism and Mass Communication (Honours / General)		

The above shall be effective from the academic session 2018-2019.

SENATE HOUSE  
KOLKATA-700073  
The 4<sup>th</sup> June, 2018

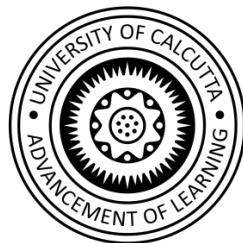
*Santnu Paul*  
4/6/18  
(Dr. Santnu Paul)  
Deputy Registrar

**UNIVERSITY OF CALCUTTA**

**CBCS SYLLABUS OF ZOOLOGY  
2018**

**F  
O  
R**

**THREE-YEAR HONOURS  
DEGREE COURSE OF STUDIES**



# Outline Structure of CBCS Curriculum for Zoology (Hons), C.U.

<b>PART I; SEM I</b>				
Subject Code	Name of Paper	Theory	Practical	Internal assessment
CC 1	Non Chordata – I (Protists to Pseudocoelomates)	50	30	20
CC 2	Molecular Biology	50	30	20
<b>PART I; SEM II</b>				
CC 3	Non Chordata – II (All Coelomate Phyla)	50	30	20
CC 4	Cell Biology	50	30	20
<b>PART II; SEM III</b>				
CC 5	Chordata	50	30	20
CC 6	Animal Physiology: Controlling & Co-ordinating System	50	30	20
CC 7	Fundamentals of Biochemistry	50	30	20
SEC-A (1/2)	Apiculture / Sericulture	80	NA	20
<b>PART II; SEM IV</b>				
CC 8	Comparative Anatomy of Vertebrate	50	30	20
CC 9	Animal Physiology: Life sustaining system	50	30	20
CC 10	Immunology	50	30	20
SEC- B(1/2)	Aquarium Fisheries/ Medical Diagnosis	80	NA	20
<b>PART III; SEM V</b>				
CC 11	Ecology	50	30	20
CC 12	Principle of Genetics	50	30	20
DSE A(1/2)	Parasitology/Biology of Insect	50	30	20
DSE B (1/2)	Endocrinology/Reproductive Biology	50	30	20
<b>PART III; SEM VI</b>				
CC 13	Developmental Biology	50	30	20
CC 14	Evolutionary Biology	50	30	20
DSE A (1/2)	Animal Biotechnology/Animal Cell Biotechnology	50	30	20
DSE B (1/2)	Animal Behaviour & Chronology/Fish & Fisheries	50	30	20

**Abbreviations:**

**CC:** Core Course; **DSE A/B:** Discipline Specific Elective A/B; **SEC A/B:** Skill Enhancement Course

## **PART III: SEMESTER 5 CORE COURSE 11. Ecology**

### **Ecology Lab, ZOOA-CC5-11-P**

Full Marks 30	60 Hours	2 Credits
<b>List of Practical</b>		
1. Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon-Weiner diversity index for the same community 2. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, salinity, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO <sub>2</sub> 3. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary/ any place of ecological interest/ ecological uniqueness/ Zoological garden		

## **PART III: SEMESTER 6**

### **DSE1. Animal Cell Biotechnology**

### **Animal Biotechnology Lab, ZOOA-DSE(A)-6-2-P**

Full Marks 30	60 Hours	2 Credits
<b>List of Practical</b>		
1. Genomic DNA isolation from <i>E. coli</i> and Plasmid DNA isolation (pUC 18/19) from <i>E. coli</i> 2. To study following techniques through photographs - Southern Blotting, Northern Blotting, Western Blotting, PCR, DNA fingerprinting 3. Project report on animal cloning & Application & ethical Issues.		

## **PART III: SEMESTER 6**

### **DSE1. Animal Behaviour and Chronobiology**

## **Animal Behaviour and Chronobiology Lab, ZOOA-DSE(B)-6-1-P**

<b>Full Marks 50</b>	<b>60 Hours</b>	<b>2 Credits</b>
<b>List of Practical</b>		
<ol style="list-style-type: none"><li>1. To study nests and nesting habits of the birds and social insects.</li><li>2. To study the behavioural responses of wood lice to dry and humid conditions(demonstration only).</li><li>3. To study geotaxis behaviour in earthworm.</li><li>4. To study the phototaxis behaviour in insect larvae.</li><li>5. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.</li><li>6. Study of circadian functions in humans (daily eating, sleep and temperature patterns).</li></ol>		

## BUDGE BUDGE COLLEGE

Academic Session: 2022-2023

Department of Zoology

1.3.2 Percentage of students undertaking project work/field work/ internships (Data for the latest completed academic year)

### B.Sc. ZOOLOGY HONOURS

#### Semester-V

Course Name: Ecology

Course Code: ZOO-A-CC-5-11-P

Serial No.	Name of student	University Roll Number	Project Title	Supervisor
1	ANANNYA MONDAL	203561-11-0026	"A field report on visit to Okhrey, Varsey, Rangaroon and Padmaja Naidu Himalayan Zoological Park"	Dr. Partha Pratim Choudhuri, Dr. Debjani Datta, Dr. Papia Das
2	SEBIKA GHOSH	203561-11-0029	"A field report on visit to Okhrey, Varsey, Rangaroon and Padmaja Naidu Himalayan Zoological Park"	Dr. Partha Pratim Choudhuri, Dr. Debjani Datta, Dr. Papia Das
3	SWASTIKA KUMAR	203561-11-0032	"A field report on visit to Okhrey, Varsey, Rangaroon and Padmaja Naidu Himalayan Zoological Park"	Dr. Partha Pratim Choudhuri, Dr. Debjani Datta, Dr. Papia Das
4	BRISHTY CHAKRABORTY	203561-11-0035	"A field report on visit to Okhrey, Varsey, Rangaroon and Padmaja Naidu Himalayan Zoological Park"	Dr. Partha Pratim Choudhuri, Dr. Debjani Datta, Dr. Papia Das
5	NAZMA KHATUN	203561-11-0039	"A field report on visit to Okhrey, Varsey, Rangaroon and Padmaja Naidu Himalayan Zoological Park"	Dr. Partha Pratim Choudhuri, Dr. Debjani Datta, Dr. Papia Das
6	PARAMITA PRAMANIK	203561-11-0048	"A field report on visit to Okhrey, Varsey, Rangaroon and Padmaja Naidu Himalayan Zoological Park"	Dr. Partha Pratim Choudhuri, Dr. Debjani Datta, Dr. Papia Das
7	AFSANA PARVEEN	203561-11-0057	"A field report on visit to Okhrey, Varsey, Rangaroon and Padmaja Naidu Himalayan Zoological Park"	Dr. Partha Pratim Choudhuri, Dr. Debjani Datta, Dr. Papia Das
8	SIDHARTA ADHIKARY	203561-21-0004	"A field report on visit to Okhrey, Varsey, Rangaroon and Padmaja Naidu Himalayan Zoological Park"	Dr. Partha Pratim Choudhuri, Dr. Debjani Datta, Dr. Papia Das

<b>Serial No.</b>	<b>Name of student</b>	<b>University Roll Number</b>	<b>Project Tittle</b>	<b>Supervisor</b>
9	SK NADIR RAFED	203561-21-0005	"A field report on visit to Okhrey, Varsey, Rangaroon and Padmaja Naidu Himalayan Zoological Park"	Dr. Partha Pratim Choudhuri, Dr. Debjani Datta, Dr. Papia Das
10.	PRAJJAL PAL	203561-21-0018	"A field report on visit to Okhrey, Varsey, Rangaroon and Padmaja Naidu Himalayan Zoological Park"	Dr. Partha Pratim Choudhuri, Dr. Debjani Datta, Dr. Papia Das

**B.Sc. ZOOLOGY HONOURS**

**Semester-VI**

**Course Name: Animal Biotechnology  
COURSE Code: ZOO-A-DSE-A-6-02-P**

<b>Serial No.</b>	<b>Name of student</b>	<b>University Roll Number</b>	<b>Project Tittle</b>	<b>Supervisor</b>
1	UPASANA DAS	203561-11-0004	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
2	ANANNYA MONDAL	203561-11-0026	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
3	SEBIKA GHOSH	203561-11-0029	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
4	SWASTIKA KUMAR	203561-11-0032	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
5	BRISHTY CHAKRABORTY	203561-11-0035	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
6	NAZMA KHATUN	203561-11-0039	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
7	PARAMITA PRAMANIK	203561-11-0048	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
8	TRINA MONDAL	203561-11-0055	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
9	AFSANA PARVEEN	203561-11-0057	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri

<b>Serial No.</b>	<b>Name of student</b>	<b>University Roll Number</b>	<b>Project Tittle</b>	<b>Supervisor</b>
10	NANDITA PRAMANICK	203561-11-0061	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
11	SIDHARTA ADHIKARY	203561-21-0004	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
12	SK NADIR RAFED	203561-21-0005	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
13	KRISHNENDU GAYEN	203561-21-0015	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
14.	SHUVIJIT MONDAL	203561-21-0017	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri
15.	PRAJJAL PAL	203561-21-0018	"A Project Report on Animal cloning, its applications & ethical issues"	Dr. Partha Pratim Choudhuri

**B.Sc. ZOOLOGY HONOURS**  
**Semester-VI**

**Course Name: Animal Behaviour and Chronobiology**  
**COURSE Code: ZOO-A-DSE-B-6-01-P**

<b>Serial No.</b>	<b>Name of student</b>	<b>University Roll Number</b>	<b>Project Tittle</b>	<b>Supervisor</b>
1	UPASANA DAS	203561-11-0004	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
2	ANANNYA MONDAL	203561-11-0026	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
3	SEBIKA GHOSH	203561-11-0029	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
4	SWASTIKA KUMAR	203561-11-0032	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
5	BRISHTY CHAKRABORTY	203561-11-0035	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera

<b>Serial No.</b>	<b>Name of student</b>	<b>University Roll Number</b>	<b>Project Title</b>	<b>Supervisor</b>
6	NAZMA KHATUN	203561-11-0039	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
7	PARAMITA PRAMANIK	203561-11-0048	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
8	TRINA MONDAL	203561-11-0055	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
9	AFSANA PARVEEN	203561-11-0057	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
10	NANDITA PRAMANICK	203561-11-0061	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
11	SIDHARTA ADHIKARY	203561-21-0004	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
12	SK NADIR RAFED	203561-21-0005	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
13	KRISHNENDU GAYEN	203561-21-0015	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
14.	SHUVOJIT MONDAL	203561-21-0017	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera
15.	PRAJJAL PAL	203561-21-0018	"A Project on Study Of Circadian Functions In Human"	Dr.Barnali Bera

of

17/10/2022

To  
The Principal  
Budge Budge College  
Budge Budge  
24 Parganas (South)

(P)  
27/10/2022

**Sub: Request for sanction of an advance of Rs. 60,000.00 for conducting field study at Okhrey and Varsey, West Sikkim.**

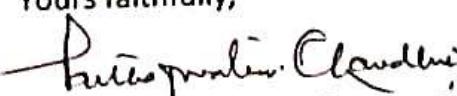
Madam,

This is to inform you that the Department of Zoology is going to organize a field study as a part of the curriculum of the syllabus of the University of Calcutta for the students of B. Sc. (Hons) 5<sup>th</sup> Semester at Okhrey and Varsey, West Sikkim, between 14<sup>th</sup> and 21<sup>st</sup> of November, 2022. In this connection, I do request you to sanction an amount of Rs. 60,000.00 to meet the expenses related to full maintenance (Fooding, Lodging, etc.) and transport support for 4 staff members and partial support to 8 students, who will be participating in the said field study.

Enclosing herewith the list of participants of the above trip for your verification and necessary action.

Thanking you,

Yours faithfully,

  
(Partha Pratim Chaudhuri) 17/10/22  
Head, Dept. of Zoology

## **Department of Zoology**

### **Field Trip 2022-2023**

**Field Trip to Okhrey, Varsey, Rangaroon and Padmaja Naidu Himalayan Zoological Park by Semester V students, Zoology Honours, Budge Budge College.**

**Trip Duration/Time:** 14<sup>th</sup> November, 2022 to 22<sup>nd</sup> November, 2022

#### **Objective of Field Trip**

The field study gives an opportunity to observe the animals in their natural abode. The field trips are a way of enhancing classroom learning by making real world connections. It is required to have a complete knowledge on the subject. During exposing to the nature's laboratory during field work and getting a chance to interact with creatures living in diverse habitat, one's knowledge seems to be completed. Field study also helps in generating love to nature in our mind which will definite be helpful in conservation of precious diversity. The different places of Himalaya and its biodiversity is considered one of the megadiversity zone with various flora and fauna give the chance of observing the wonders of nature from close quarters.

#### **Project Outcome**

**Hands-on Experience:** Field trips allow students to experience hands-on learning opportunities. They can experience real-life situations that enable them to apply what they have learned in class. Students can observe the animals 'diversity which they have studied in their books. They can collect the information about their behaviour in natural habitat also which makes them more dutiful towards the preservation and conservation of that particular animal. During the present trip the students got the chance to observe different flora and fauna of Alpine Forest area in their natural abode.

**Better Teacher-Student Relationship:** Field trips help teachers connect with their students on an emotional level. When teachers take their classes on field trips, they get to know their

students in ways that they don't usually do when simply teaching them in a classroom setting. Teachers can use this connection to motivate their students to learn more about whatever topic they're studying at the time of the trip. The present trip has gifted a nice teacher-student bonding.

**Foster Collaboration:** Students learn more when they work together. Field trips provide an opportunity for students to collaborate on a project or task, which fosters their ability to work together.

**Develop Life-Skills:** Field trips help students to build self-confidence by exploring new places and situations on their own.

**Improve Learning Outcomes:** Field trips also give students a chance to practice skills they've learned in class, such as reading maps, following directions and interacting with strangers. This helps solidify what they've learned in class. During the present trip students got the opportunities to observe how people live in small villages in the hilly regions, came to know about their daily life struggles which helped them to make better understanding about life.

**Department of Zoology**

**Field Trip to Okhrey, Varsey, Rangaroon and Padmaja Naidu Himalayan Zoological Park by Semester V students, Zoology Honours, Budge Budge College.**





# UNIVERSITY OF CALCUTTA

B.Sc Honours Semester : V  
Examination : 2022

## FIELD REPORT



UNIVERSITY ROLL NO	203561-11-0032
UNIVERSITY REG. NO	561-1211-0421-20
SUBJECT	ZOOA
PAPER	CC11
EXAMINATION	PRACTICAL

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EXAMINED  
 Book of Zoology  
 WITH PAPER WORK

# ACKNOWLEDGEMENT

The period of 7days excursion from **14-21<sup>th</sup> NOVEMBER** at "**Okhrey, Varsey and Rangaroon**" had been truly encouraging and informative. I have gained a lot of knowledge regarding biodiversity, forest ecosystem and experience gained here would be highly beneficial for my future career as well.

Who always guided me during my excursion at "**Okhrey, Varsey and Rangaroon**"-----

- **Dr. Debjani Datta (Principal)**
- **Dr. Partha Pratim Chaudhuri (Head of the Department of Zoology)**
- **Dr. Papia Das (Assistant Professor, Department of Zoology)**

Who candled my spirit of learning by his presence and guidance.

I would also like to thank our staff member, **Mr. Tapas Show** and all my fellow friends of our College who have helped me immensely during the excursion, making my trip an enriching one.

EXAMINED  
Dept. of Zoology  
VIVEKNANDA COLLEGE  
TOMORROW

## NECESSITY AND PRIORITY OF THE PROJECT

### (1) Necessity of the Biodiversity Conservation in the State of Sikkim:

In the State of Sikkim, more than 4,500 flowering plants are found, and among those plants in particular, there are 550 species of **Orchids** and 36 species of **Rhododendron**. Furthermore, in view of the global biodiversity conservation, there are more than 50 flowering plants which are considered to be in danger of extinction, and precious flowering plants are conserved in the State of Sikkim. The State of Sikkim is located in the area of the **Biodiversity Hotspot of Eastern Himalaya Region**, and flowering plants per unit area are abundant compared with the other neighbouring states and countries such as Nepal and Bhutan. Moreover, other than flowering plants, there are many animal species living in the State of Sikkim; more than 50 kinds of fishes, 690 kinds of butterflies, 16 kinds of amphibian (one species recognized in danger of extinction), 78 kinds of reptiles, 550 kinds of birds (11 species recognized in danger of extinction), 154 mammals (12 species recognized in danger of extinction).

### (2) Necessity of the Forest Management in the State of Sikkim:

The forest cover in Sikkim was 37% in 1975. However, the forest cover increased steadily, and it became 46% in 2005. However, the open forest accounts for around 25%, and forest cover in Sikkim does not satisfy the national forest cover target, which is two third of the total geographical area in the hilly states. Considering the severe natural environment of the northern part of Sikkim to grow trees, although is difficult to achieve the national target. Department of Forest, Environment, and Wildlife Management (DFEWWM) considers to increase the forest cover substantially in the near future for people living in the forest fringe area who are heavily dependent on the natural forest resources such as fuel wood for the source of energy, and fodder, medicinal plants, herbs for their own consumption. Although the scale is not so clear, there seems to be illegal collection of the forest products within the public lands by the local people. Furthermore, soil moisture conservation capacity is not enough to prevent landslides which occur in many part of Sikkim.

# BIODIVERSITY

## **What is Biodiversity?**

**BIODIVERSITY**, short for **biological diversity**, is the term used to describe the variety of life found on Earth and all of the natural processes. This includes ecosystem, genetic and cultural diversity, and the connections between these and all species. To describe this immense variety and richness of life on this planet, the term "**Biodiversity (Bio Diversity) or Biological Diversity**" was coined. The origin of the term is credited to two papers published in 1980 (Lovejoy, 1980; Norse and Mc Manus, 1980). However, after the Rio Earth Summit (1992), biodiversity gained a global audience.

The diversity of life on earth is immense. Although taxonomists have so far recognized less than 2 million species, some biologists opined that as many as 5 and 30 million living species may inhabit the earth, most of them small insects in Tropical forests (Wilson, 1992). Scientists believe that total number of on earth is in between 10 million to 80 million (Stork, 1988; Wilson 1988). Each species contains upto 400,000 genes and virtually no two members of the same species are genetically identical. Nature has taken more than 600 million years to develop this exceedingly complex spectrum of life on this planet.

## **Values of Biodiversity:**

The different aspects of biodiversity all have a very strong influence on each other. We have only just started to understand the relationships between living things and their environments. It is helpful to think of an ecosystem as a woven carpet; if you pull on a loose thread it might only affect the thread and those closest to it or it might unravel the whole carpet.

Biodiversity also helps us in our day-to-day lives. Unfortunately, the greenhouse gases produced by human activities are building up in the atmosphere and causing climate change. Climate change is a major threat to biodiversity. Climate change affects air and ocean temperatures, the length of seasons, sea levels, the pattern of ocean and wind currents, levels of precipitation, as well as other things. These changes affect the habitats and behaviour of many different species. Many will not be able to adapt fast enough and may become extinct.

## Types of Biodiversity:

Biodiversity can be subdivided as three types---

- I. Genetic Diversity
- II. Species Diversity
- III. Ecosystem Diversity

### Genetic Diversity :-

At finer levels of organisation, biodiversity includes the genetic variation within species, both among geographically separated populations and among individuals within the single population.

Differences between individual organisms have two causes: variation in the genetic material which all organisms possess and which is passed on from generation to generation; and variation caused by environmental influence on each individual organism. New genetic variation, which arises by gene and chromosome mutation in individuals and in sexually reproducing organisms, is spread in the population by a recombination of genetic material during cell division preceding sexual reproduction.

A great deal of work needs to be done on the conservation of genetic diversity within wild species in India. Protecting the Gir Habitat, for instance, has saved the Asiatic Lion. India also has a long tradition of domestic animal breeding for specific qualities. These include cattle, goats and sheep as well as horses and pigeons for sport.

The replacement of numerous locally adapted varieties with a few high yielding strains in the large contiguous areas presents the danger of the spread of serious diseases capable of wiping out the entire crop, as happened prior to the Bengal rice famine in 1942.

A productive and stable agriculture requires genetic diversity on the farm. Genetically diverse crop varieties enable farmers to fit their cropping systems to heterogeneous conditions, to enhance the food security of their households and to exploit a range of crop products.

The challenges are at least two-fold; to meet farmers' needs for wide genetic diversity whether through enhanced access to local varieties or newly introduced genetic resources; and to find strategies for linking longer-term conservation goals with immediate product needs.

## ♦ Species Diversity :-

Biodiversity at its most basic level includes the full range of species on earth from micro-organisms such as viruses, bacteria through the multicellular kingdom of plants, animals and fungi. Thus, it refers to the variety of species within a region. It is measured on the basis of number of species in the region. Species' richness varies geographically. Out of an estimation 30 million species on earth, only one-sixth has been identified and authenticated in the past 200 years. Only 250,000 species of the total stock are plants.

Keystone species have an important role in maintaining the diversity of a whole community of other species. Keystone species would include pollinators, top predators and the decomposer organisms and so-forth. The wild species are of considerable potential benefit to man in medicine, agriculture and industry as a natural source of drugs, food, fuel, fibre, industrial base compounds and additives.

## • Ecosystem Diversity :-

On the wider scale, biodiversity includes variations in the biological communities in which species live, the ecosystem in which communities exist, and the interactions among these levels.

In the living world, interdependence and interaction between organisms and their environment are a very common practice to assert one's existence on this planet. On the other hand, nature always tries to remain in homeostatic state and various life forms help to maintain this equilibrium. For both these cases, biodiversity serves as the source of livestock. To human beings, it opens avenues for understanding the laws and ways of nature and for making the optimum sustainable use of life support systems gifted to man by nature.

The regulation of biogeochemical cycles, maintenance of predator-prey relationships by various types of food chains and food webs and finally the balance of nature are maintained through biodiversity. Again it indirectly influences the climatic factors, soil nature, chemistry of air etc. that are the abiotic elements of an ecosystem. Ecosystem diversity could be best understood if one studies the communities in various ecological niches within the given ecosystem.

## Levels of Biodiversity:

### • Alpha Diversity ( $\alpha$ -diversity) :-

The term **alpha diversity** ( $\alpha$ -diversity) was introduced by **R. H. Whittaker** together with the terms beta diversity ( $\beta$ -diversity) and gamma diversity ( $\gamma$ -diversity). Whittaker's idea was that the total species diversity in a landscape (gamma diversity) is determined by two different things, the mean species diversity in sites or habitats at a more local scale (alpha diversity) and the differentiation among those habitats beta diversity.

Ecologists have used several slightly different definitions of alpha diversity. Whittaker himself used the term both for the species diversity in a single subunit and for the mean species diversity in a collection of subunits. It has been argued that defining alpha diversity as a mean across all relevant subunits is preferable, because it agrees better with Whittaker's idea that total species diversity consists of alpha and beta components.

Definitions of alpha diversity can also differ in what they assume diversity to be. Often researchers use the values given by one or more diversity indices such as species richness, the Shannon index or the Simpson index. However, it has been argued that it would be better to use the effective number of species as the universal measure of species diversity.

### • Beta Diversity ( $\beta$ -diversity) :-

The term beta diversity ( $\beta$ -diversity) was introduced by R. H. Whittaker together with the terms alpha diversity ( $\alpha$ -diversity) and gamma diversity ( $\gamma$ -diversity). The idea was that the total species diversity in a landscape ( $\gamma$ ) is determined by two different things, the mean species diversity at the habitat level ( $\alpha$ ) and the differentiation among habitats ( $\beta$ ). Whittaker proposed several ways of quantifying differentiation, and subsequent generations of ecologists have invented more. As a result, the definition of beta diversity has become quite contentious. Some use beta diversity as a broad umbrella term that can refer to any of several indices related to compositional heterogeneity. Others argue that such broad usage should be avoided because it leads to confusion. Instead, they propose that the term beta diversity be used to refer to one phenomenon only (true beta diversity), and that other things be referred to by other names.

Gamma diversity and alpha diversity can be calculated directly from species inventory data. The simplest of Whittaker's original definitions of beta diversity is

$$\beta = \gamma/\alpha.$$

Here gamma diversity is the total species diversity of a landscape, and alpha diversity is the mean species diversity per habitat. Because the limits among habitats and landscapes are diffuse and to some degree subjective, it has been proposed that gamma diversity can be quantified for any inventory dataset, and that alpha and beta diversity can be quantified whenever the dataset is divided into subunits. Then gamma diversity is the total species diversity in the dataset and alpha diversity the mean species diversity per subunit. Beta diversity quantifies how many subunits there would be if the total species diversity of the dataset and the mean species diversity per subunit remained the same, but the subunits shared no species.

#### ❖ Gamma Diversity ( $\gamma$ -diversity) :-

The term **gamma diversity** ( $\gamma$ -diversity) was introduced by **R. H. Whittaker** together with the terms alpha diversity ( $\alpha$ -diversity) and beta diversity ( $\beta$ -diversity). Whittaker's idea was that the total species diversity in a landscape ( $\gamma$ ) is determined by two different things, the mean species diversity in sites or habitats at a more local scale ( $\alpha$ ) and the differentiation among those habitats ( $\beta$ ). According to this reasoning, alpha diversity and beta diversity constitute independent components of gamma diversity.

Researchers have used different ways to define diversity, which in practice has led to different definitions of gamma diversity as well. Often researchers use the values given by one or more diversity indices, such as species richness, the Shannon index or the Simpson index. However, it has been argued that it would be better to use the effective number of species as the universal measure of species diversity. This measure allows weighting rare and abundant species in different ways, just as the diversity indices collectively do, but its meaning is intuitively easier to understand. The effective number of species is the number of equally-abundant species needed to obtain the same mean proportional species abundance as that observed in the dataset of interest (where all species may not be equally abundant).

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## **Biodiversity Hotspot:**

A **biodiversity hotspot** is a biogeographic region with a significant reservoir of biodiversity that is under threat from humans. The concept of biodiversity hotspots was originated by **Norman Myers** in two articles in “**The Environmentalist**” (1988), & 1990 revised after thorough analysis by Myers and others in “**Hotspots: Earth’s Biologically Richest and Most Endangered Terrestrial Eco regions**”.

To qualify as a biodiversity hotspot on Myers 2000 edition of the hotspot-map, a region must meet two strict criteria:

1. It must contain at least 0.5% or 1,500 species of vascular plants as endemics, and
2. It has to have lost at least 70% of its primary vegetation. Around the world, 25 areas qualify under this definition, with nine other possible candidates. These sites support nearly 60% of the world's plant, bird, mammal, reptile, and amphibian species with a very high share of endemic species.

Four regions that satisfy these criteria exist in India and are described below.

### **The Western Ghats and Sri Lanka**

The Western Ghats are a chain of hills that run along the western edge of peninsular India.

### **The Eastern Himalayas**

The Eastern Himalayas is the region encompassing Bhutan, northeastern India, and southern, central, and eastern Nepal.

### **Indo-Burma**

The Indo-Burma region encompasses several countries. It is spread out from Eastern Bangladesh to Malaysia and includes North-Eastern India south of Brahmaputra river, Myanmar, the southern part of China's Yunnan province, Lao People's Democratic Republic, Cambodia, Vietnam and Thailand. The Indo-Burma region is spread over 2 million sq. km of tropical Asia.

### **Sundaland**

Sundaland is a region in South-East Asia that covers the western part of the Indo-Malayan archipelago. It includes Thailand, Malaysia, Singapore, Brunei and Indonesia. India is represented by the Nicobar Islands.

## Distribution by Origin:

- ↓ North and Central America
- ↓ South America
- ↓ Europe and Central Asia
- ↓ Africa
- ↓ South Asia
- ↓ South East Asia and Asia Pacific