



Assessment of environmental, health and socio-economic status of a village of Purba Bardhaman, West Bengal, India – A Pilot Study

Koushik Dutta

Department of Environmental Studies, Trivenidevi Bhalotia College, Raniganj, Paschim Bardhaman, W.B., India
koushikdutta32@gmail.com

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Abstract

Purba Bardhaman is basically an agricultural based part of West Bengal. This investigation is carried out to measure the environmental, health and socio-economic status of the region. It is an experimental as well as survey based study. Standard scientific methods were adopted to analyse different water, soil and biological samples. The study is very relevant in the present day context. The analytical study of soil and water (ground water as well as surface water) of this vicinity show that the water and soil do not contain traceable amount of heavy metals and lethal constituents for instance cadmium (Cd), chromium (Cr), lead (Pb), arsenic (As) etc. But some parts of this constituency are contaminated with iron. Farmers mainly apply chemical fertilisers instead of biofertilisers in their crop field. Fishes and fruits grown in this region do not contain toxic heavy metal and hence do not pose any health related threats to the consumers. Villagers are suffering from water borne diseases (especially the children) during the rainy season. The socio-economic study reveals that people of this region are peace loving and lives happily irrespective of the religion. Open defecation is very common practice among the villagers (including the women) although all the villagers are having their own toilet. Educational status of this province is not quite satisfactory. Electricity and water supply are provided to all the villagers. The main earning sources of the people of this region are crop cultivation and pisciculture. New generation of this region are slowly left their traditional jobs and are shifted to other jobs. However the economic status of this section is somewhat satisfactory. But slowly and gradually the lifestyle and socio-economic condition of this region is changing.

Keywords: Arsenic, environmental health, GDP (gross domestic product), ground water, socio-economic, surface water.

Introduction

India is proverbially known as the nation of villages. Traditionally, Indian villages from its pre-historic period have maintained unity. In spite of so many natural calamities, human activities like wars and attacks even, disturbance in between the neighbouring states, there has not been any disturbance in the unity of the village. The collective consciousness among the villagers has been so strong that they have unbreakable ties among themselves which are manifested in the collective celebrations of village festivals, rituals and ceremonies. It is argued that the village self-sufficiency contributes to the maintenance of village uniqueness. The villagers are much closer to natural environment as compared to their counterparts in urban communities. A little degradation of environment, natural resource base directly influences the village people. Agriculture is the backbone of village economy. Village can be considered as the basic unit of rural areas with definite surveyed boundaries¹.

The nature of Indian villages is changing very fast due to the effect of globalisation²⁻⁴. Some researchers have studied on the present status of Indian villages⁵⁻¹⁷. But those are very insufficient. To fill this lacuna the present work has been carried out. Current study was conducted to know the eminence of

water (ground water and surface water), soil, some locally available biological organisms (fish and fruit), condition of health and the socio-economic status of a village of Purba Bardhaman, West Bengal, India.

Materials and methods

The methodology of this study is survey based as well as of experimental in nature. Water, soil and biological samples were collected, preserved, stored, digested (for extraction of metals) and analysed following different standard methods¹⁸⁻²⁵. The entire study was conducted in the year 2017 - '18. Spatial (location wise) and temporal (season wise) variations were observed.

Description of the study area: Purba Bardhaman district of West Bengal is famous for agriculture and produces huge amount of crop every year since very long time. The study area i.e., Chhota Bainan village of Purba Bardhaman district (latitude: 22° 59' 01" to 22° 59' 54" N and longitude: 87° 51' 00" to 87° 51' 46" E) is 35 km away from Burdwan railway station and is well connected by road with other parts of the state.

This village is under Painta I gram panchayet of Riana II block and covers 608.80 hectares of area.

Results and discussion

Analysis of water: Analysis of physicochemical parameters of surface water and ground water samples were represented in Table-1 and Table-2 respectively. Average pH values of surface water (6.50 to 7.80) and ground water (6.51 to 6.92) samples were found 7.07 and 6.74 respectively with seasonal fluctuations. All the values were within the specified limit²⁶. Conductivity (EC) values of surface water (40 to 61 $\mu\text{S/cm/sec}$) and ground water (50 to 81 $\mu\text{S/cm/sec}$) samples were also varied seasonally. Average values of dissolved oxygen (DO) concentration of surface water (6.20 to 6.40 mg/l) and ground water (1.20 to 1.40 mg/l) samples were recorded as 6.20 mg/l and 1.20 mg/l respectively. Short seasonal deviations were noticed. DO content of surface water samples were found suitable for fish and other aquatic organisms whereas the DO content of ground water were recorded very low. Chemical oxygen demand (COD) values of surface water (3 to 4 mg/l) and ground water (8 to 10 mg/l) samples varied seasonally and were very much within the desirable limit²⁶.

Total dissolved solids (TDS) values of surface water and ground water samples deviated from 90 to 114 mg/l and 75 to 120 mg/l respectively with distinct seasonal variations. TDS values of all the water samples were always found within the specified limit²⁶. Total suspended solids (TSS) values of surface water and ground water samples oscillated between 5 to 9 mg/l and 1 to 3 mg/l respectively with very short seasonal fluctuations. TSS values of all the water samples remained within the desirable limit²⁷. Total alkalinity (TA) values ranged from 16 to 24 mg/l and 14 to 18 mg/l in the surface water and ground water samples respectively. The results showed spatial and temporal deviations. The values of all the samples always remained within the specified limit²⁶ throughout the entire period of study. Total hardness (TH) contents varied between 88.00 to 108.30 mg/l and 98.00 to 120.00 mg/l in the surface water and ground water samples respectively with unambiguous seasonal deviations.

All the values were within the specified limit²⁷. Nitrate-nitrogen values of surface water and ground water samples were found as 0.12 to 0.27 mg/l and 8.00 to 12.00 mg/l respectively with notable seasonal variations. All the respective values were well below the desirable limit²⁶. Phosphate contents of surface water and ground water samples were deviated from 0.03 to 0.05 mg/l and 2.30 to 4.70 mg/l respectively. Sharp seasonal variations were also recorded. All the values were within the specified limit²⁸. Potassium (K) of surface water and ground water samples varied between 130 to 180 mg/l and 12 to 18 mg/l respectively. Results showed seasonal fluctuations. All the values exceeded the desirable limit²⁶. Extremely high contents of potassium were recorded in the surface water samples which might be due to excessive application of potassium containing chemical fertilisers by the farmers in the crop field and also due to use of detergents and soaps for cleaning of cloths, bathing etc. by the villagers.

Table-1: Physicochemical analysis of surface water samples.

Parameter	Mean \pm SD \pm SE	Range
pH	7.07 \pm 0.67 \pm 0.39	6.50 - 7.80
EC	52 \pm 10.82 \pm 6.25	40 - 61
DO	6.20 \pm 0.20 \pm 0.11	6.20 - 6.40
COD	3.0 \pm 1.00 \pm 0.58	3.00 - 4.00
TDS	102.00 \pm 12.00 \pm 6.93	90 - 114
TSS	7.0 \pm 2.00 \pm 1.15	5 - 9
TA	20.00 \pm 4.0 \pm 2.31	16.00 - 24.00
TH	94.00 \pm 12.16 \pm 7.02	88.00 - 108.30
Nitrate-N ₂	0.20 \pm 0.07 \pm 0.04	0.12 - 0.27
Phosphate	0.04 \pm 0.01 \pm 0.005	0.03 - 0.05
K	150 \pm 26.46 \pm 15.28	130 - 180
F ⁻	0.70 \pm 0.10 \pm 0.06	0.60 - 0.80
Fe	0.02 \pm 0.01 \pm 0.006	0.02 - 0.03
Cr	BDL	BDL
Pb	BDL	BDL
Cd	BDL	BDL
As	BDL	BDL

[All values are denoted in mg/l excluding pH and EC ($\mu\text{S/cm/sec}$)]

Fluoride (F⁻) values were oscillated between 0.60 to 0.80 mg/l and 0.60 to 0.67 mg/l in the surface water and ground water samples respectively. The results showed sharp spatial as well as temporal fluctuations and were within the desirable limit²⁷. Analysis of metals in the surface and ground water samples disclosed that all the water samples were devoid of toxic elements like chromium, lead, cadmium and arsenic except the iron. Iron content oscillated between 0.02 to 0.03 mg/l and 0.20 to 0.40 mg/l in the surface water and ground water samples respectively. All the values were within the desirable limit²⁷ except few ground water samples. Several workers reported on the status of surface and ground water of different Indian villages^{5-10,12,17}.

Analysis of soil: Analysis of physicochemical parameters of soil samples were documented in Table-3. pH of soils ranged from 5.50 to 6.20 with an average of 5.79 which were acidic in nature but all the values were within the desirable limit²⁹. Conductivity of soil samples varied between 52 to 131

µs/cm/sec and the mean value was recorded as 96 µs/cm/sec. The values showed seasonal fluctuations. The organic matter (OM) content of soils was found 1.34 to 2.69 % which was high²⁰ and can be considered as good for plant community. The values of available nitrogen ranged between 31.36 to 40.77 kg/ha and were supposed to be low²¹. Short seasonal fluctuations were noticed. Average value (60.67 kg/ha) of available phosphate content of soil samples was found slightly high²². Seasonal variations (43.17 to 91.37 kg/ha) were also recorded. Available potassium content of soil samples varied from 185.17 to 308.61 kg/ha with distinct seasonal oscillations and the values were always remained in the medium²³ range. The iron content of soil samples ranged between 0.60 to 0.90 mg/kg and the mean value was recorded as 0.75 mg/kg. Short seasonal deviations were also observed. The study of toxic elements and heavy metal content (Cr, Pb, Cd and As) revealed no detectable amount of heavy metals in the soil samples which is a good indication for soil health. It can be mentioned that the quality of soil of the village is conducive for agriculture and cropping system. Different scientists have worked on the physicochemical parameters (including the heavy metals) of soils of various Indian villages^{9-10, 12, 17}.

Table-2: Physicochemical analysis of ground water samples.

Parameter	Mean ± SD ± SE	Range
pH	6.74 ± 0.21 ± 0.12	6.51 - 6.92
EC	64 ± 15.72 ± 9.08	50 - 81
DO	1.20 ± 0.20 ± 0.11	1.20 - 1.40
COD	9.0 ± 1.00 ± 0.58	8.0 - 10.0
TDS	98.0 ± 22.52 ± 13.00	75 - 120
TSS	2.0 ± 1.00 ± 0.58	1 - 3
TA	16.00 ± 2.0 ± 1.15	14.00 - 18.00
TH	110.00 ± 11.13 ± 6.43	98.00 - 120.00
Nitrate-N ₂	10.00 ± 2.00 ± 1.15	8.00 - 12.00
Phosphate	3.27 ± 1.27 ± 0.73	2.30 - 4.70
K	15.00 ± 3.00 ± 1.73	12.00 - 18.00
F	0.63 ± 0.04 ± 0.02	0.60 - 0.67
Fe	0.30 ± 0.10 ± 0.06	0.20 - 0.40
Cr	BDL	BDL
Pb	BDL	BDL
Cd	BDL	BDL
As	BDL	BDL

[All values are denoted in mg/l excluding pH and EC (µs/cm/sec)].

Table-3: Physicochemical analysis of soil samples.

Parameter	Mean ± SD ± SE	Range
pH	5.79 ± 0.37 ± 0.21	5.50 - 6.20
EC (µs/cm/sec)	96 ± 40.26 ± 23.24	52 - 131
OM (%)	2.06 ± 0.68 ± 0.39	1.34 - 2.69
Available Nitrogen (kg/ha)	36.59 ± 4.79 ± 2.77	31.36 - 40.77
Available Phosphate (kg/ha)	60.67 ± 26.67 ± 15.39	43.17 - 91.37
Available Potassium (kg/ha)	255.46 ± 63.48 ± 36.77	185.17 - 308.61
Fe (mg/kg)	0.75 ± 0.15 ± 0.09	0.60 - 0.90
As (mg/kg)	BDL	BDL
Cr (mg/kg)	BDL	BDL
Pb (mg/kg)	BDL	BDL
Cd (mg/kg)	BDL	BDL

Analysis of biological samples: Assessment of bioaccumulation in different locally grown plant (vegetative part i.e., fruit of mango tree) and animal species (muscle of fishes) was carried out to know the extent of metal toxicity and contamination in food chain (Table-4). In the present study the amount of heavy metals and toxic elements (like Cr, Pb, Cd and As) in the fruits of *Mangifera indica* and muscles of different fishes like *Labeo rohita*, *Catla catla* and *Cirrhinus mrigala* were found below the detection level (BDL) and consequently showed no intimidation to its consumers as far as the health status is considered. It is a very good sign for the biosphere of the region. Several workers were assessed the level of metal accumulation in various biological samples^{7-8, 10, 14-15, 17}.

Table-4: Analysis of heavy metals in biological samples.

Biological Sample	Cr	Pb	Cd	As
<i>Mangifera indica</i> (Mango tree)	BDL	BDL	BDL	BDL
<i>Labeo rohita</i> (Ruhu fish)	BDL	BDL	BDL	BDL
<i>Catla catla</i> (Catla fish)	BDL	BDL	BDL	BDL
<i>Cirrhinus mrigala</i> (Mrigel fish)	BDL	BDL	BDL	BDL

[Cr – Chromium, Pb – Lead, Cd – Cadmium, As – Arsenic]

Assessment of health and socio-economic status: Study of health and socio-economic status are very important because it

will demonstrate the real picture of any society. The general information about the village was collected from primary source (formal interview with the villagers) and secondary source¹ and was recorded in Table-5. The study of health status revealed some common water borne disease (especially among the children) as well as some infectious diseases like STI (Sexual Tract Infection) and white discharge (among the women). No polio or leprosy patient was found in the village. Very few tuberculosis and Hepatitis A patients were also found. Socio-economic study revealed that the people of this village were lived with unity since long back. The entire village is provided with inbuilt sanitation system by the local panchayet but still many villagers are reported to use the open fields. This bad habit should be stopped. Many students left their education in midway in quest of earning money. As a result very few graduates are found among the villagers which are not a good sign for the village society. Modern amenities like colour television, cable channels, mobile handset etc., are consumed by the villagers. Agriculture and pisciculture are the focal occupation of the villagers since long past. Toxic chemical fertilisers and pesticides (insecticide, fungicide, rodenticide, herbicide etc.,) are cheap and easily available and hence those are applied by the farmers. This must be stopped immediately because those are very harmful for the whole ecosystem. Farmers should be encouraged to apply green manures (like biofertilisers) as well as biopesticides in their crop field which are ecofriendly in nature and environmentally safe in all aspects. The young generations are not interested in their traditional jobs and either they are adopting other profitable businesses or are migrating towards the cities in search of better occupation. Some unlawful and unscientific beliefs and superstitions are present among the villagers such as male baby is preferred than female baby (which is reflected in the male-female ratio), child marriage, dowry system etc. These could only be stopped by scientific awareness campaigning and spread of education among the villagers by the competent authorities and NGO's. Some researchers were reported on the socio-economic and health status of Indian villages^{2-4, 11, 13, 16.}

Conclusion

India is mostly a village based country. Indian economy (GDP) is greatly dependent on village production. Globalisation is leaving its impact on Indian villages. As a result the Indian villages are changing very fast and the present village of study is not an exception to it. The new generations of Indian villages are slowly addicted to the so called city culture and are gradually forgotten their age-old rich culture and tradition. Hence it is the upmost duty and responsibility of the central as well as the state governments of India to sponsor various developmental projects (such as construction of better transportation system, educational organisations, health facilities etc.) and to create different employment opportunities in the villages and thereby giving a new hope of light to the Indian villagers and also to arrest their migration towards the so called cities and metropolis in search of better opportunities.

Table-5: General informations about the village.

Village	Choto Bainan
Panchayet	Painta-I
Block	Raina II
District	Purba Bardhaman
Total Population	10,301
Male	5,225
Female	5,076
Male : Female	103:100
Children (upto 5 years)	837 (Male: 437, Female: 400)
Male Child : Female Child	109.25:100
Literacy Rate	70.70%
Total Schedule Caste	3,685 (among them 1,601 are female)
Total Schedule Tribe	179 (among them 91 are female)
Total Number of Primary School	11 (including one English medium school)
Total Number of High School	02 (upto secondary level)
Religion	Hindu (major), some Muslims and very few Christians
Total Number of Family	2,064
Number of Family (BPL)	1,101
Primary Health Centre	One
Main Diseases	STI, white discharge, common water borne diseases
Transportation	Bus, toto, auto, cycle, two wheelers, van rickshaw
Nearest Hospital	Arambag General Hospital (22 km)
Nearest College	Shyamsundar College (13 km)
Water Supply	Tube well, deep tube well
Electricity Supply	100% (provided by State Government)
Sanitation System	100% (in built by local panchayet)
Main Occupation	Agriculture and pisciculture

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