Assessing the Impact of Flyash on Crop Productivity and Surrounding Environment around Budge-Budge Thermal Power Station, S.24 parganas, West Bengal

Mousumi Basu
Part time Lecturer
Department of Geography
Prafulla Chandra College,Kolkata,India

Abstract - Since the initial planning, the power sector has played an indispensible role in economic development of our nation. Thermal power generation dominates the power sector accounting almost 64 % of total power generation in India. BBGS is situated on the western bank of river Hooghly near Budge Budge railway station. It lies in Pujali Municipality of Budge Budge-I block of Alipur subdivision, S.24 Parganas district. This power station is operated by Calcutta Electric Supply Corporation (CESC), having three units of total 750 MW capacities. This paper seeks to assess the impact of fly ash generated by BudgeBudge Thermal Power Station (BBGS)on the surrounding environment and also to analyse the imapact of fly ash on crop productivity in and around BudgeBudge Thermal Power Station. Satellite image (Resourcesat-2; LISS-3, band 4) is used to identify the location and various statistical methods are applied to assess the impact of fly ash. Recent land use map of BBGS and its surrounding area shows changing land use characteristic of this region. BBGS acquired area was formerly covered by 'hogla' forest and paddy fields. Often BBGS dumps fly ash on the adjoining farm land and often pump their ash slurry directly into the nearby river. As a result soil is getting contaminated and climate is being polluted by various hazardous gases. Some remedial steps have already been taken by the authority of power plant to minimize the negative impact of fly ash. It can be concluded that BBGS can play a positive role in regional planning if proper management is being taken.

Key words: BBGS, Fly ash, PM, TSS, ash slurry

➢ INTRODUCTION:

The effective use Energy is essential for economic growth and economic development is depended upon the rate of improvement in per capita energy consumption. India has a fast growing energy market. Still 80% of energy requirement is fulfilled by fossil fuels. But unfortunately, fossil fuels are the major source of pollutants, greenhouse gases, and other trace atmospheric varieties. Coal plays major role to run thermal power stations. There is also limited use of natural gas in these energy activities.India ranks 6th in the world in energy consumption accounting for 3.4% of the global energy consumption.

➢ OBJECTIVE OF THE STUDY

The primary objective of this work is to know the impact of fly ash generated from BBGS on the the agricultural production system and to analyse the impact on local livelihood and to mitigate the problems. Other objectives are –

1. To know the causes and consequences of environmental problems in the surrounding area of Budge-BudgeThermal Power Station.
2. To know the status of thermal plants in Budge-Budge.
3. To know how excessive emission of fly ash is affecting the cropping pattern.
4. To know the present situation of the of agricultural land holders in this area.
5. To know that how the local administration is involved to solve these problems.
6. To give probable solutions and to draw a conclusion about the future of this project.

➢ METHODOLOGY

Most of the analysis of the data and information is based upon intensive field work including data collection and empirical observations in field work. For Primary data collection, I have taken 15 families from each ward of Pujali Municipality (15families X 15wards=225 families) for interview purpose. For secondary data collection, Topographical maps, LANDSAT imageries, questionnaire, literature reviews has been used. Field work includes visit to the site, official discussions, and interview with the executives, staffs and labours of associated plant and photographs. All these field observations, samples and data are analyzed in qualitative and quantitative way.

➢ 1. LOCATION AND AREA – BTPS

BBGS is located in the south-western suburb zone of Kolkata. It lies under Pujali municipality of Alipur Sub Division of South 24 Parganas district, West Bengal, India. This Thermal Power Station is managed by Calcutta Electric Supply Corporation,

having three power generating units of 250 MW capacities each .This is a coal based power plant which at present occupies a total area of 308 acres from $22^0$27'38"N to $22^0$28'40"N and from $88^0$8'15"E to $88^0$8'50"E. (Fig.No. 1.1).

Fig1.1.-Location map of Budge-budge Thermal Power Station
(Source: District planning map series & Pujali Municipality Office)

2. STATUS OF BUDGE BUDGE THERMAL POWER STATION (BBGS) :

Former area of BBGS (Acres)	extended area of BBGS(Acres)	Present Total Area (Acres)
308	83	391

Budge Budge Thermal Power Station (BBGS) is established on 16th Sept, 1997.Then the total area was about 126432 Sq.m. On 6th march, 1999, unit-II of the plant was established. Finally, on 3rd July, 2009, unit III was set up .Now the area extended to 335889 sq. m(Fig. no.2.1&Table no. 2.1).Today, with three operational units the total installed capacity of this station stands for 750 MW.(Fig. no. 2.2 &Table no. 2.2)

Source: G.M office, B.B.G.S

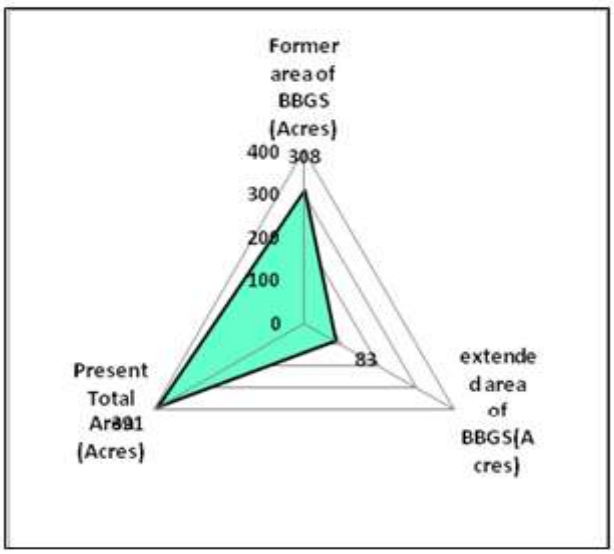


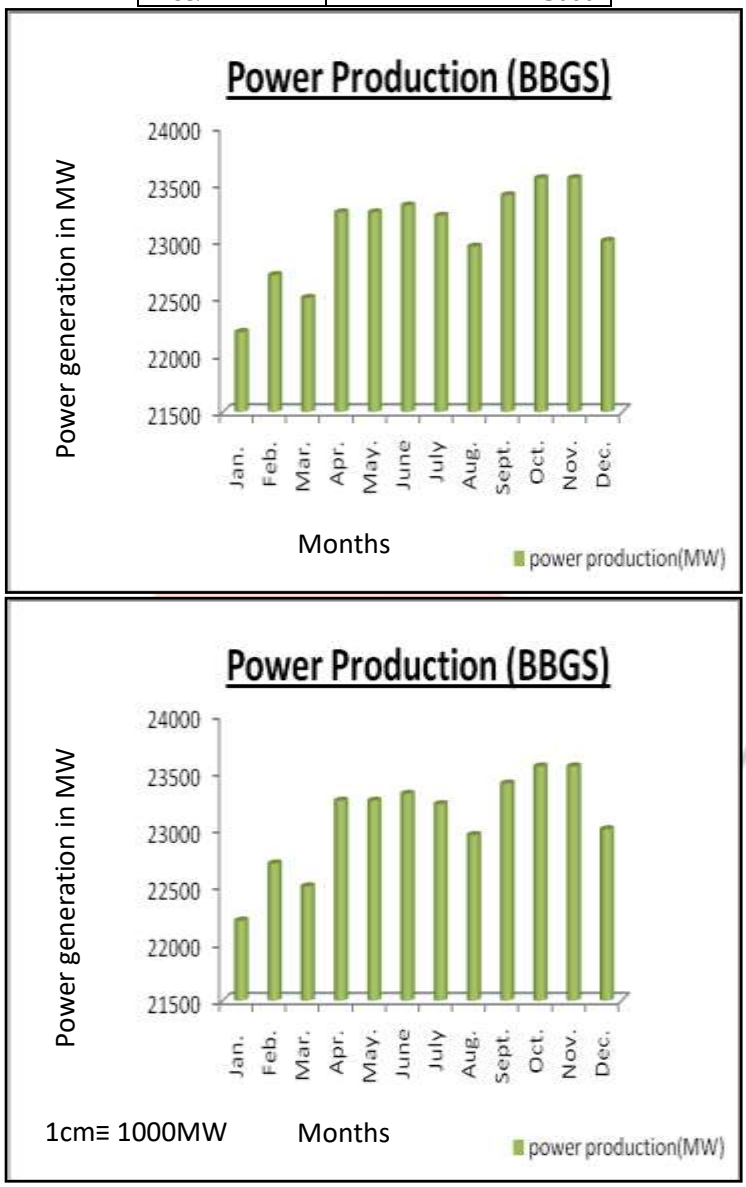
Fig .2.1- Area of BBGS (2015)

Table no. 2.2

Months (2014)	power production(MW)
Jan.	22200
Feb.	22700
Mar.	22500
Apr.	23250

May.	23250
June	23310
July	23220
Aug.	22950
Sept.	23400
Oct.	23550
Nov.	23550
Dec.	23000

1cm≡ 1000MW



Source: G.M Office, 2015 Fig no. 2.2: Power Generation by BBGS, 2014

3. Fly ash (FA) Generation:

The FA is a part of coal combustion residues (CCRs). CCRs include FA, bottom ash, boiler slag, flue gas desulfurization (FGD) residue and other solid fine particles which possess major environmental problems. Mainly two types of fly ash are there (Fig no.3.3).

1. Fly ash (50%)-collected in Electro Static Precipitator (ESP) and stored in Burge. Then exported to Bangladesh for Ceramic Plant as raw material.
2. Bottom Ash (42%)- collected in boiler bottom ash hopper and stored in ash Silo for removal by truck for earth or low land filling .
3. Flue gases (8%) - these are mainly SO x, NO x, CO and also water vapour etc. (Fig. no.3.4).

Types of waste material	Waste material amount (%) (2015)

Fly ash	50
Bottom Ash	42
Flue gases	8

Table no.3.1

Various uses of fly ash	Amount (%)
ceramic industry	52
road/dam	23
pesticides	6
brick	4
land filling	4
mine filling	17
other	2

Table no. 3.2

Source: G.M. Office, 2015 (B.B.G.S)

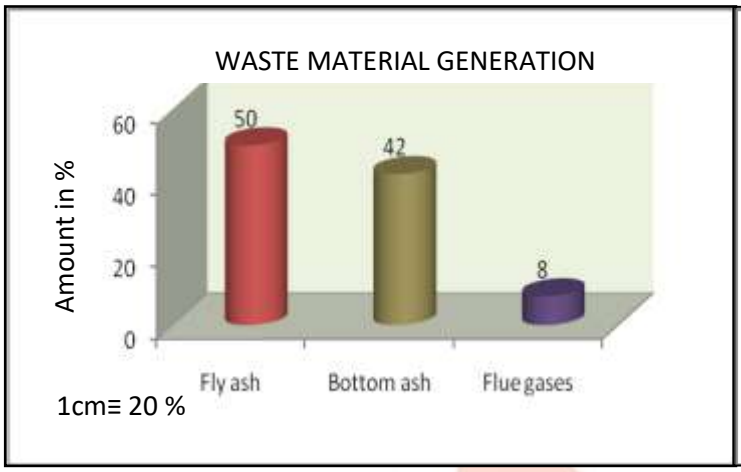


Fig. no. 3.3: Waste material generation (BBGS)

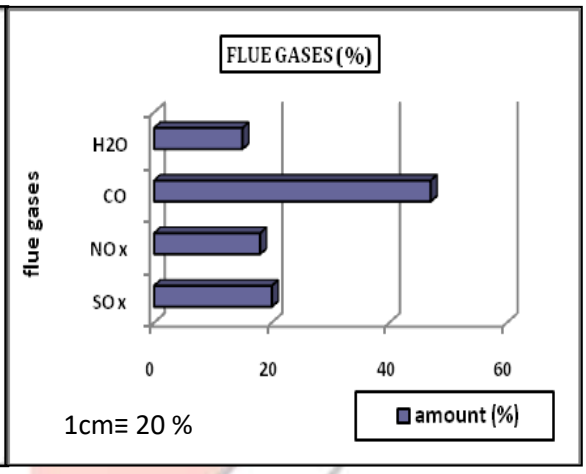


Fig. no. 3.4: Flue gases emitted by BBGS

Source: G.M. Office, 2015 (B.B.G.S)

[1] Fly ash collection:

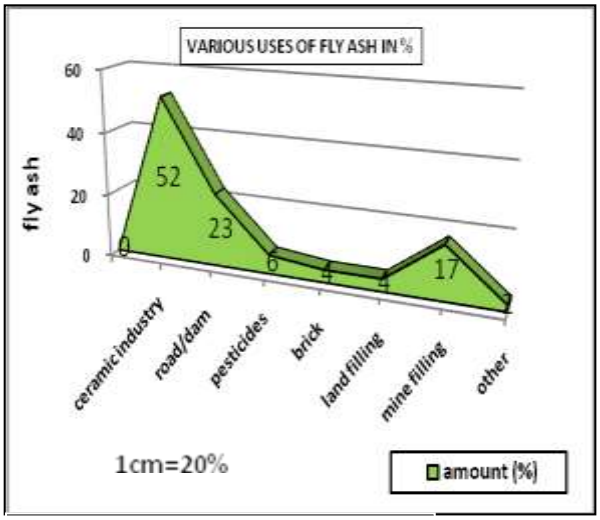
In case of BBGS, fly ash is captured and removed from the flue gas by electrostatic precipitators or fabric bag filters (or sometimes both). The precipitators or bag filters are removed fly ash gradually and sometime it is removed periodically. Generally, from the storage silos, fly ash is subsequently transported by trucks to the cement factory or brick field (Fig no.4.1).

[2] Bottom ash collection:

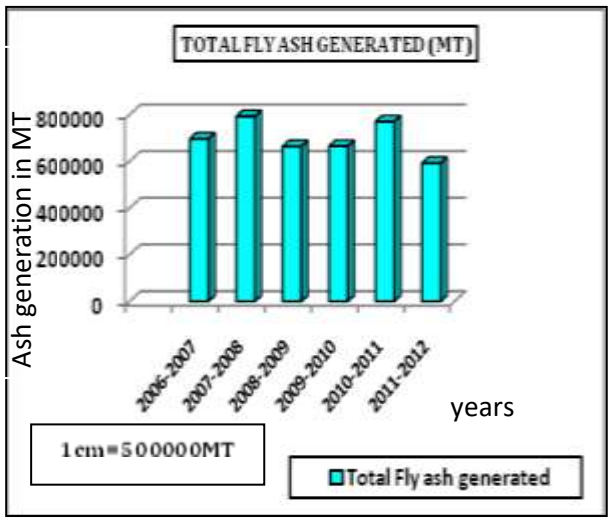
Bottom ash generally collected from the bottom of the boiler. Bottom ash is generated mixed with water, and then it is disposed to ash pond. The mixed component of the fly ash is leached in the soil with the help of rain water and gradually hampers the fertility of soil. One of the major problems of BBGS is fly ash management. The plants are overflowed during the season of monsoon and contaminated nearby water bodies.

4.Fly ash Utilization:

In the past ,fly ash is generally released to the atmosphere after coal burning. But now pollution control equipment mandated.So, it should be captured before release.At present BBGS generates almost 48000 MT ash/Month which is mainly exported for ceramic industry in bangladesh. And Some portion is used for brick making, land filling, cement factory,road or dam construction, pesticide making, mine filling et**c**. (Fig. no. 4.2 & table no. 3.2).



Source: G.M. Office, (B.B.G.S)

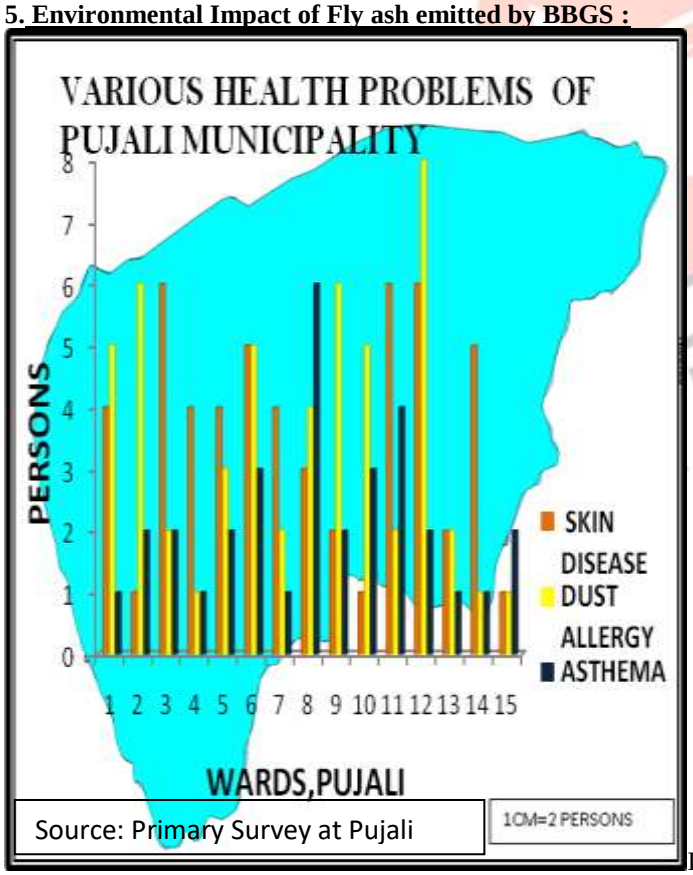


Source: G.M.Office, 2015 (B.B.G.S)

Fig 4.1: Yearwise flyash generation

Fig no. 4.2 Utilization of fly ash

5. Environmental Impact of Fly ash emitted by BBGS :



It is the only plant in India to have installed a de-watering system for disposal of bottom ash, which is largely used for filling of low-lying areas. The company was in compliance with water pollution and waste management. Unlike most of the plants in the sector, the plant meets strict PM norms of 50-75mg/Nm3 except in some incidences where high stack PM emissions were recorded by the state pollution control board (Fig. no. 5.2& 5.3). Its fly ash utilization record is also positive as76 per cent of total ash is used for cement and bricks. The plant sells its fly ash to cement manufacturers in Bangladesh. The plant has adopted many good practices for handling ash, including pneumatic storage

in silos, pneumatic transport into barges and high concentration slurry disposal (Fig. no. 5.1).

Fig no.5.1- Ash related Problems around BBGS

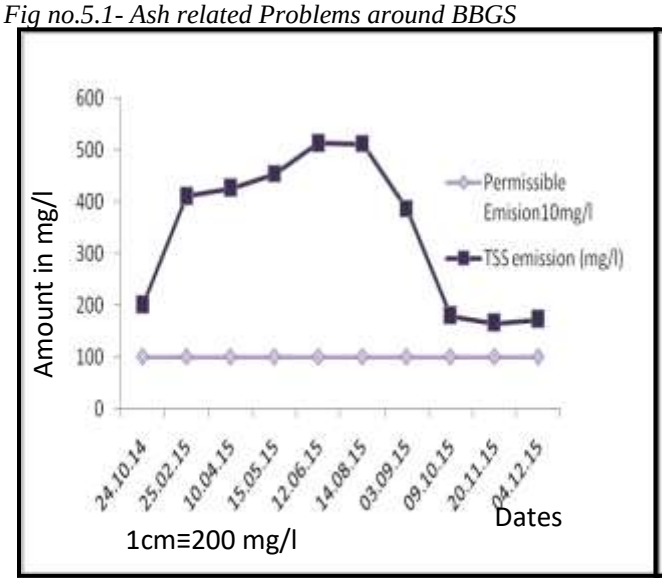


Fig.no.5.2:TSS Emission by BBGS

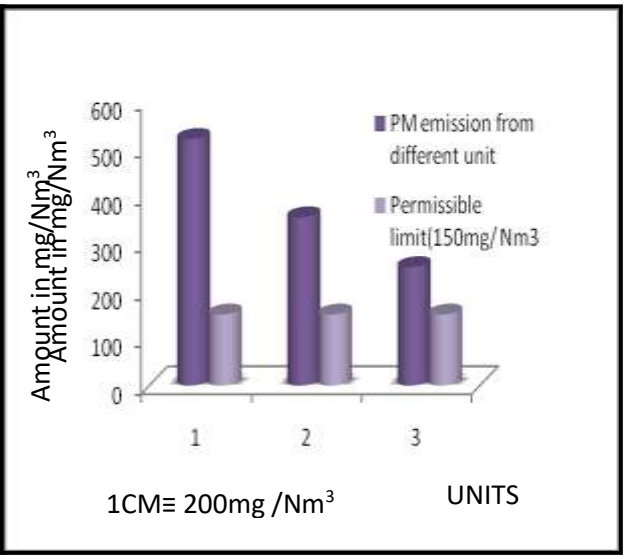


Fig.no.5.3:PM Emission by BBGS

Table no.7.6.3.2 Source: G.M.Office,B.B.G.S

Date/Year	Emission mg/l from B.B.G.S	
	Permissible Emision10mg/l	**TSS emission (mg/l)**
24.10.14	100	200
25.02.15	100	410
10.04.15	100	625
15.05.15	100	700
12.06.15	100	812
14.08.15	100	710
03.09.15	100	185
09.10.15	100	180
20.11.15	100	165
04.12.15	100	172

Table no.7.6.3 Source: G.M.Office,B.B.G.S

Units	Emission mg/Nm^3	
	PM emission from different unit	Permissible limit(150mg/ Nm^3
1	520	150
2	355	150
3	250	150

6. CHANGING PATTERN OF LAND UTILIZATION IN AND AROUND BUDGE BUDGE THERMAL POWER PLANT:

- The Budge Budge Power Generating Station acquired area was covered by dense 'Hogla Bon' and marshy land (0.96km^2+0.13km^2). A marshy land is a wetland that is dominated by herbaceous rather than woody plant species. Marshes can often be found at the area where they form a transition between the aquatic and terrestrial ecosystems. They are often dominated by grasses.

- Some of the portion of agricultural lands in Pujali Municipality had taken by CESC for ash disposal ground (Fig.6.1). Thermal Power stations generally use pulverized coal or lignite as fuel which generate large quantities of ash as a by-product. Concerning the environment and the need for safe disposal and effective utilization of fly ash, Department of Science & Technology (DST as the nodal agency) and Technology Information and Assessment Council (TIFAC as the implementing agency) commissioned a Fly ash Mission in 1994 which includes Fly ash Characterization, Handling and Transportation coal and fly ash, Agriculture related studies and Application, Ash Ponds and Dams, Reclamation of Ash Ponds for Human Settlement, Roads and Embankments, Underground Mine Filling etc (Fig.no.6.1).

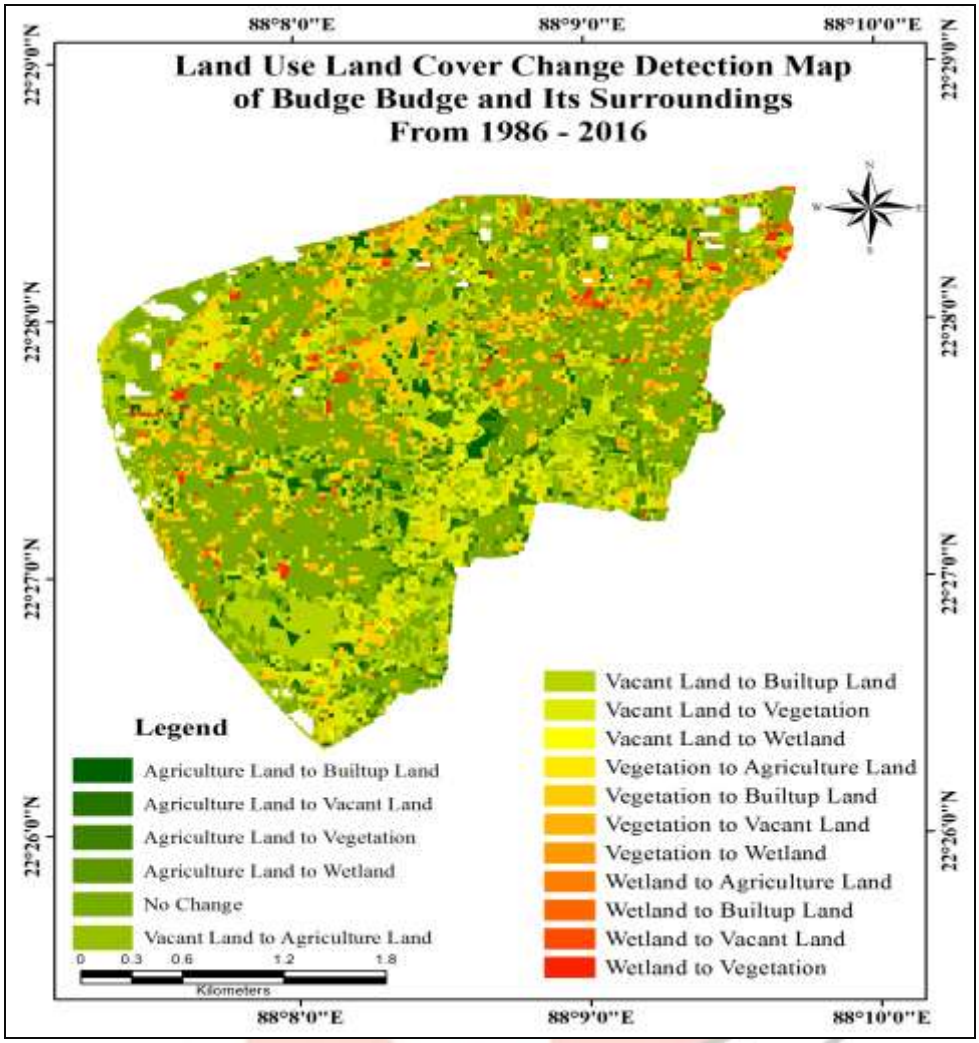
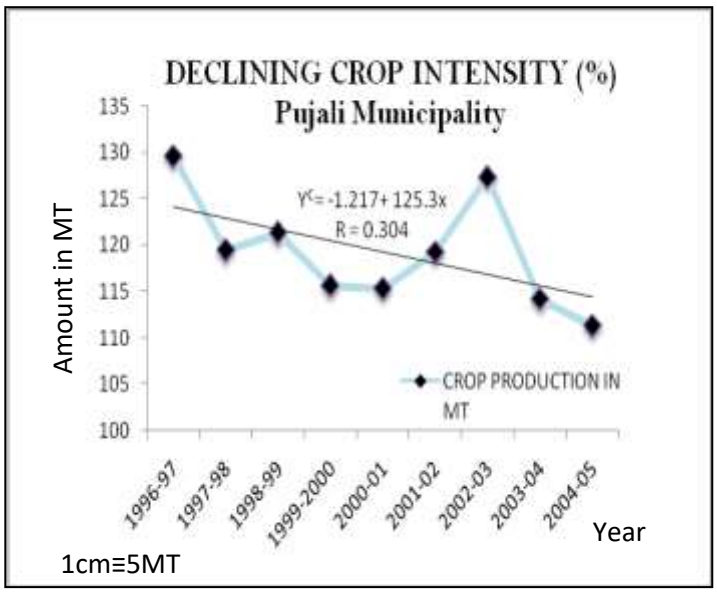


Fig.No.6.1. Land use change detection map around BBGS

7. DECLINING CROP INTENSITY :

BBGS claimed that ash was being used in agriculture and waste land development but the community complained about illegal ash dumping on agricultural fields and wetlands. Agricultural productivity in the surrounding region has been declining during the last three decades. Some of the farmers are of the opinion that the fly ash has also to some extent hindered the production. The layer of the fly ash sometimes blocks the air circulation in the soil and saplings cannot have sufficient amount of nutrients and food and as a result the growth is threatened. Thus, local farmers are selling their land to others. The characters of land are incredibly changed from agriculture land to fallow land. The trend of land use change is from agro-economic to industrial based economy. According to the report of crop coverage pattern, production of paddy has already decreased.

YEAR	CROP INTENSITY (%)
1996-97	129.52
97-98	119.42
98-99	121.3
99-2000	115.62
2000-01	115.31
2001-02	119.2
2002-03	127.3
2003-04	114.17
2004-05	111.3



Source: Agricultural Dept. Of Pujali Municipality *Fig no.7.1 -Declining crop intensity in and around BBGS*

SUGGESTIONS

Suggestions are discussed likewise :

- Application of better technology for controlling the emission of fly ash should be introduced. For example to reduce boiler efficiency loss due to blow down. All volatile treatment/ zero solid treatment and modification of furnace related to ID Fan vane and scoop control may be introduced. Definition of Boiler Efficiency is "The percentage of the total heating value." In other word, it is a rate how the boiler runs efficiently.
  The actual calculation for the boiler efficiency is the followings;

  （Steam value per hour:kg）×（h2－h1）×100

  Boiler Efficiency＝ (Fuel consumption per hour: kg）×（Fuel low calorific heating value: kcal/kg）

  h2: The ratio enthalpy of feed water (kcal/kg）

  h1: The ratio enthalpy of steam (kcal/kg）

- After the combustion of the coal in the boiler, 20% of the ash is collected at the bottom of the boiler called bottom ash and 80% is carried along with flue gases called fly ash. Bottom ash is mixed with water and made into sludge form and sent through pumps into the ash ponds. The Electro Static Precipitator is used to collect the ash particles in the flue gases.

- Transportation of ash from ash ponds in properly covered vehicles should be stared to avoid spillage of ash. There are some guidelines but Central Pollution Control Board to protect the environment, conserve top soil and prevent dumping & disposal of ash .

- The industry should take adequate measures to avoid spreading of dust during excavation, loading unloading and transportation of ash.

- Proper utilization of fly ash will not only minimize the disposal problem but will also help in utilizing precious land in a better way.

➢ CONCLUDING REMARK:

If we consider agricultural development along with industrial developer, it will be difficult to come to conclusion weather the establishment of thermal power station is justified or not, nobody can deny about the infrastructural and economic development of an area after the establishment of a plant. On the other hand according to environmental impact assessment, fly ash has already caused enormous damage to the local agricultural land and river ecology and if this trend countries for few years more, the area will surely face difficulty in persuading profitable economic activities and problems of the local people will increase. Whereas WBPDCL has suggested some better application of advanced technology to control the emission of fly ash and few afforestation programmes have already taken by plant authority in the surrounding areas to maintain the environmental quality and ecological balance.

References:

[3] Annon (2006): Summary Report of the Study on Post-clearance Environmental Impacts and Cost-Benefit Analysis of Power Generation of India; National Environmental Research Institute (NEERI)
[4] Annon (2006-07): Annual Report of Kolaghat Thermal Power Plant (KTPP)
[5] Annual Report published by West Bengal Pollution ControlBoard, 2004.
[6] Basu, S.R.(2005):Recent Findings on the River Dynamics of Bengal: PostFarakka Condition of the Off take and Bank Erosion of the River Bhagirathi- Hugli, Geog. Rev. of India,Vol. 67,No.4, pp.315-346.
[7] Berkavoa, V. (2007). Application of Remote Sensing and GIS for Change Detection from Various Data Type of Remote Sensing M.A Thesis (unpublished).
[8] Census of India (2001), Series-22, West Bengal, Part X-A and B District Census Handbook, S.24 Parganas, Town and - Village Directory and Primary Census Abstract, pp 78-81.
[9] Economic Survey,2009-10,2010-11
[10] Estimation of area and production of principal crop in West Bengal,(2008-09), Evaluation wing, Directorate of Agriculture, Govt. West Bengal.
[11] Kumar,S. "Coal Ash Utilization: An Overview" ,Seminar organised by CAII,November'98
[12] K., Chakraborty T. K. & Das A. K. "Coal ash utilization - Threat and Opportunity" Seminar organized by CAII, November, '98
[13] O'Malley,L.S.S. (1905) Indian Civil Service, Bengal District Gazetteers: 24.Parganas.pp-
[14] Ramachandra TV, Ramakrishna YB, Krishnadas G, Bhat SP, Mahapatra. DM, Aithal BH. Environmental Profile and People's Livelihood Aspects in the Vicinity of Coal Based Thermal Power Plant at Yellur Panchayat, Udupi District, CES Technical Report 12604/2012
[15] Saigo B. (2005). Nigeria. W. P{ & Cunningham: M.A. Global Environmental Issues National Open University of & Environmental Science
[16] Santra, A., Mitra, D., and Mitra, S., (2011), Spatial modeling using high resolution image for future shoreline prediction along Junput Coast, West Bengal, India. Geo-Spatial Information Science, 14(3), pp 157- 163.
[17] Santra, A., Mitra, D., and Mitra, S., (2013), Change detection analysis of the shoreline using Toposheet and Satellite Image: A case study of the coastal stretch of Mandarmani- Shankarpur, West Bengal,India .
[18] Sau. P.K "Role of thermal power Plant in Regional Planning".
[19] Sengupta B. & Paliwal S. K. "Strategies to control pollution from coal based thermal power plants in India" Journal o CAII, July '97.

Website assistance:

[20] www.Google.co.in
[21] www.wikipedia .com
[22] www.agaportal.de/pdf/nachhaltigkeit/eia/eia_tuerkei_kraftwerk.pdf