DEFORESTATION AND GREENHOUSE GAS EMISSION CAUSED BY THE BRICKFIELDS: BANGLADESH PERSPECTIVE

MD. Danesh Miah[1], Syed Ashraful Alam
Institute of Forestry and Environmental Sciences, University of Chittagong, Chittagong 4331, Bangladesh

Abstract
The study focuses on the potentialities of the total brickfields of Bangladesh of deforesting and emitting greenhouse gases due to the consumption of woodfuel and fossil fuel. The result was analyzed on the basis of the observation of 12 brickfields in Hathazari Upazilla, Chittagong, Bangladesh. The methodological approach followed the procedures outlined by the Intergovernmental Panel on Climate Change (IPCC) for conducting inventory of deforestation and greenhouse gas emission. It was estimated that due to the consumption of wood fuel in the brickfields of Bangladesh, the total deforested wood would be 42,48,600 m^3 encompassing round wood 14,65,020 m^3 and branches 27,83,580 m^3 annually. By considering all wood fuel and fossil fuel, it was estimated that, the total emissions from all the brickfields of Bangladesh would be 40,57,110 t CO_2, 17,700 t CH_4, 1,54,920 t CO, 123 t N_2O, 4,410 t NO_x and 2,880 t NO per annum while the total carbon released in the atmosphere would be 11,06,490 t annually.

INTRODUCTION

The most and important greenhouse effect is global warming, referring to the increased temperature in the atmosphere of the earth, in part, due to the emissions of greenhouse gases associated with human activities, such as burning of fossil fuels, biomass, cement manufacturing, livestock rearing, deforestation and other land use changes. The most recent report of the Intergovernmental Panel on Climate Change (IPCC), indicates that an increase in the mean global temperature of 2^0c over the 21st century is likely, potentially resulting in a sea level rise of as much as one meter, increased inundation of coastal areas, higher frequency of flooding and more intense storms (IPCC, 1996). It is predicted that Bangladesh will be 0.5 to 2.0^0C warmer than today by the year 2030 (SEHD, 1998). As a result, the sea level rise may be about 20 centimeter by 2030 and this could be as much as 1 meter by the end of the 21st century (Mahtab, 1992).

[1] Author for correspondence [dansmiah@yahoo.com]

The total area of Bangladesh is 1,44,862 km^2 (55,931 $mile^2$), of which major rivers and estuaries occupy about 9,700 km^2. Bangladesh lies astride the Tropic of Cancer (Latitude 23^0 30/ N) and the 90^0 E Meridian. The range of latitude in Bangladesh is between 20^0 25/ N and 26^0 38/ N. Longitude ranges from 88^0 01/ E to 92^0 40/ E (Brammer, 1996). In Bangladesh, two billion bricks are produced every year. Out of which, one billion and 375 million are burnt with wood, 400 million with coal and 225 million with natural gas. Every year the total quantity of wood fuel available in Bangladesh is 204 million cft, out of which 52 million cft are burnt in the brickfields (SEHD, 1998).

Wood fuel and fossil fuels (coal and crude oil) are the responsible for the emissions of the trace and non-trace greenhouse gasses, such as CO_2, CH_4, CO, N_2O, NO_x and NO (WB, 1998). So, brick industries are important sources of greenhouse gases as they use wood fuel, coal, fuel oil (crude oil), tremendously for brick burning. Brickfields in Bangladesh solely burn fossil and wood fuels to produce bricks releasing a huge amount of greenhouse gases in the atmosphere and declining a large quantity of wood volumes from the forests. Taking this hypothesis the present study has been carried out to assess the rate of the emission of greenhouse gases in the atmosphere as well as the rate of deforestation.

Previously no basic research work was carried out especially on the emission of greenhouse gases from the brickfields in Bangladesh. Miah (2001), BCAS (1996), Ahmed *et al*. (1996) and Mahtab (1992) well documented on the greenhouse gas emission, global warming and climate change in Bangladesh. But most of the results were based on secondary information. Thus, the present study was accomplished with the observation of randomly selected 12 brickfields in Hathazari Upazilla, Chittagong, Bangladesh, carried out over a period of three months from October to December 2001(Alam, 2002) to achieve following objectives: a) To predict the rate of deforestation caused by the brickfields due to the consumption of woodfuel in Bangladesh; b) To predict the emission of greenhouse gases from the brickfields due to the consumption of fossil fuels in Bangladesh. The methodological approach followed the procedures outlined by the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 1994; WB, 1998).

BRICKFIELDS IN BANGLADESH AS WELL AS THEIR POTENTIALITIES AS A SOURCE OF GREENHOUSE GASES

Brickfields are operated almost all over the country during the dry season (December to April) in Bangladesh. Brickfields as an industrial venture bring easy money, but generally corrode the ecology and human health. Brickfields, with rapid urbanization are being indiscriminately developed throughout the country (SEHD, 1998). There are about 3,000 brickfields in Bangladesh, they used 2,000 and 108 thousands tonnes of wood fuel and coal respectively for brick burning in 1993 (FAO, 1993). The Brick Manufacturers Association of

Bangladesh (BMA) estimates that there are approximately 2,500 brick manufacturers in Bangladesh, each producing about 1 million bricks/year on average. The largest units can produce about 5-6 million bricks/year. Most brick production units are located in rural and semi-urban areas while the larger plants are often concentrated near urban centers. It is believed that a sizeable but unknown number of smaller units are also scattered in rural areas, meeting local demand when required. The annual production of bricks has been estimated at about 3,000 million bricks/year (FAO, 1993).

The Brick industry is energy intensive in Bangladesh and energy accounts for close to 50% of production cost. Bricks are fired using various sources of energy. These include wood fuel, coal, and natural gas. Fuel oil is also used but limited to only a few factories (FAO, 1993).

Wood fuel, which can also be a cheap fuel depending on its source, has been as a source of energy but it is still widely used by the industry as is evident from estimates from the 1987-1988 season when approximately 50% of total production was thought to be produced using wood as fuel. Coal is also widely used but from time to time there appear to be problems with coal's availability as well as with its quality, which apparently has deteriorated in the last few years. The amount of energy required to fire bricks varies, depending on the fuel type used. If wood fuel is used to make fired brick, 2.8-4.3 MJ/kg is required while for all other fuels, it ranges from 1.5-2.8 MJ/kg (FAO, 1993).

According to an account of Bangladesh Atomic Energy Commission one brick needs 430 grams of wood fuel for it to be burned. The Department of Environment (DOE) accounts that every 100,000 bricks need 430 Metric Tonnes wood fuel. Of the total wood fuel burned annually in the country, 22.03% is in the brickfields (SEHD, 1998). The Department of Environment (DOE), in a survey of 193 brickfields near Dhaka Metropolitan city in March 1997 found that of the brickfields surveyed 99 used only coal, 87 used only wood fuel, 5 burnt only tires and 2 used both coal and wood fuel (SEHD, 1998). From the above discussion it is clear that brick industries are important contributors of the emission of greenhouse gases in our country as they burn wood fuel, coal, fuel oil (crude oil) and tires for brick manufacturing. On the other hand brickfields are also responsible for deforestation either it may be village forests or natural forests as they use huge amounts of wood fuel for brick burning.

DEFORESTATION

Deforestation means those practices or processes that result in the conversion of forested lands for non-forest uses. This is often cited as one of the major causes of the enhanced greenhouse effect for two reasons: (1) the burning or decomposition of the releases carbon dioxide; and (2) trees that once removed carbon dioxide from the atmosphere in the process of photosynthesis are no longer present (EPA, 2001). Deforestation, in recent years, has emerged as a central problem, both in Asia and in tropical forests all over the world. On a

regional basis, the annul loss of forest cover was: Latin America and the Caribbean, 7.4 million ha (0.8% of the total forest area), Asia and the Pacific, 3.9 million ha (1.2%) and Africa, 4.1 million ha (0.7%). Annual rates of deforestation in the tropics have increased when compared to the previous decade. During the 1980s, the annual rate of tropical deforestation was 11.3 million ha (Lanly, 1982). The average annual rate of tropical deforestation during the decade of 1981-90 was 15.4 million ha (FAO, 1993a).

Although tropical forests are estimated to contain half the world's plant and this resource is being "deforested" or converted to non-forestry purposes at an alarming rate of some 5,000 hectares daily in tropical Asia. From 1976-1980, the trend, if it persists, would by the 2000 convert some 37 million hectares of closed forest area to non-forestry uses. This represents a decrease from a total 306 million ha in Asia in 1980 to 259 million ha in 2000 or 12% depletion. The average annual rate of deforestation of closed forest is 0.6%. Analysis of deforestation rates by country shows that it is highest in Indonesia (over 5,00,000 hectares), followed by Thailand (3,33,000 ha). The range is between 1,00,000 and 2,50,000 ha in Malaysia, India, Laos, The Philippines and Burma. The least affected countries in absolute terms are Bhutan (2,000 ha), Pakistan (7,000 ha), and Bangladesh (8,000 ha) (Zabala, 1991). Annual deforestation rate in Bangladesh is 3-4% and average South Asian deforestation rate is 0.8% (Kibria *et al*., 2000).

In Bangladesh, the Brick Burning Regulation Ordinance, 1989 (amended in 1992) prohibits use of logs or any other product made from logs as fuels in the brickfields except the bamboo stumps. But it seems that the practical application of the law is too lose and this encourages the brickfields owners to burn the logs even more. As a result, obviously brickfields are acting as a serious agent of deforestation in Bangladesh.

PREDICTION OF DEFORESTATION CAUSED BY THE BRICKFIELDS OF BANGLADESH DUE TO THE CONSUMPTION OF WOOD FUEL

Due to the supply of wood fuel in the brickfields (3,000) of Bangladesh, the study estimated that the total deforested wood would be 42,48,600 m^3 while deforested round wood and deforested branches would be 14,65,020 m^3 and 27,83,580 m^3, respectively annually (Table 1).

Table 1: Deforestation due to the consumption of woodfuel by the brickfields (3000) of Bangladesh

Mean and total observation	Woodfuel Consumed (t dm)	Deforested round wood (m^3)	Deforested branches (m^3)	Total deforested wood (m^3)
Mean of our observation	317.42	488.34	927.86	1416.20
Total from 3000 B.F.	9,52,260	14,65,020	27,83,580	42,48,600

PREDICTION OF THE EMISSION OF GREENHOUSE GASES FROM THE BRICKFIELDS OF BANGLADESH

The study revealed that the annual required quantity of wood fuel for 3,000 brickfields in Bangladesh would be 9,52,260 t dm. Due to the burning of that quantity of wood fuel 15,71,250 t CO_2, 6,870 t CH_4, 60,000 t CO, 60 t N_2O, 1,710 t NO_x and 1,110 t NO were estimated to emit per annum while the total carbon released in the atmosphere would be 4,28,520 t annually (Table 2).

It was estimated that the annual required quantity of coal for 3,000 brickfields in Bangladesh would be 12,80,010 t and for burning that quantity of coal 23,73,330 t CO_2, 10,350 t CH_4, 90,630 t CO, 60 t N_2O, 2,580 t NO_x and 1,680 t NO were estimated to emit per annum while the total carbon released in the atmosphere would be 6,47,280 t annually (Table 2).

It was also estimated that the annual required quantity of crude oil for 3,000 brickfields in Bangladesh would be 36,900 t. Due to the burning of that amount of crude oil 1,12,530 t CO_2, 480 t CH_4, 4,290 t CO, 3 t N_2O, 120 t NO_x and 90 t NO were estimated to emit per annum while the total carbon released in the atmosphere would be 30,690 t annually (Table 2).

By considering all categories of fuel the study revealed that, the total emissions from 3,000 brickfields in Bangladesh would be 40,57,110 t CO_2, 17,700 t CH_4, 1,54,920 t CO, 123 t N_2O, 4,410 t NO_x and 2,880 t NO per annum while the total carbon released in the atmosphere would be 11,06,490 t annually (Table 2).

Table 2: Emissions of greenhouse gases from the brickfields (3000) of Bangladesh due to the use of wood fuel and fossil fuel including coal and crude oil

Categories of fuel	Mean and total Observation	Fuel used (t)	Carbon released (t C)	CO_2 (t CO_2)	CH_4 (t CH_4)	CO (t CO)	N_2O (t N_2O)	NO_x (t NO_x)	NO (t NO)
Non fossil fuel (wood fuel)	Mean of the Observation	317.42	142.84	523.75	2.29	20.00	0.02	0.57	0.37
	Total from 3000 B.F.	9,52,260	4,28,520	15,71,250	6,870	60,000	60	1,710	1,110
Fossil fuel (Coal)	Mean of the Observation	426.67	215.76	791.11	3.45	30.21	0.02	0.86	0.56
	Total from 3000 B.F.	12,80,010	6,47,280	23,73,330	10,350	90,630	60	2,580	1,680
Fossil fuel (Crude oil)	Mean of the Observation	12.30	10.23	37.51	0.16	1.43	0.001	0.04	0.03
	Total from 3000 B.F.	36,900	30,690	1,12,530	480	4,290	3	120	90
Grand Total	Total emissions from 3000 B.F. considering all categories of fuel		11,06,490	40,57,110	17,700	1,54,920	123	4,410	2,880

Note: B.F.-Brickfields.

COMPARISON BETWEEN PREDICTED QUANTITY OF WOOD FUEL AND COAL CONSUMPTION FOR 3,000 BRICKFIELDS OF THE PRESENT STUDY WITH THE PREVIOUS ANALYSIS GIVEN BY FAO (1993)

According to the present study for 3,000 brickfields of Bangladesh, the required quantity of wood fuel and coal are 9,52,260 and 12,80,010 tonnes respectively per year. On the other hand, according to the previous analysis given by FAO, 1993; the predicted required quantity of wood fuel and coal for about 3,0000 brickfields were 20,00000 and 1,08,000 tonnes per year. It is clearly observed that the required quantity of wood fuel is decreased and coal is increased than the previous study for 3,000 brickfields in Bangladesh. This phenomenon may be happened due to the application of the Brick Burning Regulation Ordinance, 1989 (amended in 1992). This ordinance postulates that the prohibition of the use of logs or any other product made from logs as fuels in the brickfields except the bamboo stumps. As a result dependency on coal for brick burning is increased tremendously than the previous years though the use of wood fuel in the brickfields cannot be completely prohibited due to the improper application of law.

As a concluding part, it is expressed that, the substitution of biomass in place of fossil fuels and wood fuel in the brickfields as a modern energy source has the potential to dramatically change the global warming implications of rising energy consumption, especially in tropical countries. Opportunities exist to use large quantities of agricultural and forest residues that would otherwise go to waste. There are also opportunities to develop biomass crops primarily for energy production. If produced efficiently, “biofuels” could supply a significant proportion of commercial energy demand in coming decades.

The benefits of bioenergy utilization go beyond substitution of fuel sources. Biofuels (charcoal, crop residues, animal dung and other forms of biomass) can not only help to close the CO_2 cycle and reduce GHG emissions, but biomass plantations, established on presently fallow lands, would also expand carbon reservoirs. In addition, the substitution of domestically produce biomass could also contribute to improve the balance of payments of energy poor countries. Other benefits include the reduction of deforestation due to the supply of wood fuel in the brickfields for brick burning from the natural and village forests and new job opportunities in rural areas and a decentralization of energy resources. The most obvious opportunities for use of biomass for energy involve agricultural and industrial wastes. Sugar cane and rice wastes offer similar opportunities. Some agricultural and industrial wastes can also be incorporated into the soil to increase carbon storage.

CONCLUSION AND RECOMMENDATIONS

It was observed that emission of greenhouse gases from the brickfields due to wood fuel burning is greater than the burning of the fossil fuel like coal and crude oil as they use greater quantity of wood fuel than coal and crude oil for burning of bricks. As a result the total forest coverage is gradually decreased in Bangladesh day by day. Widespread destruction, unplanned extraction, clearing of forest land for cultivation have reduced the forest coverage to about 8 percent against the minimum requirement of 25 percent of the land area of the country (BBS, 2000).

Bangladesh contributes only 0.1%of the total world's greenhouse gas emission. In general, the condition of carbon dioxide gas emission is still not very alarming in Bangladesh. The trees in the country still consume more carbon dioxide than is produced by human beings though Bangladesh suffered a lot due to the consequences of global greenhouse effect (SEHD, 1998).

Changes in the environment due to emission of trace gases is the most burning question of today in national, regional and global context. So the following recommendations are prescribed especially for Bangladesh to combat or reduce the emission of greenhouse gases:

i. Massive afforestation/reforestation programs should be under taken by the government with the help of NGO's ensuring the participation of local people
ii. Shifting from fossil fuels to renewable resources such as wind, tide and wave, geothermal and solar energy
iii. Producing wood fuel with more calorific values
iv. Integrated programs/co-ordinates should be increased between developed and developing countries
v. Public awareness should be increased by using the mass media including radio, television, newspapers, posters, leaflets, pamphlets, *jarigan* (local song) etc.
vi. The brick burning regulation ordinance, 1989 (amended in 1192) should be applied appropriately
vii. Biofuels (charcoal, crop residues, animal dung and other forms of biomass) should be used instead of fossil fuels and wood fuel.

REFERENCES

Ahmed A.U., Islam K. and Reazuddin M. (1996), An inventory of greenhouse gas emissions in Bangladesh: Initial results, *Ambio.,* **25**(4): 300-303.

Alam S.A. (2002), *Emission of Greenhouse Gases from the Brickfields of Hathazari Upazilla, Chittagong, Bangladesh*. A Review paper submitted to the Institute of Forestry and Environmental Sciences, University of Chittagong, Chittagong, Bangladesh, for the partial

fulfillment of the degree of Bachelor of Science (honors) in Forestry (Unpublished), 62p.

BBS (Bangladesh Bureau of Statistics) (2000), *Mid-Term Review of the Fifth Five Year Plan (1997-2002)*, Planning Commission, Ministry of Planning. Government of the People's Republic of Bangladesh, 226p.

BCAS (Bangladesh Center for Advanced Studies) (1996), *Emission inventory, final report,* Under the Bangladesh Climate Change Country Studies Program.

Brammer, H. (1996), *The Geography of the Soils of Bangladesh,* University Press Limited, Dhaka, Bangladesh, 287p.

EPA (Environmental Protection Agency) (2001), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1999,* U. S. Environmental Protection Agency, Office of Atmospheric programs (6202N), 1200 Pennsylvania Avenue, NW, Washington, DC 20460, USA.

FAO (Food and Agriculture Organization) (1993), *Status and Development Issues of the Brick Industry in Asia.* Field Document No. 35, FAO/RWEDP, Bangkok, Thailand.

FAO (Food and Agriculture Organization) (1993a), *Forest resources assessment 1990: tropical countries*, FAO Forestry Paper 112, Rome, Italy. 59p.

IPCC (Intergovernmental Panel on Climate Change) (1996), *Climate change 1995: The Science of Climate Change, Summary for Policymakers,* IPCC, Working Group I, Bracknell, United Kingdom.

IPCC (1994), *IPCC Guidelines for National Greenhouse Gas Inventories.* Volumes I, II and III. Intergovernmental Panel on Climate Change. United Nations Environment Program, World Meteorological Organization, Organization for Economic Co-operation and Development and International Energy Agency, 1994.

Kibria, M. G., Sarker, D.C., Mannan, M.A., Motaleb, M.A. and Islam, S.S. (2000), *Forests Statistics of Bangladesh*. Bulletin 4. Forest Economics Division, Government of the People's Republic of Bangladesh. Bangladesh Forest Research Institute, Chittagong, 119p.

Lanly, J. P. (1982), *Tropical forest resources*, FAO Forestry Paper 30, Rome, Italy, 106p.

Mahtab, F. U. (1992), Climate Change and Sea Level Rise due to Greenhouse Effect-Its Consequences on Bangladesh, In: M. Reazuddin and L. khan (eds.), *Training Manual on Environmental Management in Bangladesh*.Dhaka, Bangladesh, pp. 148-172.

Miah, M.D. (2001), Global warming and carbon trading: Bangladesh perspective, *Journal of Forestry & Environment,* **1**(1): 69-75.

SEHD (Society for Environment and Human Development) (1998), *Bangladesh Environment Facing the 21st Century,* P. Gain (ed.). SEHD, Dhaka-1205, Bangladesh, 305p.

WB (The World Bank) (1998), *Greenhouse Gas Assessment Handbook: A Practical guidance Document for the Assessment of Project-level Greenhouse Gas Emissions,* Global Environment Division. The World Bank. USA. 168p.

Zabala, N. Q. (1991), *Urban Forestry and World Forestry,* UNDP/ FAO BGD/85/011. Field Document No. 29, Development of Professional Education in the Forestry Sector, Institute of Forestry, Chittagong University, Chittagong , Bangladesh and FAO, Rome, Italy,133p.