Peat Resources, Condition of Deposition as Well as their Utilization, Hakaluki Haor, Moulvibazar and Sylhet District, Bangladesh

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Peat resources, condition of deposition as well as their utilization, Hakaluki Haor, Moulvibazar and Sylhet district, Bangladesh

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Abstract: The study area is the Hakaluki Haor which is the second largest wet land of Bangladesh. It spans over the districts of Moulvibazar and Sylhet in northeast Bangladesh. The study was focused in the exploration of peat reserve, reconstruction of the paleo-environment as well as the utilization of the peat resources. Peat is found randomly from 0.5 m to 7 m below the surface and 1 m to 11 m thickness at over 40 beels as well as small plain lands of 90 km2 area of Hakaluki Haor. The total reserve of peat is 282 million ton in wet condition and 112 million ton in dry condition. Peat bearing Hakaluki Haor is a low-lying wet land which geological term is synclinal depression. It may be a syncline between two anticlines which was filled with sediments as well as various plant materials derived from the hilly region (anticline) on both sides (west and east) of the Haor. On the other hand vegetation occurred in this depression as aquatic plants which might have been destroyed by large natural disasters or any tectonic reason. As environment dictates the characteristics and the source of sediments, various aspects of the sediment are indicators of condition of peat deposition. Peat has mainly industrial importance as a fuel for power production, traditionally used for cooking, domestic heating and in brick fields, also used as insulator in many industries, agricultural purposes, retaining moisture in soil, raw material in horticulture and colour industries etc. Power plants of about 100 MW capacities may be established in this region based on peat of Hakaluki Haor which may be continued more than one hundred years.

Keywords: Haor, Beel, Deposition, Environment and Peat

1. Introduction

Peat dominant Hakaluki Haor is one of the largest peat reserves of Bangladesh which is very important both economically and geologically. Peat is one of the most important mineral resources around the world. The peat dominant area is surrounded by Fenchuganj and Gopalganj upazila of Sylhet district; Baralekha, Juri and Kulaura upazila of Moulvibazar district (Fg. 1). The peat is characterized as thin to thick bedded (0.5 m to 8 m), brownish black to black colour, fibrous, mature as well as the chemical analysis of the peat reveals that the heating value is high, carbon content is high, ash content is low and sulfur content is low. The dominant type of peat in the study area is of mature class which is mature type of peat. Most potential use is for small power plant which may help meet the current demand for power which in turn may help the economy of the country.

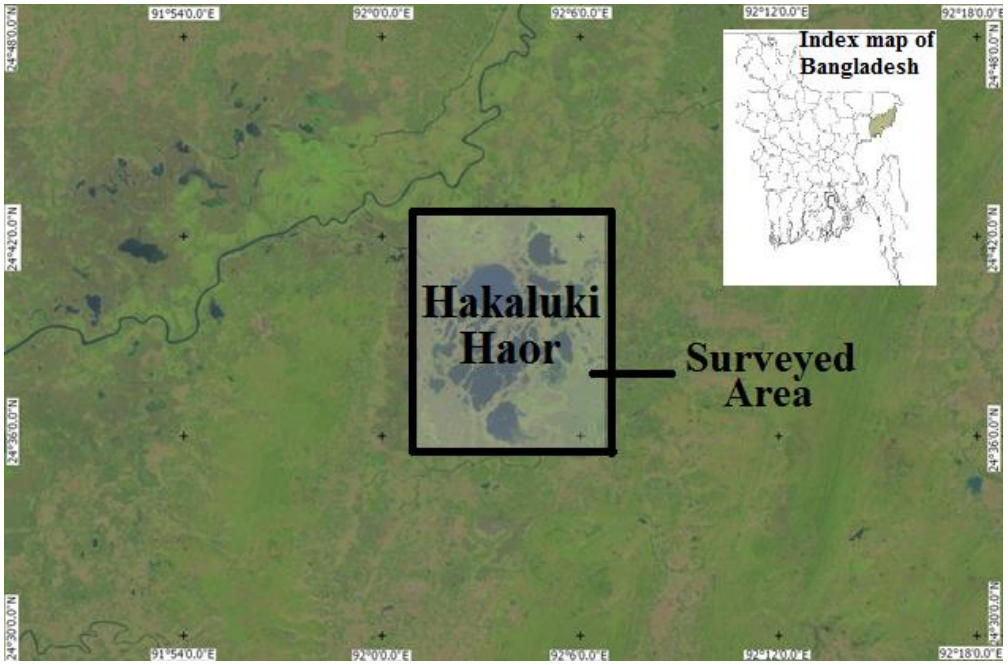

Figure 1. *Map showing the location of surveyed area, Hakaluki Haor, Sylhet and Moulvibazar district, Bangladesh.*

1.1. Description of Peat Bearing Hakaluki Haor

The surveyed area of Hakaluki Haor comprises grass lands, plain lands, swamp forests, agricultural lands, river channels and more than 40 beels. The haor area is a lowlying shallow depression which submerged for 3 to 5 months in a year. 1352 auger hole (Fig-2) have been drilled during the field investigation. The western part of Hakaluki is rich in dry peat which is about 56 km2 in areal extent. The eastern part of Hakaluki haor covers the eastern extreme part as well as north-eastern part of this haor which are mainly wet peat dominant. The minimum thickness of the peat encountered is 0.5 m in the peripheral zone and the maximum thickness is 12 m in the area near Chatal Beel. The peat is characterized by brownish black to black colour, fibrous texture and mature type. The peat is very fine grained at some places (westarn part) whereas contains large fragments of woody and leafy matters at other places (eastern part). The dryness of the peat deposit is of remarkable degree. There is only a very negligible amount of water within the peat while squeezed with bare hand. The organic matters of the peat have altered to a very high degree into dense, dark coloured and compact peat materials. The colour of the peat is a good indicator of its maturity and also indicator of a high degree of maturation in the coalification processes. At some places it is close to lignitic coal in nature which is observer during the field investigation. The thickness of peat decreases in dry upland areas may be due to vertical pressure of thick overburden whereas a reverse case is observed in the lowlying beel areas because of their thin overburden. The peat depostis of eastern part of this area is comperatively less mature in nature than that of the western part.

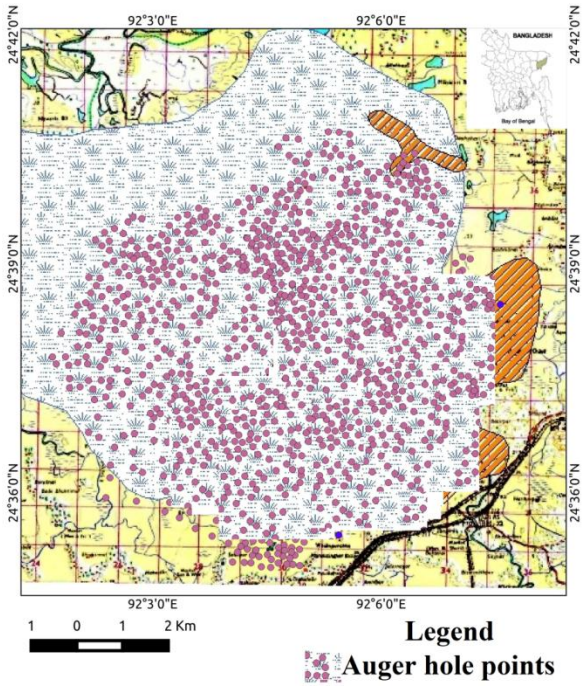

Figure 2. *Map showing the auger hole locations of Hakaluki Haor, Sylhet and Moulvibazar district, Bangladesh.*

1.2. Economic Aspacts of the Peat Deposits

Hakaluki Haor is a vast peat dominated region in Bangladesh. Peat is found at shallow depths (0.5 m to 7 m below the surface) which reserves is higher than others peat field in Bangladesh. The surveyed area of Hakaluki Haor is designated the largest peat field in Bangladesh. This peat of this Hakaluki Haor may be used at different purposes; most notable use is heating fuel for small power plant. The peat

deposit of Hakaluki Haor is one of the most important mineral resources which may be used for power production as well as other home and industrial uses. If 50% of the deposits may extract, 100 MW power plant may be established in this region which would continue for a period 100 years. It should be mentioned here that annual fuel requirement for every 20 MW of capacity would be 200 thousand tons of dried peat (35% moisture level).

1.3. General Geology of the Area

The study area of Hakaluki Haor occupies a syncline between two anticlines. The Patharia anticline on the east and Bhatera anticline in the west. The geology dictates the physiography of the area which is essentially a flat land with many small depressions termed as beels. The beels are wet lands that go under water for the whole of the year, while the whole area turns into a vast water body only in the wet season and is termed as haor.

1.4. Lithological Description of the Study Area

The Hakaluki Haor is a vast low lying area with many localized water bodies that persist throughout the year. Sediments derived from the nearby hills get deposited in the haor largely during wet seasons when the whole area goes under water. During winter when the haor dries up for the most part, the sediments are deposited only by small and narrow channels. The sediments settle over beel beds in calm and quiet condition. Thus coarser grained sediments are deposited on and near streams and finer grained sediments are deposited all over the haor. Thus, the surface lithology of the deposits is dominated by finer grained clay, silt, silty clay and clayey silt.

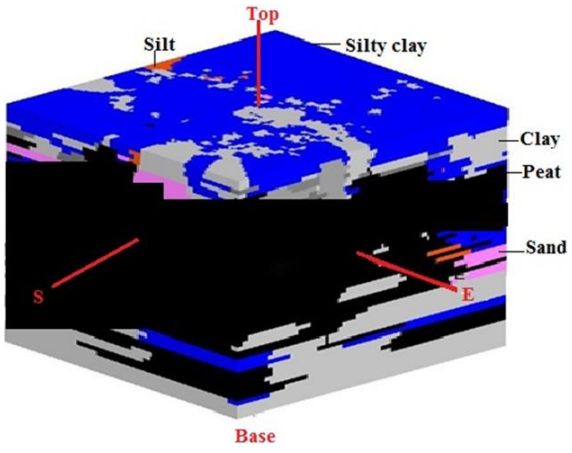

Figure 3. *3-dimensional view of underground layers in the surveyed area, Hakaluki haor, Sylhet and Moulvibazar districts (vertical scale greatly exaggerated, approximately 100 times).*

3-D view (Fig 3) of the study area shows the overall distribution of the sedimentary layers and also shows that the highest thickness of peat as well as vertical exaggeration**.**

The lithological layers of surveyed area have been grouped in a generalized way into three units based on their dominant lithology as unit-I, unit-II and unit-III.

They reveal that under the surficial fine clastic deposits lies a thin to thick bedded carbonaceous layer. This is a peat bearing layer that from the main economic mineral resource of the area. The peat deposit is dominated by vegetal matter and is very fresh i.e. the sediment content of peat deposit is very low. Both dry and wet peat occurs in the area. In the southern part, the peat occurs in two or more layers whereas in the northern part, the peat is represented by only one layer.

The peat layer is underlain by a characteristic bluish gray, silty clay layer all over the area. At places, this layer is represented by sand or clayey silt which are localized in nature. The base of the layer could not be encountered due to limitation of the boring depth with a maximum depth of only 11 m. The content of vegetal matter in this layer is negligible and only some rootlets occur sparsely.

1.5. Holocene and Pleistocene Boundary Condition

6 tube well boring have been done at different places (more than 1 km distance) in the eastern part of Hakaluki haor of the study area to identify the base of the Holocene deposits and the Holocene-Pleistocene boundary . The bore hole-1 is in the eastern most boundary at Nayabazar plain land, bore hole -2 is in the Chinaura beel, bore hole -3 is in the Chatal beel, bore hole-4 north-eastern boundary at Gorkori beel, bore hole -5 is in the middle-eastern extreme part of Hakaluki haor near Belagaon village and bore hole -6 is in the Sahpur village near Gobidhopur. The boundary occurs at different depths ranging from 15.7 m to 23.3 m. The maximum depth was attained in the bore hole of 1, 3, 4, 5 and 6 (21 m to 23 m) while the depth was minimum in the bore hole-2 which is eastern extreme peat dominant part of the study area. This signifies that the haor depression was deepest in the western part while shallowest in the eastern part. The nature of the boundary is not the same at every place. The upper layer is dominated by clay. At only two places it is dominated by sand. The lower sand bed is present everywhere but it is much thin in bore hole-3 and bore hole-5. The underlying sand is the Dupi Tila sand which is the main water bearing formation of the Bengal Basin. The average thickness of the upper layer is about 19 meter which indicates that the sedimentation rate was 0.162 cm per year (average thickness/age of Holocene, 11700 years).

1.6. Condition of Peat Deposition

Geologically the haor is a synclinal depression located between two anticlines on eastern and western sides. The syncline has been filled up mostly by sediments derived from these anticlines. As environment dictate the characteristics along with the source of sediments, various aspects of the sediment is an indicator of the environment of that time. The above characteristics may indicate a uniform environment of deposition in shallow to deep water lacustrine environment with little vegetal growth. This environment may be persisted as a deep to shallow lake allowing fine grained sediments to be deposited. The sediments of this unit may indicate the upper part of the deposit which may represent the last stage

of lake sedimentation. At the end of the sedimentation of the unit the water depth might have been less enough to allow vegetal growth on top of the unit. A hypothetical model has been constructed in the following figure indicating the environmental condition (Fig 5) during the deposition of Unit III. The Unit II is dominated by peat deposit and is situated on top of the Unit III. This

may indicate that at the last stage of the filling up of the lake the water of lake was reduced and the lake bed got exposed for the most part. The lacustrine environment gave way to swampy environment of shallow water and vegetal growth. However, the dry peat and woody to twiggy matter in the northwestern part may indicate that the lake was entirely disappeared in that part. But in the southeastern part the wet peat and filamental to fibrous vegetal matter may indicate that this portion was not entirely exposed. Rather this part was under water for long time. This part was dominated by aquatic plants whereas the northwestern part mentioned before may be dominated by small and medium trees of terrestrial forest environment. In this environmental setting occasional channels might have persisted which allowed herbivorous plants. [Type a quote from the document or the summary of an interesting point. You can position the text box anywhere in the document. Use the Drawing Tools tab to change the formatting of the pull quote text box.]

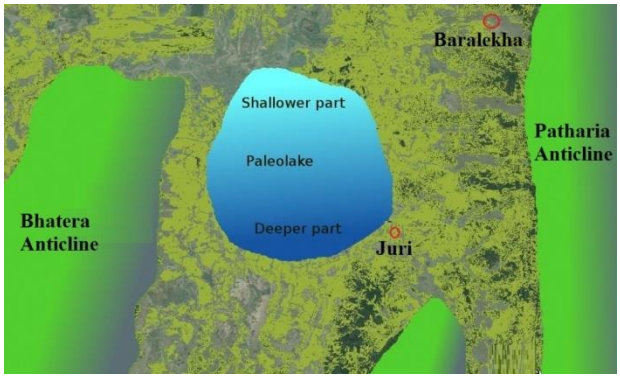

Figure 4. *A hypothetical environmental reconstruction model showing the lacustrine deposits where sediments and water were deposited from the adjacent anticlines. The water was deep enough to allow no vegetal growth.*

Figure 5. *A hypothetical model for peat deposition of Unit II. The northwestern part is dominated by land plants while the southeastern part is dominated by aquatic/lake plants.*

The environmental model (Fig 5) for Unit II shows a gradual change in vegetation pattern from northwest to southeast. Thus the area can broadly be subdivided into two parts. However, the presence of multiple peat layers intercalated with silty clay to clay layers may indicate disastrous events that transported huge amount of sediments. Nonetheless, the influx of sediments could not destroy the plant growth entirely but allowed vegetal growth on top of them.

After the completion of peat deposition the swamp got totally destroyed by huge sediment influx which forms the Unit I of the stratigraphic succession. This may indicate a sudden subsidence of haor area and upliftment of adjacent hills from which the sediment came. May be this was the last event of upliftment of the hills. This upliftment turned the low lying areas a vast alluvial plain. The silty to sandy clay, suggests the same thing.

At present, however, the haor is slowly downwraping and the vegetation growth has been taking place since the completion of the deposition of Unit I. The current environmental situation has been hypothesized in the following model (Fig 06). This model shows that the current environment is a complex of swamps, lakes (beels), forests, small channels etc. In summary, today all the pale environments persist at smaller scales and are localized in nature. For example, the whole haor area goes under water during the wet season which represents the earliest stage of the pale environment. During dry period the area gets dry and vegetation only exists on channel banks which indicate the middle stage of environmental condition. The present environment is a complex of the earlier ones which is well evidenced by its sediment content.

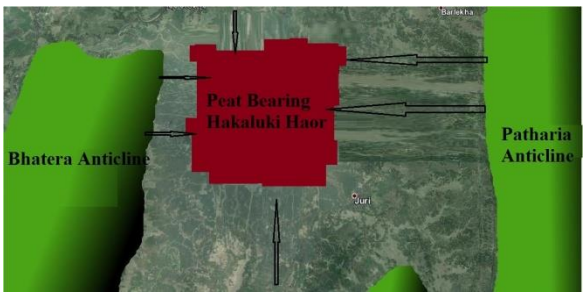

Figure 6. *A simplistic representation of present environmental condition at the Hakaluki Haor. This is the scenario of the haor which turns into a vast water body in wet season.*

1.7. Utilization of Peat

Peat is one of the most important mineral resources which is being extensively used around the world. Peat based power station established at different countries in the world like as Ireland, Scotland, Russia, Uganda, and Finland etc. The largest peat based power plant is in Russia named Shatura Power Station with production capacity of more than 1000 MW. The source of peat of that power station from different peat fields of Moscow oblast, Russia and their moisture level is 30%. Another peat based power station is Kirov oblast in Russia with a capacity of 300 MW. The Toppila, Kenjonlahti as well as Haapavesi peat based Power Stations in Finland

and their installed capacities are 210 MW, 209 MW and 160 MW respectively. So, Finland is holding the leading position with respect to peat based power station. West Offaly (installed capacity 150 MW), Edenderry (installed capacity 120 MW) and Lough Ree (installed capacity 100 MW) peat based power stations in Ireland are mentionable. Vao peat based power station in Estonia which installed capacity is 25 MW. Peat has many other uses without the heating fuel for power generation which are describing below.

Use in agriculture: Peat is important for farmers and gardeners who improving the soil structures and acidity with the help of peat. In Sweden, farmers use dried peat to absorb excrement from cattle which are wintered indoors. The most important property of peat is retaining moisture in soil when it is dry and yet preventing the excess of water from killing roots when it is wet. Peat is an important raw material in horticulture. However, it is recommended to treat peat thermally, e.g. through soil steaming in order to kill inherent pest and reactivate nutrients.

Use in Freshwater aquaria: Peat is sometimes used in freshwater aquaria, most commonly in soft water or black water systems, such as those mimicking the Amazon River Basin. In addition to being soft in texture and therefore suitable for demersal (bottom-dwelling) species such as Corydoras catfish, peat is reported to have a number of other beneficial functions in freshwater aquaria. It softens water by acting as an ion exchange; it also contains substances that are beneficial for plants, and for the reproductive health of fishes. It can even prevent algae growth and kill microorganisms. Peat often stains the water yellow or brown due to the leaching of tannins.

Use in water filtration: Peat is used in water filtration, such as for the treatment of septic tank effluent, as well as for urban runoff. Due to its purifying properties, peat also serves as a filter for septic tanks, as well, may be used as a water purifier.

Use in Balneotherapy: Peat is widely used in balneotherapy (the use of bathing to treat disease). Many traditional spa treatments include peat as part of peloids. Such health treatments have a very long tradition in Europe, especially in Poland, the Czech Republic, Germany and Austria. Some of these old spas go back to the 18th century, and they are still active today. The most common types of peat application in balneotherapy are peat muds, poultices, and suspension baths.

Use in environmental and ecological issues: One of the characteristics for peat is that bioaccumulations of metals are often concentrated in the peat of significant environmental concern is accumulated mercury. The distinctive ecological conditions of peat wetlands, they provide habitat for a distinctive fauna and flora. Such habitats also have many species of wild orchids and carnivorus plants. It takes centuries for a peat bog to recover from disturbance.

Use in drainage: Large areas of organic wetland (peat) soils are currently drained for agriculture, forestry, and peat extraction. This process is taking place all over the world. This not only destroys the habitat of many species, but also heavily fuels climate change. As a result of peat drainage, the organic carbon which was built up over thousands of years and is normally under water is suddenly exposed to the air. It decomposes and turns into CO2) which is released into the atmosphere. The global CO2 emissions from drained peat lands have increased which particularly taken place in developing countries, as Indonesia, China, Malaysia, and Papua New Guinea, are the fastest growing top emitters.

Use in fires: Peat has a high carbon content and can burn under low moisture conditions which smoldering fires can burn undetected for very long periods of time (months, years, and even centuries) propagating in a creeping fashion through the underground peat layer. Burning of peat bogs in Indonesia, with their large and deep growths containing more than 50 billion tons of carbon, has contributed to increases in world CO2 levels.

Use in brickfields: Peat may be used in brickfields for heating fuel around the world which can reduce the destroying forest. Many of brickfields have been used wooden logs as heating fuel which is directly harmful for environment to decreasing the standard forest level. So the use of peat in brickfields increased to decreasing the environmental degradation.

Use in cooking: Peat can be used as domestic fuel for cooking purposes which may reducing the cutting forest and save the environment.

Use in paint industry: Peat is randomly used in several kinds of paint industries for making colour around the world.

It should be mentioned here that the quality of peat is better than that of peat which is using in the above

power plant as heating fuel. The moisture levels of peat at Hakaluki Haor as well as other constituents are very low which is good for heating purposes and reserve is sufficient for power production as heating fuel. So, the peat of Hakaluki Haor may be used also as a heating fuel for the production of power generation. This peat also used in agriculture, water filtration, brickfield, paint industry, fires, drainage and domestic purposes.

1.8. Potential for Heating Fuel in Small Thermal Power Plant at the Study Area

The peat in investigated areas of Hakaluki Haor may be used to run peat fired power plant of 100 MW of capacity. Annual fuel requirement for every 20 MW of capacity would be 1000 tons of dried peat (35% moisture level, Masum et. al, 2012). This could be obtained easily by mining of peat at Hakaluki Haor Moulvibazar and Sylhet district. The total reserve of peat is about 112 million tons in the dry condition (35% moisture level). If 60% of the peat is mined and used in 100 MW power station, this could run for about 100 years.

2. Conclusion & Recommendation

Based on the surveyed information of peat exploration of Hakaluki Haor of Moulvibazar and Sylhet Districts, the following conclusions and recommendations are made. The peat of the investigated area is moderate to good quality

according to the results on physical and chemical properties of peat. The reserve of wet peat in the surveyed area is about 282 million tons whereas the dry peat is 112 million tons. The peat may be mined by using local dredgers in dry season and in wet season when the area remains under water, the peat may be mined by barge mounted dredgers. This peat may be used at different purposes of domestic and small industrial purposes after mining. Small power plant like 25 MW may be run using this peat. A proper planning for land use, environmental management and policy should be taken before extraction of peat. Mining of peat must be in such ways that prevents every kind of environmental hazards like landslide/subsidence of the peat dominant surrounding area. Before extraction of peat detailed feasibility study must be done in order to ensure sustainable and environmentally friendly operation.

References

[1] Masum, M. Haq, N, M. Sayem. A. M. Rana, R. M. Sheikh, R. M. and Paul, K, A. 2012: Report on Exploration of Peat at 4000 hectre area of Bijoynagar upazila, B, Baria district. GSB, Unpublished report