Agricultural Land Use and Land susceptibility in Bangladesh: An overview

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Abstract

Bangladesh is one of the most densely populated country in the world. With the growing population, and their increasing needs in various sectors, land use patterns are undergoing a qualitative change in which the areas under the net cropped land, and forest land is gradually shrinking. This country has humid tropical monsoon type of climate, warm and humid in the summer, dry and moderate cool in the winter with three meteorological seasons summer, monsoon and winter. With the temperature remaining above the biological zero all through the year, the annual rainfall ranges from 1500mm in the northwestern part to 5000mm in the northeast. It is the rainfall along with depth and duration of flooding that remains the critical factor for agriculture in this country. The critical aspects of rainfall in relation to the use of land for agriculture relate to the uncertainty of the start and parting of the monsoon as well as the occurrence of droughts. Bangladesh is really very lucky in having a hyper-thermic temperature regime where agricultural production is possible all over the year. More than 60% of the land area of Bangladesh is used under agricultural purposes against only 12 % for the world. Very few countries in the world employed such a high percentage of its land area under cultivation. This has been possible for the existence of the proverbially fertile soils on the few vast floodplains that are annually replenished by siltation during the flood. Two-thirds of the population in Bangladesh depends directly or indirectly upon agriculture, while nearly 25% of the gross national product comes from this sector. With scattered settlement patterns in Bangladesh homesteads, urban centers, industries, educational institutions and inhabited lands together occupy about 25% of the national area. Although forests are officially stated to occupy 15% of the land area of Bangladesh, the actual tree-covered area is reported to have fallen to only 6% at present (Huda and Roy, 2000). Remnants of tropical rainforest occurs in the hilly regions in the northeast; while the world's largest mangrove forest, the Sundarbans, with an area of 6,017 sq. km., occurs along the coast of the Bay of Bengal in the southwestern corner of the country. Land use has evolved through natural forces as well as human needs, cultivated land, forestland and settlements and homesteads are the major land use types in Bangladesh.

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Introduction:

Like many other countries, soil is overwhelmingly the greatest national resource of Bangladesh on which its entire population depends for food supply. To understand the nature and properties of the soils in Bangladesh and their geographical distribution, this country has conveniently been divided into three physiographic units having three distinct geological ages, such as: (1) Tertiary hills (12 %), (2) Pleistocene terraces (8%) and (3) Recent floodplains (80%). Interestingly, the above demarcation of Bangladesh on the basis of physiography also conveniently coincides with the types of their parent materials. More than 60% of the land area of Bangladesh is used under agricultural purposes against only 12 % for the world. Very few countries in the world employed such a high percentage of its land area under cultivation (Table 1).

Table 1. **Some geo-environmental facts about Bangladesh.**

Index	Facts	Remarks
Total area	14.7 million ha	-
Latitudinal location	$20^0 34^/$ to $26^0 88^/$ N	Tropical environment
Longitudinal location	$80^0 1^/$ to $92^0 41^/$ E	-
Climatic type	Humid tropical monsoon	-
Annual rainfall	Varies from 1500 – 5500 mm	Distinct wet and dry seasons
Mean annual temperature	25.5^0C	Hyperthermic regime
Mean winter temperature	19^0C	-
Mean summer temperature	29^0C	-
Present population	130 million	-
Population density	800 persons/sq. km	Increasing trend
Land /man ratio	0.07 ha / person (2000)	Not enough to produce required food and fiber
Length of coast line	654 km	Mostly muddy and fragile
Coastal area below one meter contour line	2.85 million ha	May disappear by sea level rise
Area under cultivation	9.3 million ha	Almost 63% of total land area
Area of grassland	Nil	No grazing land
Cropping intensity	175 % in 1999	Increasing trend
Forest area	2.2 million ha	Actual tree covered area is 6%
Number of farm holdings	11.3 million	Increasing trend
Average farm size	Less than 1 ha	Decreasing trend
Irrigated land	3.7 million ha	35% of total agricultural land
Flooded land	56 % of total area	Normally flooded
Labor in agriculture	60 %	Increasing trend
Natural hazards	Tropical cyclones, flash floods, storm surges, river bank erosion and drought	All are disastrous

Source: **Bangladesh Bureau of Statistics (BBS), 1999.**

The major portion of the fabulously fertile agricultural land in Bangladesh occurs on the vast floodplains of the Bengal delta formed by the deposition of sediments from the enormous rivers-the **Ganges, the Brahmaputra and the Meghna (GBM)** and the Tista, all of which have been originated from outside the country. The combined total catchments area of these major river

systems is about 174 million sq km, of which only 7% lies within Bangladesh territory. The rest comes from the upper catchments of the rivers. For this reason Bangladesh has very little control over the huge quantity of surface water of this vast catchments area that flows through these rivers to the Bay of Bengal.

About 17 percent area of the country along the coast has an elevation of less than one meter above the mean sea level. Elevation gradually increases towards the north. Due to the flat terrain, the rivers in the floodplains of Bangladesh have low gradients causing deposition of substantial quantities of river-borne sediments on the riverbeds forming sandbars, while the rest of the 2.5 billion tons of the sediments annually move to the offshore areas through the Meghna estuary (Khan,1978 and Coleman,1969). The sediments are finally carried away towards the middle of the Bay of Bengal through the Swatch of no ground, a submarine canyon that occurs only 20 km to the south of the coast of Bangladesh. Over 20 percent of the total area of Bangladesh along the coast is tidally affected. Only 0.83 million hectares of land along the coast is saline, and a part of this saline tract is occupied by mangrove forest locally known as Sundarbans. This forestland is flat and developed through the process of sedimentation, subsidence and down warping of sediments. About 80 percent of Bangladesh territory can be defined as wetlands according to the Ramsar convention (Ullah, 2002). These include the entire floodplain areas. Although during the rainy season the floodplains behave like wetlands because of standing water for varying periods, during the dry season when the droughts are long, many of them demonstrate deserts like appearance. Because of hyperthermic temperature regime the organic matter mineralization rate in soils is usually very high. There is therefore depletion of organic matter, which is a basic problem of these soils (Karim and Iqbal, 2001). There are many freshwater wetlands in the floodplain areas, which include haors, baors, beels and jheels, where 200-300 wetland plant species are found. Histosols occur in the few large depressions that occur in the Gopalganj-Khulna and in the Sunamganj-Netrokona areas that constitute around one percent of the area of Bangladesh (SRDI Staff, 1965-86).
In the floodplains of Bangladesh there is a general textural gradation from river bank to basin sides north to south with the fine-textured soils predominantly occurring towards the south (Brammer, 1997). There is also textural gradation from river bank to basin sides. The major agricultural soils in Bangladesh have moderate textures with the majority ranging from loam or silt to silty loam to silty clay loam. Only a relatively few soils in Bangladesh belong to the extreme textural classes. With respect to textural aspects majority of the Bangladesh soils appear to be suitable for having quick resilience.

Land Use Scenarios in Bangladesh

Land use in Bangladesh has evolved through natural forces as well as human needs. Cultivated land, forestland and settlements and homesteads are the major land use types in Bangladesh (Table 2). With the growing population, and their increasing needs in various sectors, land use patterns are undergoing a qualitative change in which the areas under the net cropped land, and forest land is gradually shrinking. A large part of the forestland is now under different types of non-forest land use, for example, as shifting agriculture, illegal occupation for homestead, shrimp culture etc. Another important feature in land use in Bangladesh at present is the small area (only 3%) of fallow land, which indicates that land in this country is not allowed sufficiently long rest period for regaining their natural biophysical properties which is vitally needed for good maintenance of soil health. It is perhaps needless to say that for sustained agricultural

production maintenance of good biophysical condition of soil is essential.

The land area under the head, not available for cultivation includes mainly urban, rural settlements, and industrial lands cover around one-fourth of the total national land area (Table 3). Area covered by homestead is around 9.3% of the total land area and is characterized by intensively planted but is not efficiently managed (Bashar, 2001). The homesteads represent the agroforestry model in rural Bangladesh. In the face of diminishing trend in forest reserve the homestead agroforestry is playing an important role in mitigating the needs of rural masses. These rural homesteads are often uncared and underutilized and can be made more productive through application of better technology. Well planned marginal land management combining woody perennials with vegetables, fruits, livestock, poultry, fish and farming in tune with the farmers need will lead to sustainable livelihood.

Table 2. Land Use Scenarios in Bangladesh

Land Use Types	Hectares (in 000)	%
Total land area	14,845	100
Not available for cultivation	3,700	24.9
Forest	2,255	15.2
Cultivable waste	445	3.0
Current fallow	2,999	20.2
Double cropped area	979	6.6
Single cropped area	451	3.0
Triple cropped area	4,013	27.0
Net cropped area	7,992	53.8
Total cropped area	13,964	--
Net cultivable area	9,443	56.9

Source: **BBS (1999).**

Areas under double and triple cropping are showing an increasing trend over time. Cropping intensity, which may be an indicator of land use intensity, is gradually increasing and stood at 176 percent in 1996-97 (BBS, 1999). Soils of Bangladesh are revealed that Moderately good and good agricultural lands together constitute the bulk of the land area in Bangladesh (Table 3). It is interesting to note that almost one-fourth of the agricultural land is of poor quality. Care will be needed to manage these lands otherwise they may turn unproductive. Quantified data for land and soil properties need to be developed for major crops for sustainable production, development and conservation of the limited land resources of the country.

Table 3. Summary of Land Capability Classes and Percentage.

Land capability class	**Area (million ha)**	**%**
I. Very good agricultural land	0.19	2
II. Good agricultural land	4.19	34
III. Moderate agricultural land	4.82	39
IV Poor agricultural land	1.92	16

Source: FAO, 1988.

3. Land Use Conflicts in Bangladesh

Since there is an acute shortage of land in Bangladesh, still competition among the various land uses is natural. Agriculture, being the dominant land use type, is in constant conflict with other uses. Land type, area and proportion of Country's total area are shown in Table 4. There are competitions for land within each use type. Most often land related disputes end up in litigation and murder. It has been reported that around half of the murders in Bangladesh are caused over conflicts / enmity related to land. The shortage of land is so serious that more than 50 percent farmers have become landless and many people are compelled to settle in the undeveloped offshore islands as soon as this appear on the middle of riverbeds or in the offshore areas, risking their lives (Mahbub Ullah, 1996). Some of these undeveloped and unstabilized charlands are inundated during the high tide and dry out during the low tide.

The conflict between agriculture and urbanization is the direct result of population increase, as new living houses are needed for new families. Agricultural lands owned by parents are being converted to homestead for building new houses to accommodate the offspring. The net result is the decrease of total agricultural land and an increase in the number of smaller sized plots. As the development is going on in all sectors of economy with aid from international agencies, more and more lands are being diverted to development activities for building townships, industries, educational institutions, roads and highways etc. Encroachment of forests for agricultural use and human settlement near the fringe of forests is very common and in this process the actual forest land under tree cover is estimated to have gone down to 6 percent at present (Ullah, 2002).

The competition for land between agriculture and livestock has become very acute. At present there are about 37 million bovine population for which there is no demarcated grassland. This huge bovine population thrives mainly on rice straw and grasses that grow on road and canal side patches and homestead areas. Seasonally the cattle can graze in the agricultural fields during their short lay period. But these fields are rarely available for grazing if they are used for double or triple cropping. Land in Bangladesh has tremendous potential for growing grass and herbs but the main problem is the shortage of land. Shrimp culture is mainly concentrated in the coastal areas of Bangladesh where the previous croplands and forests have been converted to shrimp culture fields. When the shrimp culture fields are abandoned they cannot easily be converted to croplands, as these fields are made saline artificially by adding salts. The estimated area of shrimp cultivation in four coastal districts of Khulna, Shatkhira, Bagerhat and Cox's Bazar is 140,000 hectares, around 70 percent of which are located in greater Khulna district (Rahman, 2000). Although economically profitable the unplanned expansion of shrimp culture has created a negative impact on water quality, mangrove deforestation and degradation of agricultural land. Chakoria Sundarban along the southeastern Chittagong coast has almost disappeared due to the encroachment by shrimp farms.

Good quality agricultural lands are randomly being used as brickfields all over the country but their concentration is more in the villages than the cities. About 4000 brickfields require soils and woods as fuel, which, indiscriminately destroying trees, homestead forests and agricultural lands. When the brickfields are abandoned they cannot be easily converted to crop fields as burnt soils cover the land there. So the loss of land due to brick making becomes more or less permanent.

Table 4. Land type, area and proportion of Country's total area

Land type	Area (ha)	Proportion (%)
Highland	4199952	29
Medium Highland 1&2	5039724	35
Medium Lowland	1771102	12
Lowland	1101560	8
Very Lowland	193243	1
Total Soil Area	**12305581**	**85**
River, Urban, Homesteads etc	2178045	15
Grand Total	**14483626**	**100**

Source: FAO, 1988.

The intensified monocropping, shrimp cultivation and numerous brickfields are all degrading the long-term soil quality. New and fragile char lands are being cultivated for rice before they are stabilized which initiates erosion and even sometimes cause the disappearance of the entire char. In the newly formed charlands there is competition between afforestation and agriculture use of lands. Structures built for flood control and drainage regulation in many areas sometimes drastically altered the land and water use patterns and the environment which has resulted in unbelievably decline in fresh water fish culture and production in many areas in the recent years (Nishat and Bhuiyan 1995).

4. Calamity and land vulnerability in Bangladesh:

The geographical settings as well as some man-made activities have made the country vulnerable to various natural disasters. These natural calamities occasionally cause drastic crop failures along with huge loss of lives and properties. In some cases the natural calamities influence land use and land management practices. Annual flooding in central part of Bangladesh is a regular feature during the peak monsoon season when a certain part of the country remains inundated for varying depths and duration; and when the land temporarily goes out of control of man. Different natural calamities impacting on land use in Bangladesh is describing below:

4.1. Flood:

Several types of floods are there in Bangladesh depending on the sources of water. Over 26,00,000 hectares of land or 18% of the country are inundated normally every year by river water alone coming from the upper reaches (FAO-UNDP, 1988). During the 1987 and 1988 floods, 39 and 61 percent area, respectively of the country had been submerged. As compared to that about 66 percent of the country went under water during the 1998 flood (Chowdhury, 2000). The 1998 flood in Bangladesh is yet to become part of history, as it still is very fresh in the minds of the people. However, such abnormal floods inundate the country only infrequently damaging crops and property, disrupting economic activities and causing loss of lives and properties. Influence of flood on land management is so intense that the land types in Bangladesh have been designated on the basis of depth and duration of flooding (FAO-UNDP, 1988). Land management (cropping seasons and cropping pattern) in this country has become dependent on annual flooding. Sustainability in land management in Bangladesh faces a big challenge from the unusual flooding. Flood control is not feasible beyond a certain limit as it is gigantic natural calamity and it may have adverse impact on other sectors. There is thus a suggestion that people

in Bangladesh should learn the habit of 'living with floods'. It is often argued that floods enrich our soil with addition of fresh nutrients by new siltation. Loss of crop production in one flood season may be compensated by increased yield in the subsequent cropping seasons. This is the empirical experience the farmers of Bangladesh have learnt over the past centuries. However, recently it has been observed that fresh sediments deposited by flood in 1998 contained higher amount of nutrient elements and organic matter content (Idris, 1999).

4.2. Cyclones and tidal surge:

Tropical cyclones, which are the most devastating natural calamities in terms of tolls of human lives, originate near the equatorial region of the Bay of Bengal and slowly move northward towards the offshore areas of Bangladesh. Colossal loss of lives of human and livestock along with the loss of agricultural crops are common. The water surges that accompany these cyclones often sweep the coastal areas with saline water causing the soils to become temporarily saline and rendering them completely unsuitable for agricultural use. After several washings with rainwater the soils ultimately become normal again by natural ways and be again suitable for agricultural use. These storms cause loss of standing crops by depositing eroded materials from the foothills over the adjoining crop fields in the lowlands.

4.3. Drought:

Drought is another serious calamity for agriculture in Bangladesh that is most unpredictable and uncertain and cause heavy loss to the standing crops. During long droughts, if there are no facilities for supplemental irrigation, crop failure may occur over a large area. Drought is due to rainfall shortage and can be mitigated in some areas by provision of irrigation, use of improved cultivation techniques and introduction of more drought tolerant crop varieties. Drought tolerant crops (millet, sorghum, ground nut, legumes, cassava and yarns are the good choices (Brammer, 1975). In Bangladesh, drought is more severe at the South-western part in the month of October to March. At this time, some places remain barren, which turn to severe erosion. Construction of Farakka barrage aggravates the situation in a serious turn and the whole area performs almost like deserts.

4.4. Riverbank erosion:

In Bangladesh, riverbank erosion is caused mainly by strong river current triggered by channel diversion especially during the rainy season when the river water is heavily laden with suspended materials. About 1.7 million hectares of floodplain areas of Bangladesh are prone to riverbank erosion. The loss of land due to riverbank erosion is highest in the Brahmaputra-Jamuna basin, where the erosion rate is estimated to be between 139 and 358 hectares per year (Chowdhury, 2000). Riverbank erosion causes not only quantitative loss of the land, but also severely affect the socioeconomic condition of million of the affected owners. Displaced people lose everything including stability in their lives and social status and become destitute over night. Finding no alternative the affected people move away in search of new land and shelter. People of this category in Bangladesh run into millions some of which live on dykes near the vicinity of their former home and work as landless labour. Those who cannot do that move on to the big cities in search of work and ultimately settled in slums.

4.4.1. Water erosion:

Water erosion is a serious menace in the soils formed on the older formations the hills and terraces of Bangladesh. In many places the surface horizon has been washed away and the soils have become truncated. In around 1.7 million hectares of land in the hilly region erosion is very severe (Karim and Iqbal, 2001). In Chittagong hill tracts erosion is being hastened by deforestation as well as jhum cultivation. Erosion is the major cause of land degradation in the hilly region. Some researches have been carried out on land erosion in the hilly region but no work has been done on erosion on the floodplain soils. In the floodplain areas erosion occurs on the higher locations and deposition takes place on the depressions. On the floodplains as a whole, deposition of sediments in the form of siltation is a common phenomenon. As a consequence the water bodies are being gradually silted up with a change in biodiversity.

4.5. Saline water intrusion:

Soil salinity is another natural disasters in Bangladesh. About 0.883 million heactares of the arable lands, which constitutes about 52.8 percent of the net cultivable area in 64 Upazilas of 13 districts, are affected by varying degrees of soil salinity (Karim, et al. 1990). The factors that contribute significantly to the development of saline soils are: tidal flooding during wet season (June-October), direct inundation by saline water and upward on lateral movement of saline ground water during the dry season (November-May). The severity of soil salinity increases with the dryness of the soil body. On the other hand, the severity of salt injury is reduced due to the dilution of the salt in the root zone of the standing crops.

The availability of water during the dry season is reduced, drying up of riverbeds and salinity intrusion in the Ganges basin area of Bangladesh are caused by reduced flow of water from the Farakka dam point. About 10 percent land in the hilly areas is considered to be highly eroded and less than 50 percent land has impeded drainage which suffer from water logging and poor aeration (Karim, 1993 and Karim and Iqbal, 2001).

4.5.1. Water logging:

Water logging caused by rise in ground water is also responsible for lowering of land productivity in many areas. Water logging may be natural or may be due to faulty irrigation management. About 8000 hectares of waterlogged land occurs in Khulna- Jesssore area (popularly known as Beel Dakatia). This is an example of human induced land degradation caused by faulty construction of embankment. The land in this beel area is now under process of reclamation through introduction of appropriate management practices with integrated approach and easy engineering work. Estimated land degradation situation in Bangladesh is shown in table 5.

Table 5. Estimated land degradation situation in Bangladesh.

Type of degradation	Areas affected (million ha)			Total area (M ha)	% National Area
	Light	Moderate	Strong		
Water erosion	0.1	0.3	1.3	1.7	12
River bank erosion	-	-	-	1.7	12
Soil fertility decline	3.8	4.2	-	8.0	54
Organic matter depletion	1.9	1.6	4.0	7.5	51
Water logging	0.7	-	-	0.7	5
Stalinization	0.6	0.3	-	0.9	6
Plough pan	-	1.0	-	1.0	7
Acidification	-	0.6	-	0.6	4
Deforestation	-	1.5	-	1.5	10
Total	**7.1**	**11.2**	**5.3**	**23.6**	**-**

Source: **Hussain, M.S. (1999).**

4.6. Deforestation:

Deforestation is a serious environmental concern in Bangladesh, which is caused by industrialization, rapid urbanization, high population pressure, jhum cultivation and shrimp culture. Deforestation is becoming more and more an acute problem with time and is threatening the destruction of evergreen tropical rainforest of the country at an alarming rate. According to present estimate the actual tree cover in the forest area has now been reduced to only 6 percent of the total land area of the country. Another startling fact is that about 50 percent of the forest of the country has been destroyed during the last 20 years (Huda and Roy, 2000). Such a drastic depletion of forest cover is now blamed for the doughtiness of the central part of the Barind tract in northwestern Bangladesh.

4.7. Acidification

Severe forms of acidification have been developed in the soils of the hills, terraces and some floodplains of Bangladesh. Intensive acidification has been reported in the heavy clays in the Sylhet and lower Atrai basins and in some broad valleys within the Madhupur and the Barind tracts. Aluminium toxicity and phosphate fixation the major are problems in the tea growing soils. Active acid sulfate soils occupy about 62,000 ha in the eastern coastal area and potential acid sulfate soils are reported to occupy some 8,000 ha in the adjoining tidal lands.

4.8. Plough Pan formation

More than one million hectares of cultivated land of the Tista, Ganges, Brahmaputra, Meghna floodplains and the Barind tract of Bangladesh are reported to have developed a compacted plough pan at 10-15 cm depth below the surface (Brammer, 1997). Due to repeated puddling of wet soils by using country made plough for rice cultivation this pan has been formed.

Proliferation of roots and utilization of subsoil moisture and nutrients by the deep rooted crops are restricted by this firm pan (Karim and Iqbal, 2001).

4.9. Sedimentation:

Sedimentation, drainage congestion and loss of wetlands contribute infertile sand or coarse sediments in the Brahmaputra basin of Bangladesh and reduce the productivity of the topsoil. Climate change induced by higher sedimentation rates has serious social and economic implications (World Bank Report, 2001). Land types in the floodplain areas of Bangladesh are changing as a result of rural infra-structural development (USAID, 1991. Andriesse (1982) mentioned that changes in land type occurs in Ganges and Brahmaputra areas of Bangladesh due to irrigation expansion and development of flood control and drainage projects. Transplanted Aman rice has largely replaced by Broadcast Aman rice in the Flood Control Drainage and Irrigation polders with the decrease of inundation depth, more over with the fall of general flood level in the Brahmaputra and Ganges floodplain, the Medium Low Land (MLL) have changed to Medium High Land (MHL) (Karim and Iqbal, 2001).

5. Chemical pollution

Fertilizers, insecticides and pesticides applied to croplands are the leading sources of chemical pollution of surface and ground water. Fertilizers, pesticides, insecticides and farmyard wastes enter waterways as runoffs from the agricultural lands are polluting water and soil. Bangladesh has at present more than 30,000 industrial units, large and small. They are discharging their wastes and effluents in the natural systems in most cases without any treatment and thereby cause environmental pollution especially due to heavy metals and organic toxins. The hazardous wastes and effluents are generally discharged in low-lying areas or in the vicinity of the industrial installations. The toxic heavy metals discharged from industries in Bangladesh are cadmium, lead, chromium, mercury, zinc, arsenic and in few cases copper and manganese. The industries like tannery, paper and pulps, textiles, carbides, pharmaceuticals, pesticides, distilleries etc, discharge heavy metals with their effluents and wastes. The heavy metals that are present in the effluents may enter the growing crops from contaminated soils. When the effluents enter the river water it may cause harm to the biodiversity, plant and soils. The concentration of the harmful effluents increases during the dry season resulting in the death of many fishes. Most of the industries in past were established without thorough study of their environmental impact assessment (EIA).

6. Arsenic problem

Problem of arsenic pollution of the ground water of Bangladesh has turned to a crisis of unprecedented proportion. The sources of arsenic in the deep-scaled sediments are mainly the parent rock materials from which they were derived. For long, the arsenic bearing minerals such as arsenic sulfides were submerged in groundwater and remained inert. With the start of intensive withdrawal of groundwater for irrigation for growing Boro rice, the aquifers started to drop causing arsenic to oxidize. Once oxidized, arsenic sulfides become water-soluble which ultimately come up with the pumped water.

It has been identified that a vast area in the lower Ganges delta, the Jamuna, the Padma and the lower Meghna river alluvia has emerged as the single largest arsenic contaminated region in the world. The people of this vast region are continuously getting exposed to the arsenic toxicity

causing serious health hazards through drinking arsenic contaminated ground water. Using arsenic polluted water for irrigation potentially is risky, as this poisonous element will ultimately enter the food chain. Latest information indicates that out of 64 districts in Bangladesh, waters of 61 districts have arsenic in their ground water where more than 65% of the country's population live (Chowdhury, 2000).

7. Global warming and sea level rises

Bangladesh constitutes with the 654 km long coastline along the Bay, the coastal zone about one-fifth of the country's total area, whose average elevation is less than one meter above the mean sea level. The anticipated global sea level rise of one meter by the middle of this century may cause inundation of the coastal zone by seawater (Bijlsma, 1995). The estimated loss of land along the coast will be more than 17%, and is likely to displace more than 30 million people (Huq *et al.*, 1995). These people will move northward in the un-inundated areas where the population density will increase and the environment will be further aggravated. Other environmental and agricultural issues associated with this global warming and potential sea-level rise are cause for grave concern for Bangladesh (Islam, 2001). It is horrifying to think that many islands in the offshore areas of Bangladesh including Bhola, Hatia, Swandip, Kutubdia and Manpura, where millions of people now live, will face extinction. The Sundarbans is the world's largest mangrove forest and the extensive shrimp farms and the associated agricultural lands will disappear. The Sundarbans, as declared as the world heritage is still quite rich in terms of biodiversity and is the home of around 315 species of birds and 13 forest and 4 non-forest types of vegetation (Ullah, 2002). But global warming and sea level rise will inundate this portion of Bangladesh has been assumed by the environmental scientists.

8. Conclusion:

Appropriate land use and adoption of suitable management technology can enhance and sustain high productivity and soil management, include crop and livestock management.
Although no study has been undertaken as yet on the soil nutrients management of Bangladesh, the alarmingly low organic matter content in Bangladesh soils indicates that their resilience may be at the lower end. The growing demand of ever-increasing population of Bangladesh for growing more food, fuel, and timber has resulted in rapid oxidation of organic matter in soils, massive deforestation and as well as ecological imbalance. Land use changes in Bangladesh and related to land type degradation is impacting on the socioeconomic condition and on agricultural system of the country. At the present time the important environmental impacts of agriculture in Bangladesh is the gradual degradation of its land resources because of high population density of the country. Land degradation is taking place due to both natural causes as well as human induced causes. Natural hazards like sudden flash floods, tidal surges and droughty situations causes agricultural vulnerability. Significant, land degradation processes due to soil erosion, soil salinization, continuous water logging, river bank erosion, jhum cultivation, acidification, plough-pan formation, organic matter reduction, deforestation etc. are sometimes causes difficult to land use planning and appropriate land management practices.

A good soil should have an organic matter content of more than 3.5 percent. But in Bangladesh, most soils have less than 1.7 percent and some soils have even less than 1% organic matter. It is

believed that, the declining productivity of Bangladesh soils is the result of depletion of organic matter caused by high cropping intensity. In Bangladesh, crop residues are widely used as fuel and fodder and usually not returned to the soil. Even cow dung is widely used as fuel in rural areas. This results in a decrease in soil organic matter content. In Bangladesh, the average organic matter content of top soils have gone down, from about 2% to 1% over the past 20 years due to intensive cultivation which means a decline by 20-46% (Miah et al, 1993). Soil organic carbon levels tend to be stable or increase under irrigated rice double cropping sites (Cheng, 1984, Nambiar, 1994). Organic matter content is generally lower in the upland sites of rice–wheat cropping (Nambiar, 1994 and Cheng, 1984). Soil organic carbon variability depends on the land class variability and also management conditions. Land-use management and soil organic carbon management is important phenomenon for agricultural land management and crop yielding.

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