



Environmental and Socio-economic Impacts of Salinity Intrusion in the Coastal Area: A Case Study on Munshigong Union, Shymnagor, Satkhira

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Abstract

One of the major problems in the coastal zone of Bangladesh is Salinity intrusion. It is increasing alarmingly due to natural and anthropogenic reasons. About 53% of the coastal areas are affected by salinity. Salinity is causing decline in soil productivity and crop yield which results in severe degradation of bio-environment and ecology. So, a study has been made on the effect of salinity intrusion on environment and socio-economic condition of the worst salinity affected Munshiganj union of Satkhira district. The study was conducted on the basis of primary and secondary both data sources. To collect primary data different methods had been adopted which were informal interview, a pre-formulated questionnaire survey and Focused Group Discussion (FGD). It has been found that salinity increase results in reduction of agricultural production, vegetation growth, hampering ecosystem and biodiversity, deteriorating natural environment and creating negative impact on the socio-economic conditions of the study areas people. Moreover, in maximum cases people of the study area are changing their occupation such as farmer to shrimp farming, prawn collection, shopkeeper, labor etc. including cultural changes. Different kinds of diseases are also spreading and food habit changing. A great concern is found that there are no any kinds of drinking water without saltiness. In this perspective, some time oriented immediate steps have to take to protect salinity intrusion and to find out suitable ways to adapt with salinity problems with the collaboration of Government and local NGOs.

Key Words: *Salinity, Climate change, Environment, Sea level rise, Socio-economic impact.*

Introduction

There are a number of environmental issues and problems that are hindering development of Bangladesh. Salinity is a current problem, which is expected to exacerbate by climate change and sea level rise. Salinity intrusion due to reduction of freshwater flow from upstream, salinity affected of groundwater and fluctuation of soil salinity are major concern of Bangladesh. Cyclones and tidal surge is adding to the problem. Tidal surge brings in saline water inside the polders in the coastal area. Due to drainage congestion, the area remains waterlogged, increasing the salinity (Abedin, 2010). Among the coastal area of Bangladesh, Munshiganj Union of Satkhira is most vulnerable to salinity intrusion impact (Rahman, 2009). So, study was set to explore the various environmental and socio-economic impacts due to salinity intrusion in small scale. Dutta and Iftekhhar (2004) studied tree species survival in the homestead forests salt affected areas of Satkhira district and they have found that in reduction of tree growth (2% per year) and vegetation coverage (1.87% per year). Uddin *et. al.* (2011) discussed about Climate Change and Salinity in coastal areas of Bangladesh and they have described how to manage such a kind of problem now and in coming days. Islam and Gnauck (2005) studied about the impacts of salinity

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intrusion in mangrove wetlands ecosystems in the Sundarbans and suggested several ways to sustainable management and alternative approaches. Observations in the recent past by SRDI in 2000 indicated that due to increasing intensity of salinity of some areas and expansion of salt affected areas normal crop production becomes more restricted in the coastal area. In this regard, soil salinity is believed to be mainly responsible for low land use as well as low cropping intensity (Rahman and Ahsan, 2001). Moreover, Shrimp farming being a profitable business, most of the coastal polders constructed during 1950s and 60s by the water development board to protect agricultural land from inundation of salt water have now been turned into large shrimp culture ghers (ponds) (Khan *et al.*, 2006). The priority has now been reversed and salt water is willingly being allowed in the ghers of the polder areas to raise shrimps. Unplanned and rapid expansion of shrimp farming in study areas has generated many environmental, ecological, social, and economic problems; most notable of them being destruction of mangroves and planktonic resources during collection of shrimp fry and environmental pollution.

Materials and Methods

Study area

The study was carried out in Munshiganj Union (22°14'-22°17' N and 89°04'-89°12') of Shyamnagar upazila under Satkhira District of Bangladesh as it is one of the worst salinity affected area (It is placed under highest salinity zone in the soil salinity map produced by SRDI, 1987) of the country.

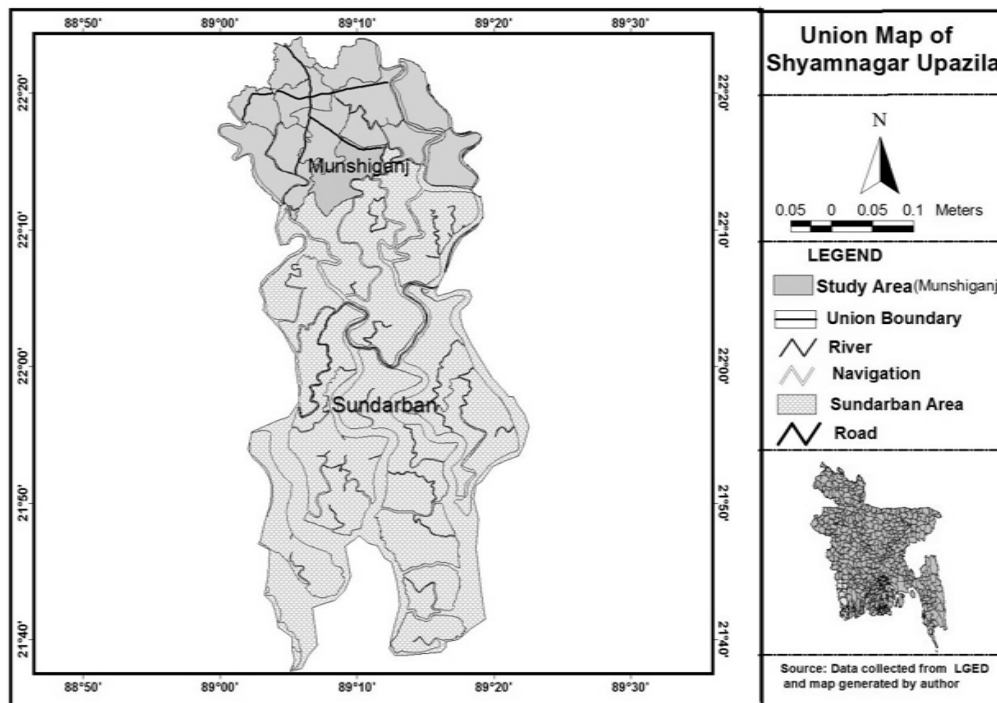


Figure 1: Location of the study area (inside the Upazila Union Map)

Shymnagar Upazila consists of 11 union and out of them Munshigonj Union (Figure 1) was chosen as study area because Munshiganj Union of Satkhira is most vulnerable to salinity intrusion impact. It is located beside the Sundarbans and southern parts of this union are covered by the Sundarbans Reserve Forest. Most part of this union is affected by salinity under different intensity levels.

Data collection and Analysis

The study was conducted mainly based on primary data sources. Secondary data has been also used from different journals, reports, research papers, web sites and others published and unpublished documents of government and non government. To collect primary data different methods had been adopted which were informal interview, a pre-formulated questionnaire survey and Focused Group Discussion (FGD). For questionnaire survey, sample size was 110 and it was done through random sampling techniques. GIS, RS and statistical data summarized techniques such as SPSS, MS Excel have been used in the study.

Results and Discussion

Salinity Affected Land

The intensity of salinity is high in the study area because of geographical location. Maximum agricultural lands are affected by salinity under different intensity level. Though effects of salinity have not reached on residence yet but agricultural land is fully affected (Rahman and Ahsan, 2001). In some cases people bring and store saline water to his land for shrimp farming. Following (Table 1) indicates that 84% lands are affected by salinity which indicate alarming situation in the study areas salinity condition.

Table 1: Salinity Affected Land

Land percentage class	Frequency	Percentage (%)
0%-25%	0	0
26%-50%	0	0
51%-75%	18	16
76%-100%	92	84
Total	110	100

Source: Field Survey, 2012

Impact on Vegetations and Biodiversity

The trees are affected by different diseases and gradually disappearing from the villages of the study area due to salinity, like, top dying, leaf shedding and root rot (Dutta and Iftekhar, 2004). It has been found that *Achras Zapota* Linn., *Cocos nucifera* Linn., *Psidium guajava* Linn., *Swietenia macrrophylla* king are disappearing due to these diseases at a larger rate than other species (Dutta and Iftekhar, 2004). Mangrove species like the sundari from which the Sunderbans gets its name is also slowly disappearing. "Particularly the sundari cannot stand high salinity so it is suffering the most along with that the fishing cat and the deer population. There has been a migration along the area of the tiger. They also don't like a lot of salinity so they are also migrating," said Professor Pranabes S Sanyal, member National Coastal Zone Management (Islam and Gnauck, 2005). Salinity is one of the most important factors of mangrove forest growth and distribution. 20-35% salt concentration is congenial for mangrove ecosystems. A salt concentration of 40-80%

diminishes the number of species and their size and only a few species can exist and grow in 90% concentration. Some information about biodiversity-

- 20 mangrove species are available out of 70 species
- Large part 45% mangrove are disappeared
- 12 species of plant are already vanished

Extinct animals of the study area due to salinity problems are Javan rhinoceros, Single horned rhinoceros, Water buffalo, Swamp Deer, Mugger Crocodile, Gaur and Hog Deer. Extinct worms and Insect are Beetle, Centiped, Earthworm, Leech, Firefly, Grasshopper, Worm. Moreover, Extinct and near to extinct Fish due to salinity intrusion in the study area are- Close to extinct fish - Breeding fish, Climbing fish, Carp fish, Walking fish, Salon fish and Extinct fish - Butter fish, Flat fish, Mango fish, Sheet fish, Trout fish (Field Survey, 2012).

Soil Salinity and Agriculture Production

Agriculture is a major sector of Bangladesh’s economy and the coastal area of Bangladesh is very fertile for growing rice. Increase in salinity intrusion and increase in soil salinity will have serious negative impacts on agriculture (Hossain, 2009). Now in the study area practiced rice varieties may not be able to withstand increased salinity. People of the study area are converting their agricultural land to shrimp farming because of salinity impact. There is no sufficient land without saline water affected where they produce agricultural products. The food production does not seem to have a better future in the event of a climate change in Munsiganj union. In Bangladesh, rice production may fall by 10% and wheat by 30% by 2050 (Synthesis Report, IPCC, 2007). Table 2 indicates agricultural and vegetable production are hampered dramatically in the study area on account of salinity intrusion. It is found that above in all cases 70% products have to buy from the market and these are exported from the different parts of the country.

Table 2: Green Piece Source after salinity

Green piece types	Vegetable	Fruit	Medicinal plant
From household source	20%	10%	30%
From Market	80%	90%	70%
Total	100%	100%	100%

Source: Field Survey, 2012.

Environmental Changes in the Study Area

Local people can identify the changes of environment easily. Especially drinking water crisis, extinction of many kinds of plants, trees, extinction of native fishes, and extinction of various kinds of animals, increasing temperature are easily noticed by local people. The data about over all changes noticed by local people are collected in the prior of survey is given in (Table 3). it can be said that a great environmental change are happening in the study area. As a result every aspects of environment will face dire situation and ultimately causes great suffering human who are living in the study area. Data also showed that total drinking sources of the study area are affected by salinity. And fishes and trees are going to last stages of distinct.

Table 3: The environmental changes in the study area

Types	Frequency (Out of 110)	Percent
Salinity in Drinking water	110	100%
Extinction of plant, trees	108	98%
Ruin of native fishes	100	91%
Extinction of animal	95	86%
Increasing Temperature	65	59%
Destruction of Bio diversity	32	29%

Source: Field Survey, 2012

Environmental Losses due to salinity

Salinity intrusion is responsible to great environmental losses in the study area. Plant, vegetables, milk and milk products, native fishes, drinking water crisis create so many problems to localities to survive there. Many of them have started to shift their habitat to another place like Chittagong hill tracts area.

Table 4: Environmental Losses due to salinity

Types	Frequency (Out of 110)	Percentage
Plant	95	86
Animal	85	77
Vegetables & Milk products	100	91
Drinking water	110	100

Source: Field Survey, 2012.

Salinity Impacts in the Coastal Rivers

As sea level continues to raise the associated effects of permanent inundation is likely to increase the salinity near coastal areas. A study conducted by IWM in 2005 shows that 5 ppt saline front will penetrate about 40 km inland for SLR of 88 cm which is going to affect the only fresh-water pocket of the Tetulia River in Meghna Estuary and by which is affecting the study area spreading salinity (Figure 2) . A big chunk of the fresh- water zone that will be disappearing due to sea level rise near to the estuary will have a far reaching effect on the country’s ecology and will extinct some of its endangered (Sarwar, 2005).

Changing livelihood pattern

The impact of salinity on crop production is already visible in the study area. Most of the respondents in the study area already experienced dramatically yield reduction that’s why they have changed their occupation. Maximum people of the study area are engaging with shrimp farming which percentage is 61% and some are baby prawn collection which percentage is 18%. A small number of respondents reported that they have changed the crop variety to cope up with increasing salinity keeping farmer which percentage is 18%.

Table 5: Changing pattern of livelihood

Changing pattern		Frequency	Percentage
From farmer to other profession	Shrimp Farming	67	61%
	Baby prawn collection	20	18%
	Shopkeeper	11	10%
Continuing Farmer	Farmer	20	18
Total		110	100%

Source: Field Survey, 2012.

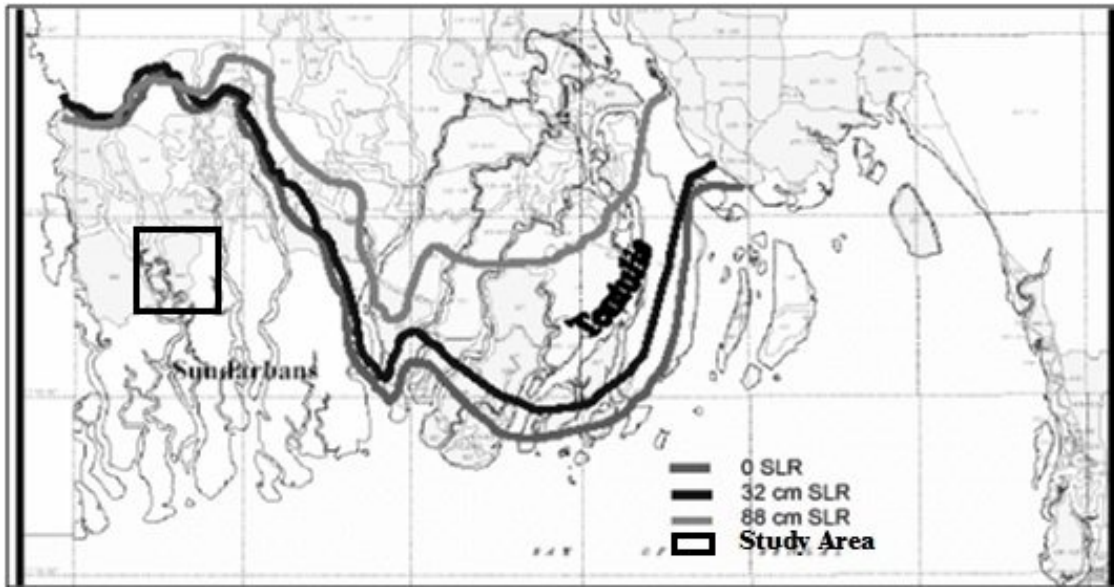


Figure 2. Five ppt line for different sea level rise in dry season (After: Impact of Sea level Rise on Coastal Rivers of Bangladesh, IWM, Bangladesh, 2005)

Impact of Salinity Intrusion on Health

Health risk increases in a great number due to salinity problems. Disease prone also increases. People are affected easily by different kinds of diseases especially waterborne diseases. Moreover specific diseases affect people frequently.

Table 6: Impact of salinity intrusion on health

Types	Increasing Disease Magnitude	Advent various Diseases	Increasing some specific diseases proneness	Decrease Health condition
Frequency (Out of 110)	90	82	94	96
Percentage	82%	75%	85%	87%

Source: Field Survey, 2012.

Environmental and Socio-economic Impacts of Salinity Intrusion

From above (Table 6) it can be said that because salinity intrusion in the study area different kinds of disease are prevailing and in some case some specific diseases which are directly linked with salinity are more.

Impact of Salinity Intrusion on Economy

Threat to Fisheries Sub Sector: The Climate Change and Sea Level Rise (CCSLR) is likely to affect the fisheries in Bangladesh. Increased water temperature and salinity may not be suitable for many species. Sea level rise, by reducing the fresh water fishing area, will cause reduction in fish production. Pond culture in the coastal area will be affected by intrusion of salt water into ponds, unless embankments are made around them. Shrimp farming in the coastal area is a lucrative business. Increase in salinity is likely to jeopardize the shrimp farming. For the last few decades, more and more attention is being given to sea fish and brackish water fisheries.

Impact of Salinity Intrusion on Life style

Life style has immensely changed in the study area. Leisure time has increased because most of their previous occupations are not continuing further due to salinity problems such farming, fishing etc. Although comfort have come in life but they are not good overall economically due to impact of climate change phenomena. Culture has also been going to change due to adaptation with changeable environment.

Table 7: Impact of salinity intrusion on life style

Types	Frequency (Total 110)	Percentage
Changing Economic Activities	70	63%
Changing social approach	25	23%
No variation in daily life	15	14%

Source: Field Survey, 2012

From above data (Table 7) it is said that in maximum case, people have been changed their habit and culture because of environmental change.

Future Plan about Land Use

Fertility of soil to cultivate has been damaged by salinity. In this situation, men are without aiming. They don't know what should do or what should not do in future. Primary data supports so. The following (Table 8) shows 10% of people have no plan and 72% men want to shrimp firming.

Table 8: Future Plan about Land Use

Types	Frequency	Percentage
Shrimp farming	79	72%
Fallow	20	18%
Having no plan	11	10%
Total	110	100%

Source: Field Survey, 2012

Conclusions

Salinity is a worldwide problem. Bangladesh is no exception to it and coastal areas are more vulnerable to salinity problem. Salinity intrusion is one of the major natural hazards hampering on environment and socio-economic condition of the study areas people. In the study area salinity increase results in reduction of agricultural production, vegetation growth, hampering ecosystem and biodiversity, deteriorating natural environment and creating negative impacts on the socio-economic conditions of living local communities. Moreover, in maximum cases people of the study area are changing their occupations. Different kinds of diseases are also spreading and food habit changing. In addition, agricultural land use in these areas is very poor. Declining land productivity with shift towards negative nutrient balance is among the main concerns with food security problem in the country. To protect the wetland ecosystem, endangered plant, animal species, their habitat, agricultural land, high water salinity has to take effective steps immediately.

Recommendations

- ❖ More study and scientific research should be done for innovating and introducing salinity tolerant crop varieties.
- ❖ Have to develop alternative livelihoods for the people who are sufferer by the salinity intrusion problems.
- ❖ Should be given more Emphasize on salinity issue in Integrated Coastal Zone Management (ICZM) Plan.
- ❖ Have to Raise global awareness of the need to address vulnerability to salinity as sea-level is rising.
- ❖ Have to incorporate drinking water crisis due to salinity in the National Water Policy.
- ❖ Have to integrated coastal and marine management to face climate change related problems.

Salinity is a current problem which is expected to intensify by climate change and sea level rise. Salinity intrusion due to reduction of freshwater flow from upstream, salinisation of groundwater and fluctuation of soil salinity are major concern of study areas people. If the above stated recommendations regarding to reduce and adjustment with the salinity intrusion problems are implemented then the damages and impacts of salinity intrusion will be reduced largely in the study area.

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