INTRUSION OF SALINITY IN THE COASTAL BELT AREA: A CASE STUDY IN CHITTAGONG (ANWARA TO MIRASARI UPAZELLA)

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ABSTRACT

The magnitude of salinity intrusion in coastal areas depends on sensible balance between fresh water flow and saltwater from the sea. Rising of sea level due to global warming is now a major environmental issue. It is a matter of serious concern for countries with long coast line. As a consequence of sea level rise, coastal belts of Bangladesh will be affected. Bangladesh is one of the most vulnerable countriy to be affected by a rise in sea level. Taking the above facts into consideration, this research has been undertaken particularly to find out the variation of concentration of salinity (brix %) with distance from the shore line in surface water and ground water (used for irrigation and drinking purpose) used by the coastal people. A section of the coastal belt in the south-eastern part of Bangladesh, from Anowara to Mirassarai, was taken as the study area. Concentration of salinity in surface and ground water of six upazillas: Anwara, Patenga, Bhatiary, Kumira, Sitakunda and Mirassarai of Chittagong were studied. From this study it was found that intrusion of salinity decreases with the increase in distance from the coast. From this analysis, it is also observed that Anowara coast have the lowest concentration of salinity. At Chittagong city, concentration of salinity in shallow tube well and surface water exceeded the recommended limit (0.05%) up to a distance of 9 km from the shore line. It was found that concentration of salinity was high during high tide and low during ebb tide. It was also found that concentration of salinity in ground water is not uniform throughout the length of the shore line. The line drawn with the limiting value 0.05% is not straight rather it is undulated from Anowara to Chittagong city indicates that salinity intrusion in ground water and surface water may have varied depending on the grain size of the soil through which the intruding water had to move. The aim was to find an empirical identification of a line beyond which towards the shore water will not be drinkable and cannot be used for irrigation. If the depth of this narrow strip of land continues to increase
over the years, people may have a tendency to migrate inward in search of drinking water abandoning their ancestral homesteads.

*Keywords: Salinity, Intrusion, Coastal belt, Chittagong city, climate refuge, Ground water, surface water, high tide, ebb*

**INTRODUCTION**

**Background of the Study**

The movement of saline water into a freshwater aquifer or surface reservoir is known as saltwater intrusion. The coast of Bangladesh consists of 19 districts, covers 32% of the country and accommodates more than 35 million people (Huq et al. 2011). Increasing salinity is a crucial issue to the people of the coastal region of Bangladesh. Due to increasing salinity in the water and soil, the people of the region are suffering from scarcity of safe drinking water, irrigation, agriculture and other uses. Ecology of the coastal region especially in the southwest region is greatly concerned with salinity. A recent study indicates that the salinity affected area has increased from 8330 square km in 1973 to 10560 square km in 2009 (Soil Resource Development Institute, 2010). But it has been observed that all the coastal cultivable lands are not being utilized for crop production, mostly due to soil salinity. Increased soil salinity limits growth of standing crops and affects overall crop production, and also makes the soil unsuitable for many potential crops. Soil salinity has been considered a major constraint to food grain production in coastal areas of the country. Increasing the level of water salinity is impacting on the livelihood operation in several ways. First, it is making the whole coastal belt’s water availability unsecure and pushing poor people’s lives to a more vulnerable position than before (Huq S 1999) Second, water salinity also causes an increase in soil salinity which further decreases the agricultural productivity and brings enormous pressure on food security. In this situation management of salinity intrusion is the vital issue for Bangladesh. With the mission of saline water proofing by structural management, such as coastal embankment projects, dam, sluices etc. and coastal area zoning as non-structural management to change the land use and other activities can be the vision of sustainable livelihood and environment of Bangladesh. Hence diagnosis of the causes of saline intrusion is required.

**Statement of the Problems**

There are multiple reasons of salinity intrusion in the coastal area of Bangladesh. Bangladesh is one of the most vulnerable country to be affected by a rise in sea level. Taking the above facts into consideration, this research has been undertaken particularly to find out the variation of concentration of salinity (brix %) with distance from the shore line in surface water and ground water (used for irrigation and drinking purpose) used by the coastal people. A section of the coastal belt in the south-eastern part of Bangladesh, from Anowara to Mirassarai, was taken as the study area. Concentration of salinity in surface and ground water of six upazillas: Anwara, Patenga, Bhatiary, Kumira, Sitakunda and Mirassarai of Chittagong were studied. From this study it was found that intrusion of salinity decreases with the increase in distance from the coast. From this analysis, it is also observed that Anowara coast have the lowest concentration of salinity. It includes natural, socioeconomic and political systems. All these systems are interlinked to each other. This section describes how these systems play a role in increasing salinity intrusion in the inland part of the country.
Objective of the Study

To determine the changes of salt concentration in ground water during high tide and ebb tide in several locations from Anowara to Mirashari in Chittagong. To assess & draw a demarcation line between safe and unsafe zone, considering salinity in surface & ground. To get information about increasing climate refuge in Chittagong. A stretch of land in the coastal area of Anowara to Mirashari in Chittagong city, having a width of 0 to 15 Km from the sea is considered in this study.

METHODOLOGY

Study Area

Anowara to Mirashari in Chittagong districts comprise the south-eastern part of Bangladesh. Chittagong city is included in it. A stretch of coastal land from six upa-zillas are taken as the study area for this research. These sections of land are in direct interaction with the Bay of Bengal and can be classified as Coastal zone in the South-Eastern part of Bangladesh. There is little physical, climatic and geomorphic difference between selected zone. The names of these areas are mentioned below: 1) Anowara 2) Patanga 3) Bhatiari 4) Kumira 5) Mirashari.

[Fig. 1.: Study area from Anowara to Mirashariin Gps Track map.]
Sample collection
Along a cross section perpendicular to the shore line, identified the tube well locations in local homesteads. Locate the tube-wells at an approximate distance of (1-15) km from the shore line. The distances are measured by mile meter using a motor cycle. However, since tube-wells already in existence are used the distances given are approximate only. Seven water samples are collected from each station where one sample is collected from the sea and the rests are collected from the tube-well locations. For each experiment station, water samples are collected two times, one during ebb tide and the other during high tide.

Laboratory test of surface and ground waters sample
The study intended to explore the salinity level in surface and ground water of the study area, which is mainly used for drinking and irrigating agriculture crops purposes. Chlorine of water is analyzed in the households. A total of 100 samples are collected, among them 20 sample are from the Bay of Bengal in six experimental stations. The others are collected from surface and ground identified in areas from Anowara to Mirashari. All samples are measured by salinometer for determining the concentration of salinity.

RESULTS AND DISCUSSIONS
[Fig. 2.: Ground water and surface water analysis for salinity (Brix %) of different stations of Patenga to Bhatiary]
[Fig. 3: Safe area of Surface water Anowara to Mirashari]
CONCLUSIONS

From the study it was found that intrusion of salinity decreases with the increase in distance from the coast. It was also observed that Salinity concentration is minimum at three substations in Anowara (Haildhar, Barkhain, Pharkora) Sitakunda & Mirashari. The contamination of Salinity at Patanga (Ananda bazar), Bhatiari (Bhatiari bazar), Kumira station is more than Anowara station which is further increased with the distance from the sea shore. The Salinity concentration are maximum at Chittagong city than other stations. It is also found that concentration of Salinity in surface & ground water is not uniform throughout the length of the shore line. It has also been found from the study that two family migrate their location for water salinity problem as climate refugee. Whatever A surface & ground water salinity map is to be prepared for the coastal belts of Bangladesh without any further delay. The map is to be revised every five years. These maps will help Bangladesh in monitoring the scale of deterioration of qualities of ground water and the scale of salt water intrusion in the ground water.

[Fig. 4.: Safe area of Ground water Anowara to Mirashari]
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