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SCENARIO OF CLIMATE CHANGE ON AGRICULTURE IN SOUTH-EAST COASTAL BELT OF BANGLADESH

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***Abstract*— The impact of global climate change on agriculture has been studied extensively for various crops at different scales in many countries of the world. Bangladesh is likely to be one of the worst hit countries, being an Asian and a Third World country .Especially Coastal people are highly exposed to a range of natural hazards, from storms and cyclones to widespread flooding and coastal erosion. This study is under taken to investigate the effect of climate change on agriculture in the coastal belt of Bangladesh. The coastal zone of Bangladesh is worldwide recognized as an extremely susceptible area. Influences of climate change and sea-level rise should have real consequences on the livelihoods of the coastal people as it would be affected by salinity disturbance, flooding, drainage overcrowding, cyclones, heavy storms and erosion of the land masses .Therefore, agriculture in low-lying areas is likely to become increasingly difficult to sustain. The saline water causes the different impact on cultivable land and fisheries. The main aim of this study to identify the potential impacts and propose recommendations for agriculture adapt to climate change. Investigation on climate change on agriculture land varies with seasonally to respect sea level, salinity flood etc.**

***Index Terms*— Salinity, Climate Change, Agriculture, Sea Level Rise.**

I. INTRODUCTION

Available reports show that tropical and subtropical countries would be more vulnerable to the potential impacts of global warming. Bangladesh is likely to be one of the worst hit countries, being an Asian and a Third World country. The frugality of Bangladesh is established going on services, industry and agriculture. The agriculture segment contributes a major share in the GDP, which is about 21% and employs about 48% of the working force (Table -a).

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Table- a: Occupations and GDP and sector wise contributions

Country	Occupation	GDP(At constant procedure price)
Bangladesh	Agriculture: 48.1%	Agriculture: 21.10%
	Industry: 51.9%	Industry: 78.90%

Identified suitable varieties have to this study rice and non-rice crops and available adaptation measures or technologies for agriculture that have the potential to help farmers to adapt to climate change in the future.In the past, many studies have been conducted on climate change issues by different organizations and future impact scenarios have also been developed. Different adaptation measures, technologies and strategies have already been developed by different organizations as well as by communities to adapt with climate change. As the economy is the main sector of agriculture, it is vital to identify appropriate adaptation technologies or varieties of agricultural crops through field-testing and community awareness for sustainability. Suitable and ideal adaptation measures and varieties of crops have been identified through this study. The results will give hope and confidence to farmers in adapting their crops to climate change. The goal of this research has to identify the potential impacts and propose recommendations for agriculture to adapt to climate change.

A. World sea level rise scenario

In 1990, Intergovernmental Panel Climate Change (IPCC) estimated a 3.3˚C rise in the global temperature under business-as-usual conditions by 2100 with a range of uncertainty of 2.2 to 4.9˚C. Such a change in global temperature occurred naturally over previous 10,000 years. IPCC's assessment of global sea level rise was 1.0 to 2.0 mm/ year over the last century. Increasing rate of temperature with the high global, sea level will rise at a faster rate of 2-6 times than the present rate [5]. Estimated that the greenhouse-gas-induced thermal expansion contribution to sea-level rise between 1880 and 1985 was 2-5 cm and for the period 1985-2025 the estimate of greenhouse-gas-induced warming was estimated to 0.6-1.0°C [7]. The resulting concomitant oceanic thermal expansion would raise sea level by 4-8 cm. [6] predictable that by the 2080s, the loss of up to 22% of the world's coastal wetlands by rise of sea level.

When combined with other losses due to direct human action, up to 70% of the world's coastal wetlands could be lost by the 2080s. IPCC estimated that sea level rise would be 66 cm under business-as-usual conditions by 2100 with a range of uncertainty of 13 to 110 cm. The resulting concomitant oceanic thermal expansion would raise sea level by 4-8 cm [6].

B. *Sea level rise in Bangladesh*

Sea level rise in Bangladesh is highly vulnerable, as it is a densely populated coastal country of smooth relief comprising broad and narrow ridges and depressions [2].World Bank (2000) showed 0.10 m, 0.25m and 1 m rise in sea level by 2020, 2050 and 2100; affecting 2%,4% and 17.5% of total land mass respectively (Table-b). [4] Reported 1.0 cm per year sea level rise in Bangladesh.

Subsidence is also a considerable factor for sea level rise in Bangladesh. The Brahmaputra and the Ganges convey about 1.6 billion tons of sediment annually to the face of Bangladesh [3].So, sediment replenishment is considered to balance subsidence of the delta that results a net sea level rise [1].The rate of the tidal trend is almost double in the eastern coast than that of the western coast. This modification could be due to subsiding and uplifting of land. However, Sing (2002) mentioned that the difference is mainly due to land subsidence.

Table-b: Sea level rise (SLR)in Bangladesh and its possible impact

Year	2020	2050	2100
Sea level rise	0.10m	0.25m	1m(high end estimate)
Land below SLR	2 % of land (2,500km^2)	4 % of land(6,300km^2)	17.5%of land (25,000km^2). Patuakhali, Khulna and Barisal regions will be most affected
Flooding	20%increase in inundation	Increase flooding in Meghna and Ganges flood plain. Monsoonal floods increase yield loss	Both in undation area and flood intensity will increase tremendously
Agriculture	Inundate 0.2Mmt. of production:<1%of current total	0.3mSLRinundate0.5 Mmt.ofproduction;2% Of current total.	Devastating flood may cause crop failure for any year.
Salinity	Increase	Increase	Increase

II. METHODOLOGY

A. *Data collection*

a) Collection of secondary data Relevant information on global warming and sea-level rising have been accumulated by consulting files, papers, journals, browsing internets, personal communications, attending seminars and conferences, and visiting several institutions/civil service. Climatic parameters like temperature, humidity, rainfall, storms, tidal flows etc. and geo-morphological information covering elevation, river mouth, banks, floods, tides and expected areas of sea etc. of the coastal regions have also been composed by visiting pertinent organizations.

b) Collection of primary data The land patterns, managements and socio-economic features of the coastal people Koyra Upazilla of Khulna District in the Division of Khulna . Koyra Upazilla is bounded by paikgacha (Khulna) and Assasuni and paikgacha upazillas, Sundarbans on the north and Bay of Bengal on the south, Dakop upazillas on the east, Shyamnagar (satkhira) on the west. The local people in some selected areas of the coastal zones were also interviewed about their socio-economic aspects and maintenances. In each location, some farmers were randomly selected for the purposes. Khulna was also made On-spot observation

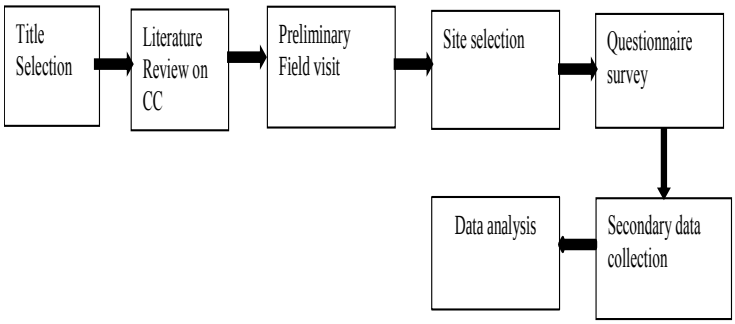

Figure -a: Flow diagram in this research work

B. *Geo-Physical Environment:*

An attempt was made to understand the geo-physical environment of the study area. A hydrological analysis was done to understand the extent and nature of flood in the study area. The flood depth and spatial distribution of rainfall were examined during the monsoon season. Extreme temperature and soil salinity were observed for the whole season. The effects of climate change on the geophysical environment of the study area were identified from these observations and investigate. Participation of local contributors was ensured during this process.

C. *Field -Testing Sites Selection:*

Define abbreviations and acronyms thBased on previous data and information collected from a non-structured questionnaire survey from different stakeholders, such as scientists of different research organizations and local

farmers, koyra to be the most suitable site for conducting the experiments. According to the suggestion of the Environment Engineering Department of Khulna University of Engineering and Technology (KUET), the proposed method for field testing has modified. It has been certain to bring out the study at Koyra Upazilla for change of properties of soil as well as effect of climate change on overall agriculture. According to the some parameters of measuring the variation of agricultural data with respect to different years the experiment sites were selected at the farmers' fields at Koyra.

III. RESULT AND DISCUSSION:

Sea level rising

Sea level rise will increase flood frequency and flooding duration, affecting Aman production. Due to sea level rise, salinity of water and soil will increase, and this will damage Aman cultivable land. Production of T. aman and Boro is varied due to sea level rise seasonally. Damage of rice was highest in 2009-10 since due to flood and cyclone (aila) as shown in figure-b.Becauseofthe shortage of fresh water, Boro rice production will be decreased. Agricultural lands in the coastal area will be affected by salinity; soil quality will be degraded and flooding event will loss the agricultural production of the coastal land of Bangladesh. Therefore sea level rise will have to effect on agricultural production, most important Bangladesh to be unsuccessful, obtaining food security, especially on food production.

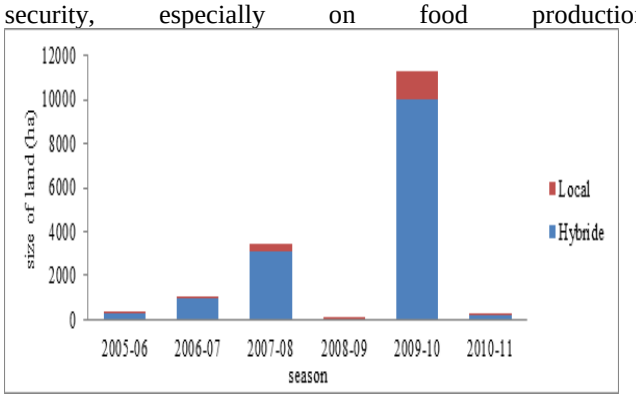

Figure-b: Damage of crops due to flood and cyclone.

Salinity

Shrimp farm areas in the year 2004 were 87 fold more than that of the year 1975. It is another indicator of salinity intrusion in the coastal zone. In last thirty years' time period, salinity intrusion has degraded land quality and farmers can't grow any agricultural crops in their fields. Thus farmer's become zero productive land owners, in one sense landless with their existing saline land. Salinity intrusion causes loss in agriculture, loss in biodiversity, loss in fresh water and its resource. Size of land which is the firm of shrimp with Transplanted amon (rice) decrease 15294ha to 10000ha cause of salinity as in table -c below.

Table-c: Variation of Cultivation with respect to salinity

Types of crops	Before five years		Present status	
	Size of land (hector)	Percentage of cultivable land	Size of land (hector)	Percentage of cultivable land
Transplanted amon(rice) with Prawn/Shrimp	15294	11	10000	9

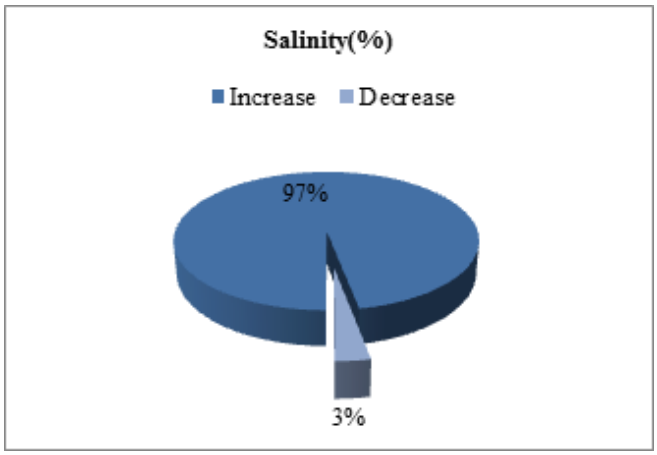

Figure-c: variation of salinity with season

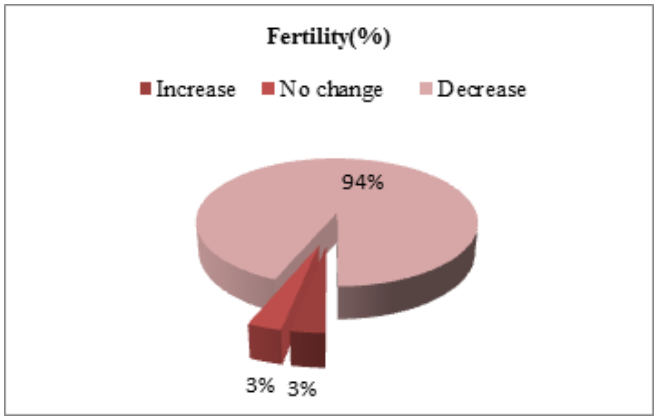

Figure-d: variation of fertility with season

Present status of salinity and fertility is appeared by local farmer according to their previous experience as in figure -c and d above.

IV. CONCLUSIONS:

Sea level rise in Bangladesh impacts are really high, though the country plays very slight part in greenhouse gas releases, sea level rise and climate change to leading. By affecting different livelihood activities and important ecosystem of the country, sea level rise imposes a grave threat to the existence of Bangladesh. Therefore, Bangladesh government need to pay keen attention to the issue and should develop strategy to combat sea level rise impacts and thus safe its citizen. For comparing the impact of climate change, yields of crops under this study were generated for baseline (360 ppmv CO,

temperature and precipitation of 1990) climate and with no stress condition (no stress means that optimum levels of fertilizer and irrigation).Effect of climate change on cultivable land is vary with seasonally (figure -e).

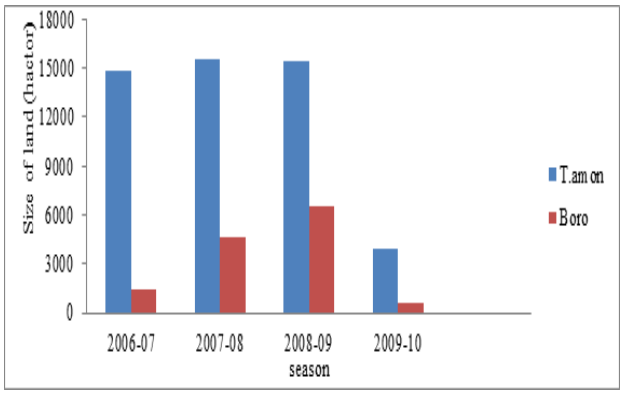

Figure -e: Size of cultivable land with various seasons.

Next four year of season 2008 water level overall rises but in 2009-2010 abrupt increase for several cyclone and storm surges (figure-f).

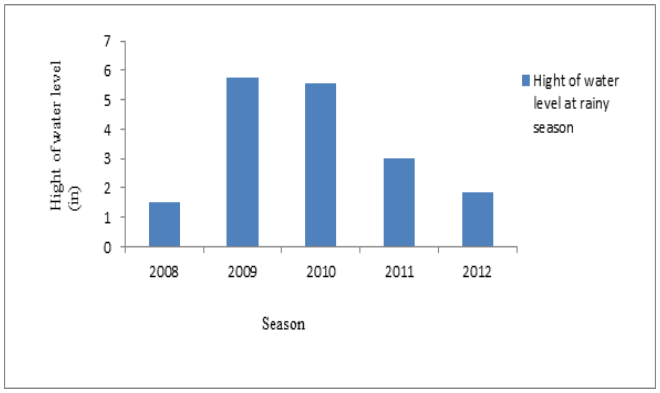

Figure-f: Rise of water level at rainy season.

V. RECOMMENDATION

It is difficult to confirm a crop as adaptive under climate change situations using only one season crop connected data. At least two years of experimentation is required to conclude if a crop is adaptive under climate change situations in the coastal regions. The finding of rice crops cultivate in boro season and T.Aman season need to confirm by more trails. The results that were found from rabi season experiments (tomato, okra and aroids) are preliminary findings. The findings for rabi crops need to be confirmed by more trails. The findings should be disseminated to the farmers of the whole coastal areas. Necessary inputs and technology should be provided to the farmers with a purpose to start farming practices in their respective fields with the recommended variety and technology. The finding should be expanded throughout the salt affected coastal zone of Bangladesh.

VI. REFERENCES

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