FACING CLIMATE CHANGE BY SECURING WATER AND FOOD IN DACOPE UPAZILA OF KHULNA IN BANGLADESH

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ABSTRACT

Climate change poses now-a-days severe threat mostly in agricultural sector along with water and food security among all other affected sectors. The coastal area of Bangladesh is naturally susceptible to disaster whereas climate change asserts a new depressing effect to the lives and agronomy. This study focuses on socio-economic aspects, climate variability and its impacts on water and food security in Dacope upazila. The methodology includes field investigation, data collection, water and food demand estimation, simulation of scenario, and proposal of some adaptation programs with regards to water and food security. Year-wise monthly average maximum temperature has been rising gradually about 1.94 °C and total annual rainfall has increased around 27% since 1950. Presently, 80% of land area is affected with varying degree of salinity and it will reach approximately 91% by the year 2040. At the same time, sea water level in the Bay of Bengal is supposed to rise about 23 cm which will merge with an increment of about 54 cm in high water level of Bhadra River in this area. In Dacope upazila, potable drinking water supply is also a challenging task especially for salinity and arsenic contamination. Agricultural production is severely affected by frequent extreme weather events. Adaptation programs like excavation of ponds with Pond Sand Filter, invention and cultivation of more climate tolerant crop varieties, transformation of saline soil into cultivable land, etc. are to be done to ensure water and food security.

Keywords: *Climate change, coastal area, food security, rainfall, water security*

1. INTRODUCTION

Weather is the state of the atmosphere at a specific time in a specific place. Climate is defined as long-term weather patterns that describe a region. Climate variability refers to variations in the prevailing state of the climate on all temporal and spatial scales beyond that of individual weather events (CCIR-NYC, 2004-2005). Climate change is a long-term shift in weather conditions identified by changes in temperature, precipitation, winds, and other indicators. Climate change can involve both changes in average conditions and changes in variability, including, for example, extreme events (CACC, 2013).

The Earth is getting warmer because people are adding heat-trapping gases to the atmosphere, mainly by burning fossil fuels. These gases are called greenhouse gases. Warmer temperatures are causing other changes around the world, such as melting glaciers and stronger storms. These changes are happening because the Earth's air, water, and land are all linked to the climate. People are causing these changes, which are bigger and happening faster than any climate changes that modern society has ever seen before (USEPA, 2015).

Water security can be defined as the reliable access to water of sufficient quantity and quality for basic human needs, small-scale livelihoods and local ecosystem services, coupled with a well managed risk of water-related disasters (WaterAid, 2012).Food Security means that all people at all times have physical and economic access to adequate amounts of nutritious, safe, and culturally appropriate foods, which are produced in an environmentally sustainable and socially just manner, and that people are able to make informed decisions about their food choices (FSN, 2014).

Fresh water is crucial to human society – not just for drinking, but also for farming, washing and many other activities. It is expected to become increasingly scarce in the future, and this is partly due to climate change. Approximately 98% of our water is salty and only 2% is fresh. Of that 2%, almost 70% is snow and ice, 30% is groundwater, less than 0.5% is surface water (lakes, rivers, etc) and less than 0.05% is in the atmosphere. Climate change has several effects on these proportions on a global scale. The main one is that warming causes

polar ice to melt into the sea, which turns fresh water into sea water, although this has little direct effect on water supply (theguardian, 2012).

Climate change is regarded as one of the several interacting factors that affect food system in many ways. Firstly, agriculture, forestry and fisheries all are sensitive to climate change as their production system are likely to be affected by climate change (FAO, 2008). Crop yields are predicted to fall by up to 30 percent creating a very high risk of hunger and only sustainable climate-resilient agriculture is the key to enabling farmers to adapt and increase food security (Sikder, 2010). This study aims at socio-economic investigation, climate variability and its impacts on water and food security in Dacope upazila. Furthermore, this study proposed some adaptation programs to ensure water and food security.

2. METHODOLOGY

2.1 Description of the Study Area

Dacope upazila of Khulna zila was the selected study area which was established in 1983. The upazila occupies an area of 991.57 sq. km. including 494.69 sq. km. reserve forest area. It is located between 22˚24′ and 22˚40′ north latitudes and between 89˚24′ and 89˚35′ east longitude. According to 2001 Bangladesh census, it has 30,130 households and a total population of 157 thousands. The main rivers are Pasur, Sibsa, Manki, Bhadra. The southern part of this upazila is surrounded by Sundarban. This locality is frequently affected by devastating climate events such as storms, floods and tidal surges as being a disaster prone area. Because of presence of excessive salinity, climate variability and climate change, extreme weather events, proving water and food security a major challenge in this upazila.

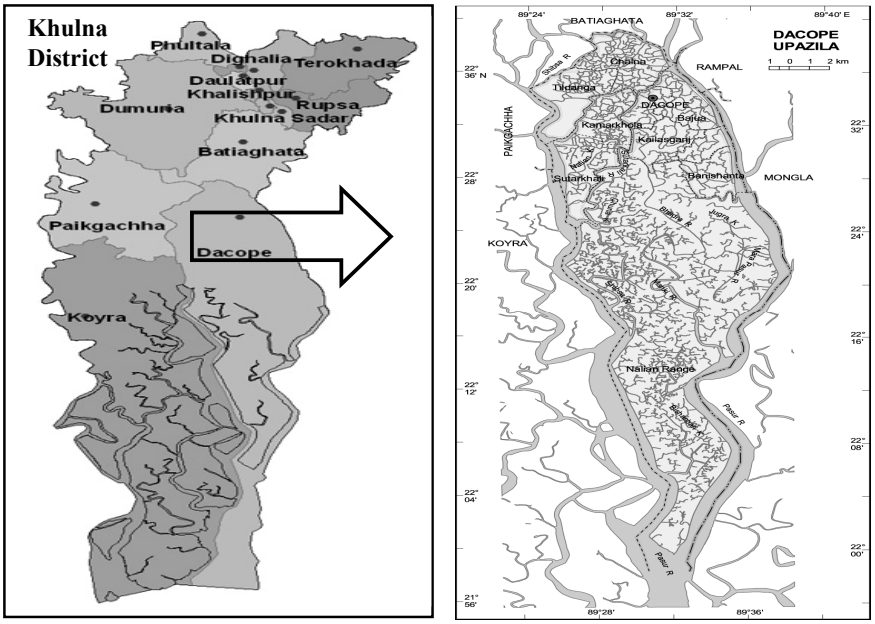

Figure 1: Study area (Dacope Upazila)

2.2 Data Collection and Analysis

At first, a primary survey was conducted in the study area in order to have a preliminary concept about climate change, water and food security. After that, a detail field survey was conducted to visually investigate the present socio-economic features, existing impacts of climate change on water and food security. To assess the impact of climate change on water supply and food security secondary data were collected from Water Development Board, Bangladesh Bureau of statistics, Department of Public Health Engineering, Department of Agricultural Extension, Bangladesh Meteorological Department, Department of Food, Bangladesh Agricultural Research Institute, Soil Resource Development Institute, and from Bangladesh Agricultural Research council. Relevant information have been accumulated by journals, periodicals, browsing internets, personal communications and visiting various Non-Government Organization (NGO)s offices like Rupantor, Prodipon, World Food Program, etc. The data have been interpreted in a quite easy and straightforward way. Simple linear

regression model was used to forecast future high water level of Bhadra River as well as percent saline affected land in the study area.

3. ILLUSTRATIONS

In Dacope upazila, 55.02% of the dwelling households own and 44.98% do not own agricultural land. 66.07% of the dwelling households depend on agriculture directly or indirectly as the main source of income. Other dwelling households earn main incomes from non-agricultural labor 4.85%, business 12.86%, employment 4.10%, construction 0.93%, religious service 0.24%, rent and remittance 0.05%, transport and communication 1.72% and others 9.18%.

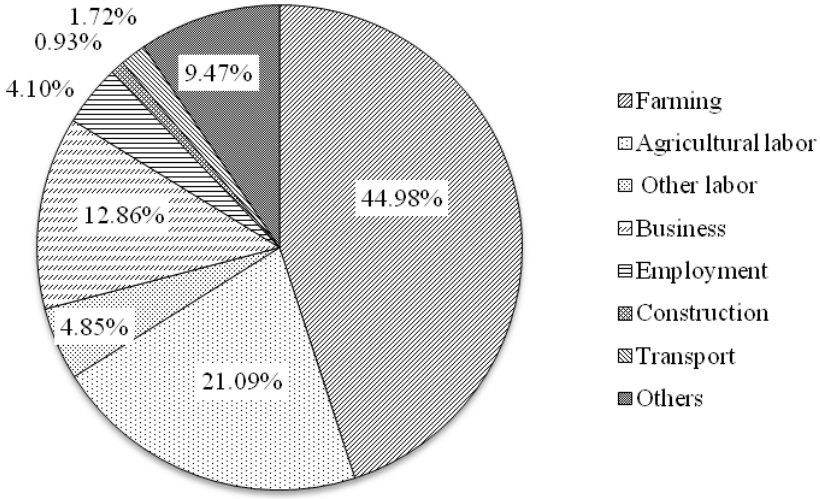

Figure 2: Sources of household income in Dacope upazila

There are a total of 28557 hectares of land in this locality among which 18894 hectares are cultivated and 9663 hectares area remains uncultivated. The saline area is 22760 hectares which is about 80% of total land area of Dacope upazila.

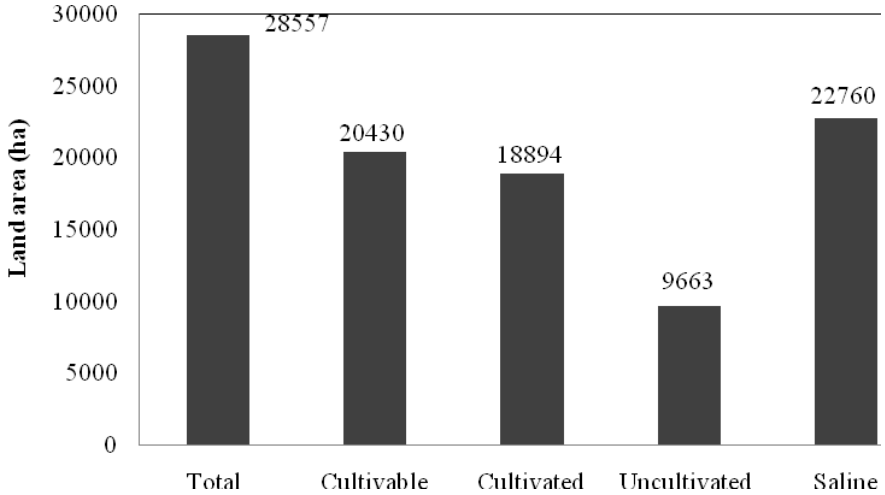

Figure 3: Types of land in the study area

Out of 20430 hectares of cultivable land, about 50% of them remain fallow in Rabi season because of late drainage problem. The cropping patterns followed in the study area are mainly Fallow-Fallow-Transplanted Aman rice. The risks and hazards to agriculture are the soil salinity, lack of fresh irrigation water, cyclones, tornadoes, storm surges etc.

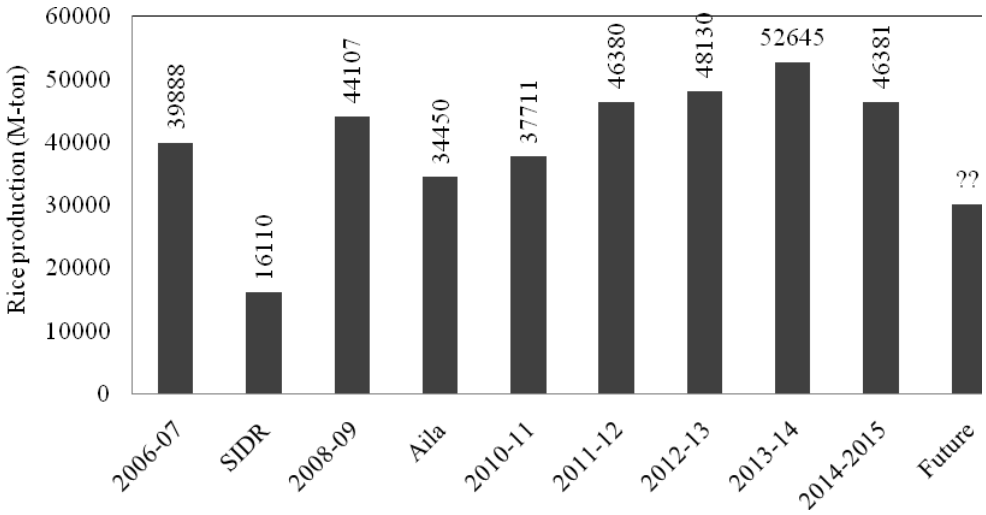

Figure 4: Rice Production Scenario in Dacope Upazila

The dominant crop grown in this saline area is local transplanted Aman rice with low yields. Despite of increasing soil salinity rice cultivation is in a satisfactory state at present. But the overall situation may worsen when an extreme climate event arrives as we can see from the above figure. SIDR and Aila reduced rice yield in 2007-2008 and 2009-2010 crop years respectively. Since the intensity and probability of such extreme events are increasing, net agricultural yield might be diminished and even ruined in the coming decades. Presently, annual demand for food is 31200 metric tons, additional 3200 metric tons are gone for cattle feed and wastage.

Since 1950, monthly average maximum temperature remains almost similar only in February and decreases in December and in January. Temperature in this perspective has grown in all the remaining months to a considerable extend (up to 1.94 ℃ in Jun). Moreover, temperature is arriving at a steady state in two cycles, namely, April to May and July to October.

In Dacope upazila, annual average rainfall is approximately 1500 mm. whereas in 2012, total yearly rainfall was about 1560 mm. Years are existing in which total annual rainfall was below 1500 mm. It is observed that from Jun to September 76% of yearly rainfall took place. Each year record stands for an average of adjacent five years data in figure 5.

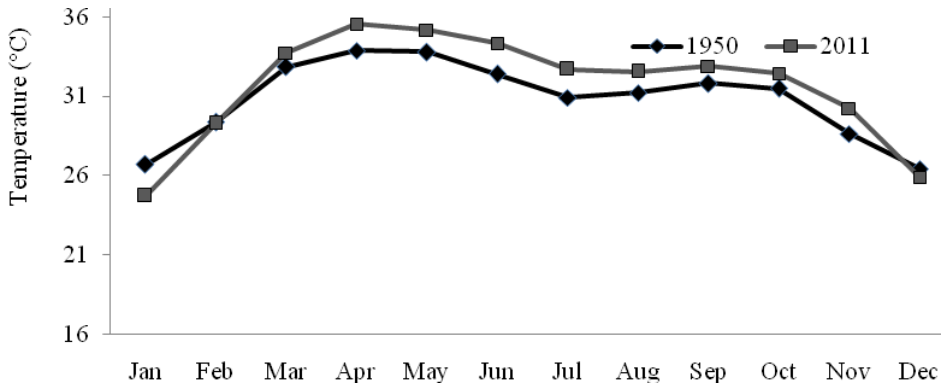

Figure 5: Variation in monthly average maximum temperature

Rainfall decreases in almost all the months, whereas it increases in July, August and in September. Total annual rainfall has also increased simultaneously around 27% since 1950. Moreover, rainfall is shifting and getting

concentrated in a small portion of the year. In figure 6, each year record is an average of adjacent five years data.

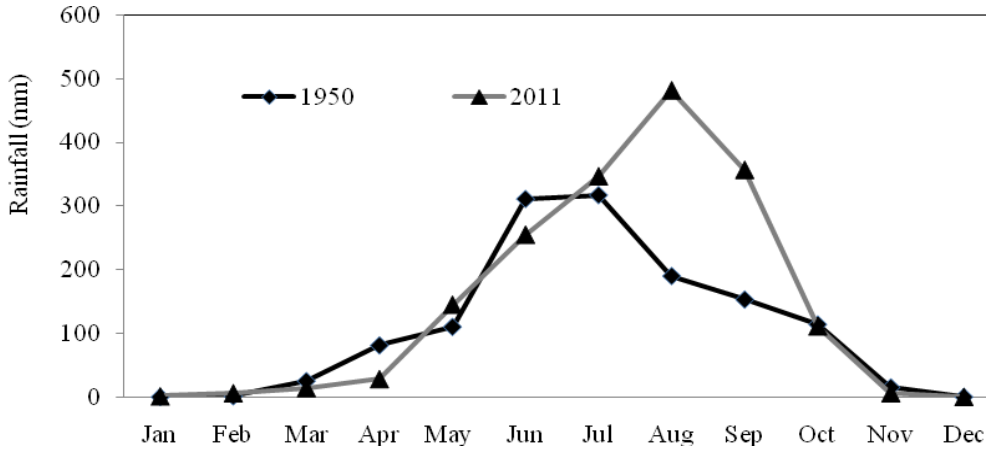

Figure 6: Variation in monthly average rainfall

Rain water is the main sources of drinking water in this area. Ponds store rainwater in wet season and provide 54% of drinking water all the year round. Besides, tubewells of various types provide about 40% of water for domestic purposes. Taps and other sources also provide some amount of drinking water. Annually, people in this upazila need about 363 million liters of water but they badly meet their demand due to scarcity of potable water.

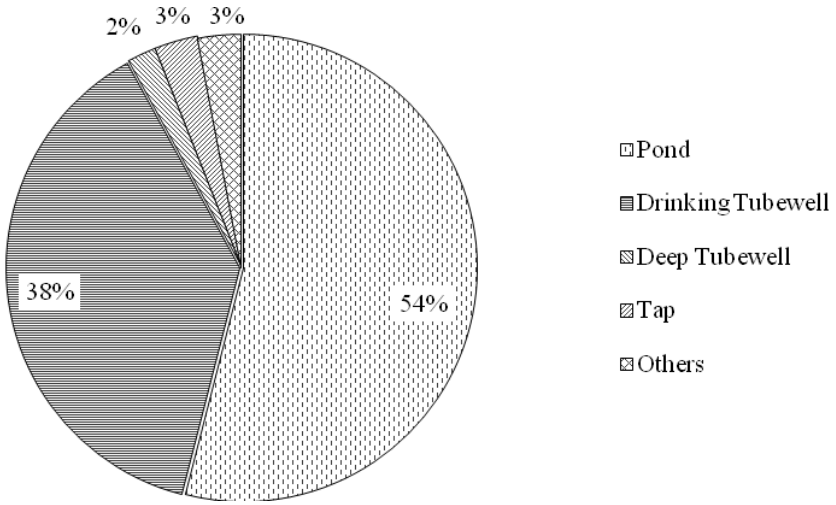

Figure 7: Sources of drinking water in the study area

The people are not aware about the ill effects of drinking pond water without any treatment as because the scarcity of potable water. Many of them directly use pond water for their day to day domestic and drinking purposes.

The high water levels of the rivers in the study area are presently found 2-3 feet higher than it was few years ago. Sea water level in the Bay of Bengal is projected to rise about 23 cm (IPCC, 2007) which will merge with an increment of about 54 cm in high water level of Bhadra River by the year 2040. Presently, 80% of land area is affected with varying degree of salinity and it will reach approximately 91% by the year 2040.

Excavation and re-excavation of ponds with Pond Sand Filter, keeping ponds free from pollution and inundation with saline water, etc. are essential to ensure water security. Provision of further Income Generating Support (IGS), invention and cultivation of more climate tolerant crop varieties, transformation of saline soil into cultivable land, etc. are to be done for the sake of food security.

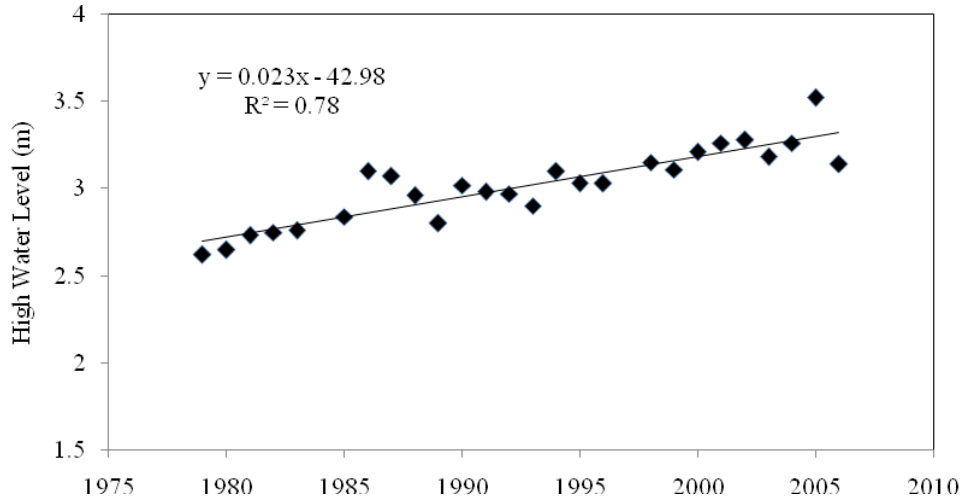

Figure 8: Linear regression model for high water level of Bhadra River

4. CONCLUSIONS

In Dacope upazila, agriculture is key means of earning livelihood. There are villages where 55%-60% people are poor to extreme poor. Rice is staple food of the inhabitants and surface water is the main source of drinking water. Year-wise monthly average maximum temperature has been rising gradually about 1.94 degree Celsius and total annual rainfall has increased around 27% since 1950.Presently, 80% of land area is affected with varying degree of salinity and it will reach approximately 91% by the year 2040.At the same time, sea water level in the Bay of Bengal is supposed to rise about 23 cm which will merge with an increment of about 54 cm in high water level of Bhadra River in this area.

Storms and tidal surges often ruin crops, pollute water supply options and make the cultivable land fallow for a long time. So, development and implementation of adaptation policies and appropriate mitigation strategies must be identified to respond to the issues of global warming induced sea level rise and climate change. Excavation and re-excavation of ponds with Pond Sand Filter, keeping ponds free from pollution and inundation with saline water, etc. are essential to ensure water security. Provision of further Income Generating Support (IGS), invention and cultivation of more climate tolerant crop varieties, transformation of saline soil into cultivable land, etc. are to be done for the sake of food security.

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