

# Community Based Adaptation to Climate Change through Integrated Agricultural Approach

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**Abstract:** *About half of Bangladesh's total labor force is somehow employed in agricultural sector. Impacts of climate change have become a growing concern for agriculture in Bangladesh as well as in the other countries of South and South-East Asia in recent years. Shifting rainfall pattern along with salinity intrusion as a result of sea level rise have made the sector very much vulnerable. Occurrence of extreme events like catastrophic cyclones has become more frequent. Increasing population is an added pressure to this sector as agricultural lands are transformed into households and rest of it is split into parts and pieces. This combined effect of climate change impact and population pressure is gradually making the agricultural land scarce. Reduced monsoon rainfall and intrusion of saline water through coastal flooding and storm surges are shortening the irrigation water availability. To make the most out of these scarce resources, an integrated approach of agriculture is needed. This paper is based on the interim outcome of a pilot research on integrated farming in the saline prone southern coastal region of Bangladesh. A combination of agriculture, vegetable gardening and fish farming was implemented in the research. Biological method was applied for pest control. Small Pond Irrigation System is another component of the project. Small pond irrigation was found to be very effective for vegetable gardening. It was also effective in suppressing soil salinity during dry season. The study found that this integrated application enabled a year round productivity from the research field. Annual turnover was profitable up to 15-20% more than the usual practice. Biological pest control managed to maintain a production rate of 85-95% compared to inorganic pesticide application. But, farmers often prefer inorganic pesticides due to ease of application and simplicity. The research concludes that integrated agriculture could be a prominent adaptation option to climate change. A community based approach would render a better result during replicating this scheme by integrating small plots into a larger one. As a whole, integrated agriculture could be a path setter toward sustainable development.*

**Keywords:** *Bangladesh, climate change, community based adaptation, integrated agriculture, rainwater harvesting.*

## 1. Introduction

It has been well demonstrated that Bangladesh is one of the most vulnerable countries to climate change. Increased frequency and severity of many natural hazards like floods, cyclones and droughts are the elementary evidences of climate change impacts on the country. Moreover, the expected variability of the rainfall pattern will surely aggravate the current scenario [1].

The rainfall dependency of livelihood due to a distinct seasonality, profound relationship between rainfall variability and food security, inadequate livelihood opportunities during the dry season and social inequality

coupled with food insecurity were the four identified factors that result in the migration process of Bangladesh [2]. All these factors explicitly demonstrate the country's vulnerability to climate change impacts.

The geographic and climatic features have rated Bangladesh as one of the most vulnerable countries of the world [3]. Temperature and rainfall, two of the major climatic components are changing and they are expected to be changed rapidly during near future. Sea level rise as result of global warming is another threat for agriculture [4]. Apart from climate change, the coastal zone is threatened by flood inundation and salinity intrusion [5]. Moreover, flood exposure in the coastal cities is increasing progressively [6]. The people in the coastal region have realized that the agricultural sector is already hit by the effects of climate change [7] [8]. Consecutive impacts of cyclones, storm surges and seasonal floods are disrupting the soil fertility causing a direct impact on agriculture. Population pressure, technological development and environmental alterations are shifting the land use pattern in this territory. Effects of sea level rise as a result of greenhouse effect and increased seasonal floods would produce an overall negative impact on agricultural production [9]. Reduced monsoon rainfall and intrusion of saline water through coastal flooding and storm surges are shortening the irrigation water availability.

Ensuring food security is among the top priorities of the sixth five years plan of Bangladesh as well as National Agriculture Policy (NAP) and Millennium Development Goals (MDG) of Bangladesh, although it still remains a challenge [10] [11] [12]. And it is obvious that ensuring food security largely depends on agriculture. Bangladesh has been known as a land of agriculture for years and this has been the driving force of the country's economy.

About 43.6% of the country's total labor force is employed in this sector [13]. But, the contribution of this sector to GDP has declined from 21.75% to 18.43% during the last decade [14]. Ever increasing population of the country is farther aggravating situation. The cultivable lands are transformed into households and the remaining is divided into parts and pieces. This combined effect of climate change impact and population pressure is gradually making the agricultural land scarce.

To make the most out of these scarce resources, an integrated approach is needed in agriculture. This paper is based on the interim outcome of a pilot research on integrated farming in the saline prone southwestern coastal region of Bangladesh. A combination of agriculture, aquaculture, vegetable gardening and fish farming was implemented in the research. Small Pond Irrigation System (SPIS) was introduced to secure saline-free irrigation water during dry season.

## **1.1. Objectives**

General objective of the study was to introduce an integrated approach in agriculture in order to maximize the productivity from the scarce agricultural resources. The Specific objectives were:

- To introduce the idea of integrated agriculture in the rural community of the study area
- To study the feasibility of integrated agricultural approach in the saline prone southwestern coastal area of Bangladesh
- To introduce Small Pond Irrigation System (SPIS) in the farming system
- To ensure a year-round productivity from the agricultural land

## **1.2. Study Area**

Since the idea was to study the feasibility of integrated agricultural approach in a saline prone land, the study area had to be situated in the coastal zone of Bangladesh. An agricultural land was selected in Saronkhola Upozila of Bagerhat district one of the worse affected areas by the catastrophic cyclone Sidr in 2007 [15].

## **2. Integrated Agricultural Approach**

A total of 0.66 acre land was leased in Saronkhola Upozila of Bagerhat district. The land is a two crop agricultural field. A combination of rice cultivation, vegetable gardening and fish farming was conducted the

first year. A pond was excavated at one side of the land. Vegetable beds were prepared with the excavated soil. The pond was used for fish farming. Rest of the land area was used for rice cultivation.

The vegetables that were cultivated in the field are:

- Cauliflower
- Gourd
- Cabbage
- Turnip
- Bean
- Tomato
- Pumpkin

Fingerlings that were stocked include:

- Silver Carp
- Catla
- Rui
- SarPuti
- Mrigel
- Common Carp

BR 11, a rice variety developed by Bangladesh Rice Research Institute (BRRI) was cultivated during Aman season in the rice field. Fig. 1 represents a schematic layout showing different plots/beds within the study field.

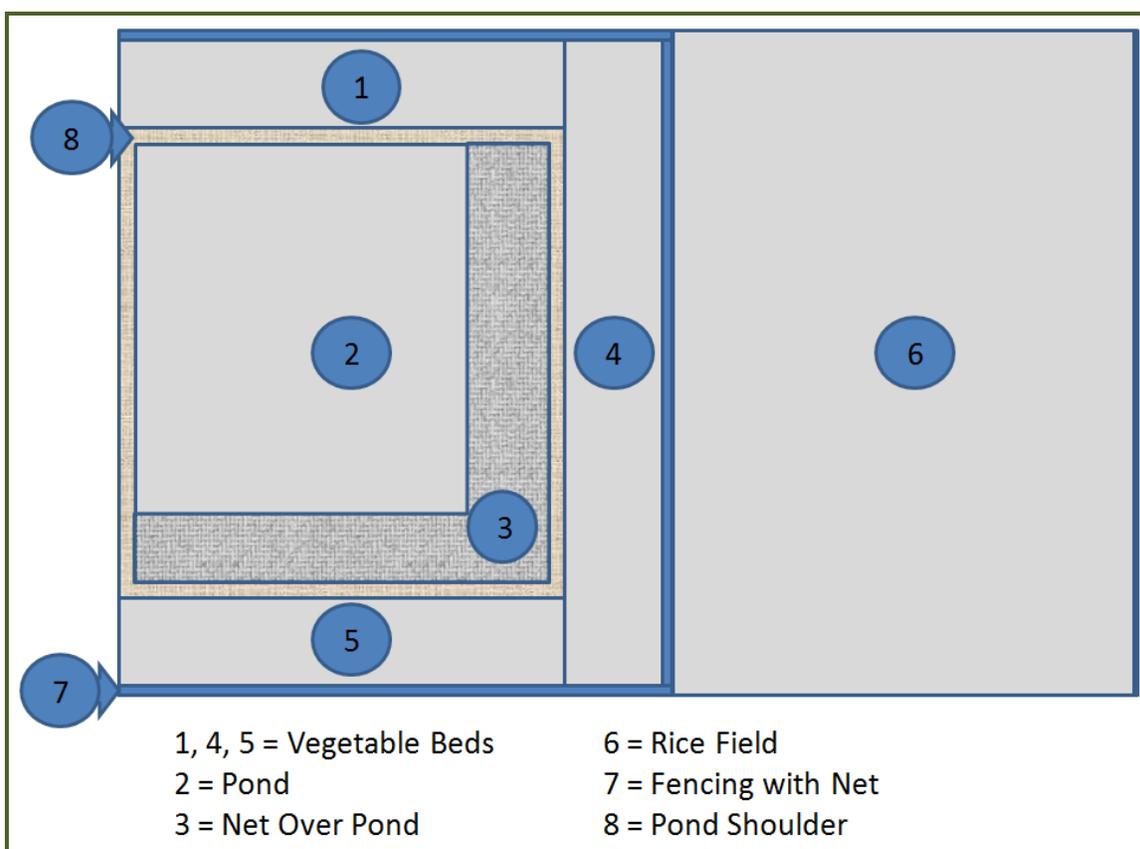


Fig. 1: Schematic layout of the study field

Cauliflower, cabbage and turnip were planted in bed number 1, 4 and 5 respectively. Gourd was planted at the pond shoulder along with tomato. Gourd plants were allowed to spread on the nets supported by scaffolds over the pond. Bean plants were seeded along the edge of the plot and were allowed to grow and cling with the net fencing. Pumpkin was cultivated between two rice seasons in the rice field.

Nutrients present in the soil must be available in a sufficient and balanced condition to permit optimum plant growth. But, the release process of present nutrients into an available form for the plants is too slow to satisfy the nutrient requirements for plant growth. For these reason, additional fertilizer is provided to supplement the nutrient demand by the plants. And commercially available inorganic fertilizers are commonly used for this purpose. But, over application of inorganic fertilizers has many disadvantages like leaching, pollution of water resources, extinction of micro-organisms and friendly insects, enhancing decomposition of organic matters present in soil leading to soil degradation [16].

An effort was taken in the study to reduce the use of inorganic fertilizer to reduce these problems. Rice husk and residue cake from the mustard oil mills were used as organic fertilizers. A limited dose of Triple Super Phosphate (TSP) and Muriate of Potash (MoP) was applied as inorganic fertilizer. No nitrogen fertilizer (Urea) was provided. Insecticides were applied once in the entire period of respective plant's life.

### 3. Experience from Season One

The production of rice was found to be about 750 kilograms i.e. about 5ton/hectare which is marginally less than the expected yield rate of 5.38 5ton/hectare in this region according to a study conducted by Bangladesh Rice Research Institute (BRRI) [17]. About 600 fingerlings of different variety were stocked in the pond which produced more than 500 kilograms of fish.

The pond water was used for irrigating the vegetable beds during the dry periods which was found to be very effective in cutting down the salinity problem. Because, the rivers and cannels that are the sole source of irrigation become extremely saline. Thus, the Small Pond Irrigation System (SPIS) could be an important alternative source of irrigation water in the saline prone region. Therefore, the study shows that this integrated approach of agriculture can ensure a year round productivity in the agricultural land.

TABLE 1 shows the amount of vegetable, rice and fish produced in the study field at a glance. The production obtained by using biological method for pest control was around 85-95% compared to that of chemical method of pest control. However, the year round productivity provided an annual turnover of 20% more than that was achievable with usual practice.

TABLE 1: Amount of vegetable rice and fish produced

Plot No.	Product Name	Area (Approx.) sft	Production	
			B.P.C.	C.P.C.
1	Cauliflower	450	400 pcs	470 pcs
2	Fish	5400	500 kg	560 pcs
3	Guard	1200	150 pcs	170 pcs
1, 4	Cabbage	2500	1200 pcs	1300 pcs
5	Turnip	750	1800 pcs	2000 pcs
6	Rice	16000	750 kg	850 kg
7	Bean	475	200 kg	225 kg
8	Tomato	300	300 kg	335 kg

B.P.C. = Biological Pest Control

C.P.C. = Chemical Pest Control

Fig. 2 shows the study field with different vegetables and fish produced in the study field.



Fig. 2: Different vegetables and fish produced in the study field

## 4. Conclusion

Salinity intrusion is seriously affecting the agricultural productivity in the coastal region of Bangladesh. Consequent impacts of natural disasters like cyclones, storm surges are further aggravating the situation. It is a tough task to combat this challenge with limited resource. Integrated agriculture introduced by this study could help the people of this region to a great extent in their battle of survival. The study established that integrated agriculture could be a worthwhile adaptation option to climate change. Small Pond Irrigation System (SPIS) showed its prospect as a source of irrigation during dry season enabling a year round productivity. But, this SPIS cannot be implemented in small sized plots because these do not have sufficient space to accommodate water storage ponds. But, if these small pieces of lands are merged into a larger field, this integrated agriculture could be very much effective through efficient planning and management.

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