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Climate Change and Floating Farming: Sustainable Livelihood Strategy in Bangladesh

Sukanta Sarkar*

Abstract

The paper discussed the significance of floating farming in Bangladesh. It has found that the tradition of growing vegetables, fruits and spices on rafts has now become a solution for farmers to cope with extreme weather conditions, floods and rising seas. Land cultivation is becoming more popular among farmers in many regions due to high market prices. Floating bed cultivation has now been extended to wet and intermittently irrigated areas in southern Bangladesh. Vegetables and other horticultural crops are now grown in this method and its popularity is increasing. The current farming system offers the local people a variety of health, wellness and agricultural activities that are beneficial to local people. Women play a significant role in these changes but are often overlooked in Bangladeshi society. While floating gardens have been successful for many, there are still those who have not benefited from this farming technique. The cost of setting up a garden is low, requiring only a small investment in fertilizer, seeds, and the work required to make the garden. Floating gardens are just one way that people living and working in Bangladesh can improve their food supply, and small water can play a significant role. Floating bed culture is considered an alternative lifestyle. Therefore, there should be more cooperation from the agriculture department and other organizations for expansion of such cultivation in flood prone and water logging districts of the country.

Keywords: Climate change, farmers, floating farming, income, natural calamities.

INTRODUCTION

Floating farm is an ancient method of farming in flood waters of southern Bangladesh. After observing the success stories of flood affected farmers in Bangladesh, this approach was replicated and has been successful in combating flood disasters in India. It is mainly confined to submerged areas/wetlands and agricultural fields which are subject to regular flooding especially during monsoon season. The most famous garden in India is Dal Lake in Srinagar, where a large area of Kuttanad-Vembanad ecosystem in Kerala, Lake in Manipur, Islands in Majuli (Assam), and flood-prone areas of Orissa has growing water vegetables The concept of such cultivation in Odisha and Assam is particularly important due to its economic, social, health and environmental impacts. The practice in Odisha involves chemical-free farming and benefits local communities affected by floods. However, this only makes sense for a simple family during a flood as it needs a flood to support itself. On the positive side, the practice has been domesticated and hence has great potential for mass adoption, producing more vegetables for sale, making it beneficial for those with weak financial conditions.

***Author for Correspondence**
Sukanta Sarkar
E-mail: sukantaeco@gmail.com

Associate Professor, Department of Economics, Gambella University, Gambella, Ethiopia

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Bangladesh is a low-lying country that is considered vulnerable to climate change and rising water levels, including storms, floods and erosion. Climate impacts, combined with natural events such as changes in geology that lead to mudslides and waterlogging, have further eroded the delta. Bangladesh is frequently affected by cyclones in the

Bay of Bengal, and global warming is making rainfall patterns more severe. Over one-third of Bangladesh's 165 million inhabitants reside along the coast. According to a 2019 report by the International Monetary Fund, due to sea level rise and coastal erosion there are more possibilities that Bangladesh could lose 30% of its food supply and 17% of its land area by 2050.

LITERATURE REVIEWS

Islam and Atkins (2007) focused on the nature and characteristics of the farming pattern in Bangladesh, where it was found that local farmers have the potential to use local water resources in such properties [1]. Hossain (2014) concluded that floating agriculture is a local technology in Bangladesh that can help to provide sustainable livelihoods in sensitive areas such as floodplains, this farming is very profitable [2]. The floating farming method of cultivation is environmentally friendly, meaning that vegetables and other crops are grown using wetlands almost every year. Floating gardens provide many social, economic, agricultural and security benefits to local residents.

Islam et al. (2015) concluded that there is a significant opportunity to promote floating farming practice in Haor in north-eastern Bangladesh [3]. Additional features need to be communicated to potential farmers to properly implement this practice. In the face of global environmental degradation, floating agriculture may be a good option for farmers in Hoar of Bangladesh. Floating beds in Jaintarpur and Kanagat and in lower wetland areas of Sylhet division of Bangladesh, these floating beds are planted with German grass and Dal grass [4]. Islam et al. (2019) explains the constraints that farmers face when implementing floating agriculture [5]. Lack of sufficient knowledge on floating agriculture; supply-related constraints such as scarcity of resources such as water hyacinth increases difficulties in bed preparation. Mohsin and Ferdousi (2019) said that floating agriculture is a good option from economic, environmental and psychological perspectives. Its capability has not received sufficient attention by policy makers [6].

Hossain (2020) found that farmers see climate change as more or less necessary, are aware of climate change, and floating agriculture is considered a useful and beneficial practice [7]. Such cultivation is a sustainable agricultural and income strategy for rural households in the coastal floodplains of Bangladesh. Floating gardens support food security by growing vegetables to absorb nutrients. During the horticulture season, uncultivated land is made available to ensure food security and diversity, and income increases. Jahan and Khanam (2020) found that most of the land in southern Bangladesh is flooded during the summer months [8]. Floating bed fields help generate income, reduce poverty, and create self-employment in flood-prone areas. Ahsan (2024) examined farmers' attitudes of climate-agriculture based on floating agriculture [9]. The potential of floating agriculture as a good climate-related adaptation in wetlands indicates the need for strategic plans and support systems that will support its widespread adoption and make farmers more informative to the impacts of climate change. Amin et al. (2024) discussed the impact of socioeconomic factors such as farm size and knowledge on floating agriculture [10]. Initiatives to expand floating farms, improve access to markets and solutions to environmental problems are recommended to achieve sustainable development.

Therefore, from the above analysis it has found that floating cultivation is growing in south-western coastal areas and north-eastern districts of Bangladesh. It is the alternative cultivation of traditional land-based cultivation. It shows hope for livelihood and additional income for food-prone and water logging regions of the country. Farmers grow organic vegetables and foods in this method of cultivation. Cost of cultivation in such cultivation is comparatively low and foods have more nutritional value.

OBJECTIVES

The objectives of the paper are:

1. To study the significance of floating farming in developing country, like Bangladesh.
2. To examine the status of floating farming in Bangladesh. and
3. To identify the merits and challenges of floating farming in Bangladesh.

THE STUDY AREA

Bangladesh is a fast-growing country in south Asia. Its area is 148,460 square kilometres and is the eighth-most populous country within the world. It has land border with India and Myanmar. It has lengthy coastal line in the southern area as shown in Figure 1. Siliguri corridor separated Bangladesh from Bhutan. Bengali and English are the major languages in Bangladesh. The largest city and capital, Dhaka serves as the center of politics, the economy, and culture. Chittagong is the port city and the second biggest metropolis. There are eight administrative divisions. There are 64 districts. Bangladesh is the 2nd largest economic system in South Asia. Bangladesh is surrounded with hills, forests, waterfalls, tea gardens, rivers, beaches, coastlines, archaeological sites, and places of worship.

METHODOLOGY

This study used a quantitative technique and has a descriptive design. The study's secondary data came from a variety of government reports and research articles. Descriptive analysis, content text analysis, and regression analysis have been used to uncover the floating cultivation in Bangladesh generally and its relevance in particular.

RESULT AND DISCUSSION

Climate change is the biggest challenge to sustainable livestock production in many countries. Many countries in the world are suffering from global warming and climate change due to geography, climate control, low sea level, overpopulation, high poverty and lack of natural resources. Agriculture is hampered by frequent annual floods and recurring water shortages, especially in coastal areas. Bangladesh is known for its abundance of rivers, lakes and wetlands. Bangladesh is a country that experiences severe flooding during the rainy season, especially in the south, west and along the coast. Many regions also experience long-term droughts every year. People living in these regions have been struggling with floods for generations. People living in these regions depend on agriculture for their livelihood. Floating agriculture is common in Bangladesh and is suitable for the Haar type ecosystem of approximately 80,000 square kilometers in Northern Bangladesh to reduce the impact of climate change on crops.

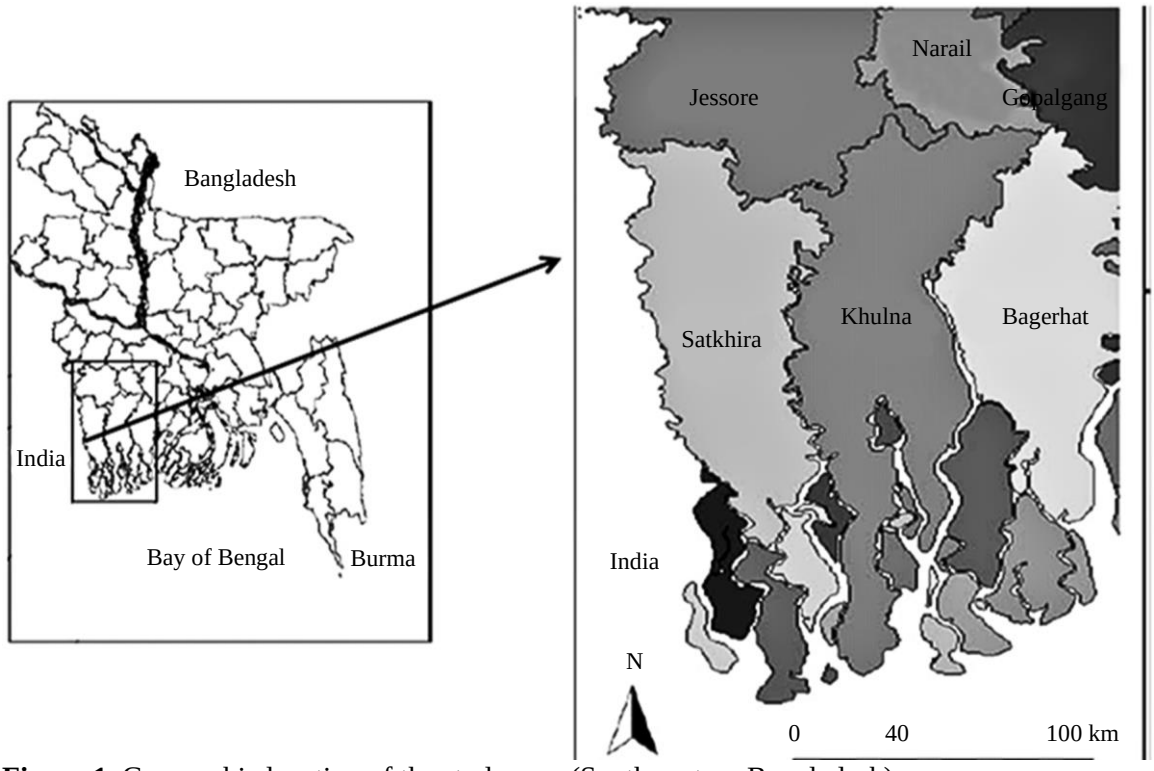

Figure 1. Geographic location of the study area (Southwestern Bangladesh).

Table 1. The long-term climate risk index (CRI): The 10 countries most affected from 2000 to 2019 (annual averages)

CRI 2000-2019 (1999-2018)	Country	CRI score	Number of events (2000–2019)	Losses per unit GDP in %	Losses in million US$ PPP	Fatalities	Fatalities per one lakh
1 (1)	Puerto Rico	7.17	24	3.66	4 149.98	149.85	4.12
2 (2)	Myanmar	10.00	57	0.80	1 512.11	7 056.45	14.35
3 (3)	Haiti	13.67	80	2.30	392.54	274.05	2.78
4 (4)	Philippines	18.17	317	0.54	3 179.12	859.35	0.93
5 (14)	Mozambique	25.83	57	1.33	303.03	125.40	0.52
6 (20)	Bahamas	27.67	13	3.81	426.88	5.35	1.56
7 (7)	Bangladesh	28.33	185	0.41	1 860.04	572.50	0.38
8 (5)	Pakistan	29.00	173	0.52	3 771.91	502.45	0.30
9 (8)	Thailand	29.83	146	0.82	7 719.15	137.75	0.21
10 (9)	Nepal	31.33	191	0.39	233.06	217.15	0.82

Table 2. Area statistics of land use change map (2010 and 2020).

Class name	Area in 2010 (%)	Area in 2010 (ha)	Area in 2020 (%)	Area in 2020 (ha)	Land use changes (ha)	Land use changes (ha)
Forest land	13.41%	20,03,242	13.34%	19,92,103	-11139	-0.07%
Cropland	49.74%	74,30,127	48.23%	72,04,586	-225541	-1.51%
Grassland	0.46%	68,207	0.47%	69,609	+1402	+0.01%
Rivers and khals	8.90%	13,30,021	9.16%	13,67,884	+37863	+0.25%
Other waterbodies	0.91%	1,36,374	0.84%	1,25,464	-10910	-0.07%
Settlements	21.70%	32,41,673	22.13%	33,05,370	+63697	+0.43%
Aquaculture	1.96%	2,92,949	2.40%	3,58,396	+65447	+0.44%
Orchards and other plantations	0.66%	98,376	1.19%	1,77,519	+79143	+0.53%
Other land	2.25%	3,35,730	2.25%	3,35,768	+38	+0.00%
Total	100%	1,49,36,699	100%	1,49,36,699		

Table 1 represents The Long-Term Climate Risk Index of worst climate affected countries. It has found that Bangladesh is included in the list of top ten worst climate affected countries. The coastal areas of Bangladesh are significantly affected by climate change, and agriculture is an important source of income for rural people. Since agriculture is often not viable in the low-lying areas of the southern coast due to prolonged flooding, floating agriculture has become a viable reform managed locally. Floating bed agriculture has proven to be an effective method of growing crops in wetlands worldwide. This floating system is used to grow vegetables, flowers, and crops in freshwater lakes and wetlands without the need for additional water or fertilizer. People in different parts adopted this practice and called it as they wished (floating agriculture, vasoman cash, kandi, geto, gatoni, gathua, dhap, boor and baira). Floating gardens are most successful in coastal areas and wet areas adjacent to the coastline where there is permanent water, especially during the monsoon season. Floating gardens (locally known as Dhap) have been cultivated in the wetlands of the south-central coast of Bangladesh since ancient times to grow crops and spices.

Table 2 discussed the changing land scenario of Bangladesh. It has found that forest land area declined in the last one decade, on the other hand rivers and khals surface land areas have increased. The population of Bangladesh is growing. This new agricultural method is even more important as the country's population growth and climate change will reduce the area of arable land [11]. In the lowlands of south-central Bangladesh, where much of the country is flooded for more than four months each year due to unstable water bodies. During the summer floods, they collect hyacinths, straw, and other aquatic

plants and push them into the water with their feet. They grow crops and spices on rafts called dhap or bajra. The size and shape of the beds vary depending on the farmer's preferences, needs, and budget, but small beds are easy to maintain and work well. There are many advantages to this. Offshore farming does not require the use of fertilizers or manures, unlike conventional farming, is more productive than conventional land, and is good for the environment as crops and fish can be grown simultaneously. Bangladesh faces serious problems due to cyclones, typhoons and floods.

Bangladesh's coastal regions frequently endure harsh weather, which significantly affects regional agricultural systems. Coastal areas must implement sustainable food production techniques to meet the growing demand for food. Today, farmers in many countries, including Bangladesh, are faced with challenges such as floods and rising sea levels that limit their growth. As global climate change is expected to make Bangladesh more vulnerable to floods and earthquakes, the country needs to develop adaptation strategies, especially in terms of awareness of traditional and local knowledge [12]. Bangladesh has a diverse and rich history. People live closer and have more knowledge of water resources. Local people use groundwater to grow spices, herbs and vegetables. Farmers' livelihood depends on cultivation, and it is their main source of income. Floating gardens is the method for managing climate effects and maintaining their livelihoods which is their source of income. Therefore, floating gardens can help farmers face the problem of labour and thus solve the problem of poverty. These tools increase productivity and increase farmers' income.

In addition to increasing a family's income, a floating garden can also save a family money by reducing the cost of vegetables, as they can now grow their own. Another benefit of a floating garden is food security. According to The Independent, people in rural Bangladesh now consume at least 1,800 calories a day thanks to a "real-life" garden. Floating gardens help reduce hunger and allow families to grow their own vegetables without pesticides. It can alleviate poverty in many ways, including increasing farmers' income and productivity and improving the health of people using the crops. In Bangladesh, they are used in Jessor, Satkhira, Pirojpur, Gopalganj and Barisal districts. Floating farms provide livelihoods to about 60-90% of the region's population. It is a sustainable way to grow vegetables and spices using a variety of biomass. Floating farming works best in water and wetlands, especially during the monsoon season. It is a water security measure that can help farmers maintain or increase agricultural production. Here, farmers collect water hyacinth, rice straw and other plants during the rainy season and regularly pour water into the river to make rafts. They grow seedlings in organic seedbeds and release them into the village water. This soilless civilization is also present in many regions of the world, including Dal Lake in Kashmir and Inle Lake in Myanmar, where people have adapted to life on water.

Both men and women work to create organic floating beds that can last five to six months. Farmers grow vegetables such as okra, squash, sorghum, spinach, eggplant, and sometimes spices such as turmeric and ginger. Rice is sometimes grown with the vegetables. During the rainy season, farmers come to the island in small boats. Most organic gardens do not need fertilizer. The plants get nutrients such as nitrogen, potassium, and phosphorus from the organic matter in the garden and from the water below. The low cost makes the garden a good choice for many farmers. These floating gardens are even more beautiful than indoor gardens. They are environmentally friendly. All the materials and resources needed are natural and do not contain waste or products that harm the environment.

Local people are becoming aware of this new farming method and their knowledge is increasing. The community has come together to build floating platforms, the remnants of which are used to build the winter garden. Both the finished growing plan and the vegetables are used by the producers and sold in the market. Input-output analysis shows that floating gardens are a viable alternative livelihood option for wetland dwellers. The Bangladesh Ministry of Agriculture, with the help of non-governmental organizations, has promoted the cultivation of rice beds and gardens in flooded areas of tidal floodplains for the south-central region of Bangladesh. About 2.29 million people in the three districts of Gopalganj,

Pirojpur, and Barisal are the intended beneficiaries of this plantation. This process is known as heritage farming because the practice is based on the agricultural culture of the people living in the flood plains of southern Bangladesh. With this method, plants can be planted in the soil or on floating beds of water hyacinth, algae or other plant debris. While the government has adopted an economic approach that includes large and medium-scale farmers, NGOs have also promoted floating farms to reduce hunger and poverty. Many floating gardens have been built by government agencies to combat climate change and by NGOs to help combat poverty and food insecurity. Many farmers have lost interest in these floating gardens because there is less market for their produce.

CONCLUSION

Floating agriculture is a method of cultivating food grains and vegetables in areas where water is available. In Bangladesh, it is typical for farming to occur throughout the summer. Grains and vegetables are grown on floating platforms made from local materials. Floating agriculture is an effective way for climate-sensitive communities to adapt to climate change, supporting food and nutrition security in coastal areas. These methods include small-scale farming, pigeon farming and duck farming. Farming should be suitable for small farmers and should not require large capital. This is a traditional farm in southern Bangladesh, which includes Pirojpur, Barisal, Satkhira and Gopalganj. Floating farms in Bangladesh have been around for 300-400 years. Products produced on floating farms are safe and environmentally friendly because most farmers do not use pesticides or fertilizers. Floating garden rafts are generally about 8m long, 2m wide and 0.6~1m deep.

Floating farms have many advantages such as allowing fishermen to grow crops and fish in the same area, providing shelter for chickens and cattle during floods, and the biomass produced after farming becomes organic fertilizer, reducing the need for chemical fertilizers and pesticides, and increasing income overall. Floating gardens use existing resources, adapt to wetlands, help people live more safely in flood-prone areas, and can facilitate transitions to less hazardous conditions. Despite some limitations and challenges, floating agriculture and growing winter vegetables on land have been shown to help improve the health, housing income, and land-use capacity of poor, landless people, especially in the months following a disaster. Some limitations of floating culture include inadequate water resources, high start-up costs, lack of participants, leech bites, lack of adequate information, and lack of water hyacinth.

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