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COPING WITH FLASHFLOOD UNDER CHANGING CLIMATE IN NORTH-EASTERN HAOR AREAS OF BANGLADESH: POTENTIALS OF PROMISING CROP PRODUCTION PRACTICES

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Haors are large bowl shaped floodplain depressions and one of the most important agro-ecological zones in Bangladesh. However, rice production in this area has been severely impacted by recent events of frequent early flashfloods. Many experts have linked the changes of flooding time and duration in haor area to global climate change. Farmers need short duration, relatively tall, lodging tolerance and non-shattering rice varieties to cope with the flashflood. With this contrast, this study is conducted in Tahirpur and Biswambarpur upazila of Sunamganj district to examine occurrence time and duration of flashflood; identify flashflood coping crop production practices; and finally investigate relationship between socio-economic characteristics of farmers and their flashflood coping crop production practices. Hence, this study utilizes a set of approaches viz. structured questionnaire survey, key informants interview with stakeholders and focus group discussions to get primary data and secondary data also collects to conceptualize the problems. Results reveal that short duration, varietal diversification, tall plant type of rice varieties are found popularly used practices in haor area. Although other coping practices like harvesting of rice at 80 percent maturity, early transplanting, aged seedling and rabi crops have substantial impact in coping flashflood but they are not extensively practiced. Study also reveals that education levels of farmers have highly positive and significant relationship with flashflood coping crop production practices; high coping practices are observed in educated farmers. In order to increase coping ability of farmers of farm practices, it is utmost important to link between government and development agencies to provide adequate technical support, extension service, education, income generating opportunity and water conservation measures.

Keywords: *Climate change, flashflood, coping mechanism, crop production practices, Haor Bangladesh.*

Introduction

Haors with their unique hydro-ecological characteristics are large bowl shaped floodplain depressions located in the north-eastern region of Bangladesh covering about 1.99 mln ha of area and accommodating about 19.37 mln people [2]. Adding together, there are about 423 small and large haors in the northeastern part of Bangladesh occupying about one-sixth area of the country [1]. The productivity of this haor basin has contributed to be food surplus of this region and there is a potentiality for further increase of land for agriculture. But the recent change in timing of flood and pattern is affecting the livelihood of the haor people. The haor basin is close to the Indian border and Meghalaya Hills where deforestation (natural and manmade) is happening everyday. In addition, climatic changes have also contributed in degrading the eco-system that causes severity of flash floods – sudden onrush of water into the haor areas [3]. The flash flood generally occurs after mid April due to heavy rainfall in the hills of Meghalaya, India. In recent years, flash flood hits the haor areas fifteen days earlier than thirty to forty years back. Thirty years before, flash flood took three to five days to reach the bordering areas and seven to fifteen days to reach the other haor areas inside the country while in the present situation, only one day and three to five days respectively, are needed. Forest in the hilly areas and haor basin used to slow down the flow of water and more water were seeped into local soils for storage. Siltation in rivers, canals, and haors has raised the haor and riverbeds. As a result, the rivers and canals cannot hold much water and severity of flood intensifies.

The haor is a single crop area and rice in this vast basin covering about 97% of the total cropped area. Few other winter crops are also sporadically grown to the bank side of the haors. In order to have higher yield the local farmer recently switched to cultivate HYV rice (BRRI dhan 29, BRRI dhan 28 etc.)

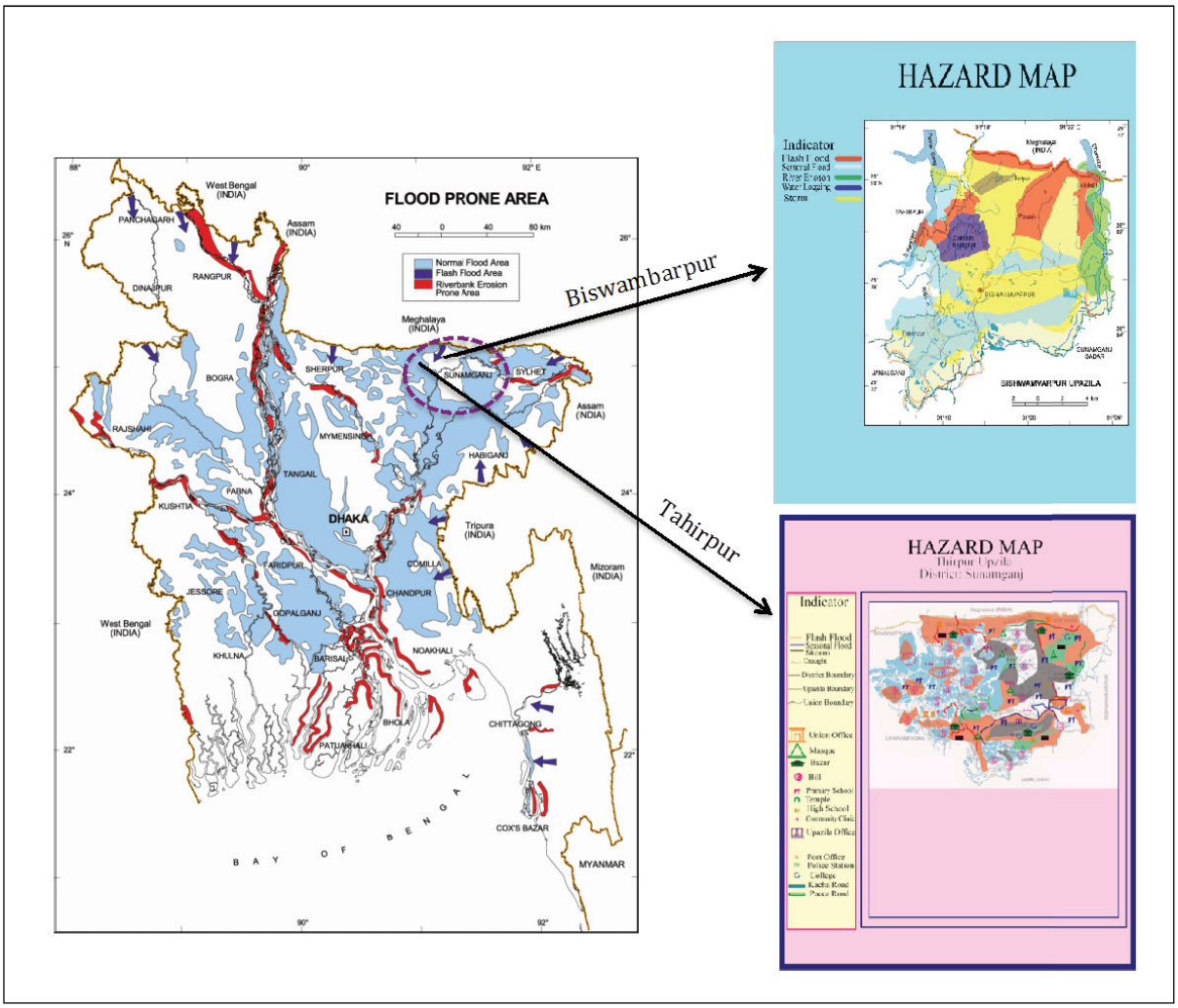

Figure 1. Location of the study area in Sunamganj district of Bangladesh

instead of local boro rice variety. But the longer duration and dwarf plant height characteristics of these varieties often become the victim flash flood. As a result, farmers cannot harvest potential yield of these rice varieties. On the other hand, climate variability and change increased precipitation early in the season make flash floods more unpredictable and damaging, affecting livelihoods and food security of thousands of haor residents. In 2003 over 80 percent of rice amounting to 0.6 million tons was completely damaged due to fashfloods. Sometimes, the flashflood comes early, just before the rice harvesting and during that time the people of haor basin, do not even get the time to harvest their crops. In many cases, it has been found that this part of Bangladesh losses 100% of its crops.

To cope with flashflood many farmers grow cereals, vegetables, spices, pulses and tuber crops successfully during rabi season in the haor basin and harvested much earlier than boro rice. To minimize the damage, haor farmers need short growth duration, relatively tall, lodging tolerance and non-shattering rice variety. Practicing of transplanting time in case of rice cultivation is always regarded as good practice against flash flood. With this contrast, this study is conducted to examine occurrence time and duration of flashflood; identify flashflood coping crop production practices; and finally investigate relationship between socio-economic characteristics of farmers and their flashflood coping crop production practices that would help in formulating effective extension program to cope with the situation in a sustainable way.

Study area and population

The study is conducted in two Upazilas namely Tahirpur and Biswambarpur of Sunamganj district. Ten villages from these two upazila are selected randomly for the study. All of the farmers of these villages are constituted the population of the proposed research. Twenty percent of them are selected as the sample farmers.

Table 1

Study approach

Instrument and method of data collection	Target group
Key Informants interview (30)	Government officials, local leader, NGO people, School and College teacher, Elected member, Mosque Imam
Focus group discussion (8)	Government officials, NGO people, Farmers, community leader, mosque imam, Journalist
Questionnaire survey at institutional level (10x2 = 20)	Government official
Questionnaire survey at community level (90x2 = 180)	Mainly Farmers

Methodological Approach

The state of the art methodologies are applied in order to get a comprehensive view of the complex issues of the flashflood coping crop production practices of haor farmers (Table 1). Firstly, research related literature have been collected to gain preliminary understanding of flashflood and related issues. Secondly, focus group discussions (FGD); key informants interviews (KII) and semi-structured questionnaire have been conducted through various stakeholders in the study area to get primary data. All the collected data then are summarized and scrutinized carefully and analyzed by MS-Excel and then presented in textual, tabular and graphical forms to the present status of the studied area.

Results and Discussion

Flashflood is a common phenomenon in northeast haor of Bangladesh and this study discloses how promising crop production practices of farmers helps to secure Boro rice from the damage of flashflood in the study area by using questionnaire survey, FGD and KII.

Occurrence and duration of flashflood

Northeastern hoar areas of Bangladesh are prone to flashflood. Flashfloods may occur in this region from the surrounding hilly region of India at least two or three times a year. Boro rice cultivation is severely damaged via early flashflood. Furthermore, Aman rice is also affected by heavy rainfall in this region via late flashflood.

Research results showed that crop loss increased with the increase of frequency and duration of flashflood comes early in April (Table 2). Data also revealed that duration of flashflood in 2014 and 2015 were only for few days and crop damages of these two years were also less in compare to the recent years. In 2017, Flashflood in Tahirpur upazila approached earlier than Biswamvarpur upazila and the duration is more prolonged in Tahirpur than Biswamvarpur. However, the crop loss is more or less similar in both two upazila.

Table 2

Occurrence and duration of flashflood in the study area

Location	Year	Duration of 1st flashflood	Duration of 2nd flashflood	Crop loss (%)
Tahirpur	2017	27 Mar – 24 April		95–100
	2016	08–14 April	23 April – October	75–100
	2015	06–10 April	10–16 April	0–40
	2014	14–18 April	----	0–15
Biswamvarpur	2017	2 April	Late April to October	80–100
	2016	08–14 April	October	70–75
	2015	06–10 April		0–30
	2014	14–18 April	----	0–15

Table 3

The extent of application of flashflood coping crop production practices, %

Promising coping practices	Frequent	Occasionally	Rare	Not at all
1. Use of short duration rice variety	80.1	10.8	4.0	5.1
2. Early transplantation	2.0	10.9	30.1	57.0
3. Local rice varieties	20.0	11.0	7.3	61.7
4. Aged seedlings	10.0	12.0	20.3	57.7
5. Varietal diversification	71.0	17.1	8.2	4.7
6. Non-shattering rice variety	47.5	38.6	13.3	0.6
7. Tall plant type rice variety	55.1	16.5	13.3	15.2
8. Crop diversification	5.7	11.4	15.8	67.1
9. Harvesting at 80% maturity	25.9	12.7	8.9	52.5

Extent of application of flashflood coping crop production practices

Focus group discussion and key informant interview are utilized at Tahirpur and Biswamvorpur Upazilas of Sunamganj district and nine promising cultivation practices are identified as the measures to cope with flashflood. After identification of the practices, farmers are asked to give their opinion about the extent of application of the selected nine-flashflood coping crop production practices in their crop field. A four-point scale of responses viz. 'frequent use', 'occasionally use', 'rare use' and 'not at all use' are used in this study and four levels of weight are assigned viz. 3, 2, 1, and 0 for the answers namely 'frequent use', 'occasionally use', 'rare use' and 'not at all use', respectively.

Table 3 illustrated that farmers of the affected area frequently used (80.1%) short duration rice variety as promising option against flashflood. Some local rice varieties such as Guchi/ Shail, Tepi and Lakhai are used to transplant as short duration rice variety where as only BRRIdhan28, a high yielding rice variety are considered as short duration rice variety in the study area.

Available local rice varieties grown in the haor areas are tall and non-shattering in nature but their yield is low (approximately 2.2 t ha^{-1}). However, these varieties are good taste to eat, short duration and sub-mergence tolerance to some extent, for which half of the haor farmers transplanted these varieties in the deep haor areas.

It is also notable that, haor farmers (57%) neither transplanted aged rice seedling nor they followed crop diversification as a mean of flashflood coping mechanism. Farmers argued that aged seedlings shorten the life cycle of rice, therefore, they could not get better yield.

Correlation coefficient (r) analysis

The data in Table 4 showed that the positive significant correlation of formal education of the respondents with flashflood coping crop production practices ($r = 0.730^{**}$, $p > 0.05$) clearly points out that with the increase of the level of formal education of the haor farmers the flashflood coping practices also increases as formal education plays a key role in the adaptation of farming practices under climate change condition [4].

Conclusion

In conclusion, it can be said that haor farmers have their own mechanism to cope with flashflood since long past. However, Results revealed that short duration, varietal diversification, tall plant type of rice

Table 4

Correlation analysis of factors influencing flash flood coping crop production

Variables	Correlation coefficient (r)
Education level	0.730**
Family size	0.342**
Annual family income	0.081
Attitude vs embankment as means of crop protection	0.611**

** = Significant at 1 percent (0.01) level with 180 degree of freedom

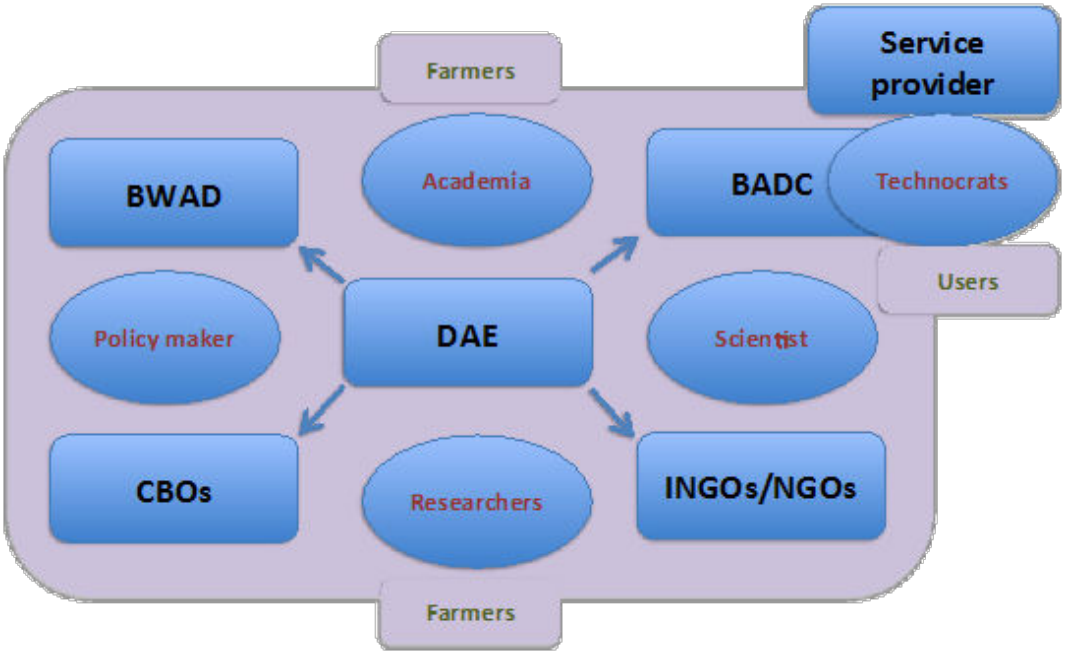

Figure 2. Linkage among different stakeholders to cope with flashflood under changing climate

varieties are found popularly used practices in haor area. Although other coping practices like harvesting of rice at 80 percent maturity, early transplanting, aged seedling and *rabi* crops have substantial impact in coping flashflood but they are not extensively practiced. Study also revealed that education levels of farmers have highly positive and significant relationship with flashflood coping crop production practices; and high coping practices are observed in educated farmers. In order to increase coping ability of farmers of farm practices, it is utmost important to link between government and development agencies to provide adequate technical support, extension service, education, income generating opportunity and water conservation measures (Figure 2).

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