



**FARMERS STRATEGIC ACTION AGAINST
FLOODS IN BANGLADESH**

A GRADUATE SEMINAR PAPER

AER 598: Seminar

Term: Summer, 2018

Submitted To:

Course Instructors

1. Dr. Md. Mizanur Rahman
Professor
BSMRAU

2. Dr. A. K. M. Aminul Islam
Professor
BSMRAU

3. Dr. Md. Rafiqul Islam
Professor
BSMRAU

4. Dr. Dinesh Chandra Shaha
Professor
BSMRAU

Major Professor

Dr. Md. Enamul Haque
Professor
Department of Agricultural
Extension and Rural Development,
BSMRAU

Submitted By:

SONJITH DAS

Reg. no. 16-11-4158

MS STUDENT

**DEPARTMENT OF AGRICULTURAL EXTENSION
AND RURAL DEVELOPMENT**

**BANGABANDHU SHEIKH MUJIBUR RAHMAN AGRICULTURAL UNIVERSITY,
SALNA, GAZIPUR-1706**



ABSTRACT

Bangladesh is a disaster prone country. Flood is the most frequent form of disaster that ravage millions of life, thousand acres crops and ultimately breakdown the economic backbone of the country. Therefore, the paper aims to describe strategic action usually practiced by the farmers against flood. The data contained in this paper was collected from secondary sources like books, journals and internet etc. Among various strategic action only the strategic action of crop, livestock and poultry and fisheries are stated in this paper. 'Storing all kind of seed' and 'sale surplus livestock and poultry before flood' were mainly practiced in pre -flood period. 'Collect early growing vegetable seeds' and 'use of hay for cattle feed were mostly practiced during flood period. 'Sowing early growing leafy vegetables', 'vaccination after flood' and 'release previously stored fingerling' were mainly practiced in post flood period. Overall coping strategies practiced by the farmer satisfactory during flood period while second in post flood period followed by pre-flood period.

TABLE OF CONTENTS

SL. NO.	TITLE	PAGE
1	ABSTRACT	I.
2	TABLE OF CONTENTS	II.
3	LIST OF TABLES	III.
4	LIST OF FIGURES	IV.
5	INTRODUCTION	1-2
6	MATERIALS AND METHODS	3
7	REVIEW OF FINDINGS	4-23
8	CONCLUSION	24
9	REFERENCES	25-26

LIST OF TABLES

TABLE	TITLE	PAGE
1	Overall Impact of flood, 2017	8-9
2	Coverage of inundation and deaths in major floods, 1954-2017	10
3	Distribution of respondents on the basis of awareness about the occurrences of flood	16
4	Extent of practice of strategic action related to crop production at pre-flood period, during flood period and post flood period	17
5	Extent of practice of strategic action related to livestock and poultry at pre-flood period, during flood period and post flood period	19
6	Extent of practice of strategic action related to fisheries at pre-flood period, during flood period and post flood period	21

LIST OF FIGURES

FIGURE	TITLE	PAGE
1	Natural disaster in South Asia	5
2	Country-wise numbers of people killed by natural disasters in recent year in South Asia	6
3	Flood crop damage in Bangladesh (1987-2017)	11
4	Flood total financial loss in Bangladesh (1987-2017)	12
5	Practice of strategic action according to farm size	14
6	Extent of practice of awareness about occurrences of flood	15
7	Relative percentage of the coping strategies practiced related to crop production	18
8	Relative percentage of the coping strategies practiced related to livestock and poultry	20
9	Relative percentage of the coping strategies practiced related to fisheries	22

CHAPTER I

INTRODUCTION

1.1 General Background

The natural disaster and environmental degradation arising from the world wide climate change is the most critical and time befitting issue all over the world. A low lying country with more than 230 rivers and waterways, Bangladesh is widely regarded as being one of the most vulnerable countries due to its disaster prone and odd geographic location, socio-eco-environmental condition and over population (Hamid, M.A. 2009). Land of the country may broadly be categorized into (i) hills (12%); (ii) terraces (8%); and (iii) floodplain (80%). Agriculture is the dominant land use in the country covering about 59% of the total land mass. Rivers and other water bodies comprise about 9% of the total land area (GOB, 2016).

Bangladesh has always experienced some degree of flooding. According to WHO 4million people are affected every year due to flood and up to 5.6 million people are physically exposed periodically and 15 coastal districts are cyclone prone (Azad, 2009). Displacement due to flood and drought and erosion along with inadequate facilities/supports during and after major disasters creates hardship and life-threatening problems to the population specially the poor, women and children. When major forms of disasters occur due to flood, river bank erosion, drought, extreme temperature, wind storms, drought and earthquakes, water borne diseases and mass internal displacement are inevitable consequence. On an average, 15 percent of land floods in each year but in recent years that figure reached 40 percent and killed more than 40000 people, 1778507 livestock and damaged 24736370 acres' crops, 1522080 households, 18075 km roads fully or partially (BBS, 2016).

The affected people applying some local strategies based on their previous experiences whenever they faced severe flood. Such as; Storing all types of seed, sale excess livestock and poultry, Collect quick growing vegetable seeds, use of hay for cattle feed Sowing quick growing leafy vegetables, completing vaccination are mainly practiced. Slowly but steadily they reached self-sufficiency by using strategic action against various damaging aspects of flood.

1.2 Objectives

- To review an overall condition of flood in Bangladesh.
- To narrate strategic action against flood by the farmers.

CHAPTER II

METHODOLOGY

This is exclusively a review paper. So, no specific methods of studies are involved to prepare this paper. All information has been collected from secondary sources. It has been prepared by comprehensive studies of various articles published in different journals, books, reports, publications, magazines, website etc. with the help of library facilities of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU).

CHAPTER III

RESULTS AND DISCUSSION

3.1 Floods

High-water stages in which water over flows its natural or artificial banks onto normally dry land, such as a river inundating its floodplain. Floods are common and mostly natural disasters. When rivers overflow their banks they cause damage to lives, property, infrastructure and crops.

Floods usually are local, short-lived events that can happen suddenly and sometimes with little or no warning. They usually are caused by intense storms that produce more runoff than an area can store or a stream can carry within its normal channel. Rivers can also flood its surroundings when the dams fail, when ice or a landslide temporarily block the course of the river channel, or when snow melts rapidly. In a broader sense, normally dry lands can be flooded by high lake levels, by high tides, or by waves driven ashore by strong winds. Small streams are subject to floods (very rapid increases in runoff), which may last from a few minutes to a few hours. On larger streams, floods usually last from several hours to a few days. A series of storms might keep a river above flood stage (the water level at which a river overflows its banks) for several weeks.

3.2 Types of Floods

3.2.1 River Flood

Flooding along rivers is a natural and inevitable part of life. Some floods occur seasonally and some when winter or spring rains; coupled with melting snows, fill river basins with too much water, too quickly. Torrential rains from decaying hurricanes or tropical systems can also produce river flooding.

3.2.2 Coastal Flood

Winds generated from tropical storms and hurricanes or intense offshore low-pressure systems can drive ocean water inland and cause significant flooding. Escape routes can be cut off and blocked by high water. Coastal flooding can also be produced by sea waves called tsunamis sometimes referred to as tidal waves. These waves are produced by earthquakes or volcanic activity.

3.2.3 Urban Flood

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization decreases the ability to absorb water 2 to 6 times over what would occur on natural terrain. During periods of urban flooding, streets can become swift moving rivers, while basements can become death traps as they fill with water.

3.2.4 Flash Flood- A flood that rises and falls quite rapidly with little or no advance warning, usually as the result of intense rainfall over a relatively small area. Flash floods can be caused by situations such as a sudden excessive rainfall, the failure of a dam, or the thaw of an ice jam.

3.3 An Overview of Flood in South Asia

While floods have been endemic to the climate and hydrological systems in South Asia, their increasing magnitude and frequency in recent times is a matter for serious concern. An analysis carried out based on CRED/EMDAT data highlights that (i) flood occupies 35% of all natural disasters in South Asia (Figure 1)

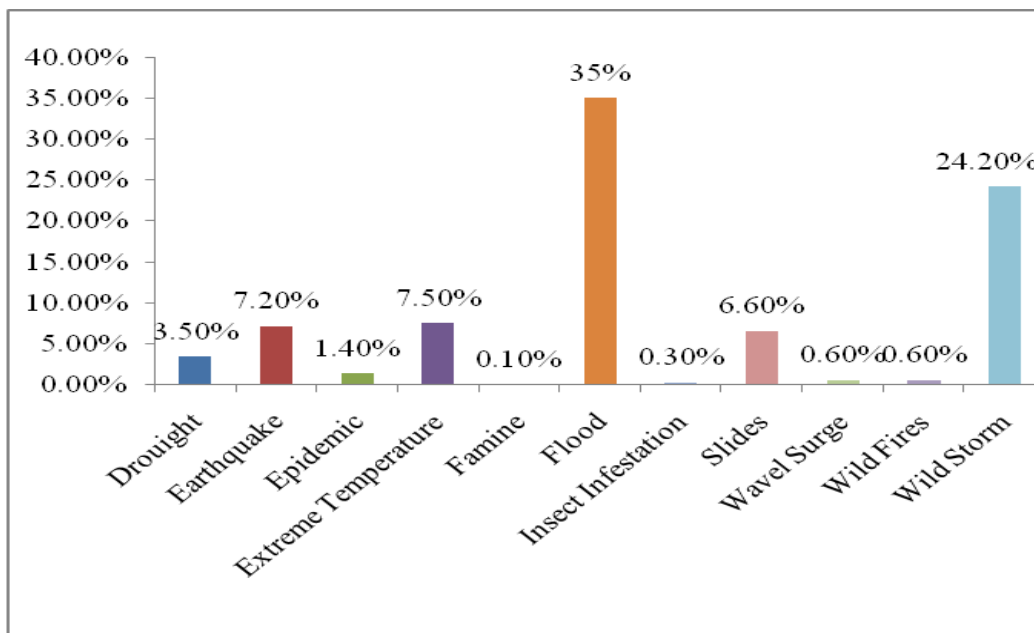


Figure 1. Natural disaster in South Asia (1975-2015).

(Source: Hoyois, 2017)

In 2016, EMDAT had classified countries in terms of two categories. One was a set of those countries that were the worst affected in terms of the number of people killed. The second was a set of other countries in terms of number of people affected due to the natural disasters.

To be precise, natural disasters in recent years killed 19718 people in South Asia. 58% of them belonged to Bangladesh, followed by India (26%), Pakistan (9%), Afghanistan and Nepal (3% each), and Sri Lanka (1%). Different flood waves contributed largely to these casualties (Figure 2).

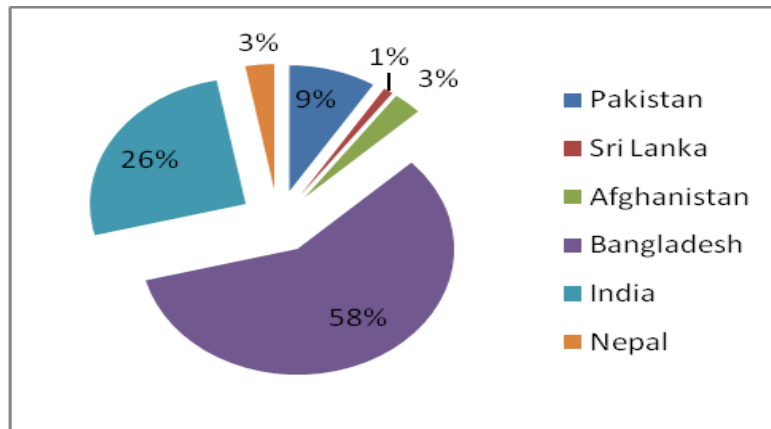


Figure 2. Country-wise numbers of people killed by natural disasters in recent years in South Asia.

(Source: CRED, 2017)

3.4 Overall concept about Bangladesh flood condition

In the 19th century, six major floods were recorded: 1842, 1858, 1871, 1875, 1885 and 1892. Eighteen major floods occurred in the 20th century. Those of 1987, 1988 and 1951 were of catastrophic consequence. More recent floods include 2004, 2010, 2015, and 2017.

The catastrophic floods of 1987 occurred throughout July and August and affected 57,300 km² of land, (about 40% of the total area of the country) and was estimated as a once in 30-70-year event. The seriously affected regions were on the western side of the Brahmaputra the area below the confluence of the Ganges and the Brahmaputra and considerable areas north of Khulna.

The flood of 1988, which was also of catastrophic consequence, occurred throughout August and September. The waters inundated about 82,000 km² of land, (about 60% of the area) and its return period was estimated at 50–100 years. Rainfall together with synchronization of very high flows of all the three major rivers of the country in only three days aggravated the flood. Dhaka the capital of Bangladesh was severely affected. The flood lasted 15 to 20 days (H. Brammer,1990).

In 1998, over 75% of the total area of the country was flooded, including half of Dhaka. It was similar to the catastrophic flood of 1988 in terms of the extent of the flooding. A combination of heavy rainfall within and outside the country and synchronization of peak flows of the major rivers contributed to the river. 30 million people were made homeless and the death toll reached over a thousand. The flooding caused contamination of crops and animals and unclean water resulted in cholera and typhoid outbreaks. Few hospitals were functional because of damage from the flooding, and those that were open had too many patients, resulting in everyday injuries becoming fatal due to lack of treatment. 700,000 hectares of crops were destroyed, 400 factories were forced to close, and there was a 20% decrease in economic production. Communication within the country also became difficult (BBC News report, 1998).

The 1999 floods although not as serious as the 1998 floods, were still very dangerous and costly. The floods occurred between July and September, causing many deaths, and many people were left homeless. The extensive damage had to be paid for with foreign assistance. The entire flood lasted approximately 65 days (Nishanthi, 1999).

The 2004 flood was very similar to the 1988 and 1998 floods with two thirds of the country under water. In early October 2005, dozens of villages were inundated when rain caused the rivers of northwestern Bangladesh to burst their banks.

The 2017 monsoon rains once again cause rivers in the north-east parts of Bangladesh to swell, floods have struck again. Available data suggested that, 167 unions of 50 upazilas under 11 districts, namely Sylhet, Sunamgonj, Moulvibazar, Rangpur, Kurigram, Serajganj, Jamalpur, Lalmonirhat, Gaibandha, Bogra, Nilphamari and Cox's Bazar are affected due to the flood. Vast

tracts of Moulvibazar, Sunamgonj, and Sylhet have become inundated for the third time this year due to the floods and the following onrush from the hills.

The 2017 flood has taken a heavy toll on the farmers and fishermen of the surrounding areas as they had no necessary precautions for such an untimely disaster. Although full damage information is still not available as assessment is still going on. As far, 113,553 households are affected; 9,973-hectare agricultural land inundated; 7,421 domestic animals died; 353 educational institutions stopped functioning. In public domain, roads, culverts, embankment have been damaged in many places. Railway tracks in some places are inundated. It adversely affected supply chain for some markets and let to price hike for essential items. The overall impact scenario is given in the below table:

Table 1. Overall Impact of flood, 2017.

Districts	Affected Upazilas	No. of Affected Union's	Affected Population	Damage	Remark
Sylhet	08 (most affected Beanibazar, Fenchuganj, Osmaninagar, Golapganj, Balaganj)		141,355	19,725 households affected 4,330-hectare agricultural land inundated 7,421 domestic animal died 20 educational institution stopped functioning	470 villages affected
Sonamgonj	All affected		371,801	95,267 households affected 55,643-hectare agricultural land	Most of affected

Moulvibazar	07 most affected Kulaura, Berlekha, Juri)	35	310,080	55,267 households affected 5,643-hectare agricultural land inundated	350 villages affected
Jamalpur	04 (Dewanganj, Islampur, Madarganj, Sarishabari)	11	Data not available	19,716 households affected 81 educational institution stopped functioning	
Gaibandha	02 (Fulchari, Sadar)	Data not available	Data not available	75 households affected due to riverbank erosion	11,500 families are waterlogged
Serajganj	05 (Kazipur Serajganj Sadar Belkuchi Chowhali Shahzadpur)	Data not available	Data not available	Data not available	1,731 families are living in embankments.
Kurigram	07 (Sadar, Rajibpur, Rowmari, Chilmari)	Data not available	Data not available	Data not available	Shelters were ready to keep affected people, but not necessary

(Source: NDRCC Report, 2017)

Bangladesh has always experience some degree of flood in every year. Table 2 shown that from 1954-2017 there were 15 flood occurs, every flood covers lowest 24% to highest 75% area flooded in total area of Bangladesh. In 1998 flood highest area flooded but in 1988 highest amount of human death occur that was 2379 which indicate 1988 and 1998 flood is most horrible than any other floods in term of percentage of total area coverage and number of deaths.

Table 2.Coverage of inundation and deaths in major floods (1954-2017).

Year	Flooded area (km ²)	Percentage of total area	Number of deaths
1954	36929	25	112
1955	50700	34	129
1956	35620	24	
1962	37404	25	117
1963	43180	29	
1968	37300	25	126
1970	42640	28	87
1971	36475	14	120
1974	52720	35	1987
1984	28314	19	513
1987	57491	38	1657
1988	77700	52	2379
1998	110000	75	1050
2004	87000	56	1200
2017	56300	37	799

(Source: T. Harris, 2003; DDM, 2017)

In the following figure it is shown that the crop damage in 2017 flood was highest, it may be due to increase of production in recent year that is compare to 1987 almost 4-5times. In 2017 and 1998 flood crop damage was 6.5 and 4.5 million tons respectively that is highest than any other flood which occur in previous years.

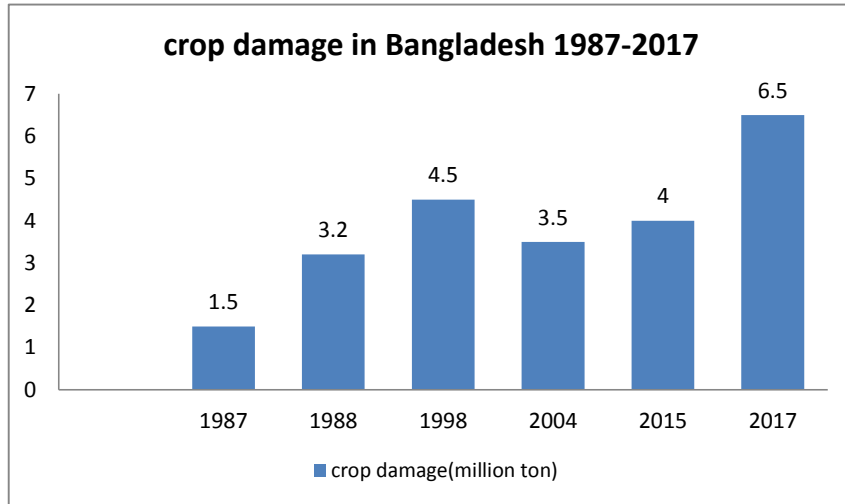


Figure 3.flood crop damage in Bangladesh (1987-2017).

(Source: DAE, 2018)

In the figure 4 shown that total financial losses due to flood in 1998 was highest. It may be due to coverage of highest total area, damaging of more roads, kalvert, affected more people, more crops damage, economic production decrease etc. In 2017 flood also destroyed due to in this flood total financial losses were 95000 million taka.

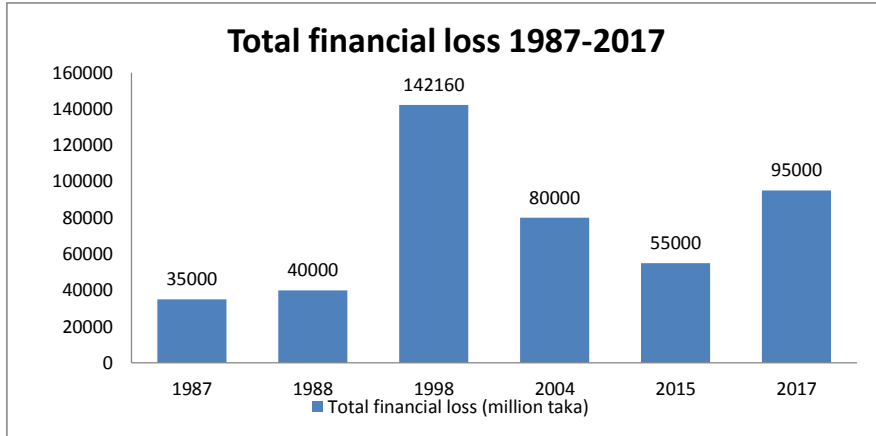


Figure 4. flood total financial loss in Bangladesh (1987-2017).

(Source: FFWC, 2017)

3.5 Flood Mitigation Strategies

There are two different ways to mitigate floods: -

- Structural
- Non- Structural

Structural measures are in the nature of physical measures and help in “modifying the floods”, while non- structural measures are in the nature of planning and help in “modifying the losses due to floods”. In the structural measures we keep the water away from people and in the non-structural measures to try to keep the people away from water. All of these works can be individually divided into long term and short-term measures.

3.5.1 Structural measures

a) Water Shed Management: Timely cleaning, de-silting and deepening of natural water reservoir and drainage channels (both urban and rural) must be taken up.

b) Reservoirs: The entire natural water storage place should be cleaned on a regular basis. Encroachments on tanks and ponds or natural drainage channel share to be removed well before the onset of monsoon.

c) Natural water retention Basins: Construction and protection of all the flood protection embankments, ring bunds and other bunds. Dams and levees can also be constructed which can be used as temporarily storing space which reduced the chances of lower plains getting flooded.

d) Buildings on elevated area: The buildings in flood prone areas should be constructed on an elevated area and if necessary on stilts and platform.

3.5.2 Non-structural measures

a) Flood Plain Zoning: Flood plain zoning, which places restrictions on the use of land on flood plains, can reduce the cost of flood damage. Local governments may pass laws that prevent uncontrolled building or development on flood plains to limit flood risks and to protect nearby property. Landowners in areas that adopt local ordinances or laws to limit development on flood plains can purchase flood insurance to help cover the cost of damage from floods.

b) Flood Forecasting and warning: These are issued for different areas mostly by the Central Water Commission/ Meteorological department and by the State Irrigation/ Flood Department.

3.6 Strategic action

Strategic action refers to the specific efforts, both behavioral and psychological, that people employ to master, tolerate, reduce, or minimize stressful events. Two general strategic action have been distinguished: problem-solving strategies are efforts to do something active to alleviate stressful circumstances, whereas emotion-focused strategies involve efforts to regulate the emotional consequences of stressful or potentially stressful events. Research indicates that people use both types of strategies to combat most stressful events (Folkman and Lazarus, 1980).

3.7 Components of strategic action

3.7.1 Biological/physiological component - The body has its own way of adaption with stress. Any threat or challenge that an individual perceives in the environment triggers a chain of neuroendocrine events. These events can be conceptualized as two separate responses, that being of sympathetic/adrenal response, with the secretion of catecholamines (epinephrine, norepinephrine) and the pituitary/adrenal response, with the secretion of corticosteroids (Frankenhauser, 1986). Social support has also been established by studies to be linked to stress (Bolger and Eckenrole, 1991).

3.7.2 Cognitive component - The cognitive approach is based on a mental process of how the individual appraises the situation. Where the level of appraisal determines the level of stress and the unique strategic action that the individual partakes (Lazarus and Folkman, 1984).

3.7.3 Learned component - The learned component of strategic action includes everything from various social learning theories, which assume that much of human motivation and behavior is the result of what is learned through experiential reinforcement, learned helplessness phenomena which is believed to have a relationship to depression, and even implications of the particular culture or society that the stress at hand is affected by can also be included in this component (Aldwin and Lazarus 1981).

3.8 Strategic action Practiced by the Farmers against flood

3.8.1 Farm size

The land holding plays a major role in practicing strategic action against flood in Bangladesh. Based on the farm size the respondents were categorized in three groups as small, medium and large.

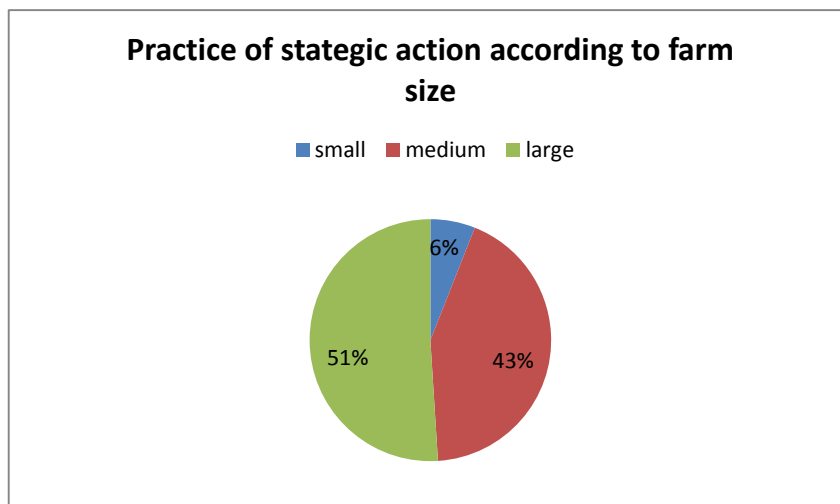


Figure 5. Practice of strategic action according to farm size.

Source: DAE, 2018

Figure 5 shown that practice of strategic action is highest 51% that used by large farmers. It is due to cultivation more land and their production also more, if any damage occurs by flood they suffer much. Also medium class farmers used large amount of strategic action that is 43% but small farmers use less amount strategic because their cultivation of crops less in amount.

3.8.2 Awareness about occurrences of flood

A list of items about awareness about the occurrences of flood that help them to select strategic action to be practiced is given in Figure 6 analysis of the data reveals that majority of the respondents assumed that farmers of the flood affected areas were aware about the occurrence of flood from mass media (radio, television, news paper) due to ranked first (19.55) followed by excess rainfall, rapid raising water level of the river and flood in upstream countries were ranked second (19.51), third (16.40) and fourth (14.57) respectively. Rest of the items i.e. idea of old and experienced person, gap between floods, making of local administration, early and excessive fog, rapid fluctuation of temperature and frequent earthquake ranked fifth (9.55), sixth (8.26), seventh (8.08), eighth (7.68), ninth (5.42) and tenth (4.310) respectively.

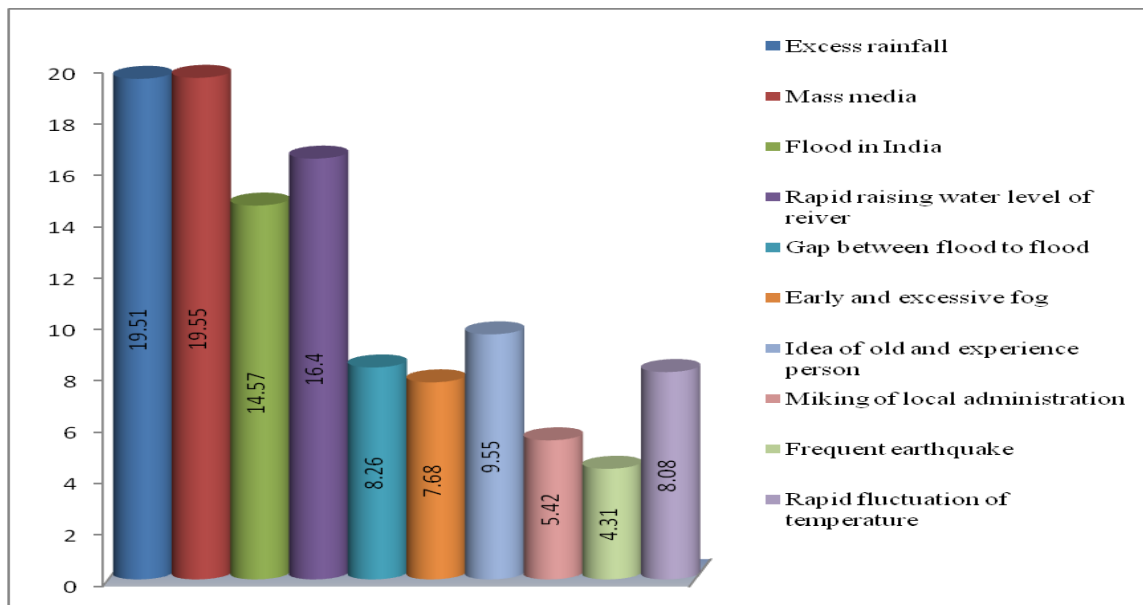


Figure 6. Extent of practice of awareness about occurrences of flood.

(Source: Aktar, 2014)

Distribution of the respondents based on awareness about the occurrence of flood, data in Table 3 indicates that 37 percent of the respondents were highly aware about the flood while 32 percent of the farmers were medium aware about the occurrence of flood and 31 percent were under low category about the occurrence of flood.

Table 3. Distribution of respondents on the basis of awareness about the occurrences of flood.

Category	Frequency	Percent
Low (<10)	47	31.0
Medium (15)	48	32.3
High (>15)	55	36.7
Total	150	100

(Source: Aktar, 2014)

Findings also indicate that majority (69 percent) of the respondents were high to medium aware about the occurrence of flood. Awareness enhances the farmers to take decision about the practices of strategic action.

3.8.3 Crop production

Crop productions are seriously hampered in every flood occurrence in Bangladesh. From their previous experiences farmers are to practice a lot of strategic action. Some of the strategic action followed during the pre-flood period, during flood period and post-flood period are listed in Table 4 Findings indicate that strategy like ‘storing all types of seeds’ ranked first and ‘storing excess seeds for emergency make up’ ranked second followed by ‘storing and placing agricultural equipments in a secured place’, ‘maintaining gap in cropping pattern during flood’ and ‘cultivation of Kanaf jute based on flood information’ ranked third, fourth and fifth respectively at pre-flood period, strategic action like ‘collecting quick growing vegetables’ ranked first and ‘storing all types seed of in a secured places’ ranked second followed by ‘harvesting flood affected submerged crop’, ‘producing seedling/ sapling by Dapok method/ poly

bag/earthen pot’ and ‘growing seed bed neighboring flood free area by land exchange system’ ranked third, fourth and fifth respectively at during flood period and

Table 4. Extent of practice of strategies action related to crop production at pre-flood period, during flood period and post flood period.

Pre-flood period	During flood period	Post-flood period
1. Storing all types of seeds	1. Collect quick growing vegetables	1. Sowing quick growing leafy vegetables
2. Storing excess seeds for emergency make up	2. Produce seedling/ sapling by Dapok method/ poly bag/earthen pot	2. Prepare seed bed and sowing seeds in a high place
3. Storing and placing agricultural equipments in a secured place	3. All types of seed stored in a secured places	3. Cultivate maize, potato, mustard without tillage
4. Cultivation of Kanaf jute based on flood information	4. Harvest flood affected submerged crop	4. Prepare pit for vegetable cultivation
5. Maintain gap in cropping pattern during flood	5. Growing seed bed neighboring flood free area by land exchange system	5. Cultivate late variety of rice like Naizershail, Poranga, BR-22/23

(Source: Farhad, 2015; DDM, 2017)

strategy like ‘sowing quick growing leafy vegetables’ ranked first and ‘preparing seed bed and sowing seeds in a high place’ ranked second followed by ‘pit preparation for vegetable cultivation’, ‘cultivating late variety of rice like Naizershail, Poranga, BR-22/23’ and ‘cultivation of maize, potato, mustard without tillage’ ranked third fourth and fifth respectively at Post-flood period.

Three period of flood scenario

Analysis the results contained in Figure 7 reveals that there was no remarkable difference among the three flood period. The relative percentage of strategic action practiced against pre-flood period was 26 percent which was slightly below than during (39%) and post (35%) flood period

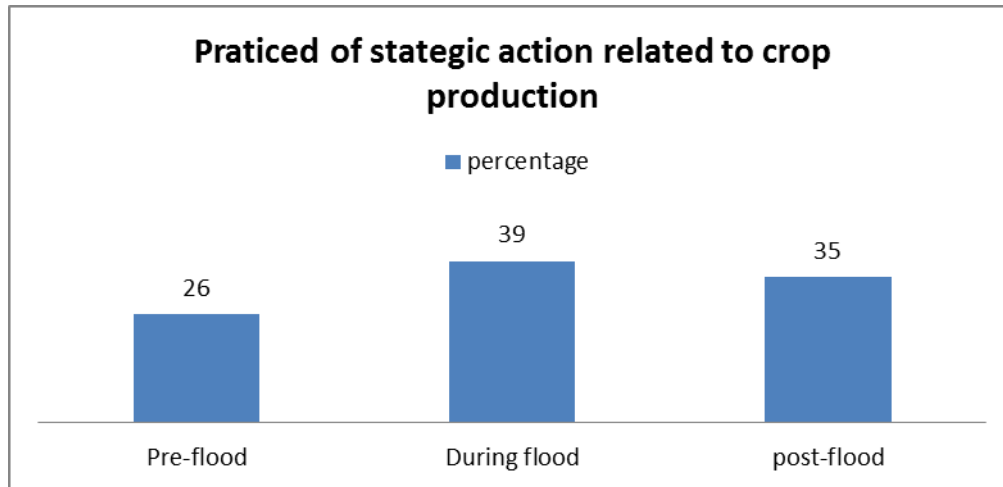


Figure 7. Relative percentage of the strategic action practiced related to crop production. (Source: Islam, 2005)

Findings also indicate that strategic action practiced against crop production may be immense importance during all period of flood.

3.8.4 Livestock and poultry

Losses of livestock and poultry are another vital issue in the flood affected areas of Bangladesh. Their impacts are visualized in the socio-economic development of flood affected farmers. To save livestock and poultry from pre-flood period, during flood period and post-flood period the farmers usually take the measures listed in the Table 5 Findings indicate that strategy like 'Sale excess livestock and poultry before flood' ranked first and 'Make temporary shade for livestock and poultry in a high place or in embankment' ranked second, although there was no significant difference between them. Other practices like 'Vaccination livestock and poultry before flood', 'Preserve hay (dried straw) heap in a high place' and 'Cultivate maize and other fodder crop in a high place' ranked third, fourth and fifth respectively at pre-flood period, strategy like 'Use hay (dried straw) for cattle feed' ranked first and 'Transfer livestock to high place/neighbors/relatives

house/shed in embankment’ ranked second. Other practices like ‘Consult with veterinary surgeon for flood related diseases’, ‘Complete vaccination of livestock and poultry’ and ‘Rearing poultry on the roof or high place’ ranked third, fourth and fifth respectively at during flood period and

Table 5. Extent of practice of strategies action related to Livestock and poultry at pre-flood period, during flood period and post flood period.

Pre-flood period	During flood period	Post flood period
1. Sale excess livestock and poultry before flood	1. Use hay (dried straw) for cattle feed	1. Complete vaccination immediately after flood
2. Make temporary shade for livestock and poultry in a high place or in embankment	2. Transfer livestock to high place/neighbors/relatives house/shed in embankment	2. Use hard-cash to re-start their livestock and poultry farm
3. Vaccination livestock and poultry before flood	3. Consult with veterinary surgeon for flood related diseases	3. Cultivate maize and quick growing fodder crop for livestock
4. Cultivate maize and other fodder crop in a high place	4. Complete vaccination of livestock and poultry	4. Repairing the livestock and poultry shade
5. Preserve hay (dried straw) heap in a high place	5. Rearing poultry on the roof or high place	5. Take loan from bank/relatives to purchase essential livestock

(Source: Farhad, 2015)

strategy like ‘Complete vaccination immediately after flood’ ranked 1st and ‘Use hard-cash to re-start their livestock and poultry farm’ ranked 2nd. Other practices like ‘Repairing the livestock and poultry shade’, ‘Cultivate maize and quick growing fodder crop for livestock’ and ‘Take loan from bank/relatives to purchase essential livestock’ ranked third, fourth and fifth respectively at post flood period.

Three period of flood scenario

Livestock and poultry livestock faced a serious problem during on rush of flood hit i.e. at the time of during flood. Livestock and poultry suffered lot in shortage of feeding, resting, water related diseases, and some time washed away and lost huge of livestock and poultry by on rush of flood hit.

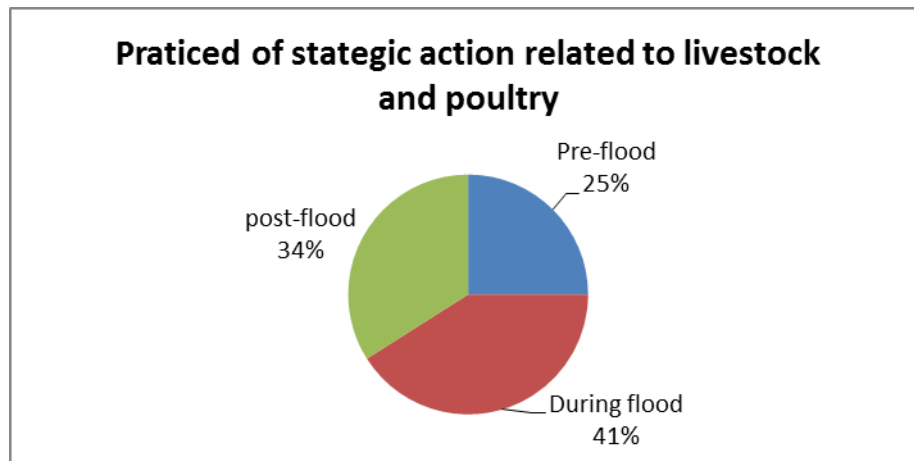


Figure 8. Relative percentage of the strategic action practiced related to livestock and poultry.

(Source: BLRI, 2017)

From those points of views, findings contained in the Figure 8 depicted that the relative percentage of the strategic action practiced against livestock and poultry practiced greater 41 percent during flood period as compare to pre and post flood period. Results further indicate that the rate of practices between pre and post flood period were 25 percent and 34 percent.

3.8.5 Fisheries

This is also another vulnerable issue in flood affected areas. In almost every flood occurrence some of the fisheries farm holders were completely ruined due to heavy economic losses. Some of the strategic action applied by the farmers based on the previously gathered experience are listed in Table 6 Findings indicate that coping strategy like 'Raising the embankment of fish farm by extra earthling up to protect the entrance of flood water' ranked first, 'Netting the surrounding of the fish farm to save the fish from flood' ranked second and 'Harvest and sale comparatively bigger fish before flood' ranked third, although there was no significant difference among them. Other practices like 'Preserve fingerling for future cultivation' and 'Stock fish

feed before flood occurrence’ ranked fourth and fifth respectively at pre-flood period, strategic action practiced ‘Protect the fisheries farm from the entrance flood water by raising embankment’ ranked first, ‘Harvest and sale bigger fish from the risky farm’ ranked second and ‘Preserve fingerling for immediate fish culture’ ranked third, ‘Cleaning the surrounding of net of the farm’ ranked fourth and ‘Use branches of trees and bamboo sticks for shelter of fish’ ranked and fifth respectively at during flood period and

Table 6. Extent of practice of strategies action related to fisheries at pre-flood period, during flood period and post flood period.

Pre-flood period	During flood period	Post flood period
1. Raising the embankment of fish farm by extra earthing up to protect the entrance of flood water	1. Harvest and sale bigger fish from the risky farm	1. Release previously stored fingerling
2. Netting the surrounding of the fish farm to save the fish from flood	2. Protect the fisheries farm from the entrance flood water by raising embankment	2. Take help from relatives/friends if possible
3. Harvest and sale comparatively bigger fish before flood	3. Preserve fingerling for immediate fish culture	3. Cleaning flood affected fisheries farm/ponds
4. Preserve fingerling for future cultivation	4. Use branches of trees and bamboo sticks for shelter of fish	4. Liming flood affected fish farm
5. Stock fish feed before flood occurrence	5. Cleaning the surrounding of net of the farm	5. Take loan from bank, NGOs and private organization

(Source: Islam, 2005; Farhad, 2015)

strategic action practiced ‘Release previously stored fingerling’ ranked first, ‘Cleaning flood affected fisheries farm/ponds’ ranked second. Rest of the strategies like ‘Take help from

relatives/friends if possible' ranked third, 'Cleaning Liming flood affected fish farm' and 'Take loan from bank, NGOs and private organization' ranked fourth and fifth respectively at post flood period.

Three period of flood scenario

Findings presented in the Figure 9 highlights that the relative percentage of the strategic action against fisheries was (38%), (32%) and (30%) for during, pre and post flood period.

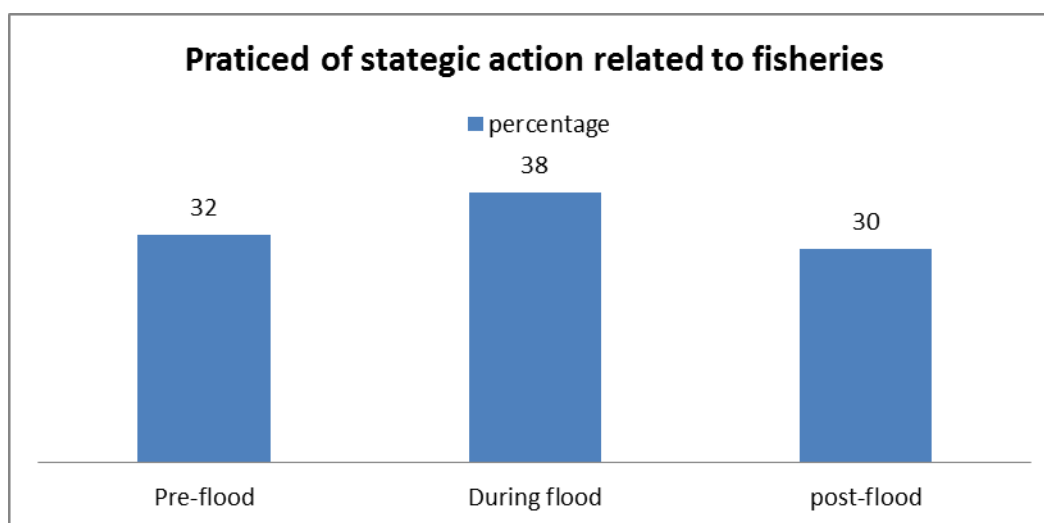


Figure 9. Relative percentage of the strategic action practiced related to fisheries.

(Source: DoF, 2017)

The rate of intensity of practices was more or less same. It implies that every strategic action is immense important for fish culture that's why coping strategies against fisheries were more or less equal important in all flood period.

3.9 Mitigation and recovery efforts of Bangladesh

Bangladesh has a very effective system for dissemination of early warning against floods. The Flood Forecasting and Warning Centre (FFWC) issued warnings to flood-prone areas of rising river flows. Based on Bangladesh's experiences of recent floods, the following aspects could be highlighted;

- Early recovery assistance not to be too early;
- Risk reduction to be an integral part of recovery;

- Integration of poverty alleviation and disaster risk reduction (DRR);
- Govt. (GO)-NGO Collaboration;
- Need for improved early warning.
- On the key influences on resilient recovery and sustainable development, the following issues could be highlighted:
 - Information management
 - Media campaign on Flood Management
 - Emergency Response Coordination and Monitoring Mechanism
 - Rapid Emergency and Needs Assessment Procedure
 - Loss and Damage Assessment Procedure
 - Partnership Building;
 - Mainstreaming DRR in development planning.

With the lessons learnt from the recent floods, Government had made the following key observations to be pursued in order to reduce the risk of future flood events in the country:

- Priority reconstruction to be focused on addressing the direct impact areas such as embankments, roads and culverts, and essentially the work to be undertaken before the onset of the 2015 monsoon to reduce subsequent vulnerability.
- Work-based safety-net programs to be used to establish/construct the embankment and also linked with employment opportunities of the flood affected people.

CONCLUSIONS

It is very much important to have satisfactory clarification about the findings and to draw conclusion. In the light of the above discussion, the following conclusions are put forwarded:

- It can be concluded that 1998 flood was most destroyed in term of total financial losses, coverage of total area and death of total human being but in 2017 flood damage more crop (6.5 million ton) than any other flood.
- Most of the farmers practiced strategic action against flood to reduce the losses of lives and other economic resources for their survival and maintain sustainable livelihood. This leads to conclude that the strategic action for overall practices were satisfactory. The practices of strategic action were comparatively higher during flood period. It can be concluded that more facilities should be provided for the better utilization of resources, that could help them to protect their family from damage and loss during on rush flood hit.

REFERENCES

- Aktar, C.K. (2014). Strategic Action by the Farmers Against Flood in Bangladesh. An unpublished MS Thesis, Department of Agricultural Extension, Sylhet Agricultural University, Sylhet, Bangladesh.
- Azad, A. K. (2009). Evaluation and Management of Disaster Shelter. A Handout of Training of Trainers on Disaster Management. Bangladesh Academy for Rural Development, Comilla, Bangladesh.
- BBC News Report, (1998). World: South Asia Bangladesh floods rise again, Broadcasting House, London, United Kingdom.
- BBS. (2016). Statistical Year Book of Bangladesh, Bangladesh Bureau of Statistics, Statistical Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.
- BLRI. (2017). Annual Report, Bangladesh Livestock Research Institute, Savar, Bangladesh.
- Bolger, N., and Eckenrole, J. (1991). Social relationships, personality, and anxiety during a major stressful event. *Journal of Personality and Social Psychology*, 61: 440-449.
- Coyne, J. Aldwin, C., and Lazarus, R. S. (1981). Depression and coping in stressful episodes. *Journal of Abnormal Psychology*, 90: 439-447.
- CRED. (2017). Emergency Data (EM-DAT), Centre for Research on the Epidemiology of Disasters, Brussels, Belgium.
- DAE. (2018). Agricultural Extension Manual. Department of Agricultural Extension, Ministry of Agriculture, Government of the People's Republic of Bangladesh, Dhaka.
- DDM. (2017). Annual Report, Department of Disaster Management, Ministry of Disaster Management and Relief, Government of the People's Republic of Bangladesh, Dhaka
- DoF. (2017). Annual report, Department of Fisheries, Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh, Dhaka.
- Farhad, A.K.U. (2015). Coping Strategies Practised by the Farmers Against Flood in Bangladesh. An unpublished MS Thesis, Department of Agricultural Extension and Rural

- Development, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh.
- FFWC. (2017). Annual Flood Report, Flood Forecasting and Warning Centre, Bangladesh Water Development Board, Dhaka.
- Folkman, S., and Lazarus, R. S. (1984). An analysis of coping in a middle-aged community sample. *Journal of Health and Social Behavior*, 21: 219-239.
- Frankenhaeuser, M. (1986). A psychobiological framework for research on human stress and coping. *Journal of Psychological, and Social Perspectives*, 35: 101-116.
- GOB. (2016). Annual Flood Report. Flood Forecasting & Warning Centre Processing & Flood Forecasting circle, Bangladesh Water Development Board, Bangladesh.
- H. Brammer (1990). Floods in Bangladesh: Geographical Background to the 1987 and 1988 Floods, *The Geographical Journal*. 156 (1): 12–22.
- Hamid, M.A. (2009). Climate Change Risk Management and Adaptation Option. Handout of Training of Trainers on Disaster Management. Bangladesh Academy for Rural Development, Comilla, Bangladesh.
- Hoyois, P. (2017). Annual Disaster Statistical Review 2016, Centre for Research on the Epidemiology of Disasters, Brussels, Belgium.
- NDRCC. (2017). NDRCC Report, National Disaster Reduction Center of China, Ministry of Civil Affairs of China, China.
- Nishanthi Priyangika (1999). Hundreds of thousands hit by Bangladesh floods, *The Geographical Journal*, 228 (3): 24–32.
- Serazul, Islam (2005). Farmers' Knowledge and Practices on Flood Coping in a Selected Flood Prone Area of Faridpur Upazila Under Pabna District (unpublished master's thesis). Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.
- T. Harris (2003). *Journal of the Faculty of Environmental Science and Technology*, Okayama University Vol 8, No. 1, Page: 56