ABSTRACT

The purpose of the study were to (i) determine the disaster coping strategy practiced by the affected people (ii) assess the socio-economic profile of the respondents, (iii) ascertain the contribution of selected characteristics of the people and (iv) identify the constraints of disaster coping strategy practiced by the affected people. The study was conducted at Gangachara Upazila of Rangpur District. Data were collected from a sample of 302 respondents, randomly selected from disaster affected population. Age, education, family size, farm size, disaster affected land, annual income, training received, extension media contact, knowledge on disaster coping strategy, environmental awareness, household assets, credit facilities, IGAs, water and sanitation condition, risk orientation, awareness about SSNP, perception of Climate Change (CC), perception of
disasters and scope of work in vulnerable situation constituted the independent variables, while disaster coping strategy practiced was the dependent variable. For measuring the disaster coping strategy practices, a 4-point rating scale was used against 50 items taking 10 items from each of five components of human needs e.g. 1) food preservation, collection and management, 2) agricultural products protection, 3) maintaining social network, 4) safeguard of health and sanitation, and 5) protection of housing and shelter. Numerical values and scales were used to measure the personal attributes. Regression and path analysis were employed to determine the contribution among the variables. For exploring relationship between the two variables Pearson’s Product Moment Correlation (r) was used. The majority (77.8 per cent) of the respondents had regular coping strategies compared to 22.2 per cent were found to have occasional coping strategies in the study area. Among 19 independent variables 16 were found significant relationship with the dependent variable. Stepwise multiple regression revealed that six variables namely education (23 per cent), participation in IGAs (3.6 percent), awareness of SSNPs (2.9 percent), disaster affected land (1.2 percent), farm size (1.9 percent) and perception of CC (1 percent) were the important contributing variables which combined explained 33.6 of the total variation of practice of coping strategy. Path analysis indicated that disaster affected land (0.589) had the highest positive direct effect while farm size (0.643) had the highest positive indirect effect to the disaster coping strategy practice. The major constraints for practicing disaster coping strategy in the study area were ‘Lack of knowledge and skills of affected people’, ‘Lack of relief materials during disaster’, ‘Lack of technologies’, ‘Weak weather forecasting’, ‘Less motivation’, ‘Low sanitation & health coverage’ and ‘Lack of communication during disasters’. To cope up with the challenges of the disasters, the people used reduction of food intake per meal, putting goods above flood level, keeping women and children in safer places, using boiled and tube well water, providing health care support to the sick family members, transfer important documents to the safer places, increasing level of homestead with soil, taking relief, credit, religious fasting, using mosque/temple as campaigning center, borrowing principal food from neighbor, use savings, migration, livestock sell, and social interconnectedness as the major coping strategies to survive the situation and improve their livelihood.

Keywords: Coping strategy; livelihood, climate change.

1. INTRODUCTION

1.1 General Background of the Study

Bangladesh is widely recognized as a country that is extremely vulnerable to the effects of climate change, due to its geographical position and low-lying flat topography. Within the past 15 years, the country has experienced an increase in the frequency and intensity of natural disasters named as cyclone, river erosion, drought, storm surge and especially floods. Livelihoods are either disrupted by the extreme weather events like cyclone, heavy downpour, floods, erosion, storm surges, dense fogs and the recent disaster like thunder storm or by slow onset disasters like salinization, dryness, ecosystem degradation etc. [1].

Bangladesh is a low lying delta with very gentle slopes. It is located at the lowest end of the Ganges, Brahmaputra and Meghna Basin [2]. Bangladesh is one of the largest deltas in the world which is highly vulnerable to natural disasters because of its geographical location, flat and low-lying landscape, population density, poverty, illiteracy, lack of institutional setup etc. In other words, the physical, social as well as economic conditions of Bangladesh are very typical to any of the most vulnerable countries to natural disasters in the world [3,4]. The total land area is 147,570 sq. km. consists mostly of Floodplains (almost 80%) leaving major part of the country [5].

Coping strategies are the sum total of ways in which people deal with minor to major stress and trauma. Coping strategies thus varies from one area to another even from person to person. It also depends on the nature and magnitude of disasters. People of the study villages have learned to cope with disasters in their own ways. Although they have limited options, people are increasingly searching for alternative livelihood strategies to adapt to the reality of severe disruption of their livelihoods [6,7]. Due to lack of financial and physical capital, households increasingly rely on natural, human, social capitals, but these capitals are not enough for making them resilient. The government and
NGOs took initiatives with the support of the international development partners in order to increase the coping and recovery capacity of the community but it only partially satisfied their consumption, so that the long-term impacts of such responses were not enough to recover livelihoods. This research identifies a set of socio-political factors and unequal access to the necessary capitals impeded the process of coping and recovery of the households.

1.2 Statement of the Problem

Due to geographical location, Bangladesh is the most disaster-prone country in South Asia. It is a poor country and faces many impacts from climate change in the form of severe cyclones, floods, droughts, rises in sea level, storm surges and severe salinity increases affecting the population, their livelihoods, their health, socio-economic systems, natural environments, and water sources.

Disasters in Bangladesh are considered to be a great constraint for sustainable development. Cyclone, tidal surge, flood, river bank erosion are some of the worst types of disaster which is badly affecting the livelihood of our citizens especially in the coastal zone [8]. Women are supposed to be the most vulnerable for many causes namely their vulnerability, mental attitude, physical structure and other social issues. There exists a lot of problems and lacking in disaster management.

Due to geo-political and territorial location, Bangladesh is widely considered to be one of the most climate vulnerable countries in the world which also has a very high population density. It has experienced frequent natural and human induced disasters including sea level rise, cyclones, storm surge, flooding, land erosion, water logging, and salinity intrusion in soil and water because of extreme variability of climate change which cause loss of life, damage the infrastructure and economic assets, and adversely affect the livelihoods of people especially the poor, vulnerable and destitute living in environmentally fragile areas. The combination of a high level of poverty, and a depleted ecological system increase the country’s vulnerability to the impacts of climate change [9]. To study the consequences of natural disasters and their coping strategies practiced by the people was carried out by making following research questions:

1) What type of disaster coping strategies are being practiced by the affected people due to climate change?
2) What are the socio-economic profiles of the disaster affected people and what relationship exists with disaster coping strategies practiced?
3) What are the contributions of selected characteristics of the vulnerable people to their coping strategies practiced in the study areas?

1.3 Objectives of the Study

In view of the above discussion and in order to give proper direction to the study, the researcher has undertaken the present study in the following specific objectives:

1. To determine the extent of practice of disaster coping strategies by the affected people in the study areas
2. To assess the socio-economic profile of the respondents in the study areas
3. To ascertain the contribution of selected characteristics of vulnerable people to their coping strategy practices

2. METHODOLOGY

2.1 Locale of the Study

Gangachara upazila of Rangpur district was purposively selected for this study. The mighty Tista river has gone through this area. As a result river erosion, flood, drought and different kinds of storms are common phenomena in the study area. Other than these, cold spell and water logging also take its dangerous form when disasters come. People of this area often used to take shelter in the nearby embankment, school building, and other nearby highlands during the disasters. Some people migrate to the urban area for leading their livelihoods.

2.2 Population and Sampling

The total numbers of the households of the selected villages were the target population for the study. However, data were obtained from a sample rather than the whole population. In drawing sample, three villages, Matukpur char from Kolkondo union, Isli char from Lakhitari union and Dhamur char from Gangachara sadar were selected purposively. Disaster affected and climatic vulnerable people from 03 villages of 03
unions under Gangachara upzilla of Rangpur district were the population of this study. In preparing the population frame, the voter lists of these three villages were obtained from the concerned Union Parishad Offices. Based on the voter lists, population frames were prepared in consultation with SAAO, NGO workers and other local elites. The total number of active households thus obtained and it was 3023. Then 10 percent of the affected people were selected randomly from the list (302 respondents) as sample size of the study. A reserve list of respondents (2 percent of the original population) from the selected villages were made to meet up the absence of the respondents.

The population and sampling were taken as follows:

- A total of 3 villages from 3 unions under Gangachara upzilla of Rangpur district was selected as the study area based on the effect of disaster prone and climatic variation
- A representative sample of 302 was selected from the affected population
- A reserve list of 60 disaster affected people of the study area

2.3 Data Collecting Instrument and Collection

Data were collected from the respondents with the help of a pre-tested and carefully designed interview schedule. The interview schedule contained both open and closed form of questions. Before data collection, a pre-test was run to justify the validity and reliability of the interview schedule. On the basis of pre-test and suggestions of the experts, the interview schedule was finalized. Each respondent was interviewed by the researcher himself. Necessary precautions were maintained at the time of data collection in order to achieve valid and reliable information.

Data for this study were collected by the researcher himself. The data were collected from the respondents with the help of an interview schedule through face-to-face interview of the respondents at their home. For collecting data the researcher established good rapport with the respondents so that they did not hesitate to provide proper response of the questions and statements. Necessary precautions were maintained before collecting data in order to achieve valid and reliable data. Secondary data were collected from different sources from GOs and NGOs as and when necessary.

2.4 Measurement of Independent and Dependent Variable

The personal socio-economic characteristics of the people were the independent variables. Their measurements were according to appropriate statistical scores and scales.

To measure the disaster coping strategy variable, at first scale and relevancy of statements were selected against each of the following five components of livelihood for maintaining coping strategies in a disaster prone area.

- a. Food collection, preservation and management
- b. Protection of livestock, fisheries and crop production
- c. Maintaining social network
- d. Protection of housing and shelter
- e. Safeguard of health and sanitation

After the determination of relevancy, each of the statements related to coping strategy practice was put against a 4 point rating scale as practiced by the respondents as 'regularly', 'ocasionally', 'rarely' and 'not at all'. The score was used as 3, 2, 1 and 0, respectively.

Thus, practice of coping strategy on their livelihood score were ranged from 0 to 150. Where 0 indicating no practice of coping strategy for the livelihood of the affected people and 150 indicating regularly practice of coping strategy for their livelihood in vulnerable situation due to climate change in the study area.

For ranking the statements Disaster Coping Strategy Practiced (DCSP) index of individual statement have also been computed by using the following formula:

$$DCSP \text{ Index (DCSPI)} = DCSP_{No} \times 0 + DCSP_{Ra} \times 1 + DCSP_{Oc} \times 2 + DCSP_{Re} \times 3$$

Where,

- $DCSP_{No}$ = No practice (Not at all) of DCSP
- $DCSP_{Ra}$ = Rarely practice of DCSP
- $DCSP_{Oc}$ = Occasionally practice of DCSP
- $DCSP_{Re}$ = Regularly practice of DCSP

Thus, the DCSP index ranged from 0-906 for 302 respondents; 0 indicating no disaster coping
strategy practiced while 906 indicating regular disaster coping strategy practiced in the study area.

Fig. 1. Data collection

2.5 Data Processing and Data Analysis

After completion of field survey data from all the interview schedules were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. The computer software SPSS (Statistical Package for Social Sciences), and microsof excel were used to analyze the data. Descriptive statistical measures such as frequency, range, mean, percentage distribution, standard deviation, coefficient of variation, rank order, categories and indices etc. were used to describe and interpret the data. For exploring relationships between the two variables Pearson’s Product Moment Correlation \( r \) was used.

3. RESULTS AND DISCUSSION

3.1 Selected Characteristics of the Respondents

For this research, a total of nineteen characteristics of the respondents were selected and classified into suitable categories for description and interpretation in relation to the practice of disaster coping strategy and presented in the following sections.

- The majority (52.30 per cent) of the affected people were young followed by middle aged (29.10 per cent) and old (18.50 per cent) in the study area.
- The highest proportion (55.41 per cent) of the affected people took primary level education, while only 1.67 per cent took above secondary level education.
- The analysis revealed that the majority (59.9 per cent) of the affected people were with small family members and only 9.3 per cent were with large family members.
- It was found that the majority (57.9 per cent) of the farm size constituted with small farmer and only 2 per cent found with medium farmer.
- The majority (44.4 per cent) of the Disaster Affected Land were found as medium followed by small DAL (42.7 per cent) and large DAL (12.9 per cent).
- About three quarter (85.8 per cent) population of the affected area were found with low income, while only 1 per cent found only with high income.
- The overwhelming majority (83.4 per cent) of the people of the study area found with low assets and only 16.6 people found with medium to high assets.
- About two-third (66.2 per cent) people of the study area were found with low participation in IGAs followed by 33.8 per cent with medium participation and no people found with high participation.
- Two-third majority (68.2 per cent) disaster affected people were found with no training experience, while only 7.3 per cent people found with high training experience in the study area.
- Extension media contact is very much miserable in the study area almost all people have no extension media contact. The overwhelming majority (96.7 per cent) people have no extension media contact followed by 3.3 per cent medium contact and 0 percent were with high contact.
- The majority (48.70) of the people of the char land had medium extent of water and sanitation condition while 17.90 per cent involved with high extent of water and sanitation condition.
- The overwhelming majority (73.5 per cent) of the respondents had access medium
environmental awareness while only 5 percent had high environmental awareness

- It is found that the majority (48.7 per cent) people of the study area had medium knowledge of disaster coping strategy followed by low (42.7 per cent) knowledge and high (8.6 per cent) knowledge
- The analysis revealed that more than half (55 per cent) of the char lander had with no credit receiver while only 3 per cent char lander with high credit receiver
- All most all (99 per cent) the respondents had with low scope while only 1 percent had with medium to high scope of work in vulnerable situation
- About two-third (68.9 per cent) of the respondents had awareness about SSN program in the study area while only 3 per cent were with high involvement at SSN program
- The overwhelming majority (70.9 per cent) of the affected people of the char land were with high risk orientation while 29.1 per cent were with low to medium risk orientation
- The majority (49.33 per cent) respondents had found with medium perception of climate change while only 7.95 people had high perception of climate change
- It is found that majority (60.60 per cent) of the disaster affected people had high perception while 39.4 people found with low to medium perception of disasters in the study area

3.2 Measurement of Extent of Practice of Disaster Coping Strategies by the Respondents for their Livelihood

The extent of practice of disaster coping strategy was measured by computing scores of practices which could range from 0-150. However, the observed score ranged from 79-136 with an average of 107.26 and a standard deviation 10.30. The variance of the practices of disaster coping strategies was found as 106.08. Based on their possible scores the practice of disaster coping strategies were categorized into three sections namely as practiced rarely, practice on occasional basis and practice on regular basis. In this analysis it was found that the highest portion (77.8 percent) of the affected people practiced disaster coping strategy on regular basis, 22.2 percent practice on occasional basis, and no disaster coping strategy practice on rarely was found in the study area (Table 1).

In the study area most of the people prefer to practice indigenous technologies those they got from forefathers. They do not want to take risk to use modern or new technology as coping strategy. Other than unavailability of training and motivational work on coping strategies in the study area people are not getting updated information and they are remain same as before and they were found dependent on only traditional coping strategies. Moreover, for want of voluntary organizations that provide training and motivational work are absent in this disaster prone area. As a result people remain ignorant about the new technologies.

Disaster coping strategy practice score for each statement was calculated by using disaster coping strategy practice index. Extent of practice of disaster coping strategy was described under five different aspects of livelihood and disaster coping strategy practice index was shown against each coping strategy with its rank order. Roy (2013) used this procedure to find out aspect-wise effectiveness scores and its ranking of social safety net programs. Disaster coping strategy practice index (DCSPI) was found to vary from 391-791 against the possible index ranging from 0-906. The extent of coping strategy practices for each of five aspects is described Table 2.

3.2.1 Food collection, preservation and management

Among the coping strategies of food collection, preservation and management ‘reduction/limitation amount of food taken per meal during disasters’ possess first position in the rank order that means ‘reduction/limitation amount of food taken per meal during disasters’ is most practiced coping strategy in the study area. In the Table of extent of practice of food collection, preservation and management it got highest score with 790. In the ranking order ‘Preparation and preservation of dry foods (Smashed/fried rice, dry fish, pulse etc.)’ is found 2nd with the scoring point 702. So, ‘Preparation and preservation of dry foods’ is another acute problem in the study area during disasters. Preparation of food takes time during cooking and raw materials and fuel are not found ready during disasters. So, dry foods become popular among the affected people. The third important coping strategy is ‘Collection of water purifying tablets or fitkiri from neighboring health center’ in the study area during disasters especially when floods occurred. For the need of pure drinking water, people were bound to collect different
types of purifying tablets and *fitkiri* for purification their drinking water. Usually this time tube well other sources of drinking water go under water and people became dependent on purifying tablets and *fitkiri* for collecting their drinking water. In the DCSP index it is with the score of 669 (Table 2).

### 3.2.2 Agricultural products protection

The information presented in Table 4 show that among the coping strategies 'Cultivation of short duration quick growing crops during and after disasters like flood/drought' was practiced most in this climatic vulnerable study area. It occupies the 1st position in the rank order with the score of 753. During and after the disaster food shortage stands as key problem in the study area. To recover the food shortage farmers cultivate quick growing crops to get harvest in a short duration, followed by 'Seed preservation and storing for emergency make-up after flood/drought/storm' under the aspect of agricultural products protection with a score of 736 in the DCSP index. After disaster, there was huge shortage of seed found in the study area. 'Growing mixed crops' is

| Categories of practices | Respondents (N=302) | Mean | SD | Variance |
|-------------------------|----------------------|------|----|----------|
|                         | Number | Percent |     |          |          |
| Regular (101-150)       | 235    | 77.8    | 107.26 | 10.30   | 106.08   |
| Occasional (51-100)     | 67     | 22.2    |        |          |          |
| Rare (1-50)             | 0      | 0       |        |          |          |
| Total                   | 302    | 100.0   |        |          |          |

Probable score range: 0-150; Observed score range: 79-136

### Table 2. Disaster coping strategy practiced for food collection, preservation and management

| Coping Strategy                                                                 | Extent of practice | DCSP index | Rank order |
|---------------------------------------------------------------------------------|--------------------|------------|------------|
|                                                                                 | Regularly | Occasionally | Rarely | Not at all |
|                                                                 (3)       | (2)       | (1)        | (0)     |            |
| Reducing/limitation amount of food taken per meal during disasters               | 198       | 92         | 12      | 0          | 790    | 1          |
| Preparation and preservation of dry foods (Smashed/fried rice, dry fish, pulse etc.) | 145       | 110        | 47      | 0          | 702    | 2          |
| Collection of water purifying tablets or *fitkiri* from neighboring health center | 110       | 152        | 35      | 5          | 669    | 3          |
| Dependent upon less expensive and less preferred food items                    | 114       | 133        | 47      | 8          | 655    | 4          |
| Storage of sweet gourd, potato, sweet potato and other tuber crops             | 108       | 122        | 68      | 4          | 636    | 5          |
| Food collection from relief and rehabilitation center                          | 122       | 121        | 23      | 36         | 631    | 6          |
| Raising tube-well head above flood level by additional pipes                  | 94        | 140        | 68      | 0          | 630    | 7          |
| Reduction adult consumption so that children can eat adequately               | 88        | 114        | 89      | 11         | 581    | 8          |
| Purchasing human food by selling fishes, poultry birds and livestock          | 97        | 98         | 84      | 23         | 571    | 9          |
| Purchasing food by expensing reserved money                                    | 72        | 79         | 109     | 42         | 483    | 10         |
| Total DCSP score                                                              | 6348      |            |         |            |        |            |
another popular coping strategies in this disaster prone area. The strategy is 3rd with the score of 732. To meet up the growing demands of family consumption, especially to meet up the grain and vegetable, farmers grow more crops in the same land. The other coping strategies practiced in the study area are given in Table no. 3 with the rank order under agricultural products protection sub-headings.

3.2.3 Maintaining social aspects/issues

Information presented in Table 4 show that different types of disaster coping strategies are practiced in the study area under the aspect of maintaining social aspects/issues. ‘Keeping women and children in safe and sound places during disasters’ was ranked 1st position among the 10 coping strategies. The DCSP index of keeping women and children in safe and sound places during disasters is 784. Women and children are weak in nature. During disasters worst of children and women are found more helpless than men. So, special care is given to the women and children during and after disaster. The 2nd most coping strategy under the aspect of maintaining social aspects/issues is ‘Providing health care support to sick family members’ with score of 770 in the DCSP index. During the disasters people are attacked with different kinds of deadly diseases. Especially with water borne and skin diseases. This time family members take care of him if he is sick. They take the sick family member to the nearest hospital or purchase or collect medicine for him/her. The 3rd coping strategy of the disaster affected area is ‘Creating social awareness about shifting houses caused by disasters’ with a score of 579. Before disasters (flood, river erosion and storm) social awareness campaign are seen as coping strategies in the study area and this way man saves their houses from the dangerous effect of disasters.

Table 3. Disaster coping strategies under the aspect of agricultural products protection

| Coping strategy                                                                 | Extent of practice | DCSP index Rank order |
|---------------------------------------------------------------------------------|--------------------|------------------------|
|                                                                                 | Regularly          | Occasionally           | Rarely     | Not at all |
| **Cultivation of short duration quick growing crops during and after disasters like flood/ drought** | 178 95 29 0        | 753 1                  |
| **Seed preservation and storing for emergency make-up after flood/drought/storm** | 169 96 37 0        | 736 2                  |
| **Growing mixed crops**                                                         | 178 88 22 14       | 732 3                  |
| **Cultivation of drought/flood tolerant varieties**                             | 147 101 54 2       | 697 4                  |
| **Providing irrigation to the pond /crop field during drought**                 | 144 102 54 2       | 690 5                  |
| **Vaccination/medicine of livestock and poultry birds before and after disaster** | 148 94 34 26       | 666 6                  |
| **Taking afforestation program after disaster**                                 | 126 93 73 10       | 637 7                  |
| **Replacement of livestock and poultry birds on comparatively high place of homestead area during flood** | 127 98 27 0       | 604 8                  |
| **Netting the surrounding of the fish farm/pond to prevent the escape of fishes during overflowing** | 96 87 77 42       | 539 9                  |
| **Using seeds as food during disasters**                                        | 26 86 141 49       | 391 10                 |
| **Total DCSP score**                                                           | 6445               |                        |
### Table 4. Disaster coping strategy practiced under the aspect of maintaining social aspects/issues

| Coping strategy                                                                 | Extent of practice | DCSP index | Rank order |
|---------------------------------------------------------------------------------|--------------------|------------|------------|
| Keeping women and children in safe and sound places during disasters            | Regularly 188 | Occasional 106 | Rarely 0 | 784 | 1 |
| Providing health care support to sick family members                             | Regularly 185 | Occasional 98 | Rarely 19 | 770 | 2 |
| Creating social awareness about shifting houses caused by disasters              | Regularly 102 | Occasional 101 | Rarely 71 | 579 | 3 |
| Maintaining communication with Union Parishad Chairman /members/local leaders   | Regularly 98    | Occasional 82 | Rarely 99 | 557 | 4 |
| Arrangement of group meeting among the disaster affected community members      | Regularly 117   | Occasional 28 | Rarely 139 | 546 | 5 |
| Formation of volunteer groups for rehabilitation after devastating disaster like strong storm, flood etc. | Regularly 104 | Occasional 55 | Rarely 116 | 538 | 6 |
| Involvement with post disasters relief and rehabilitation activities             | Regularly 103   | Occasional 63 | Rarely 82 | 517 | 7 |
| Creating social awareness about cleaning and washing of floating debris that are accumulated during flood and storm | Regularly 78    | Occasional 74 | Rarely 106 | 488 | 8 |
| Transmission of disaster related information/forecasting to the community members | Regularly 77   | Occasional 52 | Rarely 137 | 472 | 9 |
| Formation of social groups for preventing robbery, theft etc. during disasters   | Regularly 88    | Occasional 71 | Rarely 10 | 416 | 10 |
| Total DCSP score                                                                |                   |             |           | 5667 |

#### 3.2.4 Protection of housing and shelter

Information in Table 5 show that the coping strategies practiced under the aspects of protection of housing and shelter ‘Putting goods above the water level during flood’ was ranked 1st position among the strategies. The score of this strategy was 789 in the DCS index. During flood household inputs washed away and lost away by the wave of devastating flood. When flood level rise household belongings go under water. So, household goods are kept above water level during flood for unharmed. The 2nd most coping strategy in the study area is ‘Important papers, documentation and ornaments are transferred to the safer places’ with the score 762 in the DCSP index. During disasters valuable things may be damaged or lost away. So, for its better management, valuable things are transferred to the safer place. Among the coping strategies ‘Increasing the level of homestead area with soil before or after flood’ is placed 3rd with its DCSP index score 756. As flood is regular phenomena in this disaster prone area, people often raised their homestead with soil before or after the disasters.

#### 3.2.5 Safeguard of health and sanitation

Among the coping strategies ‘using tube well water for bath and other works’ possess 1st position that means during and after the disaster people of the study area always uses tube well water to avoid water borne diseases and unhygienic condition. In the DCSP index it is with the score of 783. So, under the safeguard of health and sanitation ‘using tube well water for bath and other works’ uses very much in the study area. The 2nd coping strategy of this aspect is ‘Using boiled water for drinking and cooking’
with the DCSP index 772. Boiled water removes the doubt from water borne diseases. As, diseases spread quickly through water during disaster, people of the study area practice this coping strategy abundantly. The 3rd coping strategy of the study area under this aspect is ‘Drainage out water if water logging held’ with the score 743 in the DCSP index (Table 6). This strategy is also used copiously in the study area.

3.2.6 Overall coping strategy

There is a need to compare among top ranking practicing coping strategies of five aspects of livelihood namely ‘Food collection, preservation and management’, ‘Agricultural products protection’, ‘Maintaining social aspects’, ‘Protection of housing and shelter’ and ‘Safeguard of health and sanitation’. The top 1st and 2nd ranked coping strategies were selected and thus 10 of such strategies are put in (Table 7) along with their corresponding DCSP index. However a graphical presentation has been given hereafter (Fig. 2) for easy understanding and relative importance of the coping strategy being practiced by the affected people. In addition, a comparative analysis has also been made among different livelihood components considering their DCSP index. The computation was made based on summation of five components and was converted to percentage. A pie-diagram (Fig. 3) has been given for easy understanding.

Table 5. Disaster coping strategy practiced under the aspect of protection of housing and shelter

| Coping Strategy                                      | Extent of practice | DCSP index | Rank order |
|------------------------------------------------------|--------------------|------------|------------|
|                                                      | Regularly | Occasionally | Rarely | Not at all |
|                                                      | (3)       | (2)         | (1)    | (0)       |
| Putting goods above the water level during flood     | 193       | 101         | 08     | 0         | 789  | 1 |
| Important papers, documentation and ornaments are transferred to the safer places | 176       | 112         | 10     | 4         | 762  | 2 |
| Increasing the level of homestead area with soil before or after flood | 177       | 100         | 25     | 0         | 756  | 3 |
| Selling removable assets for hazards of disasters    | 172       | 88          | 24     | 18        | 716  | 4 |
| Taking shelter in school building/govt. offices during disasters | 172       | 71          | 18     | 41        | 676  | 5 |
| Making temporary house on the same land after devastating storm | 148       | 109         | 09     | 2         | 671  | 6 |
| Setting up make shift house on embankment after strong storm/ river erosion/flood | 144       | 48          | 64     | 46        | 592  | 7 |
| Taking house and other materials in the flood/cyclone shelter during disasters | 108       | 99          | 66     | 29        | 588  | 8 |
| Living on the embankment if river erosion /storm held | 106       | 78          | 82     | 36        | 556  | 9 |
| Arranging group meeting on how to protect housing and where shelter can be set up | 98        | 65          | 73     | 66        | 497  | 10 |
| Total DCSP score                                     | 6603     |             |        |           |      |    |
Table 6. Disaster coping strategy practiced under the aspect of safeguard of health and sanitation

| Coping strategy                                      | Extent of practice | DCSP index | Rank order |
|------------------------------------------------------|--------------------|------------|------------|
|                                                      | Regularly | Occasionally | Rarely | Not at all |          |
|                                                      | (3)       | (2)         | (1)     | (0)        |          |
| Using tube well water for bath and other works       | 187       | 107         | 08      | 0          | 783 1    |
| Using boiled water for drinking and cooking          | 188       | 96          | 16      | 2          | 772 2    |
| Drainage out water if water logging held             | 168       | 105         | 29      | 0          | 743 3    |
| Using tube well water for avoiding water borne diseases | 158     | 106          | 38      | 0          | 724 4    |
| Using sanitary latrine for avoiding diseases         | 142       | 88          | 44      | 28         | 646 5    |
| Keeping oral saline at hand during/after disasters  | 123       | 68          | 100     | 11         | 605 6    |
| Contacting with nearest health workers/doctors for taking advices | 124 | 79          | 73      | 26         | 603 7    |
| Setting up deep tube well during drought             | 104       | 88          | 94      | 16         | 582 8    |
| Using purification tablets/fitkiri in water for drinking purposes | 101     | 94          | 73      | 34         | 564 9    |
| Using harvested rain water for drinking              | 98        | 108         | 23      | 73         | 533 10   |
| Total DCSP score                                     |           |             |         |            | 6555     |

In the rank order the top most coping strategy is ‘Reduction/limitation amount of food taken per meal during disasters’ with the score of 790 in the DCSP index (Table 7). People of the study area are poor and they lost a lot during disasters. This time take less amount of food per meal to save food and cover the shortage of food stuff. The 2nd coping strategy practiced in the study area is ‘Putting goods above the water level during flood’ with the score of 789 in the DCSP index. To carry the goods in the disaster period is tough. People this time try to keep the things above water level if the disaster is flood. During flood water level sometimes increases and sometimes decrease and people adjust things with its water level. The 3rd coping strategy is ‘Keeping women and children in safe and sound places during disasters’ with the score of 784 in the DCSP index. As women and children are weak in nature and they feel nervous in the disastrous period and they were taken in safe places.

Among the coping strategy practices ‘Using tube well water for bath and other works’ is in 4th place with the score of 783 in the DCSP index. During flood disaster outbreak of water borne diseases is known no bound and affected people suffer much for want of medicine and doctor. At that time people of the study area use tube well water as drinking, bath, cooking and for other purposes. The other important coping strategies of top ten are shown in the Fig. 2.

The total practices under the five aspects of livelihood of the disaster coping strategy practices found most top in the aspect of ‘Protection of housing and shelter’ with the total index point 6603, the second most practices found under the aspect of ‘Safeguard of health and sanitation’ with the total index point 6555, the third most practice are found under ‘Agricultural products protection’ with the index point 6445, the fourth most practices found under the aspect of ‘Food collection, protection and preservation’ with the grading point of 6348 and lowest practices found under ‘Maintaining social aspects’ with grading point of 5667. The practices of disaster coping strategies under five items are shown with pie chart analysis (Fig. 3). In this analysis it is found that the highest disaster coping strategy practices under five aspects of livelihood is ‘Safeguard of health and sanitation’ and ‘Protection of housing and shelter’ with 21 per cent. Seed preservation and storing for emergency make-up after disasters was the lowest disaster coping strategy practices were found.
Fig. 2. The top ten disaster coping strategies are shown among five aspects of livelihood

Fig. 3. Extent of practices of disaster coping strategies under five aspects of livelihood
Table 7. Top ten disaster coping strategies practiced in the study area

| Coping strategy                                               | Extent of practice | DCSP index | Rank order |
|---------------------------------------------------------------|--------------------|------------|------------|
| Reduction/limitation amount of food taken per meal during disasters | (3) 198(2) 92(1) 12(0) 790 | 1          |
| Putting goods above the water level during flood              | (3) 193(2) 101(1) 08(0) 789 | 2          |
| Keeping women and children in safe and sound places during disasters | (3) 188(2) 106(1) 08(0) 784 | 3          |
| Using tube well water for bath and other works                | (3) 187(2) 107(1) 08(0) 783 | 4          |
| Using boiled water for drinking                               | (3) 188(2) 96(1) 16(0) 772 | 5          |
| Providing health care support to sick family members          | (3) 185(2) 98(1) 19(0) 770 | 6          |
| Important papers, documentation and ornaments are transferred to the safer places | (3) 176(2) 112(1) 10(0) 762 | 7          |
| Increasing the level of homestead area with soil before or after flood | (3) 177(2) 100(1) 25(0) 756 | 8          |
| Cultivation of short duration quick growing crops during and after disasters like flood/drought | (3) 178(2) 95(1) 29(0) 753 | 9          |
| Seed preservation and storing for emergency make-up after disasters | (3) 169(2) 96(1) 37(0) 736 | 10         |

Table 8. The total grading point/total DCSP score of each aspect of livelihood

| Sl. no. | Name of aspect                                      | Grading point /Total DCSP score |
|---------|-----------------------------------------------------|--------------------------------|
| 1.      | Food collection, protection and preservation         | 6348                           |
| 2.      | Agricultural products protection                     | 6445                           |
| 3.      | Maintaining social aspects                           | 5667                           |
| 4.      | Protection of housing and shelter                    | 6603                           |
| 5.      | Safeguard of health and sanitation                   | 6555                           |

Under the five aspects of livelihood ‘Protection of housing and shelter’ is found with the highest grading point 6603 in the disaster coping strategy practices. And the lowest total is found with ‘Maintaining social aspects’ with the grading point of 5667. The total score of each components of livelihood are given in the Table. 8.

It means that the coping strategies under ‘Protection of housing and shelter’ practice copiously in the study area. During disasters, shelter becomes one of the important events for the affected people. More often than not, houses are damaged by the strong wind and sometimes by the flood water in the study area and affected people become helpless. This time they practice different kinds of coping strategies to save their livelihood. Some take shelter on the embankment, some take shelter at the school and flood shelter building, and some leave the places and take shelter in the upper land or in the houses of kith and kin.

3.3 Contribution of the Individual Characteristics of the Disaster Affected People to the Disaster Coping Practice in the Study Area

For the present study, nineteen characteristics of the respondents were selected as antecedent
variables and disaster coping strategy practice by the affected people on their livelihood due to climate change was the focus variable of the study. To explore the relationship between the focus variable and the characteristics of the disaster affected people, Pearson's product moment correlation coefficient (r) was computed. The relationship between the focus variable and the characteristics of the disaster affected people was presented in the Table 9.

Data presented in Table 9 show that out of the nineteen characteristics of the disaster affected people, sixteen were found having significant relationship with their disaster coping strategy practice by the affected people on their livelihood, these are age, education, farm size, disaster affected farm, annual income, household assets, participation in IGAs, training experience, extension media contact, environmental awareness, knowledge on DCS, credit received, scope of work in vulnerable situation, awareness about SSN program, perception of climate change, perception of disasters.

Contribution of the individual characteristics of the disaster affected people is a multivariate phenomenon involving interaction of many factors. Past studies and experts' opinions indicated that a variety of characteristics of an individual influencing contribution of an experiment. For the present study, nineteen characteristics of the affected people were selected.

The influence of each characteristic of the affected people on the disaster coping strategy practices had been discussed in this section. The coefficient of correlation only indicates the linear relationship between two variables. It does not express the influence and contribution of a particular independent variable to the dependent variable. The independent variables in isolation did not give a comprehensive picture of the influence of independent variables on the level of disaster coping strategy practices. The different characteristics of the respondents may interact together to contribute to a combined influence on disaster coping strategy practices of a program in vulnerable situation. Keeping this fact in view linear multiple regression analysis was used to assess the influences of the independent variables on the dependent variable. A general full model regression analysis was initially run with the sixteen independent variables (results are given in Table 10). The variables included: age, education, farm size, disaster affected land, annual income, household assets, participation in IGAs, training experiences, EMC, environmental awareness, Knowledge of DCS, credit received, scope of work, awareness about SSNP, perception of CC and perception of disaster.

Table 9. Relationship between selected characteristics of the respondents and their disaster coping strategy practice

| Focus variable                          | Characteristics of the disaster affected people | Coefficient of correlation (r) |
|----------------------------------------|-------------------------------------------------|--------------------------------|
| Disaster Coping Strategy Practiced by the Affected People | Age                                             | -.206 **  |
|                                         | Education                                       | .479 **  |
|                                         | Family size                                     | .031    |
|                                         | Farm size                                       | .154 **  |
|                                         | Disaster affected farm                          | .176 **  |
|                                         | Annual income                                   | .157 **  |
|                                         | Household assets                                | .165 **  |
|                                         | Participation in IGAs                          | .343 **  |
|                                         | Training experience                             | .421 **  |
|                                         | Extension media contact                         | .384 **  |
|                                         | Water and sanitation condition                  | -.023   |
|                                         | Environmental awareness                         | .287 **  |
|                                         | Knowledge on DCS                                | .403 **  |
|                                         | Credit received                                 | .123    |
|                                         | Scope of work in vulnerable situation           | .120    |
|                                         | Awareness about SSN program                     | .451    |
|                                         | Risk orientation                                | .074    |
|                                         | Perception of climate change                    | .284 **  |
|                                         | Perception of disasters                          | .123    |

** Significant at .01 level; * Significant at .05 level
It was observed that out of 16 independent variables, only six, namely education, farm size, disaster affected land, participation in IGAs, awareness about SSNP, perception of climate change were entered into the best fitted model of regression analysis and all these six variables were found to be significant. Hence, the concerned null hypotheses were rejected.

The multiple R and R² values found in the stepwise regression were 0.580 and 0.336 respectively, while the corresponding F-ratio was 24.910. The regression equation obtained is presented below:

\[ Y = 76.601 + 0.975X_2 - 15.611X_4 + 20.847X_5 + 0.584X_6 + 0.516X_16 + 0.725X_{18} \]

Where, \( Y \) = Disaster coping strategies practices

\( X_2 \) = Education, \( X_4 \) = Farm size, \( X_5 \) = Disaster affected land, \( X_6 \) = Participation in IGAs, \( X_16 \) = Awareness of SSNPs, \( X_{18} \) = Perception of CC

Data contained in Table 11 and 12 indicated that the whole model of 16 variables explained 35.4 per cent of the total variation of disaster coping strategy practices in vulnerable situation, whereas only six variables explained 33.6 per cent of the variation. But, since the six variables formed the equation, it might be assumed that whatever the contribution was there it was due to these six variables.

The above findings indicated that only six variables were mainly responsible for the extent of practice of disaster coping strategy for the affected people in vulnerable situation due to climate change. The unique contribution of each of the six variables was also determined by taking the changes in R² value occurred for entry of a particular variable in the step-wise regression model. Table 12 indicated that education alone contributed 23 percent of the variation followed by participation in IGAs (3.6 percent), awareness of SSNPs (2.9 percent), disaster affected land (1.2 percent), farm size (1.9 percent), perception of CC (1 percent).

The model formulated from the regression analysis meant that the disaster coping strategy practices for the affected people had inherent disaster coping strategy practices 76.601 in comparison of the mean 107.26. It was evident from the model that the affected people who had more education, more active participation in IGAs, more perception on climate change, more awareness of SSNPs, more conscious about disaster affected land and more farm size in the char land in the disastrous period was more associated with disaster coping strategy practices in the study area.

### 3.4 Contribution of the Selected Independent Variables Towards Disaster Coping Strategy Practices

In order to determine the contribution of independent variables to the dependent variable, stepwise multiple regression analysis was
conducted. In this method, the 16 variables those had significant relationship with dependent variable were run to determine their contribution. Out of these 16 variables 6 variables namely education, farm size, disaster affected land, participation in IGAs, awareness about SSNP, perception of climate change were retained. The coefficient of multiple determinations ($R^2$) indicated that these 6 variables explained 33.6 per cent of the total variation towards disaster coping strategy practices.

3.4.1 Path analysis for measuring direct and indirect effects of selected independent variables towards disaster coping strategy practices

Path coefficient was computed to determine the direct and indirect effects of the variables. Disaster affected land had the highest direct and positive effect (0.589), followed by farm size (-0.489), education (0.267), IGAs (0.212), SSNP (0.167), climate change perception (0.113)

Fig. 4. Path diagram shows direct and indirect effects of selected cha

Table 11. Regression coefficients of disaster coping strategy practices with the six significantly contributing independent variables

| Variable Code | Individual characteristics | Unstandardized co-efficient | Standardized co-efficient | t values | Significance Level |
|---------------|----------------------------|-----------------------------|---------------------------|----------|--------------------|
| $X_2$         | Education                  | .975                        | .256                      | .268     | 3.812              | .000              |
| $X_4$         | Farm size                  | -15.611                     | 5.561                     | -.492    | -2.807             | .005              |
| $X_5$         | Disaster affected land     | 20.847                      | 6.151                     | .591     | 3.389              | .001              |
| $X_8$         | Participation in IGAs      | .584                        | .145                      | .211     | 4.015              | .000              |
| $X_{16}$      | Awareness of SSNPs         | .516                        | .205                      | .168     | 2.512              | .013              |
| $X_{18}$      | Perception of CC           | .725                        | .343                      | .111     | 2.116              | .035              |

Constant = 76.601, $R=0.580$, $R^2=0.336$, Adjusted $R^2=0.323$, $F$ value=24.910, $P=0.000$
Table 12. Changes in multiple $R^2$ for enter of a variable into the step-wise multiple regression analysis models for disaster coping strategy practices

| Model | Variables entered | $R^2$ | $R^2$ change | Variance explained (%) | Significance Level |
|-------|-------------------|-------|--------------|------------------------|--------------------|
| $X_2$ | Education         | .230  | .230         | 23                     | .000               |
| $X_8$ | Participation in IGAs | .266  | .036         | 3.6                    | .000               |
| $X_{15}$ | Awareness of SSNP | .295  | .029         | 2.9                    | .001               |
| $X_5$ | Disaster affected land | .307  | .012         | 1.2                    | .021               |
| $X_4$ | Farm size         | .326  | .019         | 1.9                    | .004               |
| $X_{18}$ | Perception of CC  | .336  | .010         | 1.0                    | .035               |

Table 13. Path coefficients showing the direct and indirect effects of selected independent variables on the extent of practice of the disaster coping strategies

| Independent variables | Effect of independent variable | Variable through which substantial indirect effects were channelized* |
|-----------------------|-------------------------------|---------------------------------------------------------------------|
| Education ($X_1$)    | 0.267                         | IGAs ($X_2$)                                                          |
|                       |                               | SSNP($X_3$)                                                           |
|                       |                               | Farm size ($X_4$)                                                    |
|                       |                               | DA. land ($X_5$)                                                     |
|                       |                               | CC. per ($X_6$)                                                      |
| IGAs ($X_2$)         | 0.212                         | Education ($X_1$)                                                    |
|                       |                               | IGAs ($X_2$)                                                          |
|                       |                               | SSNP($X_3$)                                                           |
|                       |                               | Farm size ($X_4$)                                                    |
|                       |                               | DA. land ($X_5$)                                                     |
|                       |                               | CC. per ($X_6$)                                                      |
| SSNP ($X_3$)         | 0.167                         | Education ($X_1$)                                                    |
|                       |                               | IGAs ($X_2$)                                                          |
|                       |                               | SSNP($X_3$)                                                           |
|                       |                               | Farm size ($X_4$)                                                    |
|                       |                               | DA. land ($X_5$)                                                     |
|                       |                               | CC. per ($X_6$)                                                      |
| Farm size ($X_4$)    | -0.489                        | Education ($X_1$)                                                    |
|                       |                               | IGAs ($X_2$)                                                          |
|                       |                               | SSNP($X_3$)                                                           |
|                       |                               | Farm size ($X_4$)                                                    |
|                       |                               | DA. land ($X_5$)                                                     |
|                       |                               | CC. per ($X_6$)                                                      |
| DA. land ($X_5$)     | 0.589                         | Education ($X_1$)                                                    |
|                       |                               | IGAs ($X_2$)                                                          |
|                       |                               | SSNP($X_3$)                                                           |
|                       |                               | Farm size ($X_4$)                                                    |
|                       |                               | DA. land ($X_5$)                                                     |
|                       |                               | CC. per ($X_6$)                                                      |
| CC. per ($X_6$)      | 0.113                         | Education ($X_1$)                                                    |
|                       |                               | IGAs ($X_2$)                                                          |
|                       |                               | SSNP($X_3$)                                                           |
|                       |                               | Farm size ($X_4$)                                                    |
|                       |                               | DA. land ($X_5$)                                                     |

Note: DA. land- Disaster Affected land; CC. per- Climate Change perception

towards disaster coping strategy practices. The total indirect effect of each independent variables had also towards dependent variables. Among the independent variables farm size had the highest and positive effect (0.643) towards disaster coping strategy practices.

The path diagram in Fig. 4 shows the direct, total indirect and substantial indirect effects channelled through different variables. Among the six variables mentioned above education, participation in IGAs and disaster affected land had more direct effects than their indirect effects, while farm size, awareness about SSNP and
perception of Climate Change had more indirect effects than their direct effects on disaster coping strategy practices.

4. CONCLUSION AND RECOMMENDATION

4.1 Conclusion

Disaster is increasing over the time which enhancing the vulnerability of communities and their livelihood though they are undertaking some coping strategies. Survey results indicated that there was limited awareness, knowledge and capacity at local level to understand the disaster coping strategy practices. Climate change is already having serious implications on the livelihoods of the targeted communities, natural disasters have turn into hazard and affected people are taking different kind of coping strategies to save their lives and properties. Some concluding remarks based on the findings of the study are put forward as follows:

- From the analysis of dependent variable it was found that the highest proportion (77.8 per cent) of the affected people practiced regular coping strategy, occasional practice of disaster coping strategy was found with 22.2 per cent and no one found with rare practice in the study area. From the findings it may however, be concluded that, the study area is highly vulnerable to manifold disasters happen round the year. The long term experience of disasters, the people are highly sensitive to adopt some kind of taking precautionary measure against such natural calamities which has been reflected in the study.
- Findings from survey data and qualitative tools indicate that, for want of education, training and technologies of people in the study area did not have high access towards disaster coping strategy practices. It is concluded that by improving education, training and techniques in the study area leads to high practices of coping strategies can be improved.
- Flood, river erosion, droughts, strong winds (North-wester and tornado) are the main hazards reported by the people interviewed in the visited communities at Gangachara upazila of Rangpur District, and the climate variability and change had more and strong impact on the main natural resources such as farmland, plantation and water, and on livelihood. It is concluded that to cope up the situation people had to adopt new technologies regarding disaster coping strategies.
- Lack of knowledge and skills, food shortage, inadequate organizational (GOs/NGOs) relief by government and nongovernment organizations, in time, unavailability of credit, communication and infrastructure problems, low coverage of health and sanitation, lack of coping technologies, weak weather warning in the study area and pure drinking and cooking water were found major constraints in the study area. This might be concluded that these factors are likely to play a negative role in practicing coping strategies.

4.2 Recommendations

The following recommendations can be incorporated as disaster coping strategies practice on the livelihood of the affected people, creating for climate change in the study area:

1. Practice of disasters coping strategies should be more improved by providing quality education, adequate technical support, training, and other instructional activities to make them capable to cope with disasters more efficiently.
2. Motivational programs and workshop facility on modern technologies on coping strategies and disaster management should be increased through extension provider according to needs of people for increasing their management skill to cope up with disasters. New technologies and social safety net program should be introduced to combat different types of disasters prevailed in the study area.
3. No new tools and techniques are available in the study area. Therefore, in order to increase disaster coping strategy practice in the study area new, accessible, affordable and modern tools and techniques should be incorporated in the national disaster coping strategy. At the same time, training, meetings, workshop, seminar on disaster coping strategies strengthened/promoted. This will enable all people to have access to information on coping strategies. Moreover special courses and curriculum on technical issues can be included in primary and secondary level education curriculum.
4. During disastrous period, most of the affected people spent their maroon life
without any work. The GOs and NGOs could undertake and facilitate IGAs in the disasters affected areas which will increase employment opportunity as well as more family income especially in the lean period. There is a scope of uplifting women of disaster affected areas by more involving them in IGAs, food preservation, homestead gardening, embroidery, cooking, poultry rearing etc. through training.

5. Improve weather forecast services and put in place early warning system that will make it possible for farmers and communities to get information on weather conditions in time, so that they can better plan their activities. One suggestion would be to use modern technology incorporating in the existing communitarian by introducing community radio in the study area. Govt. may undertake detailed research on the current disaster coping strategies used by communities in livelihood and improve them taking in account the future climate predictions for the study area. This can be done encouraging the nearby agricultural research station and universities to develop research in Gangachara of Rangpur district to provide findings applicable to the specific scenario.

6. To remove the constraints people have to adapt with the adverse impacts of climate change by adopting alternative livelihood options such as rearing poultry, short duration crop production, planting trees, using drought and flood tolerated varieties, cultivating mixed crops, using boiled and tube well water, setting up financial institutions and establishing modern techniques, equipments and establishing training centers to overcome the issues.

Finally the recommendations for further study in this context are as follows:

1. This study investigated the relationship of nineteen characteristics with their disaster coping strategies practices by the affected people for their livelihood due to climate change in Bangladesh. Therefore, it is recommended that further study should be conducted with other characteristics which might have an influence on climate change of disaster-affected people.

2. Disaster coping strategies practices during disaster period were studied by case study, key informant indicators, scored causal diagram and focus group discussion but other qualitative research methods could be employed to determine the specific and effective strategies suitable for coping during disaster period. There is a need for such comprehensive and exhaustive research in future.

3. Correlation analysis indicated that family size, water and sanitation condition, and risk orientation did not have any significant relationship with their disaster coping strategy practices. Verification of the findings is necessary by conducting further research.

CONSENT

As per international standard informed and written consent from the participant has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Oxfam. Disaster risk reduction, climate change and livelihood of the poor and marginalized people. A Framework for Oxfam GB Bangladesh; 2009.

2. Roy BS. Effectiveness of social safety net programs for the rural poor in vulnerable situation, PhD thesis. Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh; 2013.

3. Parry M, et al. Climate change 2007-impacts, adaptation and vulnerability: Working group II contribution to the fourth assessment report of the IPCC. Cambridge University Press. 2007;4.

4. Harmeling S, Eckstein D. Global Climate Risk Index 2013: Who suffers most from extreme weather events. Weather-related loss events in. 2011;28.

5. Auteur AKD. Climate change and its impact on Bangladesh: NCDO biedt kennis en advies over mondiaal burgerschap en internationale samenwerking en wil mensen, organisaties en bedrijven inzicht geven in hun rol in de wereld. Piet Heinkade 181H 1019 HC Amsterdam; 2012.

6. Younus MAF. Vulnerability and adaptation to climate change in Bangladesh:
Processes, assessment and effects:

7. Younus M, Bedford R, Morad M. Climate-induced flooding. An International Workshop, Oslo: Autonomous Adjustments and Human Security in Bangladesh–A Geographical Assessment. in Human Security and Climate Change; 2005b.

8. Alam, K. Risks, Lives and Livelihoods of Coastal Community, Nirapad Newsletter, Dhaka. 2005;9.

9. Khan, I.A. The social dimensions of adaptation to climate change in Bangladesh. The International Bank for Reconstruction and Development, World Bank; 2010.

© 2020 Alam et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/57146