Factors affecting agriculture in response to climate change in Bangladesh

Abul Khayer*[1,2], Fatiha Sultana Eti[1,3], Md. Mohibul Hasan[4], Md. Khairul Bashar Biplob[1], Rabiul Haq Chowdhury[1], M Anwar-Ul-Alam [5], Dr. A B M Alauddin Chowdhury[6].

[1] Department of Agriculture, Noakhali Science and Technology University
[2] Department of Soil Science, Sher-e- Bangla Agricultural University
[3] Department of Biotechnology, Sher-e- Bangla Agricultural University
[4]Department of Fisheries Management, Bangladesh Agriculture University Maymensingh-2202, Bangladesh
[5]Department of Food Technology and Nutrition Science, Noakhali Science and Technology University
[6]Department of Public Health, Daffodil International University

Author email address:

1. Abul Khayer[1,2]: zitunstu24@gmail.com
2. Fatiha Sultana Eti[1,3]: etynstu@gmail.com
3. Md. Khairul Bashar Biplob[1] : basharbiplob46@gmail.com
4. Rabiul Haq Chowdhury[1] : hridoy6396@gmail.com
5. Md. Mohibul Hasan[4] : muhithasan2015@gmail.com
6. M Anwar-Ul-Alam [5] : showrovinfs@gmail.com
7. Dr. A B M Alauddin Chowdhury[6] : dralauddin@daffodilvarsity.edu.bd

Authors Detail:

AK is a MS thesis student of Department of Soil Science, Sher-e- Bangla Agricultural University and has completed B.Sc.Ag.(Hons) from the Department of Agriculture, Noakhali Science and Technology University. Bangladesh.

FSE is a MS thesis student of Department of Biotechnology, Sher-e- Bangla Agricultural University and has completed B.Sc.Ag.(Hons) from the Department of Agriculture, Noakhali Science and Technology University, Bangladesh.

MMH is a PhD fellow in Department of Fisheries Management, Bangladesh Agriculture University Maymensingh-2202, Bangladesh

KBB has completed B.Sc.Ag.(Hons) from the Department of Agriculture, Noakhali Science and Technology University, Bangladesh.

RHC has completed B.Sc.Ag.(Hons) from the Department of Agriculture, Noakhali Science and Technology University, Bangladesh.

 doi:10.20944/preprints201904.0171.v1

MAUA is assistant professor of Department of Food Technology and Nutrition Science, Noakhali Science and Technology University

ABMAC is associate professor of Department of Public Health, Daffodil International University

Co-responding Author : Abul Khayer, Department of Agriculture, Noakhali Science and Technology University, Bangladesh. Email: zitunstu24@gmail.com

Abstract:

An opinion dependent cross sectional survey was conducted among charland peoples of Noakhali, Bangladesh with a view to identify the factors that affect green economy. Nijhumdwip Island and Tamaruddi union are highly affected by cyclone and soil salinity. Unpredictable rainfall is the most acute in Nijhumdwip. Lack of information the main problem in Nijhumdwip Island. Farmers are found less interest in integrated farming and crop diversification. Few farmers from Sonadia Union are involved in homestead gardening. Regression analysis have shown a negative relationship ($p<0.001$) between education of stockholders and decrease of crop production. On the other hand education level of stockholders is to be found positively ($p<0.05$) varied with decrease of food insecurity. So it can be said that educated farmers are more adaptive against climate change.

Key Words: Adaptation, Climate change, Green economy, Agriculture.

1. Introduction:

Green Economy is getting momentum in Bangladesh. It has a quantity of pessimistic externality on agriculture due to environmental change of the country. Bangladesh, a developing country is identified as one of the developing poor frontline country to suffer from the negative effect of the climate change [1]. Coastal stockholders are mostly dependent on agriculture for their livelihood in Bangladesh [2]. Agriculture is the main source of national economy in Bangladesh. More than 47% of total population is directly or indirectly involved with agriculture and agriculture contributes 16.5% to GDP while more than 52% of foreign exchange is earned from agriculture based commodities[3]. This sector is being destroyed by various natural and man-made activities. Climate change is one of the natural factors which are directly accountable for

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 April 2019 doi:10.20944/preprints201904.0171.v1

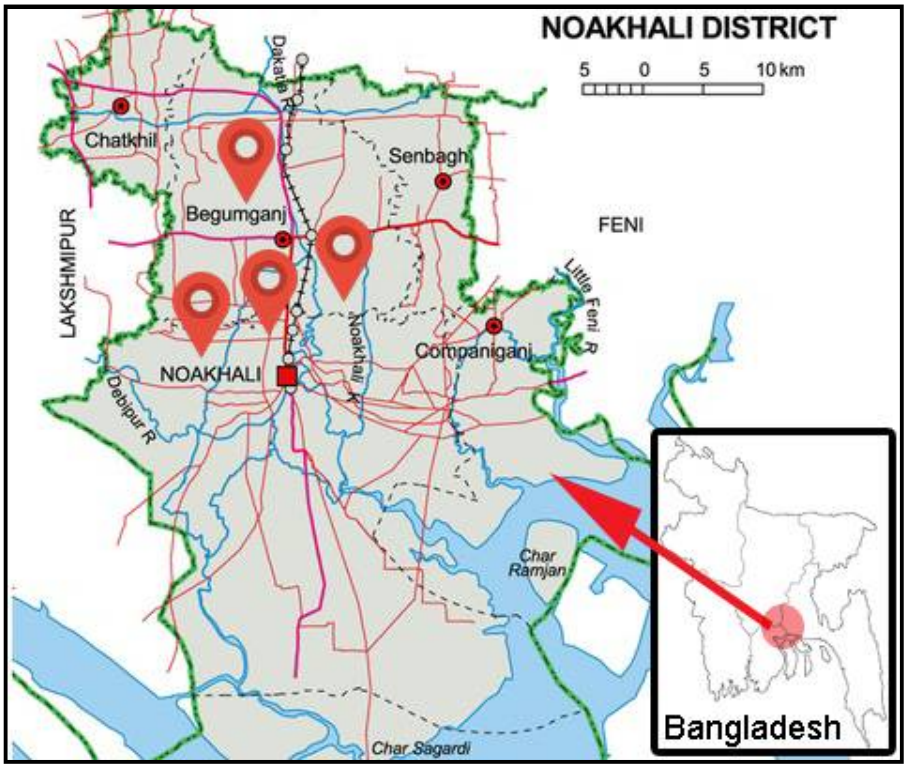
61 decreasing of agricultural production thus green economy of Bangladesh [4]. Due to climate
62 change, natural disasters are so frequent in coastal areas of Bangladesh [5]. The country also
63 familiar with many problems like over population, land degradation, food insecurity etc [6]. In
64 future, Bangladesh is likely to be one of the most vulnerable countries because of climate change
65 [7].

66 In the situation, the appropriate measures should be taken to minimize the negative effect of
67 climate change [7]. Our farmers are accustomed with traditional method of cultivation [8]. Due
68 to climatic change and technological development, new methods should be applied to gain more
69 production [8]. There are some several climatic factors like water logging, unpredicted rainfall,
70 frequent cyclones, crop diversification etc that negatively influence on green economy of the
71 country [9]. If these factors can be identified appropriately and managed properly then adaptation
72 rate can be increased which will help coastal farmers to produce more and the country to be
73 green economically strong [10]. So, proper adaptive measures are needed for Bangladesh in
74 relation to climate change.

75 ## 2. Materials and Methods:

76 **2.1 Study areas:** Study area was selected after methodological approach and design of the study,
77 sampling design, methods and procedures used for data collection, validity and reliability of the
78 study and different variables and their measurement procedures used for data analysis.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 April 2019 doi:10.20944/preprints201904.0171.v1



Hatiya upazilla (Sub-city) under Noakhali district were the study areas. Ten unions (Sub-subcity) namely Burirchar, Chanondi, Char Ishwar, Char King, Horni, Jahajmara, Nijhumdwip, Noler char, Sonadia and Tamaruddi were selected as research areas.

2.2 Experimental design:

This study employed both quantitative and qualitative research approaches in order to get a comprehensive view of the complex issues of factors influencing the green economy of Bangladesh. Qualitative methods such as focus group discussions and Key Informant Interviews (KII) were used. The quantitative survey approach was used. Thus, a mixed method research design was applied to determine the factors influencing green economy in Bangladesh.

2.3 Sampling Design:

Most of the farmers in studied areas are smallholder farmers and around 100 small farmers live in each village. The total target population was 1800, out of which 20 % population were selected from one upazilla (Sub-city) as sample. Hence, the sample size was 350.

2.4 Research Instruments:

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 April 2019 doi:10.20944/preprints201904.0171.v1

The survey instrument was developed in English. Two key informants were also interviewed for gathering their expert views about factors affecting green economy of Bangladesh.

2.5 Data collection methods:

2.5.1 Survey:

The questions were clarified whenever any respondent had difficulties in understanding. Excellent cooperation was received from the respondents and other people of the study area.

2.5.2 Focus Group Discussions (FGDs):

One session was conducted in upazilla, each group comprising of 10 participants. A semi-structured questionnaire was used to conduct FGDs. The survey instrument was refined based on the results of the FGDs. The additional information gathered from the FGDs was used for interpreting the results of survey.

2.5.3 Interviews with key informants:

The key informants were the Agriculture Extension Officer (AEO) and model farmer of the locality.

2.5.4 Processing of the Primary Data:

Collected primary data were coded and taken into SPSS (Statistical Package for Social Science) software package (16.0 Version).

2.5.5 Secondary Data:

In order to develop conceptual basis of study, the researcher collected information from different relevant sources, such as books, journals, theses, abstracts, reports and websites. The researcher also collected documents from various organizations like Upazilla Agriculture Office for this purpose.

2.6 Measurement and analysis of Variables

A dependent variable varies as the experimenter introduces, removes or varies the independent variables. The effects of climate change are considered as the dependent variable. The

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 April 2019 doi:10.20944/preprints201904.0171.v1

independent variables of the study were age, level of education, household assets, annual family income, credit received, communication exposure and agricultural training received by the farmers in the study area. Procedure for measuring independent variables has been presented below.

2.6.1 Measurement of dependent variable:

The variable was measured on the basis of different aspects of adoption. The adoption score was computed on the basis of the respondents' adoption on these aspects. The following factors (e.g. Water logging, Increase cyclones, Unpredicted rainfall, Increase of plant diseases, Crop diversification, Limited land area, Poor soil fertility, Lack of informationetc, Food security.) were selected on the basis of two FGDs and two KIIs conducted in the study area prior to develop interview schedule. A-four point rating scale was developed to measure the extent of adoption of the farmers. The extent of adoption was computed by adding all scores obtained from types of adoption practices followed by the farmers.

2.6.2 Measurement of independent variables:

Seven characteristics of the farmers were selected as independent variables of the study. The procedures followed to measure these independent variables are briefly presented here.

2.6.2.1 Age:

Age of the respondents was measured in terms of actual years from their birth to the time of interview. A score of one (1) was assigned for each year of one's age.

2.6.2.2 Level of education:

Education of respondents was measured on the basis of classes he had passed in formal educational institution.

2.7 Statistical analyses:

The coded data were put into the computer for statistical analyses. The SPSS computer program was used for analyzing the data. Various descriptive statistical measures such as range, frequency, number, %age, mean, standard deviation (SD), coefficient of variation (CV) and rank

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 April 2019 doi:10.20944/preprints201904.0171.v1

order were used for categorization and describing the variables. Pearson's product moment correlation coefficient (r) was utilized both for data evaluation and hypotheses testing.

2.8 Pearson's product moment correlation coefficient (r):

In order to test the formulated hypotheses of the study, Pearson's product Moment Correlation Co-efficient (r) was used. The formula of pearson's product moment correlation coefficient (r) is given below.

$$r_{xy} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

Where,

r_{xy} = Pearson's product moment correlation coefficient

$\bar{x}$ and $\bar{y}$ =Means of the variables x and *y,* respectively

3. Results and Discussions:

This chapter discusses with the results of the study. The findings and discussion have been displayed in this chapter according to the objectives of the study. Necessary explanation and interpretations have also been made showing possible and logical basis of the findings whenever necessary.

3.1 Climatic factors that affect green economy

3.1.1 *Water logging:* The data represented in (Table 1) indicate that 31.3% people of Horni Union (Sub-subcity) strongly supported this is an important factor for agricultural production. 30% people were not aware about water logging that means 70% people anyhow supported that water logging is harmful for their production thus green economy. Water logging significantly affects existing biodiversity which has important implication for lives and livelihoods of the people of Bangladesh [11].

 doi:10.20944/preprints201904.0171.v1

169

170 3.1.2 *Increase cyclone:* 64% people of the area strongly believed that cyclone in the
171 area increased and it affects not only agricultural production but also
172 infrastructure (Table 2). Cyclone increased most in Nijhumdwip as 89.2% of its
173 resident highly agreed with the concept. In the area no people was found that was
174 not agree with increase cyclone concept. Cyclones cause destruction due to the
175 high wind speed and also the ensuing storm surge, which causes inundation and
176 salinity intrusion into agricultural land and contaminates fresh water [12].
177 3.1.3 *Unpredicted rainfall:* 80.8% participants of studied area have given their concept
178 on this factor as the highest (Table 3). Nijhumdwip is the highest vulnerable to
179 unpredicted rainfall. Unpredicted rainfall is harmful for the seed germination,
180 pathogen infestation and pollinations in agricultural crops [13].

181

182 3.2 Increasing problems in agriculture due to climate change:
183 3.2.1 *Increase of plant diseases:* 60.1% people were moderately agreed on the concept
184 that plant diseases are increased because of climatic change in the studied areas
185 (Table 4). In Horni Union (Sub-subcity) 21.9% participants highly supported that
186 plant diseases are increased more than past due to climate change. Plant pathogen
187 evolution need to be improved to prevent the spread of new plant pathogens on
188 naive or vulnerable hosts likely weakened by climate change [14]. The pathogens
189 get favorable environment to regeneration and migration to specific location due
190 to climatic change [15].
191 3.2.2 *Practicing crop diversification:* It was somewhat rare among the participants.
192 98.5% stockholders did not follow or have idea about crop diversification to adapt
193 themselves with environmental change (Table 5). 1.5% farmers followed crop
194 diversification in the studied areas. Stockholders need to gain knowledge and
195 skills in affected areas about crop-production techniques, integrated farming
196 systems and climate resilient production techniques. Crop diversification can be
197 implemented in a variety of forms and at a variety of scales, allowing farmers to

choose a strategy that both increases resilience and provides economic benefits [15].

3.3 Problems associated with adaptation:

3.3.1 *Limited land area:* Most of the char (Islands) areas are suffering from limited land because of land degradations [16]. Among the total people of studied area 49.5% people were the worst in scarcity of land (Table 6).

3.3.2 *Poor soil fertility:* From the table 7 it is estimated that 68.4% of the people were faced soil fertility problem. Sustained fertilizer use is an important factor in increasing crop productivity, yet its use remains very low on smallholder farms in Bangladesh [17].

3.3.3 *Lack of Information:* Table 8 shows that 47.7% people of the studied area were suffered from lack of information of modern farming technology and farming methods. Nijhumdwip was the worst sufferer of this problem as Table 8 showed that 91.9% were deprived of information facilities. Information and communication technologies are the emerging field to influences positively on the agricultural sector to contribute green economy [8], [17], [18], [19].

3.4 Regression analysis: Regression analysis (Table 9) have exhibited that education of the population negatively ($p<0.001$) varied with decrease of crop production. On the other hand education level of population positively ($p>0.05$) varied with decrease of food insecurity. So, it can be concluded that educated people are more adaptive to increase of crop production and food security against the climatic change of their respective area.

4. Conclusions:

Climatic changes affect the productivity of crops in the specific areas thus decrease the green economy of that area. The present study found that better education level helps the farmers to understand about climate change, adapting new technology, cultivating high yielding varieties, new methods of cultivation etc so that they can be able to implement those to produce more and contribute to develop green economy. Furthermore, education level improves the food security condition of farmers. So, education is the top most factors which can be able to control the adaptability of farmers with climate change through limitations of

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 April 2019 doi:10.20944/preprints201904.0171.v1

227 the country. To develop the green economy condition of the country, education of the
228 farmers is badly needed.

229 ## 5. Appendices:

230 **Table 1: Water logging conditions of the studied area.**

Union (Sub-subcity)	Highly agree	Moderately agree	Somewhat agree	Not at all	Total
Burir Char	18.2%	12.1%	36.4%	33.3%	100.0%
Chanondi	12.1%	6.1%	42.4%	39.4%	100.0%
Char Ishwar	15.2%	15.2%	36.4%	33.3%	100.0%
Char King	18.2%	15.2%	36.4%	30.3%	100.0%
Horni	31.3%	18.8%	28.1%	21.9%	100.0%
Jahajmara	21.2%	15.2%	30.3%	33.3%	100.0%
Nijhum Dwip	21.6%	21.6%	29.7%	27.0%	100.0%
Noler Char	24.2%	18.2%	30.3%	27.3%	100.0%
Sonadia	24.2%	15.2%	33.3%	27.3%	100.0%
Tamaruddi	24.2%	21.2%	27.3%	27.3%	100.0%
Total	21.0%	15.9%	33.0%	30.0%	100.0%

231

232 **Table2: Increases cyclones in the coastal area of Bangladesh.**

Union (Sub-subcity)		Highly agree	Moderately agree	Somewhat agree	Total
Union	Burir Char	57.6%	33.3%	9.1%	100.0%
	Chanondi	51.5%	36.4%	12.1%	100.0%
	Char Ishwar	63.6%	30.3%	6.1%	100.0%
	Char King	60.6%	33.3%	6.1%	100.0%
	Horni	59.4%	37.5%	3.1%	100.0%
	Jahajmara	60.6%	30.3%	9.1%	100.0%
	Nijhum Dwip	89.2%	8.1%	2.7%	100.0%
	Noler Char	57.6%	36.4%	6.1%	100.0%
	Sonadia	57.6%	36.4%	6.1%	100.0%

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 April 2019 doi:10.20944/preprints201904.0171.v1

	Tamaruddi	78.8%	15.2%	6.1%	100.0%
Total		64.0%	29.4%	6.6%	100.0%

233 **Table 3: Opinion of coastal farmers on unpredicted rainfall**

Union (Sub-subcity)		Highly agree	Moderately agree	Somewhat agree	Total
Union	Burir Char	78.8%	15.2%	6.1%	100.0%
	Chanondi	78.8%	18.2%	3.0%	100.0%
	Char Ishwar	75.8%	18.2%	6.1%	100.0%
	Char King	75.8%	18.2%	6.1%	100.0%
	Horni	78.1%	15.6%	6.3%	100.0%
	Jahajmara	81.8%	15.2%	3.0%	100.0%
	Nijhum Dwip	91.9%	8.1%		100.0%
	Noler Char	78.8%	18.2%	3.0%	100.0%
	Sonadia	75.8%	18.2%	6.1%	100.0%
	Tamaruddi	90.9%	9.1%		100.0%
Total		80.8%	15.3%	3.9%	100.0%

234 **Table 4: Opinion of coastal farmers on increase of plant disease**

Union (Sub-subcity)		Highly agree	Moderately agree	Somewhat agree	Total
Union	Burir Char	12.1%	57.6%	30.3%	100.0%
	Chanondi	9.1%	51.5%	39.4%	100.0%
	Char Ishwar	12.1%	51.5%	36.4%	100.0%
	Char King	15.2%	57.6%	27.3%	100.0%
	Horni	21.9%	62.5%	15.6%	100.0%
	Jahajmara	15.2%	63.6%	21.2%	100.0%
	Nijhum Dwip	10.8%	64.9%	24.3%	100.0%
	Noler Char	18.2%	60.6%	21.2%	100.0%
	Sonadia	18.2%	63.6%	18.2%	100.0%
	Tamaruddi	12.1%	66.7%	21.2%	100.0%
Total		14.4%	60.1%	25.5%	100.0%

235 **Table 5: Farmers opinion on practicing crop diversification**

Union (Sub-subcity)		Frequently	Not at all	Total
Union	Burir Char	3.0%	97.0%	100.0%
	Chanondi	6.1%	93.9%	100.0%
	Char Ishwar		100.0%	100.0%

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 April 2019 doi:10.20944/preprints201904.0171.v1

	Char King	3.0%	97.0%	100.0%
	Horni		100.0%	100.0%
	Jahajmara		100.0%	100.0%
	Nijhum Dwip	2.7%	97.3%	100.0%
	Noler Char		100.0%	100.0%
	Sonadia		100.0%	100.0%
	Tamaruddi		100.0%	100.0%
Total		1.5%	98.5%	100.0%

Table 6: Stockholders views on limited land area

Union (Sub-subcity)		High	Medium	Low	Not at all	Total
Union	Burir Char	36.4%	27.3%	18.2%	18.2%	100.0%
	Chanondi	21.2%	33.3%	18.2%	27.3%	100.0%
	Char Ishwar	42.4%	27.3%	15.2%	15.2%	100.0%
	Char King	42.4%	27.3%	15.2%	15.2%	100.0%
	Horni	59.4%	25.0%	9.4%	6.3%	100.0%
	Jahajmara	48.5%	24.2%	15.2%	12.1%	100.0%
	Nijhum Dwip	73.0%	27.0%			100.0%
	Noler Char	48.5%	27.3%	15.2%	9.1%	100.0%
	Sonadia	63.6%	24.2%	9.1%	3.0%	100.0%
	Tamaruddi	57.6%	24.2%	12.1%	6.1%	100.0%
Total		49.5%	26.7%	12.6%	11.1%	100.0%

Table 7: Farmers views on poor soil fertility

Union (Sub-subcity)		High	Medium	Low	Total
Union	Burir Char	78.8%	15.2%	6.1%	100.0%
	Chanondi	72.7%	15.2%	12.1%	100.0%
	Char Ishwar	75.8%	18.2%	6.1%	100.0%
	Char King	75.8%	18.2%	6.1%	100.0%
	Horni	81.3%	15.6%	3.1%	100.0%

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 15 April 2019 doi:10.20944/preprints201904.0171.v1

	Jahajmara	69.7%	24.2%	6.1%	100.0%
	Nijhum Dwip	37.8%	48.6%	13.5%	100.0%
	Noler Char	81.8%	12.1%	6.1%	100.0%
	Sonadia	59.4%	34.4%	6.3%	100.0%
	Tamaruddi	54.5%	39.4%	6.1%	100.0%
Total		68.4%	24.4%	7.2%	100.0%

Table 8: Stockholders opinion on lack of information

Union (Sub-subcity)		High	Medium	Low	Not at all	Total
Union	Burir Char	36.4%	42.4%	12.1%	9.1%	100.0%
	Chanondi	30.3%	54.5%	9.1%	6.1%	100.0%
	Char Ishwar	33.3%	39.4%	18.2%	9.1%	100.0%
	Char King	33.3%	42.4%	18.2%	6.1%	100.0%
	Horni	37.5%	28.1%	18.8%	15.6%	100.0%
	Jahajmara	48.5%	30.3%	9.1%	12.1%	100.0%
	Nijhum Dwip	91.9%	5.4%		2.7%	100.0%
	Noler Char	33.3%	39.4%	15.2%	12.1%	100.0%
	Sonadia	51.5%	27.3%	9.1%	12.1%	100.0%
	Tamaruddi	75.8%	21.2%		3.0%	100.0%
Total		47.7%	32.7%	10.8%	8.7%	100.0%

Table 9: Regression analysis:

Variables	Unstandardized coefficient		standardized coefficient	t	Sig.
	B	Std Error	Beta		
Education	3.966	0.688		5.766	0.000

 doi:10.20944/preprints201904.0171.v1

Decrease of crop yield	-0.816	0.224	-0.217	-3.637	0.000
Decrease of food Insecurity	0.617	0.288	0.128	2.141	0.033

Acknowledgements: The research works was not under any projects. It was structured by authors and run by authors themselves.

Author contributions: All of the authors were contributed equally.

Conflicts of interest: There is no conflict between the authors to submit the paper.

6. References:

1. Ali, M. M.; Present status and future of green economy in Bangladesh: Some statistical analysis. 2017. Asian Business Research Conferences, Dhaka, Bangladesh.
2. Ahmed, M. T.; Bhandari, H.; Cesa, B.; Diversification of rural livelihood in Bangladesh. 2015. J. of agricultural economics and rural development. Vol. 2(2), pp 32-38.
3. BBS.; Statistical year book of Bangladesh. 2016. Bangladesh Bureau of Statistics, Ministry of Planning, Government of the Republic of Bangladesh, Dhaka, Bangladesh.
4. Mutunga, E. J.; Charles, N. K.; Muendo, P.; Factors influencing smallholder farmer's adaptation to climate variability in Kitui country, Kenya. 2018. Int. J. Environmental Science Nat. Res. 8(5).
5. NAPA.; Yearly Report of Ministry of Environment and Forest. 2005. Government of the Peoples Republic of Bangladesh.
6. Leaky.; Climate change and agriculture. Academic press. 2017. California. 34(1).
7. Kibria, G.; Climatic change impact action and programs – adaptation and mitigation from a most vulnerable country, Bangladesh. 2015. Science and Technology Article. 38(1).
8. Khayer, A.; Mian, M. S.; Hasan, M. M.; Habib, M. A.; Effects on the Growth Performance and Survival Rate of *Pangasius hypophthalamus* in Different Feeding Rate of Complete Diet. 2019. *Middle East Journal of Scientific Research*. DOI-10.5829/idosi.mejsr.2019.39.54. Vol 27 (1). 39-54.
9. Khayer, A.; Ety, F. S.; Anjum, K. I.; Ghosh, S.; Deviation in nutritional quality and physical parameters of locally grown mangoes from Himsagor. 2018. *South Asian Journal of Population and Health*. 11 (1 & 2): 67-84.
10. Billah, M. M.; Sarker, M. A.; Miah, M. A. M.; Kabir, K.H.; Adaptation of farming practices by the smallholder farmers in response to climate change. 2015. J. of Agricultural Extension and Rural Development. 7(2), 33-40.
11. Masud, M. M.; Moni, N. N.; Azad, A. K.; Impacts of water logging on biodiversity: study on southern region of Bangladesh. 2014. IOSR J. of Env. Science, Toxicology and Food Technology. Vol. 8(9). Ver.1. PP 20-27.
12. Wolf, J.; Chowdhury, G. A.; Bricheno, L. M.; Assessing the impacts of cyclones in the coastal zone of Bangladesh. 2014. Conference, EGU, Vienna.

13. Hee, D.; Baskin, J. M.; Baskin, C.; Heang, Z. Y.; Ecological role of physical dormancy in seed of *Oxytropis racemosa* in a semiarid sand land with unpredictable rainfall. 2018. J. of plant ecology. Vol. 11(4): 542-552. Doi: 10.1093/jpe/rtx063.
14. Santini, A.; Ghehardini, L.; Plant pathogen evolution and climatic change. 2015. J. of veterinary science, nutrition and natural resources. Vol. 35(10).
15. Lakhran, H.; Kumar, S.; Bajiza, R.; Crop diversification: an option for climate change resilience. 2017. Trends in biosciences. Vol. 10(2): 516-518.
16. Mohamed, E. S.; Belal, A.; Ali, R. R.; Land degradation. 2019. The soil of Egypt. DOI:10.1007/978/-3-319-95516-2-9.
17. Ochela, D.; Asten, P.J.A.; The land that feed us by sun and fertility. 2016. Conference on natural fertilizers policy.Doi:10.13140/ RG.2.1.4017.2409.
18. Haider, B. A.B.M.; Hossain, M.S.; Khayer, A**.;** Eti, F.S**.;** Islam, M.S.; Effect of information communication technologies (ICTs) and it's constrains with adaptations through agricultural sector of southern Bangladesh. 2019. *Middle East Journal of Scientific Research*. DOI- 10.5829/idosi.mejsr.2019.28.38. Vol 27 (1). 28-38.
19. Kamal, A.H.M.; Ghosh, S.; Hossain, M. S.; Khayer, A.; Effects of different postharvest treatments on ripening and quality of banana (*musa sapientum*). 2019. International Journal of Research and Review.DOI-10.4444/ijrr.1002/988; 6(2):303-313.