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Agronomic Technologies of Rice Hydrology and Climate Change Adaptations in Bangladesh

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Abstract

Studies were conducted on the 'agronomic technologies of rice hydrology and climate change adaptations in Bangladesh' covering southern regions of Bangladesh. The major objectives were to identify the elements of mitigating climate change disasters relating AEZ productivity and to identify the agribusiness factors needed for recommended crop diversification programs. The results found on the natural disasters indicating climate change: The lowest response was for Khulna Dacope followed by Shariatpur. The results on the Climate change driven disasters effects % response in favor of the vulnerability factors show that the response was for increasing temperature. The lowest response was for increasing disaster sustainability of crop. All these indicate that the effects were determined by cropping intensity and population awareness. It was recommended that more specific database should be developed giving importance to rainfall intensity and salinity-sodicity alkalinity proportions. The businessman, NGOs and teachers may be preferred as community climate player interactions and population awareness. It was concluded that the effect of climate change on agronomic adaptability of dynamic technologies are becoming very sharp at least for the southern regions of Bangladesh being vulnerable to disasters and AEZ based agribusiness sustainability.

Keywords: *Climate Change; Adaption Strategies; Farmers; Rice Production; Bangladesh*

INTRODUCTION

Agrarian communities are facing much more vulnerability across the globe (Shaw and Krishnamurthy 2012). Anthropogenic stress in terms of over exploitation of coral reef and fisheries and land based activities (i.e., agriculture intensification) already increased stress in natural system of the coasts. Climate change adds to lower recovery or resilience of the natural system for human well-being and livelihoods (Adger et al. 2005; Lebel 2012), but these have long-term impacts on social and economic functions (Nicholls et al. 2007). The tropical cyclone of 2007 caused loss of valuable mangroves, social and physical resources and livelihood bases that post-disaster recovery has not yet been possible in Bangladesh (Mallick et al. 2011). With changing frequency of cyclonic wind and storm surges and inundation coastal agriculture and domestic fisheries and open fishing have been highly affected which are significant livelihoods sources to majority coastal people.

Salinity level is slowly increasing over the time and causing serious threats to traditional agriculture farming and mangrove ecosystems (Moniruzzaman 2012). The adaptation strategies in rice production to abiotic stresses that aggravate under climate change: heat (high temperature and humidity), drought, salinity, and submergence. Higher temperatures can adversely affect rice yields through two principal pathways, namely (i) high maximum temperatures that cause in combination with high humidity spikelet sterility and

adversely affect grain quality and (ii) increased night time temperatures that may reduce assimilate accumulation.

OBJECTIVES

In this context the present piece of research has been formulated with the following objectives:

1. To identify the elements of mitigating climate change disasters
2. To find out risk factors relating to Agro-Ecological Zones of diversified cropping pattern and AEZ productivity
3. To identify the agribusiness factors needed for recommended crop diversification programs

The climate based physiographic features of the saline study area

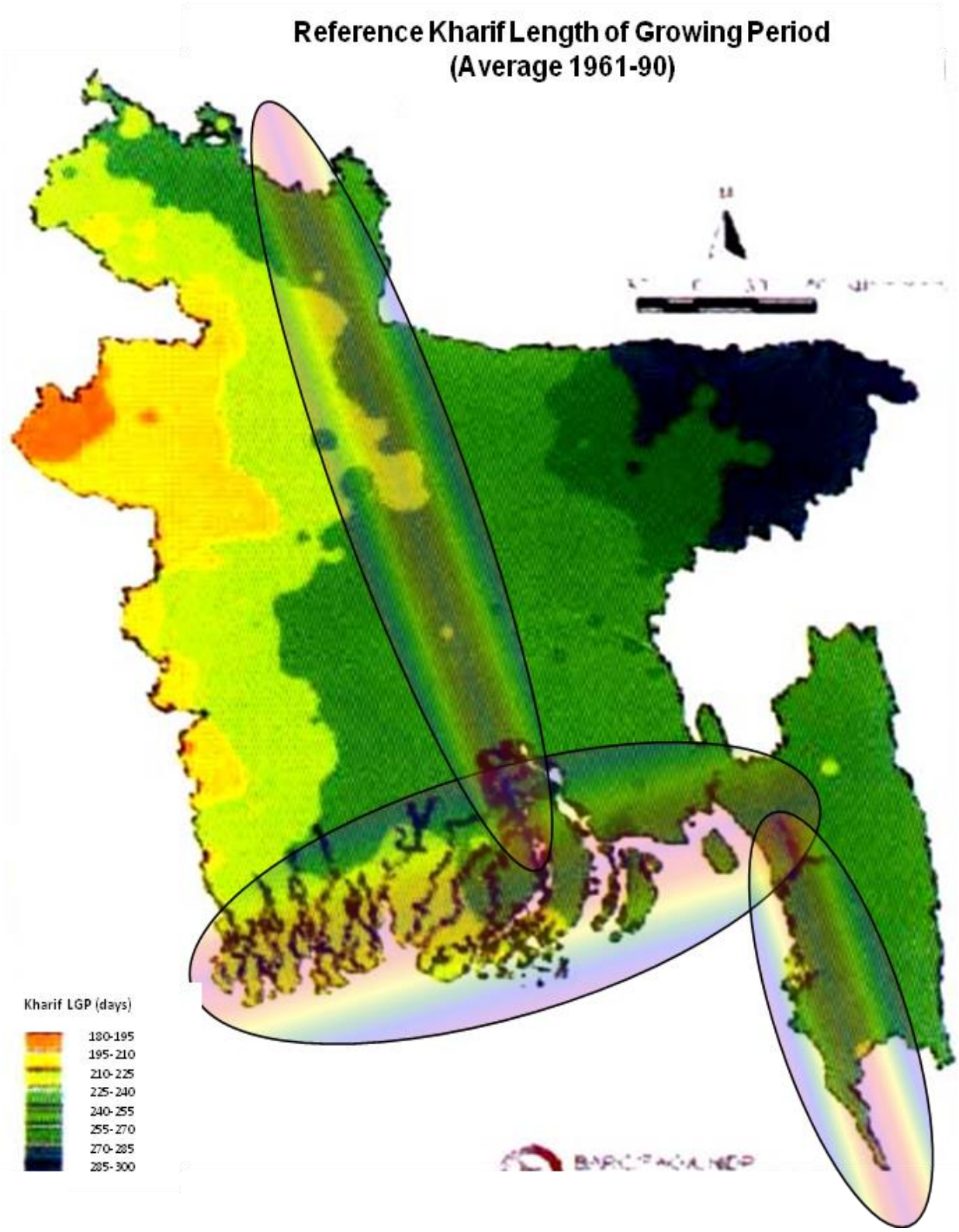
Barisal AEZ 13

Patuakhali north highland and medium highland AEZ 13

Barguna upper

Barguna lower

AEZ parameter Reference thermal zones



METHODOLOGY

This research study is descriptive-cum-empirical as well as suggestive in nature. The study was field investigation survey type.

Variables

A. Site Variables

- Barisal
- Khulna
- Noakahli
- Chittagong

B. Respondent Variables

- Govt. Officers
- Teachers
- Elites
- Farmers

C. Disaster Events

- Flood
- Cyclone
- Storms
- Droughts

D. Age Group

- 65+ year
- 40-65 years
- 25-40 years

Sample Population: 100 from each Professional group.

Data Analysis

Collected data were tabulated and analyzed by using computer program SPSS & Microsoft Excel.

RESULTS AND DISCUSSION

The results obtained from the present studies are presented and discussed here. The results are given in the broad and detailed Tables 1 to 3 and Fig. 1 to 8. The Tables and Figures are arranged as per objectives and questionnaire guidelines.

Climate change indicators for natural disasters

The results given in the Table 1 and Figs 1 to 2 on the natural disasters indicating climate change: % response in favor of the factors shows the presence of disaster events as per Agro-Ecological Zones and environmental situations. The results show the response on the problem issue is 50% as grand mean indicating low national awareness on climate change parameters. As per mean results the highest response was for AEZ 12 Madaripur Kalkini dominated by erratic rainfall. That was followed by Bhanga area. The lowest response was for Khulna Dacope as 31% followed by 37% for Goshairhat of Shariatpur. It indicates that the effects were determined by cropping intensity and population awareness.

Climate change indicators for natural disasters

Table 1: Natural disasters indicating climate change: % response in favor of the factors

AEZ areas and Environ Situations	Coastal Cyclone	Flash Flood	Storm surge	Water logging	Drought	Erratic rainfall	River bank erosion	Salinity intrusion	Sea level raise	Long high tide	Mean
AEZ 12 Faridpur Charbodrason	57	68	49	72	68	65	17	21	22	24	46
AEZ 12 FaridpurBhanga	79	72	68	65	81	77	72	49	72	68	**70**
AEZ 13 Khulna Botiaghata	61	81	21	22	24	65	32	24	49	65	44
AEZ 13 Khulna Dacope	35	58	31	22	24	54	24	24	25	21	31
AEZ 18 NoakhaliSuborna char	55	67	79	72	49	72	21	22	24	21	48
AEZ 18 Noakhali Companyganj	39	65	64	29	65	66	21	12	24	65	45
AEZ 14 Chittagong - Mirersarai	24	72	72	68	65	81	21	22	24	24	47
AEZ 14 Chittagong -anwara	43	75	68	25	64	83	18	19	74	53	52
AEZ 12 Madaripur Sodor	22	59	72	68	65	63	19	22	49	72	51
AEZ 12 Madaripur Kalkini	68	83	62	68	65	83	74	78	65	86	**73**
AEZ 13 Shariatpur Sodor	66	64	37	68	26	60	45	36	71	65	53
AEZ 13 Shariatpur Gosairhat	65	76	21	22	24	65	34	21	22	24	37
Mean	51	70	54	50	52	70	33	29	43	49	50

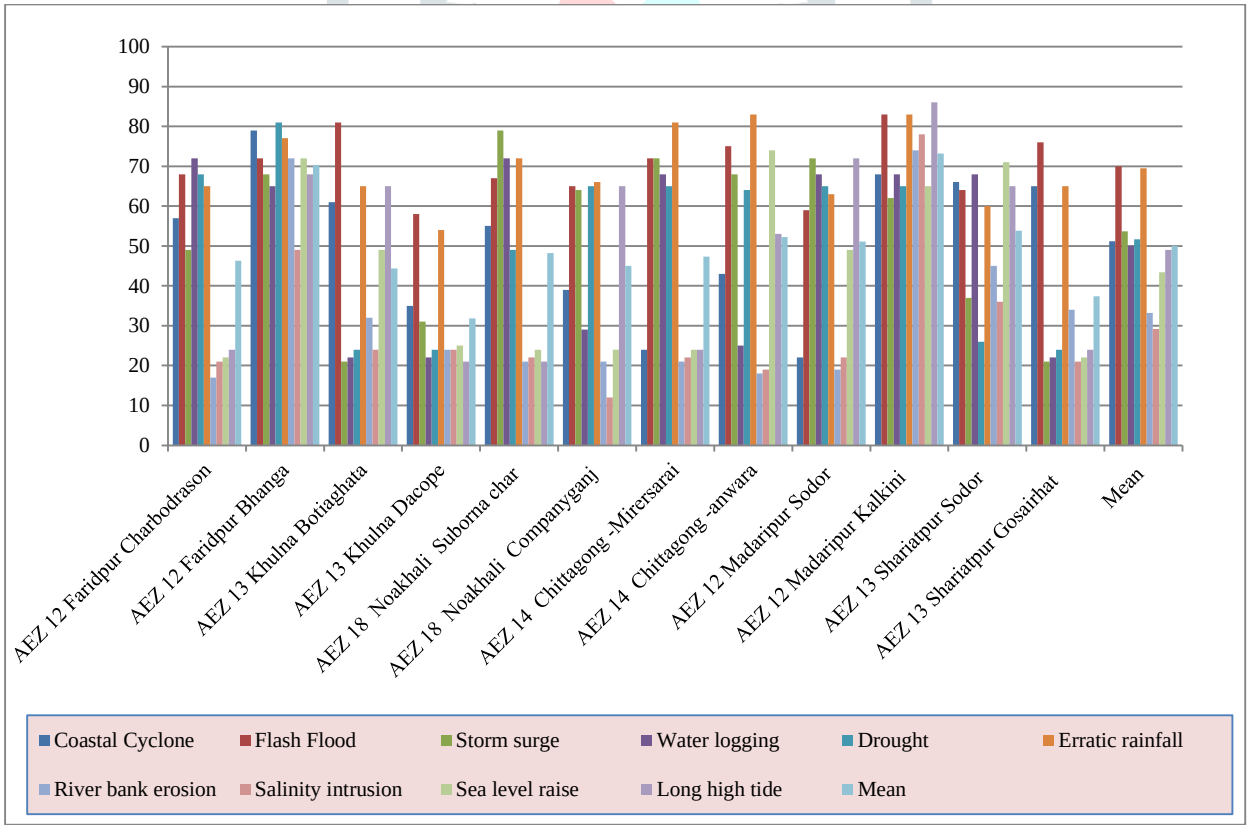


Fig. 1: Column chart showing the natural disasters indicating climate change as per Agro-Ecological Zones

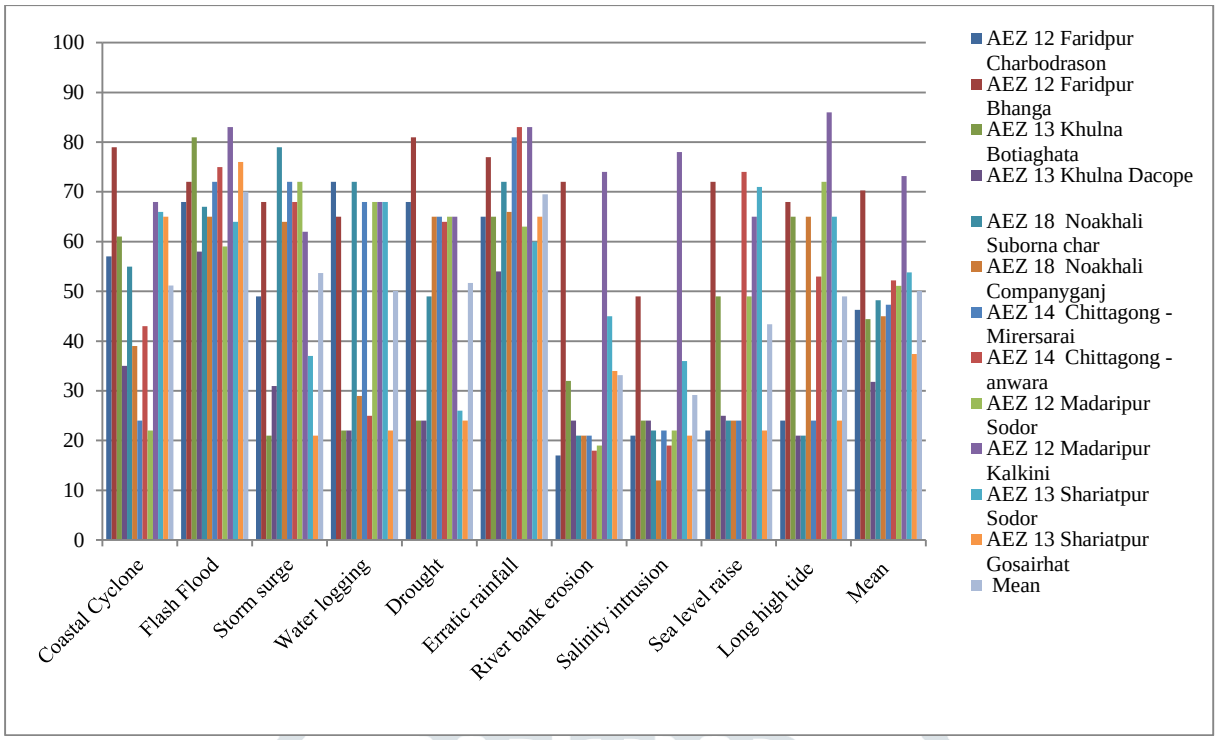


Fig. 2: Column chart showing the natural disasters indicating climate change as per disaster events

Climate Change Driven Disasters Effects

The results given in the Table 2 and Figs. 3 to 6 on the Climate change driven disasters effects % response in favor of the vulnerability factors. The results show the response on the problem issue is only 49% as grand mean indicating low national awareness on climate change effects was not so distinctly visible to the common people. As per mean results the highest response was for increasing temperature as 74% dominated by higher range. It followed by negative food security as 72% response. The lowest response was for increasing disaster sustainability of crop as 26% followed by 38% for river water crisis for irrigation as LLP was reducing. It indicates that the effects were determined by cropping intensity and population awareness. The highest response was for erratic rainfall dominated as 71%, salinity intrusion as no scientific database was not available and lowest response was for increasing disaster sustainability of crop as 26% followed by 38% for river water crisis for irrigation. It indicates that the effects were determined by cropping intensity and population awareness.

Table 2: Climate change driven disasters effects: % response in favor of the vulnerability factors

Vulnerability factors	Coastal Cyclone	Flash Flood	Storm surge	Water logging	Drought	Erratic rainfall	River bank erosion	Salinity intrusion	Sea level raise	Long high tide	Mean
Decreasing crop yield	57	68	42	72	63	75	13	21	22	24	45
Food security of cereals negative	79	72	68	65	81	77	72	68	72	68	**72**
Leaching plant nutrients	61	81	21	22	24	65	32	14	49	65	43
River water crisis irrigation	24	72	22	28	65	81	21	22	24	24	**38**
Submergence of crops	43	33	18	25	64	83	18	19	74	53	43
Increasing pests	22	59	72	68	25	63	19	22	37	72	45
Soil land compaction	12	53	67	72	35	61	46	11	71	57	48
Increasing temperature	68	83	72	68	65	83	74	78	65	86	**74**
Hot wave	66	64	37	68	26	60	45	16	71	65	51
Increasing disaster sustainability of crops	25	26	21	22	24	65	19	21	22	24	**26**

Vulnerability factors	Coastal Cyclone	Flash Flood	Storm surge	Water logging	Drought	Erratic rainfall	River bank erosion	Salinity intrusion	Sea level raise	Long high tide	Mean
Mean	45	61	44	51	47	71	35	29	50	53	49

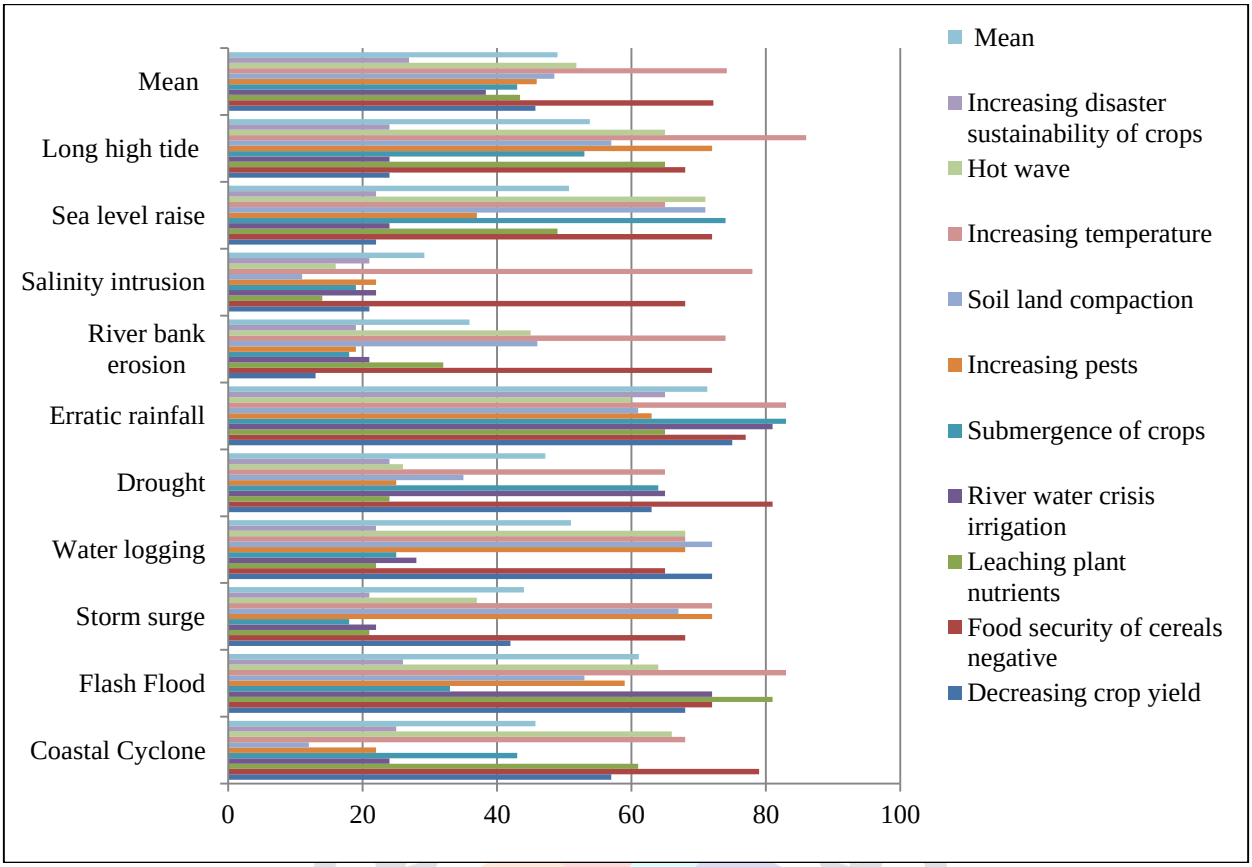


Fig. 3: Bar chart showing the natural disasters indicating climate change as per disaster effects

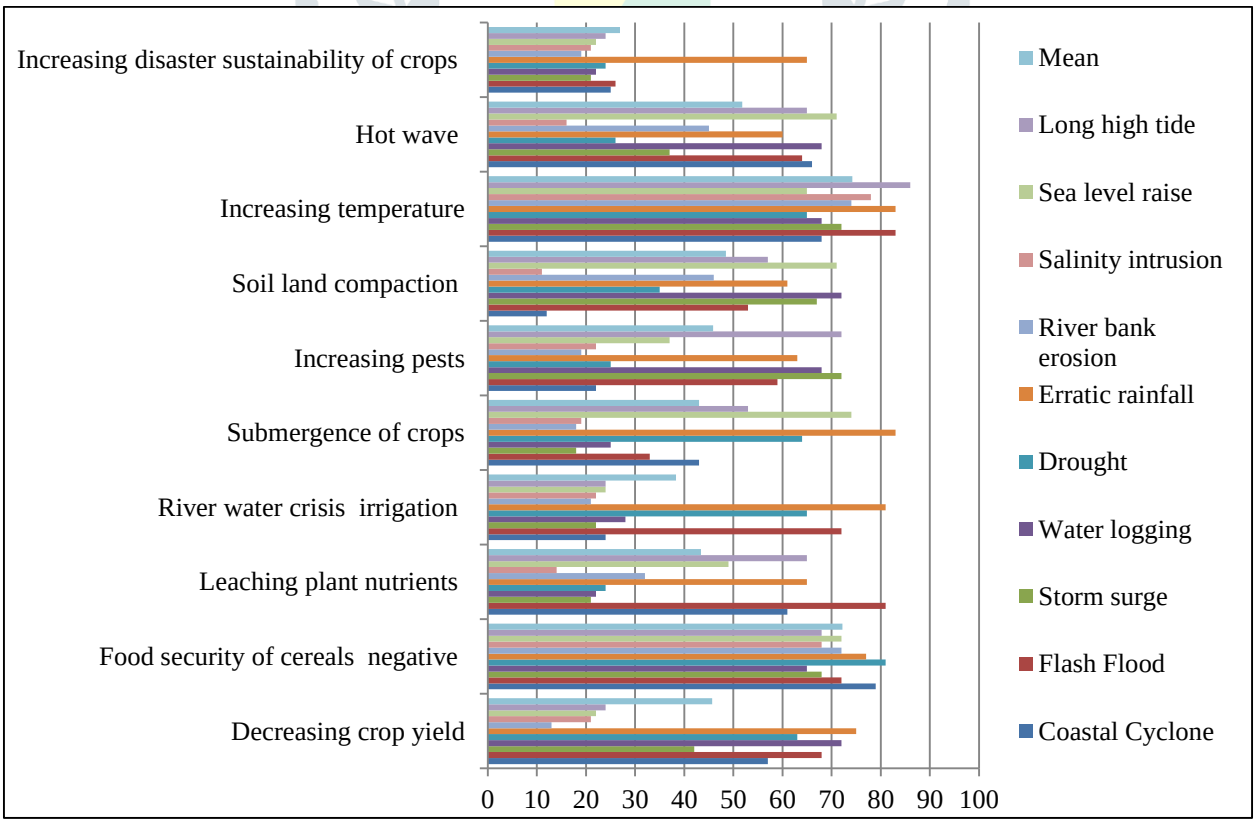


Fig. 4: Bar chart showing the natural disasters indicating climate change as per disaster events including the mean values

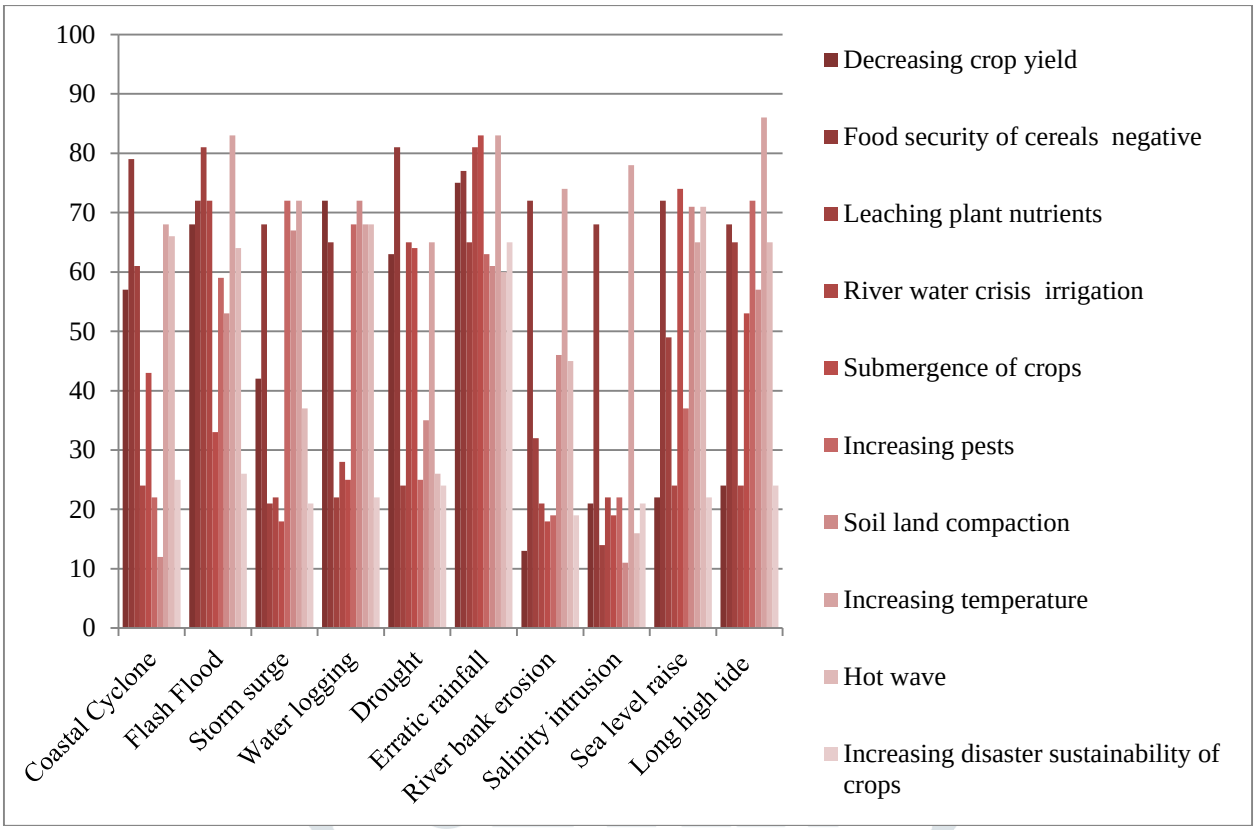


Fig. 5: Column chart showing the natural disasters indicating climate change as per disaster effects

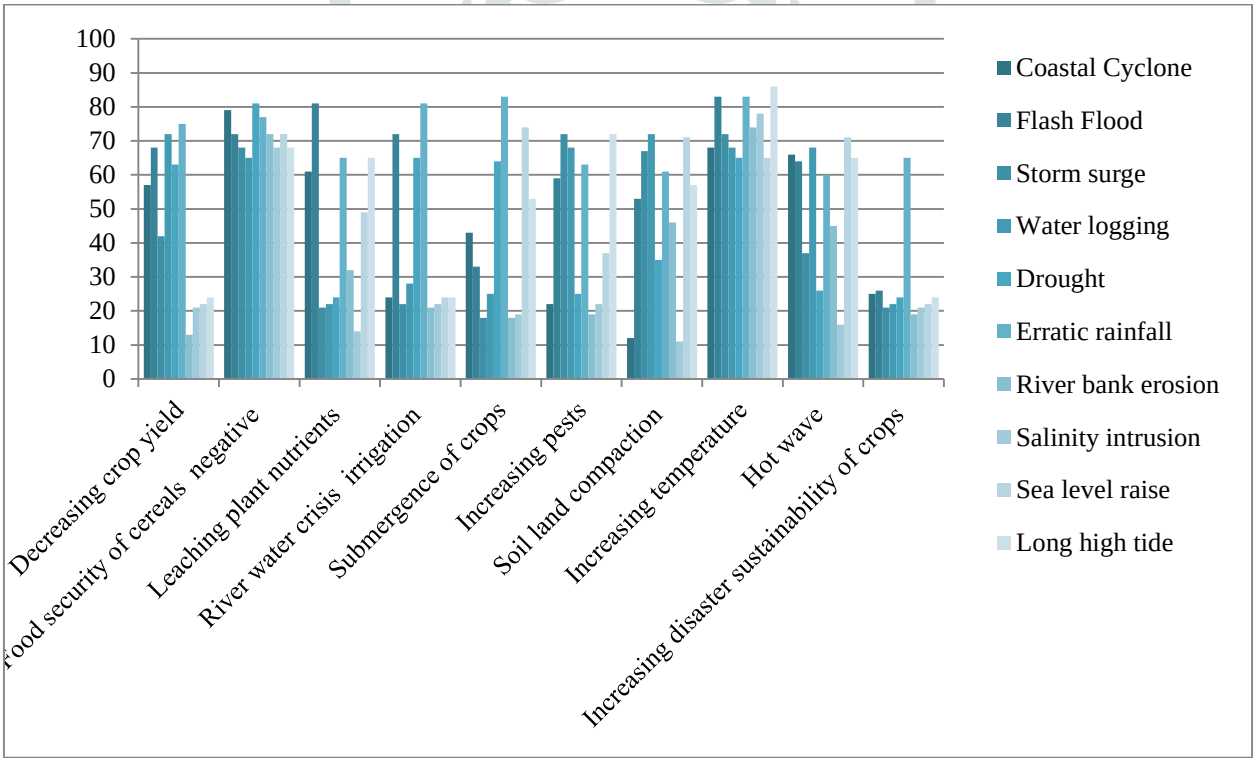


Fig. 6: Column chart showing the natural disasters indicating climate change as per disasters

Natural disasters and climate change effects as per respondents

The results given in the Table 3 and Figs 7 to 8 on the Climate change driven disasters effects: % response in favor of the vulnerability factors. The results show the response on the problem issue is only 48% as grand mean indicating very low national awareness on climate change effects; was not visible to the community. As per mean results the highest response was for food crop reduction as 69% dominated by seasonal higher price of rice. It followed by reduced farming profitability as 60% response. The lowest response was for environmental degradation as 35% followed by 36% for increasing fertilizer costs due to government subsidies. It indicates that the effects were determined by food cropping intensity and sectional population awareness. The highest response was by businessman and NGOs as 72% as they deal and face the community and the market. Lowest response was by teachers as 25% due to their higher salary and

detachment from the system. It indicates that the effects were determined by community player interactions and population awareness.

Table 3: Natural disasters and climate change effects: % response in favor of the factors as per respondents

	Officers	NGOs	Teachers	Public Represent	Focus Elites	Business man	Farmers	Mean
Production lost	46	58	13	70	60	62	12	46
Food crop reduced	76	72	43	65	71	82	72	69
Species and varieties changed	55	67	11	72	41	72	21	48
Field crops reduced	19	65	16	29	65	62	20	39
Food grain quality reduced	24	72	28	68	65	80	23	51
Environment degraded	13	77	16	25	14	83	18	35
Fertilizer cost increased	22	79	24	27	19	63	19	36
Farming profitability decreased	67	83	36	62	13	82	74	60
Crop diversification reduced	26	64	29	63	26	72	45	46
Cultivable area reduced	80	76	37	22	24	65	34	48
Mean	43	72	25	50	40	72	34	48

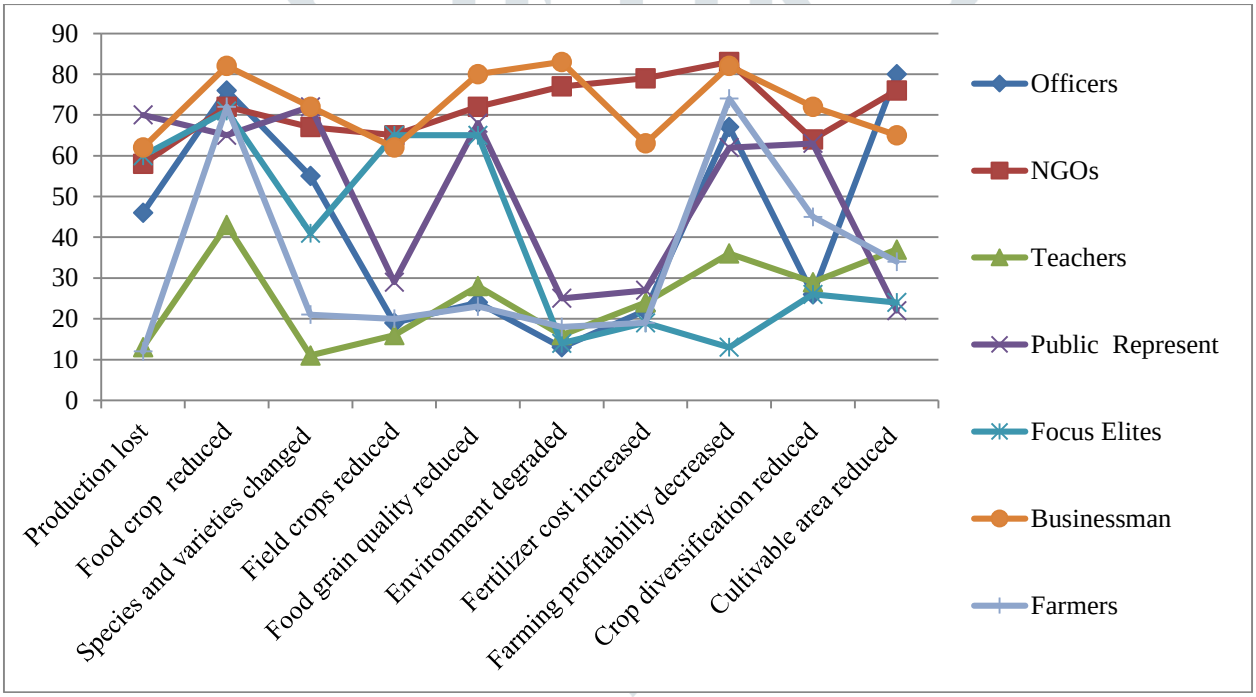


Fig. 7: Line graph showing the natural disasters indicating climate change as per community players

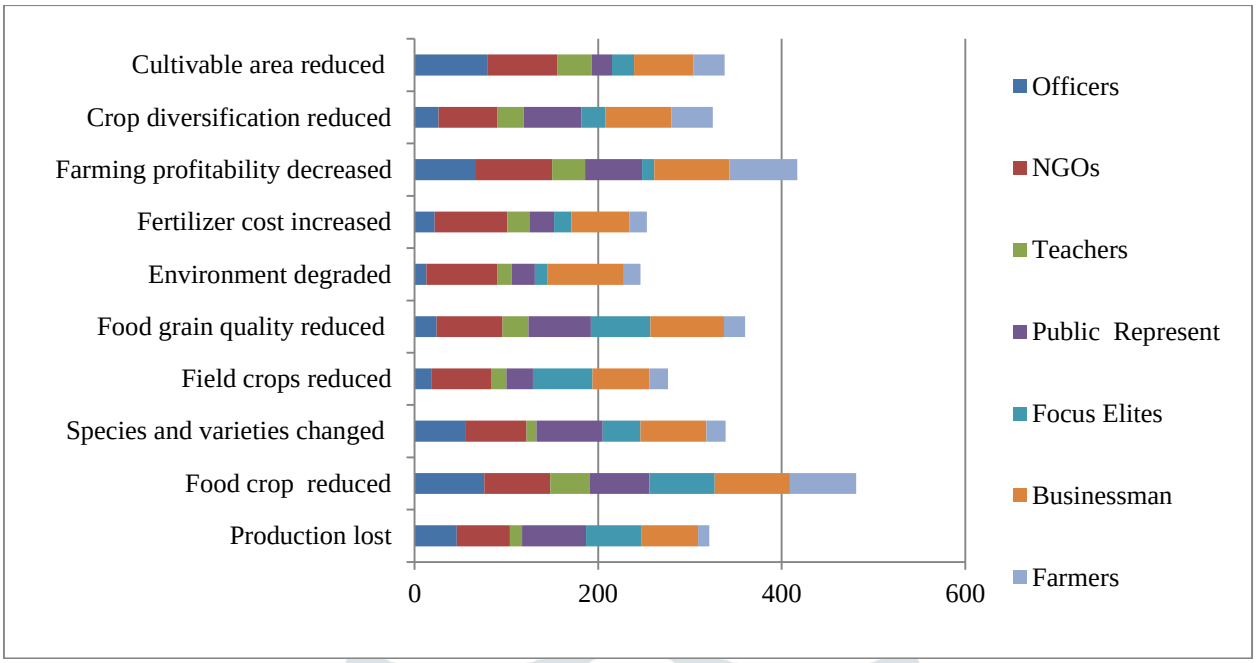


Fig. 8: Cumulative Bar chart showing the natural disasters effects as scored by the respondents

SUMMARY

The results found on the natural disasters indicating climate change: % response in favour of Agro-Ecological Zones shows the response on the problem issue is 50% as grand mean indicating low national awareness on climate change parameters. The highest response was for AEZ 12 dominated by erratic rainfall. That was followed by Bhanga area. The lowest response was for Khulna Dacope followed by Shariatpur. It indicates that the effects were determined by cropping intensity and population awareness.

The results on the Climate change driven disasters effects % response in favor of the vulnerability factors show that the response on the problem issue is only 49% indicating low national awareness. Highest response was for increasing temperature. The lowest response was for increasing disaster sustainability of crop. It indicates that the effects were determined by cropping intensity and population awareness.

RECOMMENDATIONS

1. More specific database should be developed giving importance to rainfall intensity and salinity-sodicity alkalinity proportions.

2. Disaster sustainability of crop modeling required for the purpose.

3. Awareness creation for climate change and its effect on agronomic performance of crops are urgently felt by the stakeholders.

4. The research findings indicate that the effects were determined by food cropping intensity and sectional population awareness.

5. The businessman, NGOs and teachers may be preferred as community climate player interactions and population awareness.

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