Battling the Twin Crises of the 21st Century & Stories of Community Resistance in Asia-Pacific: The Case of Bangladesh

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Executive Summary

Mapping the Battling Stories of Community Resistance against the Twin Crises (Food crisis & climate Crisis) of the 21st Century in Bangladesh

Over the years, farmers and communities have been bombarded with the corporate propaganda that agriculture can only be developed and food security be ensured by following the corporate model of agricultural development, relying on markets, synthetic agrochemicals and biotechnology. The corporate agriculture feeds only 30% of the world's population but virtually controls the total global trade and investment in food and agriculture. The global food crisis is real, and so is the climate crisis. Experts have already warned that the costs of carbon reduction would be four times greater than today due to any delaying action on climate crisis and it would boost global temperatures by at least 3.5^0C by 2100. Nevertheless, like the responsibility for the food crisis, the imperialist states, TNCs and financial institutions are dodging the responsibility for the climate crisis. Food crops have become so-called soft commodities due to trade liberalization policies. Commitments to agricultural aid by both donor governments and multilateral agencies bottomed out at 3.4 per cent of total aid. There is the need therefore to counter the corporate agenda with researches on the ground that expose the real causes of food and climate crises and will reject the notion that the crises can still be solved within the same bankrupt system, techno-fixes that muddle the issue and only strengthen corporate control, and the neoliberal approaches to the crises. The present research aims to debunk the claims of TNCs, multilateral organizations and international financial institutions that national food self-sufficiency does not make economic sense and that the vulnerable countries will have to rely on the markets and globalization to meet their development needs.

The research approach was mainly focused on developing unique country case that truly represents the Bangladesh context. Multidisciplinary Team-based Participatory Action Research with the chosen communities' has guided the research process. The analysis framework has followed the triangulation of data from different sources by a multi-disciplinary research team. In total, the study managed to involve 346 participants, including 108 participants in Quantitative Survey and 238 participants in qualitative aspects of the study. For qualitative information collection, the study conducted six (6) Focus Group Discussions involving 72 participants, 6 Key Informant participants were interviewed. In total 03 Regional Impact Workshops involved 60 regional (Sub-national) experts to identify Climate Change impact on Food self-sufficiency in Bangladesh. The study has covered three communities who are living in coastal (Barisal District), riverside (Shirajganj District) & hilly areas (Khagrachari District) of Bangladesh for collecting data on food production systems and techniques as well as climate change impact & vulnerability to document case studies that truly represents majority of the Bangladesh. The data analysis further divided coastal (Barisal District) and riverside (Shirajganj District) areas into Plainland (geographic entity) & Bengali (Ethnic identity of the respondents) and hilly areas (Khagrachari District) into Highland (geographic entity) & Indigenous (Ethnic identity of the respondents).

Majority of the community members involved with this research are middle-aged (average age is 45 years) poor farmers and have been living in their current area for more than three decades. Half of the farmers (49.1%) are functionally illiterate. Nuclear family (Husband, wife, child) dominates the family type. More than one-third (36.1%) of them are living in straw/leaf/bamboo/mud built houses which are highly vulnerable for any disaster with their 5-members family. Nearly half of their neighbors are poor (46.2%). The average family size of the respondents households is five, including two children and three adult family members. Nearly one-third Bengali households in the Plainland reported that at least one of their family members is having disability

(differently able person). In terms of religious identity, except a few Hindus (5.6%), rest of the respondents in the Plainland areas are Muslims (94.4%). However, in highland areas all the indigenous people reported Sanatan as their religious identity.

In Bangladesh poor households face highest food crisis in the months of June (61.1%), July (59.3%) and March (55.6%). Nearly one-fourth (24.1%) of the poor households in Bangladesh are always living with food insecurity and two-thirds (65.7%) households are occasionally living with food insecurity. More than one-third of the poor households have reported that they had reduced their food intake from February to July in the last 12 months.

The poor households living with chronic food insecurity are almost two (1.7) times higher in Bengali households of the Plainland (27.8%) than Indigenous & Highland households (16.7%). Indigenous Highland households are living with continuous sever food crisis for half of the year (from February to July). Particularly in May, June & July they live in famine situation. Well-structured food distribution mechanism is very poor in Plainland and virtually absent in Highland areas.

The study recognized that any natural disaster has a profound influence on the food consumption pattern of the poor households in Bangladesh. Nearly two-third households (63.9%) in Bangladesh shift from their normal food and consume dry food (Cira, Mury& Bread) during flood, cyclone & others natural disaster. One striking feature is observed among the indigenous households in the highland areas where none of the female-headed households consume normal food during any natural disaster. The study identified dramatic changes in food intake pattern in the poor households in Bangladesh between harvesting period and crisis period due to food availability. Among the households who used to take food three times in a day during the harvesting period (89.8%) take food two times in a day during the crisis period (27.8%). More than half of the households (62%) used to reduce their food intake to adjust with any crisis.

Male member of the household is primarily responsible for marketing the farm produces in Bangladesh. Majority of the farmers have used pesticide (75.0%) and fertilizer (80.6%) for growing crops in the current year. More than half of the farmers (53.7%) had preserved seeds last year for selling in the market & growing their own food. The seed preservation practice is more common among the indigenous farmers of the Highland (75.0%) than Bengali farmers of the Plainland (43.1%). More than half of the farmers do not know how much pesticide is required for specific crops (56.5%) and yet uninformed about the various methods of handling pests/insects without using chemical pesticides (62.0%). More than one-third (41.5%) of the farmers who knows how to handle insects/pests without using pesticides, do not even practice it. Majority of the farmers consider organic fertilizer is cost-effective (77.8%) and good for growing foods (58.3%). More than two-fifth (46.3%) of the poor farmers in Bangladesh has irrigated land for growing crops in this year. The agriculture production without irrigation is more common in the indigenous highland areas than the Plainland areas. In fact, irrigation of lands for growing food is almost six (6) times more prevalent in the Plainland (63.9%) areas than the Highland areas (11.1%). The community showed many example of victimization due to chemical based agriculture practice.

More than half of the respondents have admitted that food productions are decreased in their locality within the last 3 years (58.3%) as well as the same land area currently produces less food than 10 years ago (51.9%). One-tenth of the respondents (10.2%) pointed out that lands, which were used for agriculture 10-15 years ago, are currently not used for agricultural anymore.

Agricultural land is decreasing gradually to accommodate the increasing population. Many productive agricultural lands have already converted into factories, brickfields, roads and other infrastructures. Land grabbing is key factor for food insecurity of the indigenous highland population. Many lands grabbed by the influential Bengali people in the hilly regions remain fellow which earlier were used by the indigenous people for food production. Although there is a policy for the distribution of khas land of the country among the landless and marginal poor, the implementation of the policy has yet to be satisfactory.

In every stage of rice production, from land preparation to rice grain production farmers have to spend more money than the previous year. Every year farmers are cultivating less land to adapt with higher price of agricultural inputs. Farmers do not get fair price of their products as big merchants controls the market and sets the price of the products. Due to inadequate communication system in farmers are bound to sell their products in the local markets where usually market is very small. Nearly half of the farmers (49.1%) have no way to get information for marketing their products in the right time and at fair prices.

More than half of the households (61.9%) in Bangladesh opined climate change impact as the reason for the reduction of food production. One-third (34.9%) opined that modern techno-based cultivation is also responsible for the reduction of food production. Nearly two-thirds farmers in Bangladesh have experienced climate change related problems (cyclone, rainfall, drought, flood, overflow, and tornado) during growing foods (64.8%) and also faced climate change impact on households' food security (63.9%) during the last year. Untimely excessive rainfall, frequent flood, cyclone, tornado & drought are continuously damaging their agriculture produce. Food insecurity due to crop loss or failure is a common incident for the villagers. Traditional forecast methods are unable to predict current climate behavior. Majority of the farmers (87.0%) opined that excessive rainfall has been generating problems for growing foods.

Nearly two-third (65.7%) of the poor farmers in Bangladesh considers that current food production system is unable to fulfill the overall food demand of the country. The climate change impact is identified as the key reasons for not fulfilling the overall food demand. More than one-third of the poor farmers (35.2%) reported that climate change (heavy rainfall, drought) is destroying their crops. More than three-quarter of the poor farmers (80.6%) have reported that they need training for addressing Climate Change risks & vulnerabilities for growing foods. More than two-fifth (41.4%) farmers who have experienced climate change impacts now a days, had not experienced such climate change problems in 10 years ago.

More than three-quarters (78.7%) of the poor households in Bangladesh does not have the purchasing power to buy food at the current market price even in the normal situation. It is very striking that virtually all the indigenous households (97.2%) in the highland areas does not have the ability to purchase necessary food at current market price. Taking very high interest loan from local money lenders (53.7%) and selling household assets like livestock, land, trees, and crops (48.1%) are the most common strategies of the poor households in Bangladesh to collect/ensure food during the crisis period. More than one-third households (35.2%) have also borrowed crops from relatives to overcome food crisis during the last 12 months. The average stocking capacity of the Plainland Bengali households (average-stocking capacity is 105 days) is 25 days more than the indigenous highland households (average stocking capacity is 80 days). However, female-headed households have less stocking capacity than male-headed households in Bangladesh including both highland &Plainland areas.

None of the poor Bengali households in the Plainland areas has reported to sell advance labor/crops to ensure food during the crisis period. On the other hand more than one-tenth of the poor indigenous households in hilly regions of the Bangladesh had sold labor/crops in advance to overcome food crisis during the last 12 months.

Shortage of safe drinking water, especially in the coastal belt and in drought-prone areas in the north-west of the country increasing hardship on women and children, who are responsible for collecting drinking water for their families. The success and vulnerabilities of the women in climate adaptation has to be highlighted in the national & international forums through real life evidence. Women can play the leadership role in conservation of plant genetic resources, seed exchange & seed management according to the cropping calendar and promote movement of seeds between villages.

Bangladesh had responded to the 2007/08 food crisis by abandoning the neo-liberal prescription of minimal state involvement in food markets. Bangladesh consider domestic food grain production as an important factor for food price stabilization and food security, and food self-sufficiency policies aims to avoid macroeconomic and political instability from food price shocks. Bangladesh, the biggest rice buyer in South Asia, has doubled its import target (1.2 million metric tons) for the year 2011 to prevent upsurge of domestic prices. Since expansion of land under cultivation is not a feasible option, Bangladesh government has started discussions with countries in Africa and with Myanmar & Cambodia with a view to leasing foreign land to grow food for import. Government policies are more focused on achieving transient food security through price stabilization for the consumption of the vulnerable groups and also achieving 'self-sufficiency' in rice production. However, the government goal of self-sufficiency in food grains production is focused on building up national food reserves to meet about 3 weeks' consumption. Government is serving Agri-business through liberalization on the import of seed and seed processing machineries.

Bangladesh is the classic example of Biodiversity-based smallholder agricultural practice. There are several major rice-growing ecosystems in Bangladesh. These include upland (direct-seeded pre-monsoon 'Aus' season); irrigated land (mainly dry 'Boro' season); rainfed lowland (mainly monsoon 'Aman' season); medium deep-water rice-growing areas (50-100 cm) and deepwater (>100 cm); tidal saline and tidal non-saline areas. Organic farming is one of the key adaptation measures of the community for achieving food self-sufficiency for the poor households. Organic farming has great mitigation and adaptation potential, particularly with regard to topsoil organic matter fixation, soil fertility and water-holding capacity, increasing yields in areas with medium to low-input agriculture and in agro-forestry, and by enhancing farmers' adaptive capacity.

The Bangladeshi farmers with their unique and innovative coping mechanisms have proven many times their resistance to recurrent natural hazards like floods and droughts, cyclones and tidal surges. The advantage of saving crops in floating method of agriculture during flood situation at community level has been observed. The farmers of the country are also capable of switching to local varieties in places of high yield varieties in case of drought or flood as local varieties are low water consuming and taller. Within the last 10-15 years, farmers have witnessed drastic deviations in their traditional crop calendar. The women-led innovative homestead-gardening practice in waterlogged people's struggle for survival in a very difficult condition might provide new thoughts to the global community and might offer ways to the global community about how to survive if sea level rises. Nevertheless, the farmers need orientation training for generating mass awareness on climate change. Farmers also need training for adaption of agriculture, Livestock Rearing in the changing climate, Climate compatible calendar/guidelines for crops production and Vegetable cultivation.

Chapter 1

The Twin Crises (food crisis & climate crisis) of the 21st Century

1. The Reality of the Twin Crises (Food crisis & climate Crisis)

In the 21st century, we are witnessing that global hunger is on the rise due to more agribusiness, more globalization and more global food crisis. World is still facing a major problem of volatile food prices. According to the FAO State of Food Insecurity in the World report, high food prices are likely to continue and volatility may increase in coming years, making farmers, consumers and countries more vulnerable to poverty and food insecurity. Three-fourths of the world's hungry are the food producers themselves – the farmers and farm workers. Majority of the world's hungry (63% of total hungry) people are in the food producing Asia and the Pacific region. Peasants and farming communities feed at least 70% of the world's population whereas the corporate agriculture feeds only 30% of the world's population but virtually controls the total global trade and investment in food and agriculture. Now, the planet is moving rapidly into another unprecedented crisis (the climate crisis), which is driven partly by the same model of agriculture and development. The global food crisis is real, and so is the climate crisis.

1.1 Intensified Corporate Control in Food & Agriculture is driving the Global Food Crisis

The Food and agriculture Tra**n**s-National Corporations (TNCs) are creating, controlling and nurturing food crisis and corporate agriculture is ever increasing threat to biodiversity, food safety and human nutrition. The global food crisis manifests the failure of corporate agriculture to feed the world. Yet, corporate agriculture peddles a more expensive and dangerous technology such as genetic engineering and is aggressively imposing the patent regime, using food crisis as justification. Another indication of the intensifying corporate control in food and agriculture is the recent trend towards land grabbing that is happening on a massive, global scale.

Food crops have become so-called soft commodities due to trade liberalization policies. The trade liberalization policies is strengthening food and agriculture TNCs to create tight market situations, fake shortages, and practically dictate prices to wipe out the small-scale and self-sufficient peasant production. Poor people who spend up to 80 per cent of their income on food were hardest hit of the 2008 world food-price crisis. Prices for cereals and other major food commodities have experienced two global hikes recently; one in 2007 to 2008, the other in 2010 to 2011. Even the recent World Bank in its 'Food Price Watch' report has shown that global food prices at 36 percent above its 2010 levels and remains close to its 2008 peak; such food price trekking has pushed 44 million people into poverty.

According to the World Disasters Report 2011, recent deregulation, especially in the US, has stimulated speculation in agricultural futures: the number of futures and options traded globally on commodity exchanges overall increased by more than 500 per cent between 2002 and 2008.

1.2 The Discovery of Climate Crisis

The planet is currently at 0.8°C warmer than 1850, and about 1.5°C above 1990 temperatures or approximately 2°C above pre-industrial temperatures, which is the critical threshold. If global GHG emissions would continue along current rates, the IPCC projects that by year 2100, increases in global mean temperature would be around 1.4-5.8°C and sea level would rise by about 9-88 square centimetres (cm^2). To keep the future growth of GHG emissions and future warming below this threshold, GHG emissions should be reducedabout 30-55% below 1990 levels over the 21stcentury. CO2 concentrations should be stabilized to 350ppm, which requires emissions to peak by 2011 and drop to zero by 2050. The burden of advanced capitalist countries will have to be significantly higher, and it has to be now. Nevertheless, like the responsibility for the food crisis, the imperialist states, TNCs and financial institutions are dodging the responsibility for the climate crisis. They are watering down accountability, proposing market-based solutions, passing on the burden of mitigation and adaptation to poor countries, and delaying action.

1.3 The Interconnection between the Twin Crises (Food crisis & climate Crisis)

According to the Independent Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD), climate change can irreversibly damage the natural resource base on which agriculture depends. Hotter temperatures will bring about drier conditions and increase the amount of water needed for agriculture. Rainfall patterns will be irregular and unpredictable. The intensification and increased incidence of storms will make an additional three million hectares of farmland in coastal areas vulnerable to inundation. At the same time, traditional seed varieties and livestock breeds that might provide a genetic resource to adapt to climate change are being lost. Crop diseases and insect pests will also thrive in a hotter or more humid climate. Availability of forest and fishery products will be reduced, affecting people and families who depend on the forest resources and live by fishing and aquaculture. Some fish resources will become less abundant while important species may move to other areas where they are less available to the fishers. Coastal communities may also be displaced by rising seal levels.

According to the Fourth Assessment Report of WMO/UNEP Intergovernmental Panel on Climate Change (IPCC) released in 2007, the future projection of climate change indicates that south Asia is very likely to warm up during this century. Crop yields may decrease by 30% in the region by the mid-21st century and considering the influence of population growth, the risk of hunger is projected to remain very high. Other predicted impacts of climate change include inundation of arable land, salinity intrusion, droughts, reduced fresh water, availability and persistence of transboundary pests and diseases. According to IPCC projections, in tropical and sub-tropical regions, especially in seasonally dry areas, crop and animal productivity may decrease significantly due to temperature increases of 2 to 3°C.

By 2020, according to the IPCC, climate change could cause:

- significant decreases in crop yields in some rain-fed African systems;
- declines of 40-90 % of grassland productivity in semi-arid and arid regions;
- high levels of desertification and soil salinization in some areas in Asia, sub-Saharan Africa and Latin America;
- increasing water stress, particularly in irrigated production systems;
- Increased salinity from sea-level rise, leading to some areas in sub-Saharan Africa and South Asia, such as coastal plains, becoming flooded or unsuitable for agriculture.

The International Food Policy Research Institute (IFPRI) has estimated that irrigated wheat yields will fall at least 20% by 2050. According to the IFPRI as well as the World Food Programme (WFP) studies, climate change is projected to increase the number of hungry people by 10-20% by 2050. Calorie availability is likely to have declined by 2050 compared with 2000 levels, increasing the number of malnourished children in underdeveloped countries by 21% from today. Asian Development Bank (ADB) expressed that, if current patterns of warming would continue, irrigated rice production in Asia and the Pacific is expected to decline 14-20% and soya by 9-18% in the next 40 years.

According to the 2011 World Energy Outlook published by the International Energy Agency, delaying action until 2020 means that the costs of carbon reduction would be four times greater than they would be today and it would boost global temperatures by at least 3.5 degrees C by 2100. The 2°C is the target approved under the Copenhagen Accord, and the Cancun Agreement. The 1.5°C is a demand from the small islands states, the African Group, and the Less Developed Countries.

1.4 Justification for Unmasking the Twin Crises of the 21st Century

Climate change will require a new look at water storage to cope with the impacts of more and extreme precipitation, higher seasonal variations and increased rates of evapotranspiration in all types of ecosystems. Food and agriculture TNCs, along with multilateral organizations and international financial institutions are using data and directing researches to show that there will be gainers and losers in order to justify their further push for corporate and globalization agenda. They have also overemphasized the fact that agriculture itself is one of the causes of climate change thus must be made more efficient. By doing so, they are turning the correlation of the two crises upside down and using it to their advantage; they are buttressing the argument for the industrial food system and dodging responsibility for both crises. At the same time, commitments to agricultural aid by both donor governments and multilateral agencies bottomed out at 3.4 per cent of total aid.

The ‘responsible agricultural investments’ propaganda of the World Bank has actively been promoting that large-scale foreign investments in farmlands and the direct participation of TNCs and financial institutions in agricultural production are acceptable as long as they are done under the pretense of social responsibility. It is ironic that even FAO puts too much focus on the world market when in fact only a diminutive percentage of food production is traded globally.

Aside from corporate agriculture being the culprit in the so-called contribution of agriculture to global warming, the industrial food system is also consuming fossil fuel at a spectacular rate. The FAO calculates that on the average farmers in industrialized countries spend five times as much commercial energy (fossil fuels for the production of agrochemicals and for use in the operation of farm machines) to produce one kilo of cereal as do farmers in Africa. The real waste of energy happens in the processing, packaging, freezing, cooking, and transporting of food. At the end, the industrial food system wastes half of the food it produces in its chain from the farm to the traders to food processors, stores and supermarkets. However, the corporate agenda has yet to cover up these real issues with sound demonstration that science can produce solutions to help farmers and communities adapt to the impact of climate change within the system of corporate agriculture and the industrial food chain.

There is the need therefore to counter the corporate agenda with researches on the ground that expose the real causes of food and climate crises and will reject the notion that the crises can still be solved within the same bankrupt system, techno-fixes that muddle the issue and only strengthen corporate control, and the neoliberal approaches to the crises. This can be done by documenting and identifying the existing practices as well as the capability of communities in adapting to the impact of climate change on agriculture and eventually in resisting corporate and imperialist globalization.

Chapter 2

Researching for unmasking the Twin Crises of the 21st Century

2. Justification of the Research

Over the years, farmers and communities have been bombarded with the corporate propaganda that agriculture can only be developed and food security be ensured by following the corporate model of agricultural development, relying on markets, synthetic agrochemicals and biotechnology. Such propaganda thus makes farmers' production systems appear like they are the 'alternatives' when in fact farmers have been practicing these indigenous systems for generations. Around 95% of the food security of communities is derived from these indigenous systems.

To counter the corporate propaganda, there is a need to produce researches that may present the following realities:

1. the pursuit of biodiversity and ecological agriculture as a viable form of resistance not only to climate change but more importantly to corporate control, which includes farmers' seed-saving, re-integration of crops and livestock, rehabilitation of the soil, etc.
2. indigenous techniques and measures for adaptation to climate change
3. self-sufficiency through local food production
4. promotion and protection of small-scale, subsistence and community-based farming
5. the community's advocacy for state planning of human food consumption with the objective of prioritizing food and eliminating wastage
6. the community's advocacy for state planning to ensure nutritious, adequate, appropriate and accessible food
7. the community's continued struggle for genuine agrarian reform
8. the community's struggle in demanding accountability in mitigation and prioritization of free funding for adaptation

Such researches shall be significant for both the communities and APRN. For APRN, food security and climate change are critical development issues that must be articulated well. The communities shall gain from sharing what is doable and what is and may use results for advocacy and lobbying. They may also gain the valuable confidence in continuing to pursue their indigenous practices that are repeatedly belittled by huge researches. Finally, the significance of such researches is to debunk the claims of TNCs, multilateral organizations and international financial institutions that national food self-sufficiency does not make economic sense and that the vulnerable countries will have to rely on the markets and globalization to meet their development needs.

2.1 Objectives of the Research

General Research Objective

To determine the capacity of the Bangladesh to achieve food self-sufficiency and build resilience to address the climate crisis by relying on biodiversity-based smallholder agriculture

Specific Research Objectives

1. to survey and document the indigenous food production systems and techniques being used by 3 communities (coastal, riverside & hilly) that have the potentials to be promoted to address the impact of climate change on food and agriculture
2. to identify the risks and challenges to promoting these systems and practices
3. to look into the impacts of climate change on other specific issues and sectors with regard to food self-sufficiency
4. to determine the overall potential of food production systems in achieving country food self-sufficiency and resilience to food and climate crises

2.2 Design, Methods, Tools and Study Areas of the Research

The research approach was mainly focused on developing unique country case that truly represent Bangladesh context. Multidisciplinary Team-based Participatory Action Research with the chosen communities' has guided the research process. The analysis framework has followed the triangulation of data from different sources by a multi-disciplinary research team. Data collection was the most important task of the research and it generated both quantitative and qualitative data. The data collection instruments were prepared covering the objectives of the research and finalized after pre-testing in the actual field situation and in consultation with APRN. The major data collection instruments (Semi-structured Questionnaire, Observation, Workshop, FGD& In-depth Interview) had strictly followed the specific guidelines to ensure the uniform and quality information/data collection.

The following Research Methods were used:

1. **Desktop Research & Policy Analysis:** Desktop Research reviewed the available related literature from secondary sources (Policy Documents, National Statistics, Reports, Books, and maps). Policy analysis was limited to the background of the study, review of related literature and specific objectives of the research.

2. **Participatory Action Research (PAR):** Participatory Action Research has applied both the quantitative (questionnaire) and qualitative methods for data/information collection to devise case studies. PAR includes Focus group discussions (FGD), Key informant interviews, and Participatory Rapid Appraisal (PRA) methods. The PRA methods used appropriate & selective tools such as scoring & ranking, seasonality, timeline, trend diagram, SWOT analysis; etc. Baseline survey provided quantitative data to complement case studies.

3. **Participatory Impact Assessment:** Participatory Workshop will be used to obtain information on the impacts of climate change on other specific issues and sectors with regard to food self-sufficiency, as defined by workshop participants themselves according to their experience and expertise, and to validate prior secondary data analysis in a participatory fashion. Time Trends Analysis incorporating Historical and future Risk and vulnerability mapping; will be used in the Participatory Impact Assessment.

4. **Ethnographic documentation:** Ethnographic documentation (video making, sound recording and pictures) to validate the case studies.

In total, 108 respondents (50% female respondents) had participated in the Quantitative Survey. The qualitative aspects of the study also encompassed 238 participants. Altogether, the study managed to involve 346 participants.

	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	**%**	**N**	**%**	**N**	**%**
N=	**72**		**36**		**108**	
Gender of the respondents						
Female	35	48.6	18	50.0	53	49.1
Male	37	51.4	18	50.0	55	50.9
Age category of the respondents						
25 - 30 years	12	16.7	2	5.6	14	13.0
31 - 40 years	27	37.5	11	30.6	38	35.2
41 - 50 years	15	20.8	10	27.8	25	23.1
51 - 60 years	7	9.7	10	27.8	17	15.7
60 + years	11	15.3	3	8.3	14	13.0

For qualitative information collection, the study conducted 6 Focus Group Discussions involving 72 participants, 6 Key Informant participants were interviewed. In total 03 Regional Impact Workshop involved 60 regional (Sub-national) experts to identify Climate Change impact on Food self-sufficiency in Bangladesh. Poor and marginalized rural farmers, civil society, relevant Ministries, agricultural extension officials, local government, agri-business associations and women were the key participants.

District	**Upazilla**	**Data Collection Tools & Sample Size**						
		Quantitative	**Qualitative**					
		Questionnaire survey sample	***FGD (Focus Group Discussion)***		***KII (Key Informant Interviews)***	***Ethnographic documentation & Field observation***	***Regional Impact Workshop on Food & climate change (divisional/District level)***	
		Number of Respondents	Number of FGD	Number of Respondents	Number of Respondents	Number of Videos & Photos	Number of Workshops	Number of Respondents
Khagrachari	Khagrachari Sadar	36	02	24	02	02	01	20
Shirajganj	Ullapara	36	02	24	02	02	01	20
Barisal	Banaripara	36	02	24	02	02	01	20
TOTAL		**108**	6	**72**	**6**	6	**03**	**60**

In addition, on 16 October 2012, a National Press Conference will be held in the National Press Club in Dhaka to observe the World Food Day and to share the primary finding with the mass media. More or less 30 national media persons are expected to participate in the National Press Conference.

Study Areas & Data Collection Team members			
Types of information	Ullahpara (Sirajgonj)	Banaripara (Barisal)	Khagrachhari Sadar (Khagrachhari)
Local Administration	Ullahpara thana, now an upazila of Sirajgonj District was established in 1875. It was turned into a municipality in 1984. It consists of 9 wards, 25 mahallas, 13 union parishads, 263 mouzas, 433 villages.	Banaripara Upazila of Barisal District) is consists of one municipality, 11 union parishads, 87 mouzas and 77 villages.	Khagrachhari Sadar Upazila of Khagrachhari District was established in 1974. It consists of 9 wards, 61 mahallas, 9 union parishads, 36 mouzas and 77 villages.
Area	414.43 sq km	134.32 sq km	228.23 sq km
Main Rivers & waterbodies	karatoya, Ichamati, Bilsuriya	Sandha, Swarupkati. Jhanihania and Bisarkandi Khals (canals).	Chengi; noted hill Alutila
Population Diversity	Virtually all the population is Bengali people. Total population 399074 (male 51.13%, female 48.87%); Muslim 93.87%, Hindu 6.10%, Christian 0.01% and others 0.02%;	Virtually all the population is Bengali people. Total population 143825 (male 51%, female 49%) Muslim 82.55%; Hindu 16.75% and others 0.7%.	More than two-thirds of the total population is Indigenous Hill People (mainly Chakma, Marma and Tripura.) Total population 61306 (male 54.02% and female 45.98%) Muslim 30.16%, Hindu 28.43%; Buddhist 40.64% and others 0.77%;
Population density	962 per sq km	1071 per sq km	268 per sq km
Education rate	Average literacy 32.22%; male 38.5% and female 25.5%.	Average literacy 46%; male 51.1%, female 49%.	Average literacy 33.7%; male 42.3%, female 23.2%.
Occupational Diversity	Farmer 42.34%, agricultural laborer 26.14%, day laborer 2.45% Commerce 10.85%, service 4.10%, transport 2%, weaving 3.94%	Farmer 27.28%, agricultural laborer 18.54%, day laborer 4.78%, Commerce 25.51%, service 7.91%, fishing 1.87%, transport 1.47%, construction 1.29%,	Farmer 34.69%, agricultural laborer 17.73%, day laborer 25.74%, Commerce 2.81%, service 5.84% and others 13.19%.
Main Crops	Paddy, jute, barley, wheat, mustard seed, onion, sesame, and chilli	Paddy, wheat, potato, brinjal, radish	Paddy, potato, brinjal, nut and cotton.
Main Fruits	Mango, jackfruit, black berry, palm, coconut, banana	Mango, jackfruit, banana, black berry, coconut, litchi, guava, papaya and amra	Mango, black berry, jackfruit, pineapple, papaya, banana, litchi and sofeda
Main Exports	Jute, mustard seed, sesame, flour, fish and vegetables	Banana, guava and amra.	Banana, pineapple, jackfruit, papaya, phuljharu (flower duster).

Data Collection Team members		
Khagrachhari Team (Khagrachhari sadar)	**Sirajgonj Team (Ullahpara)**	**Barisal Team (Banaripara)**
Md. MizanurRahman	Md. MizanurRahman	Md. MizanurRahman
M.M. MahbubHasan	M.M. MahbubHasan	Syed ZiaulHasan
Anupamtalukder	Sirajul Islam	Imam Hasan
Disha Tripura	KhokonSikder	Bahadi Tania Khanom
Tisha Tripura	JannatulFerdous Tania	JohoraKhanom
Joy Prokash Tripura		
Jenny tripura		
Promodtripura		
KhokonSikder		

2.3 *Profile of the Communities Involved in the Research*

The study has covered three communities who are living in coastal (Barisal District), riverside (Shirajganj District) & hilly areas (Khagrachari District) of Bangladesh for collecting data on food production systems and techniques as well as climate change impact & vulnerability to document case studies that truly represents majority of the Bangladesh. The data analysis further divided coastal (Barisal District) and riverside (Shirajganj District) areas into Plainland (geographic entity) & Bengali (Ethnic identity) and hilly areas (Khagrachari District) into Highland (geographic entity) & Indigenous (Ethnic identity).

Majority of the community members involved with this research are middle-aged (average age is 45 years) poor farmers and have been living in their current area for more than three decades. Half of the farmers (49.1%) are functionally illiterate.

Study Area		Community Characteristics
District	**Upazilla**	
Khagrachari	Khagrachari Sadar	Rural Indigenous community, practicing their unique agricultural cultivation system
Shirajganj	Ullapara	Rural Community living in remote river islands
Barisal	Banaripara	Rural Community and one of the major agriculture producing region of the Bangladesh

Profile of the Community members involved with the research	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	**%**	**N**	**%**	**N**	**%**
N=	**72**		**36**		**108**	
Average age (year)	**44**		**47**		**45**	
Religion						
Islam	68	94.4			68	63.0
Hindu	4	5.6				
Sanatan/Adi Dharma			36	100.0	40	37.0
Marital status						
Married	71	98.6	34	94.4	105	97.2
Widow/widower	1	1.4	2	5.6	3	2.8
Status of dwelling place						
Straw/leaf/bamboo/mud house	17	23.6	22	61.1	39	36.1
Only roof by tin/tally	4	5.6	11	30.6	15	13.9
Fully made by tin	43	59.7	3	8.3	46	42.6
Semi pacca	8	11.1			8	7.4
Average duration (year) of living in the locality	**32**		**30**		**31**	
Educational qualification						
Pre-primary education	7	9.7			7	6.5
Primary level (class I-V)	25	34.7	7	19.4	32	29.6
Junior level (class VI-VIII)	6	8.3	7	19.4	13	12.0
Secondary level (class IX-X)	3	4.2	3	8.3	6	5.6
Higher Secondary level (class XI-XI)	3	4.2	1	2.8	4	3.7
Can sign only	19	26.4	8	22.2	27	25.0
Illiterate	9	12.5	10	27.8	19	17.6

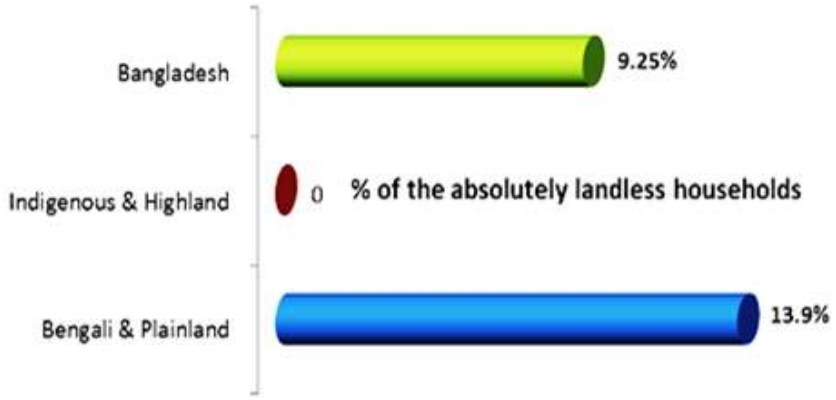
The average family size of the poor households is five, including two children and three adult family members. In terms of religious identity, except a few Hindus (5.6%), rest of the respondents in the plainland areas are Muslims (94.4%). However, in highland areas all the indigenous people reported Sanatan as their religious identity.

Profile of the Community members involved with the research	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	**%**	**N**	**%**	**N**	**%**
N=	**72**		**36**		**108**	
Poverty status of the Neighbors						
Higher middle	7	9.7			7	6.5
Lower middle	27	37.5	24	66.7	51	47.2
Poor	30	41.7	9	25.0	39	36.1
Very poor	8	11.1	3	8.3	11	10.2

Nuclear family (Husband, wife, child) dominates the family type.

Familial status of the respondent households	Bengali & Plainland	Indigenous & Highland	Bangladesh
N=	**72**	**36**	**108**
family type	**%**	**%**	**%**
Nuclear family (Husband, wife, child)	77.8	80.6	78.7
Joint family (parents, unmarried siblings)	22.2	19.4	21.3
Number of family members			
Average number of adult family member	**3**	**3**	**3**
Average number of children family member	**2**	**2**	**2**
Average number of total family member	**5**	**5**	**5**
Status of differently able members in the family	**%**	**%**	**%**
Yes	30.6		20.4
No	69.4	100.0	79.6

In Bangladesh land is the major source of power besides kinship, family status, income and education. The ownership, access and control over land very often determine the economic and social position and power relation of individuals and family. More than one-tenth (13.9%) households in the plainland areas are absolutely landless. On aveage, among the households who own land have 158 decimal or 1.58 acre land.



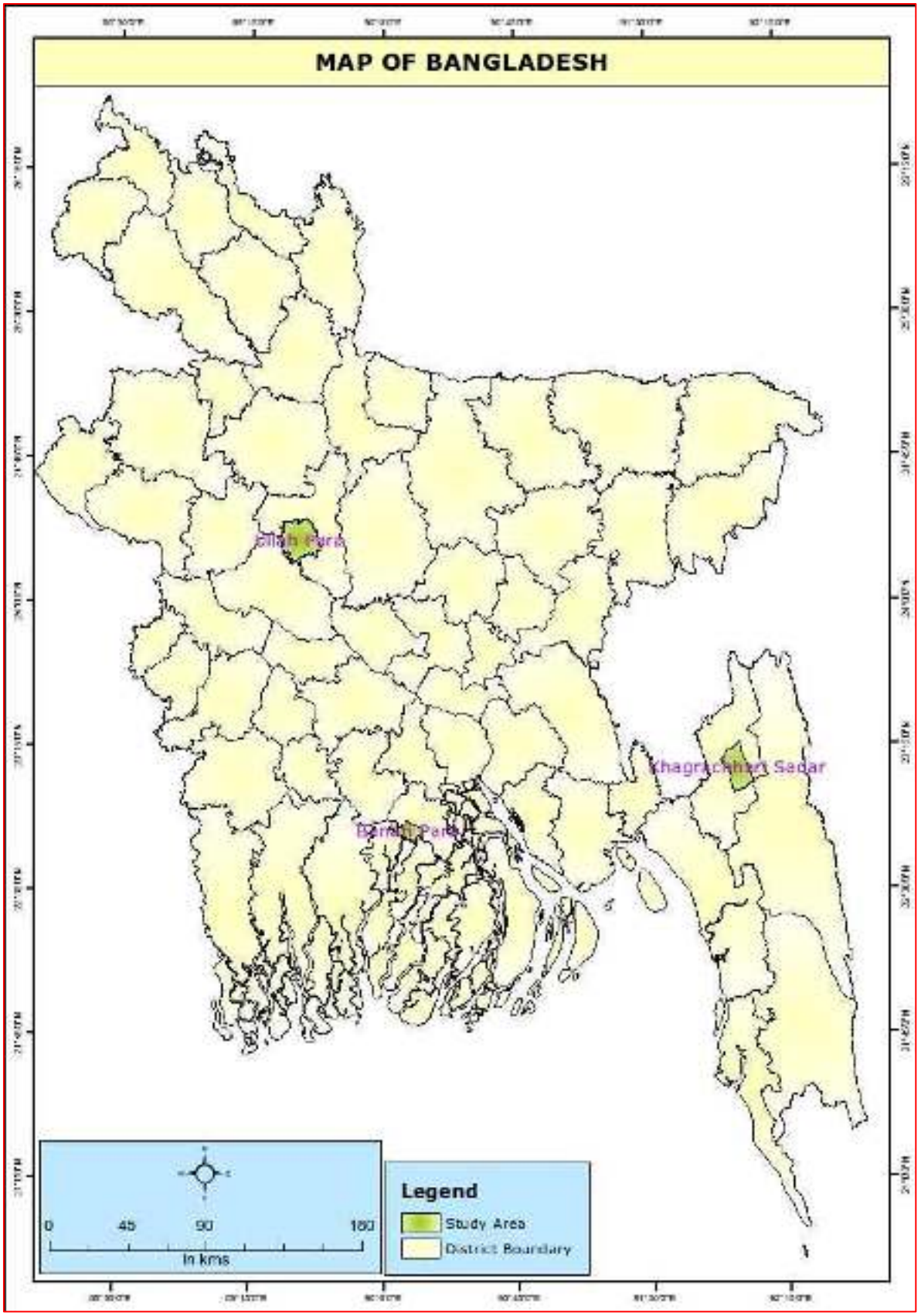
Chair, Cot/bed, Dining table and mobile phone are the most common properties that the poor housholds own. More indigenous housholds of the highlands reported to own such properties than the Bengali households of the plainland.

Ownership of other properties	Bengali &Plainland (N=72)		Indigenous & Highland (N=36)		Bangladesh (N=108)	
	N	%	N	%	N	%
Television	10	13.9	7	19.4	17	15.7
Mobile phone	26	36.1	20	55.6	46	42.6
Radio	7	9.7			7	6.5
Chair	33	45.8	24	66.7	57	52.8
Cot/bed	24	33.3	23	63.9	47	43.5
Dining table	15	20.8	8	22.2	23	21.3
Ornaments (>1 ana)	19	26.4	19	52.8	38	35.2
Swing machine	3	4.2			3	2.8
Shallow tube well	6	8.3	6	16.7	12	11.1

More highland indigenous housholds own agricultural machineries than the plainland Bengali households.

Ownership of Agricultural machineries	Bengali & Plainland (N=72)		Indigenous & Highland (N=36)		Bangladesh (N=108)	
	N	%	N	%	N	%
Power tiller	1	1.4	2	5.6	3	2.8
Crop harvesting machine	3	4.2			3	2.8
Spray machine	2	2.8	1	2.8	3	2.8
Plough			19	52.8	19	17.6
Fishing net	4	5.6	9	25.0	13	12.0

Type of public property exist in the local area	Bengali &Plainland(N=72)		Indigenous & Highland (N=36)		Bangladesh (N=108)	
	Public Propertyexist (%)	People have access to use public property (%)	Public property exist (%)	People have access to use public property (%)	Public property exist (%)	People have access to use public property (%)
Government Pond	31.9	56.5	11.1	100.0	25.0	63.0
Canal, marshy etc.	50.0	72.2	52.8	73.7	50.9	72.7
River	6.9	80.0	30.6	63.6	14.8	68.8
Grass land			36.1	100.0	12.0	100.0
Forest resources (food, wood)			91.7	100.0	30.6	100.0
Hill			97.2	94.3	32.4	94.3


MAP OF BANGLADESH
Khagrachhari Sadar
0
45
90
180
In kms
Legend
Study Area
District Boundary

Chapter 3

Overview of the Twin Crises in Bangladesh

3. Bangladesh Agriculture & Food Self-Sufficiency at a glance

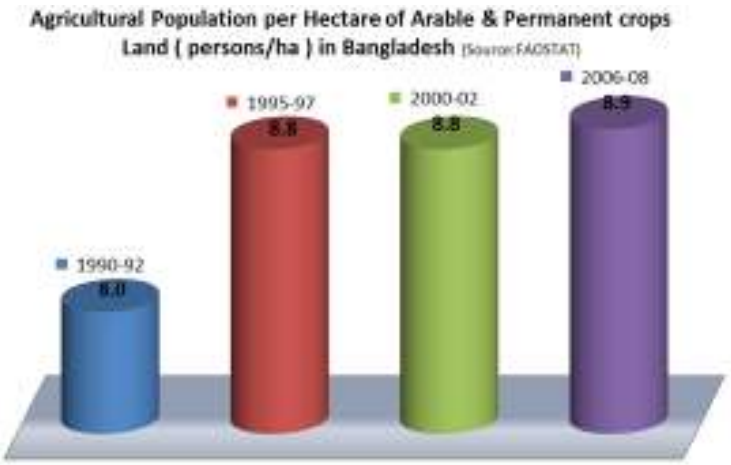
Bangladesh is one of the world's most densely populated, disaster-prone and climate-vulnerable countries. The UNDP Global Human Development Report 2010, ranked Bangladesh third out of 95 countries for the greatest progress achieved and for having doubled its Human Development Index since 1980. Bangladesh holds the longest natural beach of the world (the southeast coast of Bangladesh) and the Sundarbans; the largest single block mangrove ecosystem in the world (shared with India), 798thUNESCO world heritage site, Ramsar Wetlands (the southwestern coast of Bangladesh).

FAO Statistical Yearbook 2010	(%)								
Bangladesh Share In	1999-2001	2003-2005	2005	2006	2007	2008	2009	2010	Changes over a Decade
World GDP ($ constant 2000 prices)	0.14	0.16			0.17	0.17	0.19		**+0.5**
World Agricultural GDP ($ constant 2000 prices)	0.91	0.91			0.96	0.96	1.16		**+0.25**
World Food Production	1.08	1.05	1.07	1.10	1.12				**+0.04**
World Food Consumption	1.84	1.92	1.93	1.92	1.95				**+0.11**
Total Economically Active Population In Agriculture	55	51				47	46	45	**+10.0**
Bangladesh Share of									
Total Population In World Population	2.30	2.34				2.37	2.38	2.38	**+0.08**
Agricultural Population In World Agricultural Population	3.01	2.96				2.89	2.87	2.84	*--0.17*
Economically Active Population (EAP) In World EAP	2.25	2.32				2.36	2.37	2.38	**+0.13**
EAP In Agriculture In World EAP In Agriculture	2.81	2.80				2.75	2.73	2.71	*--0.10*
agricultural GDP In Total GDP	24.3	22.1			20.7	20.1	19.8		*--4.50*
Rural Population Of Total Population	76	75				73	72	72	--4.00
+ = increased; -- =reduced									

Agriculture (crops, livestock and fisheries) is a critical sector in Bangladesh. The main sources of livelihood for the rural population are agriculture and non-farm activities that directly or indirectly depend on agriculture. Some three-quarters of the rural population consist of landless labourers and marginal farmers with less than 0.2 hectare of land.

Population	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
Total population *million; as of 1 July*	129.9	131.6	133.4	135.2	137.0	138.8	140.6	142.4	144.2	146.2
Population density *persons per square kilometer*	880	892	904	916	928	941	953	965	977	990
Population *annual change, percent*	1.4	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Urban population *percent of total population*	23.4	...	...	23.7	24.2	24.6	25.0	25.4	...	...
Food price index	1.4	1.6	3.5	6.9	7.9	7.7	8.2	12.3	7.2	8.5
Output percent of GDP at current producers' prices										
Agriculture	24.1	22.7	21.8	21.0	20.1	19.6	19.2	19.0	18.7	18.8
Industry	25.9	26.4	26.3	26.6	27.2	27.9	28.4	28.5	28.7	28.5
Services	50.0	50.9	52.0	52.4	52.6	52.5	52.4	52.5	52.6	52.6

"Landless" farmers are considered as having access to less than 0.02 ha of land, while "marginal farmer" have access to between 0.02 and 0.2 ha of land and "small" farmers from 0.2 to 1.0 ha. A farm household is defined as a holding whose net cultivated area is 0.05 acre or more.



Agriculture labour households are those households whose main source of income was wages/earnings from agriculture labour. Landless households are those households who do not own any type of land. Agriculture labour households account for 31.13% of the total household in the country. Out of 28.67 million households in the country, 15.62% are absolutely landless households and 51.33% are agriculture farm households (households operating 0.05 acres of cultivated area). Percentage of agriculture labour households is gradually decreasing. It has decreased to 34.90% in 2008 from 39.77% in 1983-84. Absolute landlessness (households owning no land whatsoever) is steadily increasing over time. According to Agriculture Census, 2008, the current rate of landlessness is 12.84% in rural areas against 10.18% in 1996 and 8.67% in 1983-84.Agriculture provides jobs for 80% of the total population but contributes to only 22% of the gross domestic product.Only 1% of the country's farms comprise more than 3 hectares. Most of the poverty and hunger in Bangladesh is found on the 86% of farms, which are less than one hectare.

Total family	**17,600,804**
Total farm holding	15,089,000
Total area	14.845million hectare
Forest	2.599 million hectare
Cultivable land	8.44 million hectare
Cultivable waste	0.268 million hectare
Current fellow	0.469 million hectare
Cropping intensity	175.97%
Single cropped area	2.851 million hectare
Double cropped area	3.984 million hectare
Triple cropped area	0.974 million hectare
Net cropped area	7.809 million hectare
Total cropped area	13.742 million hectare
Contribution of agriculture sector to GDP	23.50%
Contribution of crop sector to GDP	13.44%
Manpower in agriculture	62%
Total food crop demand	23.029 million metric ton
Total food crop production	27.787 million metric ton
Net production	24.569 million metric ton

Source: BBS, 2006 and Handbook Agricultural Statistics, Ministry of Agriculture, Government of Bangladesh

Bangladesh is the world's fourth-biggest rice producer. Different forms of processed rice and rice products are consumed in Bangladesh; such as atap milled rice from sun-dried paddy; shiddhya-chaul rice milled from parboiled paddy; cheeda, khoi and moodi are flattened, puffed and popped products from paddy. The aman rice (monsoon season rice planted in April-May and harvested in November-December) is dominant while boro rice (dry season rice planted from December to February and harvested in April-May) has increased over the last three decades. The dry season irrigated/boro rice now accounts for over 55% of total rice production, as compared to about 25% during 1980s. Meanwhile, aus rice (pre-monsoon rice planted in April-May and harvested in July-August) has declined and recently diverted to high-value vegetable and fruit crops.

3.1 Overview of the Food Crisis in Bangladesh

According to an analysis based on data of Bangladesh Bureau of Statistics, the total rice production was 32 million tonnes in fiscal 2009-10, which is 14 percent higher than the annual demand for 28 million tonnes (if the size of the population is put at 150 million). Bangladesh should have run a surplus of rice against per-capita demand, 182.5 kilograms a year, even after a 12 percent deduction for seed, feed and waste from the total output. Despite having the full potentials to be a rice exporter, Bangladesh remains to be the world's fourth largest rice importer though it exports a small amount of aromatic rice, such as Basmati. Rice accounts for over three quarters of aggregate calorie consumption. Recent statistics indicate that per capita availability of rice increased from 140 kg in 1972 to 180 kg in 2008.

	Food Imports/ Agricultural Imports					Food Exports/ Agricultural Exports				
	(%)					(%)				
FAO Statistical Yearbook 2010	1999-2001	2003-2005	2006	2007	2008	1999-2001	2003-2005	2006	2007	2008
Bangladesh	**80.6**	**77.9**	**66.7**	**65.8**	**81.8**	**80.6**	**21.5**	**23.8**	**25.9**	**20.7**

CONSUMER PRICE INDEX AND INFLATION RATE IN BANGLADESH

Period	CPI	Inflation (General)		CPI	Inflation (Food)		CPI	Inflation (Non-food)	
	General	Point -to-Point	12- Month Average	Food	Point -to-Point	12- Month Average	Non-Food	Point -to-Point	12- Month Average
Weight	100	End of period		58.84	End of period		41.16	End of period	
2000-01	126.72	1.66	1.94	130.30	0.87	1.39	122.25	3.14	3.05
2001-02	130.26	3.58	2.79	132.43	1.94	1.63	127.89	4.14	4.61
2002-03	135.97	5.03	4.38	137.01	5.22	3.46	135.13	4.68	5.66
2003-04	143.90	5.64	5.83	146.50	6.64	6.92	141.03	4.26	4.37
2004-05	153.24	7.35	6.48	158.08	8.73	7.91	147.14	5.32	4.33
2005-06	164.21	7.54	7.16	170.34	8.81	7.76	156.56	5.73	6.40
2006-07	176.04	9.20	7.20	184.16	9.82	8.11	165.79	8.34	5.90
2007-08	**193.54**	**10.04**	**9.94**	**206.78**	**14.10**	**12.28**	**176.26**	**3.54**	**6.32**
2008-09	**206.43**	**2.25**	**6.66**	**221.64**	**0.25**	**7.19**	**186.67**	**5.94**	**5.91**
2009-10	**221.53**	**8.70**	**7.31**	**240.55**	**10.88**	**8.53**	**196.84**	**5.24**	**5.45**
2010-11	**241.02**	**10.17**	**8.80**	**268.03**	**12.51**	**11.34**	**205.01**	**5.73**	**4.15**

Source: Bangladesh Bureau of Statistics, ... = Not Available(Base: 1995-96 =100)

A study carried out by Oxfam GB, Bangladesh has mentioned that the prices of food grains started to increase abnormally in Bangladesh from the beginning of 2008 and April 2011 has experienced the highest record of food inflation in the history of Bangladesh, which is 14.36 percent.

Agriculture and Forestry		
Period	Current Producer Price (Taka in crore)	% of sectoral share to total GDP at current market price
2000-01	45631	18.00
2001-02	46003	16.84
2002-03	48798	16.23
2003-04	52419	15.74
2004-05	56167	15.15
2005-06	62223	14.97
2006-07	70124	14.84
2007-08	80202	14.69
2008-09	89426	14.55
2009-10	100588	14.49
2010-11	113388	14.40
Source: Bangladesh Bureau of Statistics		

According to a 2011 report of Trading Corporation of Bangladesh (TCB) the price of soybean oil has increased by 42.86 per cent and over the last one year, the price of palm oil has increased by 33 percent.

3.2 Overview of the Climate Crisis in Bangladesh

Bangladesh is a subtropical monsoon climate characterized by wide seasonal variations in rainfall, moderately warm temperatures, and high humidity.Within the last decade, Bangladesh has experienced local level fluctuations in rainfall pattern. In the last 4-5 years, people have been experiencing change in rainfall pattern, such as excessive, irregular and prolonged heavy rainfall in the beginning of monsoon and reduced rainfall during the peak season. The low rainfall years, such as 1997 and 2001, have demonstrated very serious implications for agricultural productivity, fish availability, and other aspects of rural livelihoods.

The range of temperature has changed both in summer and winter and the length of the cold season has alsoincreased.In Bangladesh, average temperature has registered an increasing trend of about 1°C in May and 0.5°C in November during the 14-year period from 1985 to 1998.Traditionally there were six seasons, but at present mainly rainy season, winter and summer are perceptible. Furthermore, these three seasons are also not appearing at the same time every year as they did in the past. Nor'westers or Aswins (storm in October) have not occurred at the time as occurred in the past. Similarly, intensity of cold and fog increased and duration of winter extended. One-fifth of the country is flooded every year, and in extreme years, inundates two-thirds of the country.Approximately 20 percent of the country and millions of people experiences normal annual flooding and all the previous major flooding events have inundated more than fifty percent of the country's total area. The huge sediment loads brought by three Himalayan rivers, coupled with a negligible flow gradient add to drainage congestion problems and exacerbate the extent of flooding.Cyclone and tidal bores have increased in the last 15 years.

BANGLADESH FOOD SITUATION IN 2011

Domestic Production Outlook

The foodgrain production target for the FY2010-11 was set at 35.7 (aus 2.7, aman 13.2, boro 18.7 and wheat 1.1) million metric tons (mmt). The total foodgrain production in FY2010-11 would be 34.5 mmt, 3.92% higher than last year's actual production (33.2 mmt).

Foodgrain Import

Total foodgrain import of the FY2010/11 was 56% higher (3.45 mmt) than that of the previous fiscal year. During the FY 2010/11, a total of 5.39mmt of foodgrain was imported, of which 1.59 mmt was rice and 3.80 mmt was wheat.Private sector import in the last fiscal year accounted for the major part of imports, weighing five times more than public imports.

Domestic Foodgrain Procurement

Total domestic public foodgrain procurement target for the FY2010-11 was initially set at 1.65 mmt. In a situation of already high prices prevailing in the market, the government decided not to procure foodgrain from the domestic market during aman and wheat seasons of this fiscal year to help augment overall supply of grains in the market..

Public Foodgrain Distribution

The government had a plan to distribute 2.73 mmtoffoodgrain in the FY 2010/11 and the actual distribution was 2.29 mmt. This was 17% higher than the previous year's distribution and constituted a record quantity distributed in recent decades. Indeed, in view of the higher level of grain price in the market, the government enhanced its efforts to ease poor households' hardship by distributing 1.2 mmt of subsidized grains through OMS and Fair Price Card (FPC) channels.

Public Stock of Foodgrain

The opening public stock of foodgrain for the FY2010-11 (1 July, 2010) was 0.52 mmt, which was about half of the opening stock of FY2009-10 (1.05 mmt). The public grain stock increased by 83% to reach 0.95 mmt by the end of the fiscal year (30 June 2011). Import arrivals (1.6 mmt) for public stock during second half of the fiscal year (January – June, 2011) contributed to reach this higher level of stock. Import arrival plan for the fourth quarter of FY2010-11 suggests that the public stock situation will remain satisfactory for the coming months of the fiscal year.

Domestic Market Prices

Domestic wholesale prices of rice and wheat rose steadily during the July/10-February/11 period and started declining in end-March/2011. Rice prices reached a peak in February, 2011. Rice as well as wheat prices witnessed a downward trend from April to June/11. For rice, this is in line with the expected price movement at this time of year when the harvested boro paddy enters the market.Over the entire year, between Jun/10 and June/11, nominal rice and wheat prices increased by 4.33% and 8.43%, respectively.

International Prices and Production Outlook

Rice and wheat prices in the international market have increased, between July/2010 and March/2011, by 24% and 84% respectively. Diminished production in major exporting countries resulting from drought in Russia, and floods in Canada, China, Pakistan, Thailand and Australia contributed to these price hikes. In addition to Indian export ban for three consecutive years, Russia imposed wheat export ban to cause limited supply in export market with significantly higher landed price in Bangladeshi ports.

Source: *www.fd.gov.bd*

During the last three decades (between 1960 and 1991), droughts occurred 19 times in Bangladesh and have affected about 47 percent area of the country as well as 53 percent of the population.

Length of time (decade/10 years)	Number of severe droughts	Average Drought Lag Time (interval years between two severe droughts)
1951-1960	1	10 years
1961-1970	1	10 years
1971-1980	2	5 years
1981-1990	4	2.5 years

Source Data:*Government of Bangladesh (GOB), 2001: National Report on Implementation of United Nations Convention to Combat Desertification Bangladesh, Ministry of Environment and Forests, GOB, Bangladesh Secretariat, Dhaka –1000, July 2001.*

Bangladesh have experienced only four (1951, 1961, 1975, 1979) very severe droughts in between 1950 to 1980 whereas within a decade (1981 to 1990), four very severe droughts (1981, 1982, 1984, and 1989) had occurred in the country. It is very alarming that three very severe droughts had occurred within 4 years. An analysis of the relative effects of flood and drought on rice production between 1969-70 and 1983-84 shows that drought is more devastating than floods to aggregate production.6.0 million hectares of land in Bangladesh falls below the minimum threshold for sustainable cultivation. Drought reduces total cultivable area available for production and the total economic cost of land degradation due to drought exceeds US $ 2000 million per year.

The geographic location and geo-morphological conditions of Bangladesh have made the country one of the most vulnerable ones to climate change, particularly to Sea Level Rise. Most of the country is low-lying land comprising mainly the delta of the Ganges and Brahmaputra rivers. Floodplains occupy 80% of the country. The coastal region of the country where mean elevations are within 1 to 3 meter are identified as the most vulnerable part due to climate change.

Bangladesh currently has extreme vulnerability to cyclones, because of its distinctive location and topography, as well as the low capacity of its society and institutions to cope with such extreme events. All IPCC impact assessments carried out so far have identified Bangladesh as one of the most vulnerable to the negative impacts of climate change. Salt water from the Bay of Bengal has already penetrated 100 km or more towards inland.Salinity has been changing the harvesting process, crop production, plant diversity and severe scarcity of food in the coastal regions of Bangladesh. Salinity has already encroached 21% of the cultivated land in the North-west coastal area within last three decades. Around 56% of the rivers in this area are contaminated by salinity.

Chapter 4

Study Findings on the Twin-Crises in Bangladesh

4. Status of the Twin-Crises (Food Crisis & Climate Crisis) in Bangladesh

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Households are food secure when they have year-round access to the amount and variety of safe foods their members need to lead active and healthy lives. At the household level, food security refers to the ability of the household to secure, either from its own production or through purchases, adequate food for meeting the dietary needs of all members of the household.

4.1 Status of the Food crisis, Food security and Food consumption in Bangladesh

More than one-third (36.1%) of the poor people are living in straw/leaf/bamboo/mud built houses which are highly vulnerable for any disaster with their 5-members family. Nearly half of their neighbors are poor (46.2%).

Straw/leaf/bamboo/mud house

Only roof by tin

Semi pacca (Brick wall and tin roof) with vegetable production at roof

Nearly one-third Bengali households in the plainland has reported that at least one of their family members is person with disability or differently able person. The study envisaged that in every five poor households at least one household has family member with disability or differently able person. In other words, one-fifth of the population is having somesort of disability. Although the study was not focused on person with disability or differently able person, the findings seems alarming and requires more research.

Present Situation about Living with Food Insecurity: Nearly one-fourth (24.1%) of the poor households in Bangladesh are always living with food insecurity and two-thirds (65.7%) householdsareoccasionally living with food insecurity. The study found that more than half of the poor households (52.8%) were food insecure during the previous month of the survey conducted. However, Indigenous households in the Hilly regions (55.6%) are bit more food insecure than plainland Bengali households (51.4%). Even two-fourth (40.7%) households admitted that they had less food today (during the survey day) than yesterday.

Food Security of the Household	*Bengali & Plainland (%)*		*Indigenous & Highland (%)*		*Bangladesh (%)*	
Householdhad less food than the real need during the last month	37	51.4	20	55.6	57	52.8
householdhad less food today than the yesterday	30	41.7	14	38.9	44	40.7
Households always living with food insecurity	20	27.8	6	16.7	26	24.1
Households occasionally living with food insecurity	46	63.9	25	69.4	71	65.7
Householdborrowed rice from others	61	84.7	29	80.6	90	83.3
Household provided rice as a loan to others	56	77.8	10	27.8	66	61.1
Have no arrangement to stock food in household	36	50.0	16	44.4	52	48.1
Total	72	100.0	36	100.0	108	100.0

The poor households living with chronic food insecurity are almost two (1.7) times higher in Bengali households of the Plainland (27.8%) than Indigenous & Highland households (16.7%). More than four-fifth (83.3%) of the households borrowed rice from others and more than half (61.1%) of the households provided rice as a loan to others. The provision of rice loan is found 2.8 times higher in plain land areas than hilly areas.

Nearly half (48.1%) of the households have no arrangement to stock food in their households. During the last month, on average, households were unable to manage three meals in a day for 8 days. This also matches with the number of dayswhen household had no money to buy daily-required food.

Status of the access to daily-required food by the poor households in Bangladesh	**Bengali**	**Indigenous**	**Total**
N=	**72**	**36**	**108**
Number of days' when household members took 3 meals in a day during last month (average days)	21	25	22
Number of days' when household had no money to buy daily-required food (average days)	9	6	8

The respondents perceived that in Bangladesh poor households face highest food crisis in the months of June (61.1%), July (59.3%) and March (55.6%).

Name of the months when poor households face highest food crisis	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
Boishakh / April	12	16.7	26	72.2	38	35.2
Joishtha / May	16	22.2	30	83.3	46	42.6
Ashar / June	31	43.1	35	97.2	66	61.1
Sraban / July	32	44.4	32	88.9	64	59.3
Vadra / August	29	40.3	3	8.3	32	29.6
Ashshin / September	31	43.1	1	2.8	32	29.6
Kartik / October	29	40.3	0	0	29	26.9
Agrahayon / November	5	6.9	0	0	5	4.6
Poush / December	3	4.2	1	2.8	4	3.7
Mugh / January	2	2.8	2	5.6	4	3.7
Falgun / February	15	20.8	27	75.0	42	38.9
Chaitra / March	31	43.1	29	80.6	60	55.6
Total	72	100.0	36	100.0	108	100.0

Indigenous Highland households are living with continuous sever food crisis for half of the year (from February to July). Particularly in May, June & July they live in famine situation. However, from August to January, there is virtually no food crisis in the Indigenous Highland households.

Monthly Food Crisis Trend	% households faced highest food crisis		
Monthly trend of the highest household food crisis	*Bangladesh*	*Indigenous & Highland*	*Bengali &Plainland*
Ashar / June	61.1	97.2	43.1
Sraban / July	59.3	88.9	44.4
Chaitra / March	55.6	80.6	43.1
Joishtha / May	42.6	83.3	22.2
Falgun / February	38.9	75.0	20.8
Boishakh / April	35.2	72.2	16.7
Vadra / August	29.6	8.3	40.3
Ashshin / September	29.6	2.8	43.1
Kartik / October	26.9	0	40.3
Agrahayon / November	4.6	0	6.9
Poush / December	3.7	2.8	4.2
Mugh / January	3.7	5.6	2.8

Virtually no food crisis (<10% households faced food crisis)
Notable Food Crisis (>10% but <25% households faced food crisis)
Moderate food crisis (25%-35% households faced food crisis)
Critical Food crisis (>35% but <50% households faced food crisis)
Sever Food Crisis (>50% but <75% households faced food crisis)
Famine (>75% households faced food crisis)

Household's experiences of the food crisis during the last year: The poor households in Bangladesh are living with severe food crisis for half of the year with fluctuating trend. Nevertheless, indigenous poor households in the hilly regions are living repeatedly in famine situation for half of the year from February to July. Majority of the poor households were forced to reduce food intake to survive amidst the sever food crisis. More than one-third of the poor households have reported that they had reduced their food intake from February to July in the last 12 months. Although indigenous households do not face notable food crisis during the months of September (11.1%), October (2.8%), the plainland households have faced severe food crisis during September (62.5%) and October (55.6%). November (6.5%) is found as the lone month of the last year when food crisis was lowest both in plainland (9.7%) and highland (0%).

Household Food Insecurity (households face food crisis in terms of availability & access to food in the last 12 months)	**Bengali &Plainland (%) N=72**		**Indigenous & Highland (%) N=36**		**Bangladesh (%) N=108**	
	Faced Food Crisis	Reduced Food Intake	Faced Food Crisis	Reduced Food Intake	Faced Food Crisis	Reduced Food Intake
Boishakh / April	31.9	26.4	97.2	47.2	53.7	33.3
Joishtha / May	69.4		100.0		79.6	
Ashar / June	33.3	23.6	100.0	88.9	55.6	45.4
Sraban / July	41.7	33.3	97.2	88.9	60.2	51.9
Vadra / August	47.2	36.1	30.6	30.6	41.7	34.3
Ashshin / September	62.5	33.3	11.1	8.3	45.4	25.0
Kartik / October	55.6	31.9	2.8		38.0	21.3
Agrahayon / November	9.7	4.2			6.5	2.8
Poush / December	15.3	8.3	11.1	8.3	13.9	8.3
Mugh / January	18.1	11.1	30.6	22.2	22.2	14.8
Falgun / February	31.9	23.6	97.2	72.2	53.7	39.8
Chaitra / March	51.4	30.6	97.2	69.4	66.7	43.5

More than half of the poor households in Bangladesh have face food crisis during the month of May (79.6%), March (66.7%), July (60.2%), April (53.7%), June (55.6%) and February (53.7%). More than half of the poor households in the plainland areas of Bangladesh have faced food crisis during the month of May (69.4%), September (62.5%), October (55.6%) and March (51.4%). Virtually all the indigenous highland households have faced continuous food crisis from February (97.2%) to July (100%) in terms of availability & access to food in the last 12 months.

Food Consumption during any natural disaster: The study recognized that any natural disaster has a profound influence on the food consumption pattern of the poor households in Bangladesh. Nearly two-third households (63.9%) in Bangladesh shift from their normal food and consume dry food (Cira, Mury& Bread) during flood, cyclone & others natural disaster. However, the Indigenous & Highland households mainly consume boiled green bananas/ jackfruits/ potatoes (80.6%) and dry food (63.9%) during any natural disaster. Besides, they also consume different types of fruits (11.75) and vegetables (8.3%). Nevertheless, the Bangali households in the Plainland only sticks to dry foodduring any natural disaster if normal food is unavailable.

Types of food consume during flood, cyclone & other natural disasters (total exceeds 100 due to multiple answer)	Bengali & Plainland (%)			Indigenous & Highland (%)			Bangladesh (%)		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
N=	**35**	**37**	**72**	**18**	**18**	**36**	**53**	**55**	**108**
Dry food (Cira, Muri, bread)	74.3	54.1	63.9	72.2	55.6	63.9	73.6	54.5	63.9
Normal foods	34.3	59.5	47.2		27.8	13.9	22.6	49.1	36.1
Different type of fruits				16.7	5.6	11.1	5.7	1.8	3.7
Boiled green bananas/jackfruits/ potatoes				83.3	77.8	80.6	28.3	25.5	26.9
Different types of vegetables				11.1	5.6	8.3	3.8	1.8	2.8

One striking feature is observed among the indigenous households in the highland areas where none of the female-headed households consume normal food during any natural disaster.

Chief Food Collector (CFC) of the Household: In Bangladesh male is Chief Food Collector (CFC) for their households, which is more common in Bengali households of the plainland areas where more than two-thirds (70.8%) of the households acknowledged male's role as the CFC of the household. The indigenous households reported that women & men collectively collect food. The joint food collection role of women & men in the indigenous highland households (77.8%) is almost 5 times more customary than the Bengali households (16.7%) in plainland areas.

4.2 Status of the Food stocking, warehousing and distribution systems in Bangladesh

Food stocking, warehousing and distribution systems in the community: Food stocking and warehousing is not very secure in both plainland and highland areas.

Crop Stocking	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
Farmers preserved any crops for more than two months in their household during the last year						
Yes	28	38.9	16	44.4	44	40.7
No	44	61.1	20	55.6	64	59.3
Total	72	100.0	36	100.0	108	100.0

N=	**28**	**16**	**44**
Weight of crop stocks (kilograms)			
Average weight of crop stocks (kilograms)	440	88	312
Minimum weight of crop stocks (kilograms)	10	33	10
Maximum weight of crop stocks (kilograms)	1500	350	1500

Due to food crisis, farmers do not even think about food stocking. If they manage to have surplus food, then they stock it in their household. However, rats and other insects damage the stocked food. Except few occasions, farmers do not get the fair price of their stocked food if they sell it later. Well-structured food distribution mechanism is very poor in plainland and virtually absent in highland areas. Even the farmers do not get enough relief during the flooded time. Two-fifth (40.7%) of the farmers reported that they had preserved crops for more than two months in their household during the last year. On average, they have preserved 312 kilograms of crops. However, the Bengali household of the Plainland areas (440kg) had preserved 5 times more than indigenous households of the highland areas (88kg).

4.3 Standard practices & systems of food & non-food crops production

Farming Practices & Cropping patterns: Farming system includes the procedure of using the land, labour, inputs and capital to manage farm, household, non-farm and off-farm production and consumption to meet its objectives and priorities under a certain physical, biological and socio-economic conditions. Majority of the people in Bangladesh depend directly upon their own farm production for survival.

Food Production Systems and Techniques in Bangladesh	*Sirajgonj (Ullahpara)*	*Barisal (Banaripara)*	*Khagrachhari (Sadar)*	*All Areas*
	Bengali & Plainland		**Indigenous & Highland**	**Bangladesh**
Traditional rice production system		√		√
Modern rice production system	√	√		√
Joom cultivation			√	√
Cultivation in plain land			√	√
Domestic animal (cow, goat, Duck, hen) rearing	√	√		√
Aquaculture	√	√		√
Vegetable cultivation	√			√
Integrated cultivation	√	√		√

Most farmers follow sequential cropping, mixed-cropping, and relay cropping patterns. Sequential cropping is the growing of two crops in rapid sequence, planting one after the harvest of the former. Mixed cropping on the other hand, is simultaneously growing of two or more crops intermingled on the same land. Intercropping refers to the growing of two (or more) crops simultaneously on the same land, but the crops may or may not be sown or harvested at one time.

Rice is the major staple food crop in Bangladesh. Three rice-based cropping seasons; Boro/Robi seasons (December-May/Poush-Jaistha), Aus seasons (April- August/Bioshakh-Srabon) and Amon seasons (August- December/Vhadro-Poush) dominates the agriculture in Bangladesh. Aman (broadcast and transplanted) is generally cultivated in December-January, Boro in March-May and Aus in July-August cropping seasons. In Bangladesh most of the rice grown in low-lying areas during the monsoon season are floating type, generally called deep-water rice, and locally known as jolidhan, poushdhan, etc. Smallholder farmers who produce rice for family consumption and for marketing the marginal surplus grow most rice.

In Plain land areas, local farmers are more interested for cultivating Irri-Boro paddy due to its higher yield than other rice varieties. Farmers know the practical details (fertilizer utilization, pesticide management, irrigation etc) of Irri-Boro cultivation. Virtually all the poor indigenous community of the High land (hilly areas) is dependent upon agriculture and Jhum cultivation in hills. Apart from paddy cultivation, indigenous high land community produces potato, sugar cane and various vegetables. Besides, they produce zinger, turmeric, banana, jackfruit, lychee and mango.

Land working by power tiller

Land working by cattle

Transplanting of rice

Mature Rice

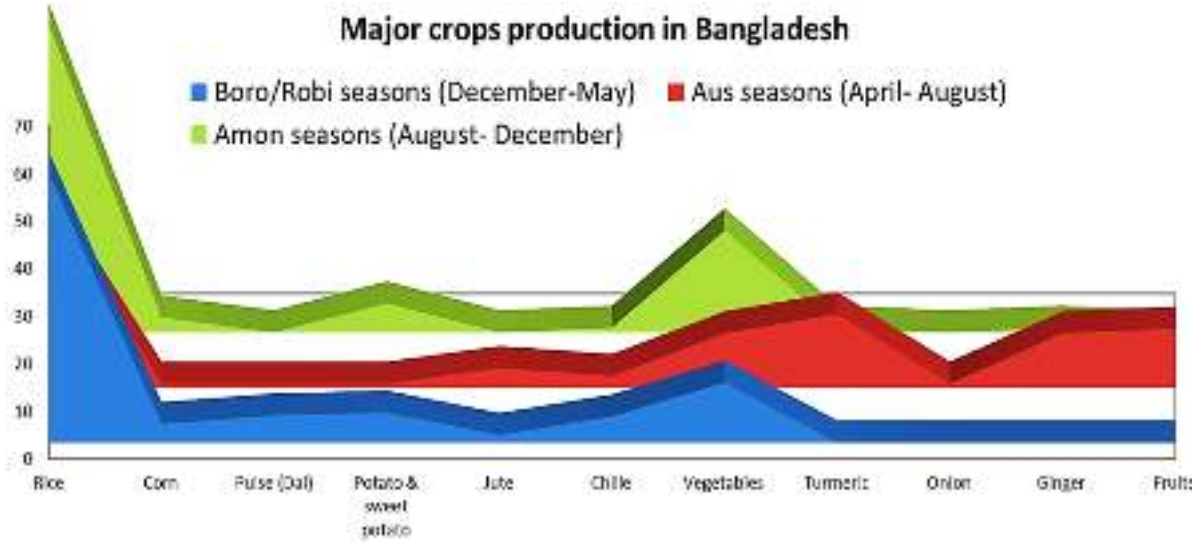
Irrigation by a rental water pump

Irrigation by traditional method

Rice harvesting

Paddy is ready

TYPICAL RICE PRODUCTION PROCESS IN BANGLADESH



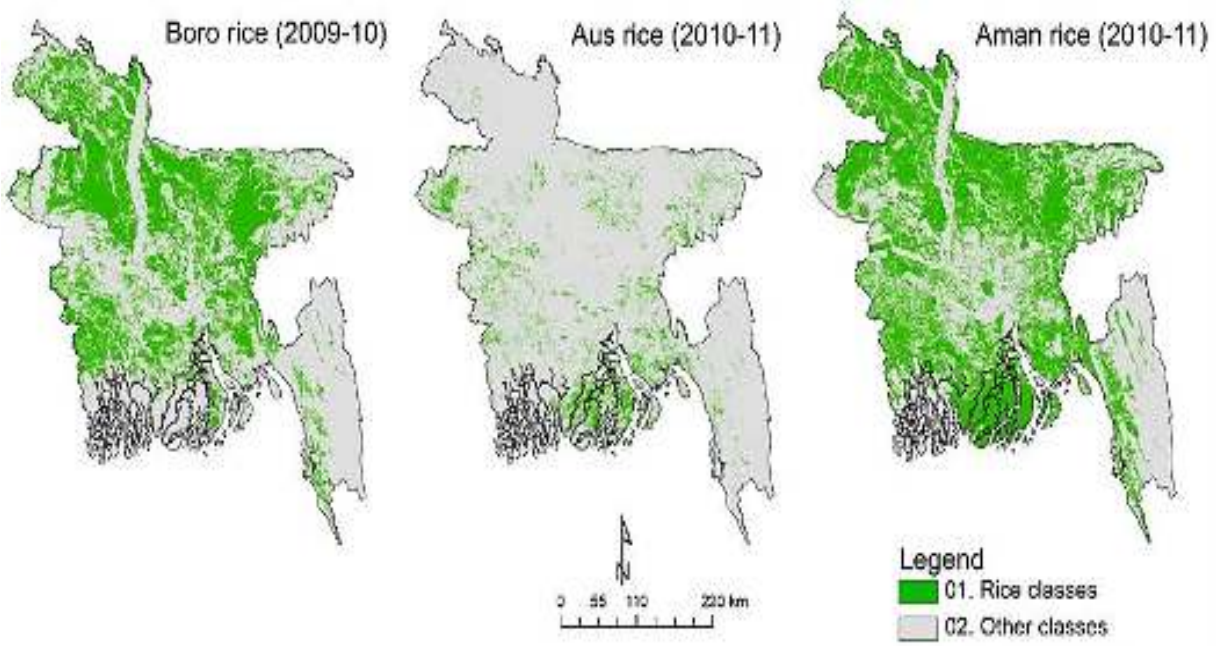
The traditional agriculture is not used anymore in the plainland regions of Bangladesh. Even those who do not use modern agriculture, use modified version of traditional agriculture.

Methods of food production	Bengali & Plainland (%)		Indigenous & Highland (%)		Bangladesh (%)	
	N	%	N	%	N	%
Modern method	65	90.3	2	5.6	67	62.0
Alternative method	7	9.7			7	6.5
Traditional method			34	94.4	34	31.5
Total	72	100.0	36	100.0	108	100.0

More than four-fifth of the Bengali households of the plainland areas (90.3%) are using modern agriculture methods. On the other hand, almost all of the indigenous households (94.4%) of the highland areas are still following traditional agriculture method.

Major crops & mode of cultivation	Bengali & Plainland			Indigenous & Highland			Bangladesh		
	Boro/Robiseasons (December-May)	*Aus seasons (April-August)*	*Amon seasons (August-December)*	*Boro/Robiseasons (December-May)*	*Aus seasons (April-August)*	*Amon seasons (August-December)*	*Boro/Robi seasons (December-May)*	*Aus seasons (April-August)*	*Amon seasons (August-December)*
N=	**72**	**72**	**72**	**36**	**36**	**36**	**108**	**108**	**108**
Major crops									
Rice	66.2	45.8	93.2	41.2	36.4	40.7	56.3	38.2	64.3
Corn	2.6		4.5	5.9	1.0	1.9	3.9	.8	3.1
Pulse (Dal)	9.1	4.2		2.0			5.7	.8	
Potato & sweet potato	1.3			15.7	1.0	11.2	6.3	.8	6.1
Jute	2.6	20.8		0			1.6	4.1	
Chilie	3.9	4.2		7.8	2.0	1.9	5.5	2.4	1.0
Vegetables	10.4	16.7	2.3	15.9	10.0	39.1	12.6	11.4	21.4
Turmeric					19.2	1.9		15.4	1.0
Onion					1.0			.8	
Ginger					14.1	1.9		11.4	1.0
Fruits		4.2				14.1		12.3	
Cultivation Mode									
Cultivate own land	49.4	50.0	50.0	66.7	75.8	72.2	56.3	70.7	62.2
Cultivate leased land	50.6	50.0	50.0	33.3	24.2	27.8	43.7	29.3	37.8

Diversity, Intensity & volume of agriculture production: The harvested area covers 11.5 million hectares (because of 2–3 crops per year) or 80% of the cultivated area. Boro rice is cultivated in most agricultural areas of the country except the coastal zone due to salinity. The aus crop is mainly in the west and south but is isolated to a few suitable areas during the summer, and the monsoon aman crop is widespread and includes the coastal zone.



Source: http://irri.org/knowledge/publications/rice-today/maps/rice-cropping-patterns-in-bangladesh

The average area of cultivation in Bangladesh falls within the 47-79 decimal (0.2-0.3 ha). The average total production falls in between 523 to 750 kilograms. Generally, the highest area under cultivation happens during the August-December season whereas the least area under cultivation happens during the April- August. On average, poor Bengali households of the plainland cultivate much bigger area in comparision with the indigenous households of the Hilly/Highland areas.

Diversity, Intensity & volume of agriculture production	**Bengali & Plainland**			**Indigenous & Highland**			**Bangladesh**		
	Boro/Robi seasons (December-May)	*Aus seasons (April-August)*	*Amon seasons (August-December)*	*Boro/Robi seasons (December-May)*	*Aus seasons (April-August)*	*Amon seasons (August-December)*	*Boro/Robi seasons (December-May)*	*Aus seasons (April-August)*	*Amon seasons (August-December)*
N=	72	72	72	36	36	36	108	108	108
Average area of cultivation (Decimals)	83	59	115	30	44	50	62	47	79
Average Total Production (Kilograms)	1025	662	831	296	489	683	734	523	750
One hectare is equal to 10000 square meter [m^2] or 2.47 acre 1 acre = 100 decimals									

4.4 Agricultural Practices, Food production & Food Intake pattern

The study identified dramatic changes in food intake pattern in the poor households in Bangladesh between harvesting period and crisis period due to food availability. Among the households who used to take food three times in a day during the harvesting period (89.8%) take food two times in a

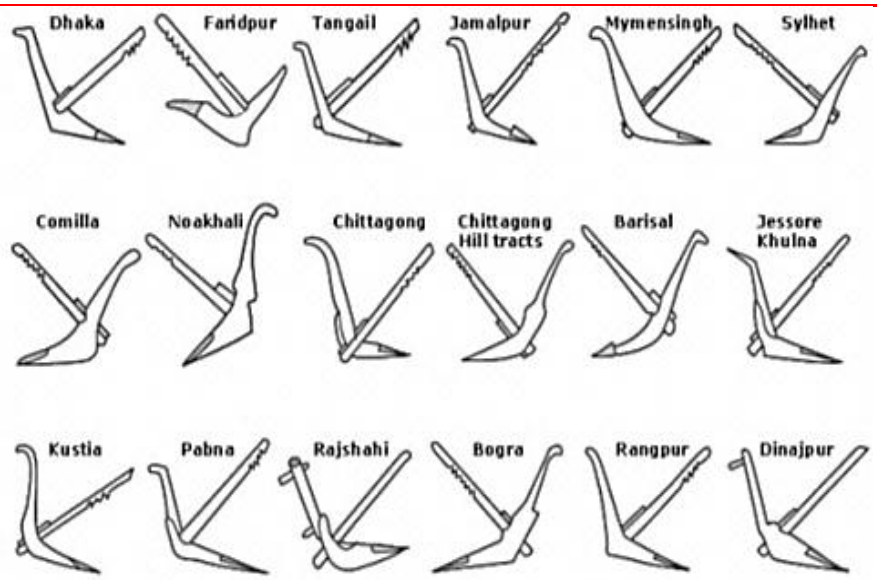
day during the crisis period (27.8%). More than half of the households (62%) used to reduce their food intake to adjust with any crisis.

Changes in household food intake pattern due to food availability	Bengali &Plainland (%) N=72		Indigenous & Highland (%) N=36		Bangladesh (%) N=108	
	Harvesting Period	Crisis Period	Harvesting Period	Crisis Period	Harvesting Period	Crisis Period
One time daily	1.4	1.4	0	0	.9	.9
Two times daily	13.9	58.3	0	97.2	9.3	71.3
Three times daily	84.7	40.3	100.0	2.8	89.8	27.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

The three times daily food intake situation is 14.4 times better in the plainland Bengali households (40.3%) than the indigenous households (2.8%) are during the crisis period. However, during the harvesting period, three times daily food intake situation is 1.2 times better in theindigenous households (100%) than the plainland Bengali households (84.7%).

Changes in Food production pattern	Bengali & Plainland (%) N=72		Indigenous & Highland (%) N=36		Bangladesh (%) N=108	
	N	%	N	%	N	%
Traditional food production system	9	12.5	36	100.0	45	41.7
Modern food production system	58	80.6			58	53.7
Alternative food production system	**29**	**40.3**	**3**	**8.3**	**32**	**29.6**
Floating vegetable production system	*3*	*10.3*			*3*	*9.4*
Hanging food production system	*7*	*24.1*			*7*	*21.9*
Vegetable production system at courtyard	*24*	*82.8*	*3*	*100.0*	*27*	*84.4*
Fruits and vegetables production system on roof	*3*	*10.3*			*3*	*9.4*

Except indigenous households of the Highlands, food production system has drastically shifted towards modern system. In the plainland areas, alternative food production systems for domestic food security are also getting popular.



Ploughs used at different locations of Bangladesh

Plough an indigenous device used for tilling the soil and preparing it for cultivation.

A plough has been a crucially important implement for traditional agricultural production.

Two drought cows, sometimes by man under extreme circumstances, draw it normally.

Source: www.banglapedia.org

In traditional agricultural system, farmers of the plain land were used to ancient equipment's, local seeds, no fertilizer in cultivation. Although such practice required more human labor and produce less, it did not polluted the environment. Langol (in bangla) is used to make land with two cows.

Despite the wave of agricultural modernization, indigenous communities in the Highland regions of Bangladesh are still practicing their traditional production system. However, indigenous farmers have pointed out some changes. Earlier they were not interested to cultivate in the plain flood plain of the hilly rivers and valleys, because Jhum cultivation was sufficient to provide required food. Now a day as jhum cultivation is unable to fulfill their food security, they have started cultivating in any available plain land in their hilly region. Even they have already started using pesticides & fertilizers.

Changes in agricultural technologies & services: Bangladesh has witnessed a rapid expansion of mechanized agriculture within the last 10 years. The modernization of agriculture has changed the traditional production system. Power Tiller replaced Langol, intensive use of chemical fertilizer, hybrid seed and pesticide dominates the farming practice. All the farmers observed that farming is changing with time.

Agricultural service syndicates are on the rise in Bangladesh

An informal market for rental of tilling, irrigation and threshing services has emerged in rural areas. The pay for the rental services vary from place to place, as there are no uniform rules prescribed. Agricultural service syndicates charges Tk 100 to irrigate for an hour and demands 20 kilograms of paddy for threshing paddy on a bigha of land. They also charges Tk 120-150 in rent to till a bigha of land. The overall market for farm implements and spare parts stood at Tk 3,000 crore in 2009 and it is growing. Power tillers, tractors and engines account for almost half of the total market.

A decade ago, almost all farmers used animals to plough with. Now, there is hardly any tilling by cattle in their locality. Very recently, the use of power tillers in land preparation felt necessary due to massive adoption of modern crop varieties. More than 100,000 power tillers are now in operation in Bangladesh.

Majority of the farmers in plain land areas have discarded traditional farming practice (using plough and cattle, organic farming) and adopted mechanized agriculture practices (using power tiller, chemical fertilizer, chemical pesticides and irrigation). The demand of less labor, less physical input, more production have encouraged plain land farmers to adopt modern mechanized agriculture practices.

Changes in cropping pattern within the 10-15 years: Rice is the most common crops in Bangladesh. Virtually all the households (99.1%) reported to cultivate rice at present. More households are currently cultivating rice than the last 10 to 15 years. As Aus rice cultivation has become quite uncertain because of drought, majority of the plainland farmers has abandoned Aus rice and started early transplanting of Aman rice.

Name of the major crops	Bengali &Plainland (%) N=72		Indigenous & Highland (%) N=36		Bangladesh (%) N=108	
	Currently cultivated major crops	Major crops cultivated 10 to 15 years ago	Currently cultivated major crops	Major crops cultivated 10 to 15 years ago	Currently cultivated major crops	Major crops cultivated 10 to 15 years ago
Rice	98.6	73.6	100.0	97.2	99.1	81.5
Pulse	25.0	73.6	16.7	97.2	22.2	81.5
Jute	8.3	25.0		22.2	5.6	24.1
Vegetables	2.8	27.8	22.2		9.3	18.5
Corn/wheat		2.8	75.0	47.2	25.0	17.6
Mustard/sesame/sugarcane	1.4	23.6	38.9	38.9	13.9	28.7
Ginger/Turmeric			38.9		13.0	
Spice		6.9		16.7		10.2

Indigenous communities in the hilly regions are now more interested in banana cultivation using traditional organic approach. The easy cultivation methods, all the year round availability, less production costs and the increasing local market demand created their interest for banana cultivation.

Knowledge and utilization of Agriculture technology: The farmers in the Plainland have more knowledge in modern agriculture or field technology, particularly on use of fertilizer, seeds, pest management, and pesticide use in comparision with the farmers of the highland regions. However, comparatively more highland farmers used to apply their technological knowledge than the farmers in the Plainland.

Agriculture Field level Technology	Bengali & Plainland (%) N=72		Indigenous & Highland (%) N=36		Bangladesh (%) N=108	
	Have knowledge	Used the technology who have knowledge	Have knowledge	Used the technology who have knowledge	Have knowledge	Used the technology who have knowledge
Fertilizer						
Use of balanced fertilizer	73.6	64.2	25.0	22.2	57.4	58.1
Use of organic fertilizer	79.2	68.4	27.8	70.0	62.0	68.7
Seeds						
Use of quality seeds	83.3	66.7	58.3	71.4	75.0	67.9
Modern seed production & management techniques	68.1	49.0	8.3	100.0	48.1	51.9
Pest Management						
Integrated Pest Management	56.9	31.7	22.2	87.5	45.4	40.8
Techniques of pesticide use	61.1	61.4	22.2	87.5	48.1	65.4
Cropping System						
Alternative cropping system	58.3	57.1	61.1	95.5	59.3	70.3
Homestead vegetable gardening in a planned way	65.3	57.4	66.7	95.8	65.7	70.4
Intercropping methods	48.6	48.6	16.7	50.0	38.0	48.8
Integrated farming system	36.1	30.8	19.4	57.1	30.6	36.4
Agro-product Processing & Preservation Technology						
Storage/preservation techniques	55.6	27.5	66.7	83.3	59.3	48.4
Post-harvest management	76.4	50.9	38.9	85.7	63.9	58.0
Food Processing	61.1	54.5	2.8		41.7	53.3

Jhuming or shifting cultivation or cultivation of slash and burn is the most prevalent form of cultivation in the hill areas of Bangladesh. Jhuming is practiced on sloppy hills outside reserve forests. The intensity of jhuming varies with changing conditions of rainfall, topography, accessibility, and density of population. The life and culture of the ethnic people of the Chittagong Hill Tracts depend largely on jhum cultivation.

Dheki: an women-led technology of food processing

Dheki is a wooden device for husking paddy to make rice, the staple food of Bangladesh. Dheki consists of a wooden lever, usually about six feet long and six inches in diameter. It moves on a small bolt passing through it and two cheeks, which are driven into the ground, until the bolt is about 18 inches high. Usually, 2-3 women work with this instrument; 1-2 alternatively press down the end of the lever with their feet to raise the pestle, and then by removing their feet allow the pestle to fall. One of them removes the beaten grain, and puts a fresh supply into the device that just is a circular hollow in the ground with a piece of wood in the bottom to receive the blow.

Knowledge and utilization of Non-AgriculturalTechnology: Handicrafts are the most common Non-Agricultural Technology among the poor households in Bangladesh. All the indigenous highland households who have handcrafts knowledge, they used it. Although repairing of agriculture tools is notable among the poor Bengali households in the Plainland, none of the indigenous highland households reported to have that knowledge.

Non-Agricultural Technology	Bengali & Plainland (%) N=72		Indigenous & Highland (%) N=36		Bangladesh (%) N=108	
	Have knowledge	Used the technology who have knowledge	Have knowledge	Used the technology who have knowledge	Have knowledge	Used the technology who have knowledge
Rickshaw/Van/bicycle repairing	30.6	9.1	2.8	0	21.3	8.7
Handicrafts	51.4	28.0	66.7	100.0	55.5	63.3
Nakshi Katha sewing	31.9	26.1	5.6	0	23.1	24.0
Repairing of agriculture tools	26.4	42.1	0	0	17.6	42.1
Ring Slab making for sanitary toilet	26.4	21.1	13.9	60.0	22.2	29.2
Tailoring	23.6	11.8	2.8	100.0	16.7	16.7

4.5 Seed Preservation and Management in Bangladesh

Seed preservation and management: More than half of the farmers (53.7%) had preserved seeds last year for selling in the market & growing their own food. The seed preservation is much higher among the indigenous farmers of the Highland (75.0%) than Bengali farmers of the Plainland (43.1%). On the other hand, the dependency upon the market for seeds is 24 times higher in the Bengali farmers in the plainland (68.1%) than the indigenous farmers of the Highland (2.8%). Farmers mainly collect rice and vegetables seeds from the market. Farmers also produce cereal seeds for personal use.

Seed preservation and management in Bangladesh	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
	72	100.0	36	100.0	108	100.0
Preserved seeds last year *for selling in the market & growing their own food*	31	43.1	27	75.0	58	53.7
General pattern of seed preservation and collection						
Collect seeds from market	49	68.1	1	2.8	50	46.3
Preserve seeds for own households	19	26.4	15	41.7	34	31.5
Both (collect from market & produce for personal use)	4	5.6	20	55.6	24	22.2
Types of seeds farmers collect from market						
Rice (Amon/Aus)	40	75.5	14	66.7	54	73.0
Vegetables	19	35.8	13	61.9	32	43.2
Corn			2	9.5	2	2.7
Ginger/Turmeric			1	4.8	1	1.4
Types of seeds farmers produce for personal use	23	100.0	35	100.0	58	100.0
Cereal	14	60.9	28	80.0	42	72.4
Different types of vegetables	11	47.8	10	28.6	21	36.2
Cash crop	2	8.7	12	34.3	14	24.1
Pepper/ginger/yellow			5	14.3	5	8.6
Joom (method of cultivation among hill tribes) Cultivation			5	14.3	5	8.6
Farmers evaluation of seeds						
Collected seeds from market are good	31	43.1	1	2.8	32	29.6
Self-produced seeds are good	41	56.9	35	97.2	76	70.4
	72	100.0	36	100.0	108	100.0
Farmers evaluation of seeds price in the market						
Seed's price in the market is high	55	76.4	36	100.0	91	84.3
Seeds price in the market is low	11	15.3			11	10.2
Seeds price in the market is appropriate	6	8.3			6	5.6
	72	100.0	36	100.0	108	100.0

Majority of the farmers opined that their self-produced seeds (70.45%) are far better than the seeds they collect from market (29.6%). Most of the farmers (84.3%) reported that seed's price in the market is higher than it should be. Farmers in plain land preserve and utilize seeds according to their knowledge & experience. They revealed that their traditional seed management knowledge fails to provide optimum results. They do not receive required assistance from the local agricultural office of the government. Indigenous communities in the Highland areas usually preserve seed in dry paces of their own households and do not face any significant problem for seed preservation. They keep seeds in cane basket, put rice husks at the bottom, then seed in the middle, and put rice husks again on the top of the seeds.

Average amount of Seeds preserved (Kilograms)		Bengali & Plainland	Indigenous & Highland	Bangladesh
	N=	31	27	58
Preserved seeds last year for growing food for own households (Kg)		29	23	26
Preserved seeds last year for selling in the market to earn cash (Kg)		59	13	36

On average, among the poor households who used to preserve seeds, have preserved 26 kilograms of seeds last year for growing food for their own households. Besides, they also preserved 36

kilograms of seeds in the last year for selling at the market to earn cash. The preservation of seeds for selling market to earn cash is 4.5 times higher in the Bengali households of the Plainland (59kg) than the Indigenous households of the Highland areas (13kg).

4.6 Management of Fertilizers & Pesticides and weed control

Fertilizer management: Four-fifth (80.6%) of the farmers has reported that they have used fertilizer for growing crops in the current year. The Urea (94.3%) and TSP (70.1%) are the two most common chemical fertilizers that farmers have used for growing food in this year. Nearly two-third (62.0%) farmers have reported that they have used organic fertilizer at least for once for food production and majority of the farmers consider organic fertilizer is cost-effective(77.8%) and good for growing foods (58.3%).

Fertilizer use	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
	72	***100.0***	***36***	***100.0***	***108***	***100.0***
Used fertilizer for growing crops this year	59	81.9	28	77.8	87	80.6
Type of fertilizers used in this year						
Urea	54	91.5	28	100.0	82	94.3
TSP	41	69.5	20	71.4	61	70.1
SSP	24	40.7	2	7.1	26	29.9
Potash	44	74.6	5	17.9	49	56.3
DAP	9	15.3			9	10.3
Boron	5	8.5			5	5.7
Mixed fertilizer	8	13.6	9	32.1	17	19.5
Organic fertilizer	40	66.8	9	32.2	49	56.0
Total	59	100.0	28	100.0	87	100.0
Used organic fertilizer at least for once	57	79.2	10	27.8	67	62.0
Farmers consider organic fertilizer is good for growing crops	49	68.1	14	38.9	63	58.3
Farmers consider chemical fertilizer is good for growing crops	23	31.9	22	61.1	45	41.7
Farmers consider organic fertilizer is cost-effective	63	87.5	21	58.3	84	77.8
Farmers consider chemical fertilizer is cost-effective	9	12.5	15	41.7	24	22.2

Availability of fertilizer according to the farmersneeds: The Plainland farmers purchase fertilizer from the local markets and the price is very high. Sometimes to reduce cost, they make organic fertilizer by themselves. In hilly regions, fertilizer is not always available. Even if available, the price of fertilizer is too high to purchase. In Highland areas, farmers accused fertilizer businessmen for making artificial crisis to sell it in very high price.

Management & application of Pesticides: Majority of the farmers (75.0%) have used pesticide for growing crops in this year. Among the farmers who used pesticide, majority of them have used chemical pesticide (85.2%) and consider their used pesticides are good for growing crops (88.9%). More than half of the farmers do not know how much pesticide is required for specific crops (56.5%) and yet uninformed about the various methods of handling pests/insects without using chemical pesticides (62.0%).

The lack of information about pesticides is more common in the Highland areas than the Plainland areas. In addition, more than one-fifth (21.3%) farmers even use pesticide in crops when there are no signs of pests/insects incursion. More than one-third (41.5%) of the farmers who knows how to handle insects/pests without using pesticides, do not even practice it.

Pesticide use	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
	72	***100.0***	***36***	***100.0***	***108***	***100.0***
Used pesticide for growing crops in this year	51	70.8	30	83.3	81	75.0
Type of pesticides used in this year						
Organic pesticide	10	19.6	2	6.7	12	14.8
Chemical pesticide	41	80.4	28	93.3	69	85.2
Farmers consider their used pesticides are good for growing crops	43	84.3	29	96.7	72	88.9
Farmers do not know how much pesticide is required for specific crops	27	37.5	34	94.4	61	56.5
Farmers even use pesticide in crops when there are no signs of pests/insects incursion	21	29.2	2	5.6	23	21.3
Farmers do not know that use of chemical pesticides is bad for crops	30	41.7	31	86.1	61	56.5
Farmers do not know that there are various methods to handle pests/insect without using chemical pesticides	41	56.9	26	72.2	67	62.0
	31	***100.0***	***10***	***100.0***	***41***	***100.0***
Farmers who knows how to handle insects/pest without using pesticides, does not practice it	14	45.2	3	30.0	17	41.5

Many Plainland farmers do not use chemical pesticide; rather use indigenous techniques to protect their crops from insects. They produce bio-pesticide Neem leaf, Mehogony fruits and use it in their lands. The highland farmers use roots of indigenous trees as pesticides. Farmers from both plainland and highland reported that it would be very helpful for them if they receive training to protect their crops and prevent insect invasion without using chemical pesticides.

Weed control: Farmers take measures for weed control during crop production. Most of the farmers (87.0%) have removed weeds for growing crops in this year by hand picking (66.0%) and using herbicides for weed controls (34.0%). Different weed control methods involved different amounts of cost, which affect the total cost of cultivation. The hand wedding is laborious and generally more expensive. Experts opined that optimum and safe use of herbicides by adopting effective weeds management methods could save crops worth Taka 6,000 crore annually in Bangladesh. Unrestricted growths of weeds cause damages to 37 crop yields on an average in all seasons with 32.2 percent losses in food crops, 41.3 percent in cereals, 31.2 percent in pulses, 40.8 percent in oilseeds and 39.2 percent in fibre crops.

Weed control	Bengali &Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
	72	***100.0***	***36***	***100.0***	***108***	***100.0***
Removed weeds for growing crops in this year	58	80.6	36	100.0	94	87.0
Types of weed control methods farers used						
Using herbicides for weed controls	16	27.6	16	44.4	32	34.0
By hand picking	42	72.4	20	55.6	62	66.0

4.7 Status of the Irrigation system and Irrigation management

The irrigation sector in Bangladeshis mostly mechanized. The shallow tube wells (STW), low lift pumps (LLP), and deep tube wells (DWT) cover irrigation of about 1.9 million ha annually. In Bangladesh, deep-water rice occupied 2.09 million ha (21% of the total rice area) in the late 1960s. The area has now shrunk to about 0.85 million ha because of cultivation of high yielding varieties under irrigation in deep-water rice fields in the dry season (boro). Majority of the plainland farmers are not part of the modernized irrigation system. The frequent electrical power shortage also hampers the effective use of irrigation system while they have to pay monthly fee for it.

Irrigation	Bengali& Plainland		Indigenous& Highland		Bangladesh	
	N	%	N	%	N	%
Irrigated land for growing crops this year	46	63.9	4	11.1	50	46.3

More than two-fifth (46.3%) of the poor farmers in Bangladesh has irrigated land for growing crops in this year.The agriculture production without irrigation is more common in the indigenous highland areas than the Plainland areas. In fact, irrigation of lands for growing food is almost six (6) times more prevalent in the Plainland (63.9%) areas than the Highland areas (11.1%).

Source of Irrigation	Bengali &Plainland			Indigenous & Highland			Bangladesh		
	Boro/Robi seasons (December-May)	*Aus seasons (April-August)*	*Amon seasons (August-December)*	*Boro/Robi seasons (December-May)*	*Aus seasons (April-August)*	*Amon seasons (August-December)*	*Boro/Robi seasons (December-May)*	*Aus seasons (April-August)*	*Amon seasons (August-December)*
N=	72	72	72	36	36	36	108	108	108
Without irrigation	***3.9***	***16.7***		***19.6***	***54.5***	***25.9***	***10.2***	***47.2***	***14.3***
LLP	16.9	16.7	11.4	9.8	5.1	9.3	14.1	7.3	10.2
Shallow tube well	35.1	25.0	40.9	15.7	8.1	13.0	27.3	11.4	25.5
Deep tube well	18.2	25.0	29.5				10.9	4.9	13.3
Local irrigation system	23.4	16.7	13.6	52.9	31.3	50.0	35.2	28.5	33.7
Pedrollo pump	2.6		4.5	2.0	1.0	1.9	2.3	0.8	3.1

Canals and rivers are the major source of irrigation for the hilly areas. Highland farmers are not getting adequate water for irrigation from rivers & canals due to droughts, less rain, and higher evaporation rate. The scope of irrigation for hilly areas is decreasing gradually and highland farmers are very worried about food production at future. They demanded urgent intervention from the government for providing better irrigation system.

The rural electricity program (REP) has been playing a significant role in attaining food self-sufficiency through use of productive and efficient irrigation equipment's. According to REP, average

yield per acre under electrified pumps is 24% higher than that of diesel operated ones. REP claims that electrified pumps contribute one-third of the food self-sufficiency in Bangladesh covering 4.1 million acres of land for HYV Boro and Aman. Government provides 20% rebate to the electric bill to the irrigation pumps to enhance the agricultural growth.

4.8 Impact of Land Use changes & land Grabbing on the food security

Agro-ecologically disadvantaged regions such as deeply flooded areas; char land, flash flood prone areas, coastal tidal surge and salinity prone areas, and hilly areas together constitute about 41 percent of the country. Demand of land is increasing day by day to provide housing for the increasing population, construction of government complexes in Thanas, industries, brick fields, roads and highways, flood protection embankments, defence installations, and educational institutions. The main areas of land use in Bangladesh are agriculture, housing, forests, rivers, irrigation and sewerage canals, ponds, railways, commercial and industrial establishments, tea estates, rubber fields, horticulture gardens, the coastal belt, sandy riverbeds and char areas. Bangladesh is one of the world's largest wetland areas, and during the rainy season about two-thirds of the country can be classified as wetlands as defined in the Ramsar Convention.

Agricultural land is decreasing gradually to accommodate the increasing population. Many productive agricultural lands have already converted into factories, brickfields, roads and other infrastructures. Consequently, cultivable land for food production has substantially reduced. Lack of public awareness also contributes unsustainable land use practices like shrimp farming. Lack of information as well as difficulties for accessing land data is responsible for lengthy land ownership related litigations, which ultimately keeps the land away from any productive use.

More than half of the respondents have admitted that food productions are decreased in their locality within the last 3 years (58.3%) as well as the same land area currently produces less food than 10 years ago (51.9%). One-tenth of the respondents (10.2%) pointed out that lands, which were used for agricultural 10-15 years ago, are currently not used for agricultural anymore.

Changes in land use pattern & it's impact on food production	**Bengali & Plainland** (%) N=72		**Indigenous & Highland** (%) N=36		**Bangladesh** (%) N=108	
	N	**%**	**N**	**%**	**N**	**%**
Previous agricultural land (10-15 years ago) are currently not used for agricultural anymore	10	13.9	1	2.8	11	10.2
The same land area currently produces less food than 10 years ago	27	37.5	29	80.6	56	51.9

According to the prevailing land laws in the country, a family can own a maximum of 100 bighas (33 decimals) of land as inherited property and can acquire a maximum of 60 bighas or 19.8 acres by purchase. But this law has not been enforced strictly. Moreover, the definition of "Family" is also not sufficiently clear. Making use of this lack of clarity, many families own large areas of land. Although there is a policy for the distribution of khas land of the country among the landless and marginal poor, the implementation of the policy has yet to be satisfactory.

Land grabbing is key factor for food insecurity of the indigenous highland population. Many lands grabbed by the influential Bengali people in the hilly regions remain fellow which earlier were used by the indigenous people for food production.

4.9 The exploitation of the Farmers' within the markets in Bangladesh

Agricultural marketing system, management and control: The marketing chain for farm products in Bangladesh is highly fragmented. Actors include local collectors, local traders, local market aratders and their agents, urban wholesalers and their commission agents, rural and urban retailers. Many of these operate on a very small scale. Marketing chains differ between commodity groups. Crops such as paddy, red chili, and vegetables are either collected by 'farias (commission agents) from the farmgate or producers take their produce to sell directly in nearby markets. Wholesalers purchase from rural markets through agents and send this produce to the commission agents in big urban wholesale markets, or sell to processors. Farmers do not have any control on local markets in Bangladesh. Farmers do not get fair price of their products as big merchants controls the market and sets the price of the products.

In hilly regions, the influential Bengali merchants control the local markets. Influential members of the indigenous community control the very small local markets within the indigenous communities. Although the highland farmers have been facing economic injustice for a long time, they have not tried to create social movements against unjust market control. In plainland, farmers are very much worried about rice cultivation. In every stage of rice production, from land preparation to rice grain production farmers have to spend more money than the previous year. Fertilizer, seeds, fuel and all other agricultural inputs cost is rising everyday with abnormal jump while the price of rice is going down. Besides, the cost of agricultural labor has also increased. Many farmers have replaced rice cultivation by corn, wheat or maize cultivations. Those who have not shifted into other cultivations, scale down the rice cultivation. Farmers are paying 40% more for diesel and 66% more for fertilizer than previous year. Therefore, every year farmers are cultivating less land to adapt with higher price of agricultural inputs.

THE GROWTH OF RURAL ECONOMY DEPENDS ON FARMERS' INCOME

In October 2011, the price of rice and wheat dropped dramatically and farmers received 10-15 Taka less per kilogram of Rice & wheat. On the other hand, they are selling their produce in a price that is lower than their production cost. Farmers have roughly calculated that they have to spend Taka 15 to bring one-kilogram rice from field to their home. If the rent of the land and labor cost of the farmer & their family members are included then it would be around Taka 22 to bring one-kilogram of rice grain in their home. They are mainly producing for their own food security as well as to ensure food for their livestock's. This has also reduced the availability of cash in farmers' household and ultimately putting rural economy towards a negative growth.

Farmers' linkage with markets and marketing of agro-products: Farmers usually market their products individually (55.6%) and collectively or in a group with other farmers (44.4%). Majority of the farmers reported that they are able to sell their products in their preferred markets (74.1%) and their products have demand in the local market (87.0%). The irrigation syndicate takes at least 25% of the crops directly from the field as the price of irrigated water.

Farmers' linkage with markets and marketing of agro-products	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
	72	***100***	***36***	***100***	***108***	***100***
Farmers market their products collectively or in a group with other farmers	23	31.9	25	69.4	48	44.4
Farmers market their products individually	49	68.1	11	30.6	60	55.6
Farmers are able to sell their products in their preferred markets	51	70.8	29	80.6	80	74.1
Farmers products have demand in local market	59	81.9	35	97.2	94	87.0
Farmers have no way to get information for marketing their products in right time and at fair prices	50	69.4	3	8.3	53	49.1
Farmers perceive that they are not getting fair price in the market	26	36.1	34	94.4	60	55.6
Reasons for not getting fair price in the market	***26***	***100.0***	***34***	***100.0***	***60***	***100.0***
Products are not sold if farmer demands fair price	9	34.6			9	15.0
Farmers are not able to know about right price	10	38.5	11	32.4	21	35.0
Local Businessman (Mahajans) are not provide right price	5	19.2	31	91.2	36	60.0
Production cost is very high	2	7.7			2	3.3
Type of products farmers have marketed during the last 12 months	***72***	***100.0***	***36***	***100.0***	***108***	***100.0***
Cereal Crops	27	51.9	17	18.7	44	30.8
Cash Crops	11	21.2	3	3.3	14	9.8
Vegetables	11	21.2	15	16.5	26	18.2
Fruits	2	3.8	23	25.3	25	17.5
Turmeric & Ginger	1	1.9	33	36.3	34	23.8

Nearly half of the farmers (49.1%) have no way to get information for marketing their products in the right time and at fair prices. It is interesting to note that more farmers in the plainland areas (69.4%) have reported such lack of access to market information than the highland areas (8.3%).

More than half of the farmers (55.6%) consider that they are not getting fair price in the market and such perception of not getting fair price is much more prevalent in the indigenous households of the Highland areas (94.4%) than the Bengali Households of the Plainland areas (36.1%). Among the reasons for not getting fair price, farmer have pointed out that as they are unable to know about right price, they cannot bargain (35.0%) and local businessman are not providing the right price (60.0%); even if they demands fair price their products are not sold (15.0%).

There are variations of marketed products between the plainland and highland areas. Fruit, Turmeric and ginger are very common products in the highland but not very common in the plainland areas. Male member of the household is primarily responsible for marketing the farm produces in

Bangladesh. Male member of the Bengali household in the plainland areas is responsible for marketing the farm produces in local market (96.2%), urban market (88.5%) and also to middlemen (96.2%). However, in the highland areas, both female & male members of the one-third indigenous households (33.0%) areresponsible for marketing the farm produces in the local market. The farmers were not happy even after producing bumper boro paddy in 2011 because of the exploitation of the multiple syndicates within the agricultural value chain of Bangladesh.

Responsible household member for marketing farm produces	Bengali & Plainland (%) N=72			Indigenous & Highland (%) N=36			Bangladesh (%) N=108		
	marketing in local market	marketing in Urban market	marketing to Middlemen	marketing in local market	marketing in Urban market	marketing to Middlemen	marketing in local market	marketing in Urban market	marketing to Middlemen
Female	3.8	3.8	0	9.9	5.5	0	7.7	4.9	0
Male	96.2	88.5	96.2	57.1	87.9	63.7	71.3	88.1	75.5
Both Female & Male	0	7.7	3.8	33.0	6.6	36.3	21.0	7.0	24.5

Income from processing of agricultural goods: More than one-tenth (13.0%) farmers earn from processing of agricultural goods, which is limited between rice and jute. On average they earn Taka 16628.

Income from processing of agricultural goods	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
	72	100.0	36	100.0	108	100.0
Farmers earn from processing of agricultural goods	14	19.4			14	13.0
Name of processed goods						
Rice	14	100.0			14	100.0
Jute	4	28.6			4	28.6
Average gross income (taka)		29857		.		29857
Average production cost (taka)		13229		.		13229
Average net income (taka)		16628		.		16628

Status of vegetables cultivation & marketing: One-third of the farmers (32.4%) do not cultivate any vegetables in the household surroundings.

Status of vegetables cultivation	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
	72	100.0	36	100.0	108	100.0
Farmers donot cultivate any vegetables in household surroundings	24	33.3	11	30.6	35	32.4
Farmers producevegetablesonly to fulfill their own household needs	51	70.8	26	72.2	77	71.3
Farmers do marketing the excess vegetables after fulfill their needs	21	29.2	10	27.8	31	28.7
Farmer's produced vegetables donot meet their daily meal needs	22	30.6	26	72.2	48	44.4

Majority of the farmers (71.3%) only fulfill own household needs by their produced vegetables and rest of the farmers (28.7%) sales the excess vegetables after fulfill their needs to the market. In fact,

more than two-fifth of farmers (44.4%) reported that the vegetables they produce do not even meet their household needs. Due to inadequate communication system in farmers are bound to sell their products in the local markets where usually market is very small. If they would get scope to send their products in bigger market, then they would get good price and might increase the production. This imposes that marketing strategies for community products have to be devised.

Earning from food production	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
	72	*100.0*	*36*	*100.0*	*108*	*100.0*
Farmers earn from produced vegetables	14	19.4	16	44.4	30	27.8
Farmers earn from domestic animals	24	33.3	29	80.6	53	49.1

4.10 Climate Crisis Imprint on the livelihood, food self-sufficiency & agriculture

Bangladesh is a densely populated country and there is virtually no space for inland migration. Therefore, escalation of conflicts for the natural resources among the poor might destabilize the social harmony and jeopardize development of the future generations. Some of the warning signs of the adverse effects of climate change such as sea level rise, water logging, poor drainage, siltation and seawater intrusion are already visible in the different regions in Bangladesh. The unscheduled occurrences of natural calamities (Cyclones, Tornadoes, Tidal bores), water scarcity & salinity, River erosion are already identified as the main causes of livelihood insecurity and food insecurity.

Climate Change Vulnerability Index of Bangladesh: An UK based consultancy, risk analysis and mapping company Maplecroft, examined the climate risks and adaptive capacity of 193 nations factoring in population concentration, development, natural resources, agricultural dependency and conflict. According to the Maplecroft Climate Change Vulnerability Index (CCVI) 2012, Bangladesh is the 2nd most vulnerable country of the world, after Haiti. In a parallel analysis of major cities at risk, Maplecroft pointed to Dhaka and Chittagong cities of Bangladesh as being most exposed cities of the world along with Addis Ababa, Manila, and Calcutta. In 2011 CCVI of Maplecroft, Bangladesh was the most vulnerable country in the world.

Farmers assessment on climate & agriculture	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	*%*	*N*	*%*	*N*	*%*
	72	*100.0*	*36*	*100.0*	*108*	*100.0*
Weather is not favorable for Agriculture/Growing Food	40	55.6	36	100.0	76	70.4
Excessive rainfall creates problem for growing foods	60	83.3	34	94.4	94	87.0
Experienced climate change related problems (cyclone, rainfall, drought, flood, overflow, tornado) during growing foods	38	52.8	32	88.9	70	64.8
Farmers who have experienced climate change problems now, have not faced as such in 10 years ago	38	28.9	32	56.3	70	41.4

Living with Climate Change: More than two-thirds of the poor farmers in Bangladesh reported that current weather is not favorable for Agriculture/Growing Food (70.4%) and linked with climate risks (74.1%). Nearly two-thirds farmers (64.8%) in Bangladesh have experienced climate change related

problems (cyclone, rainfall, drought, flood, overflow, tornado) during growing foods. Majority of the farmers (87.0%) opined that excessive rainfall has been generating problems for growing foods.

Climate risks currently linked with growing foods: All the poor Indigenous households in the Highland areas have acknowledged that weather is not favorable for Agriculture/Growing Food and present-day agriculture or growing foods are linked with climate risks. More than two-fifth (41.4%) farmers who have experienced climate change impacts now a days, had not experienced such climate change problems in 10 years ago.

More than three-quarter of the poor farmers (80.6%) in Bangladesh reported that they need training for addressing Climate Change risks & vulnerabilities for growing foods. Virtually all the poor farmers in the Highlands (97.2%) and nearly three quarter of the poor farmers (72.2%) in the Plainlands reported such training needs.

Risks linked withcurrent agriculture or growing foods	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
Present-day agriculture or growing foods are linked with climate risks	44	61.1	36	100.0	80	74.1
Types of climate risks currently linked with growing foods						
Climate change (heavy rainfall/rain less, variations in seasonal change, drought)	28	63.6	28	77.8	56	70.0
Various type of diseases/insects attacks	13	29.5	14	38.9	27	33.8
Water logging due to excessive rain/flash flood	4	9.1	1	2.8	5	6.3
Unable to harvest in due time	4	9.1	1	2.8	5	6.3
Deforestation			5	13.9	5	6.3
Land erosion			2	5.6	2	2.5
Total	44	100.0	36	100.0	80	100.0

Climate change imprint on food self-sufficiency: Rural People have been experiencing adverse symptoms of climate change for the last 10 years. Untimely excessive rainfall, frequent flood, cyclone, tornado & drought are continuously damaging their agriculture produce. Food insecurity due to crop loss or failure is a common incident for the villagers. Traditional forecast methods are unable to predict current climate behavior.

Status of climate change impacts on food availability	Bengali &Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
	72	*100.0*	*36*	*100.0*	*108*	*100.0*
Climate change has impact on food availability	24	33.3	31	86.1	55	50.9
Type of impacts						
Less crop production due to excess rainfall, drought & high	17	70.8	30	96.8	47	85.5
High food prices due to less crop production	7	29.2	1	3.2	8	14.5
Total	**24**	**33.3**	**31**	**86.1**	**55**	**50.9**

Paddy plants grown in seedbeds are gradually withering due to cold wave severe cold wave, dense fog, unavailability of sweet water and salinity are damaging the seedlings of vast lands just at the onset of irri and boro cultivation.

Farmers struggling to save the seedbeds and now very much worried about recovery of their production cost, especially against the backdrop of low market price of paddy. Bangladesh was fortunate that there was no natural disaster over last two crop seasons, after the cyclone Aila that damaged crops in the southwestern coasts in May 2009. Otherwise, the price might top down the 2008. In 1999, Bangladesh suffered the longest drought in 50 years, with more than four months without rain, and, in 2010, the country recorded its lowest rainfall since 1995.

Climate change impact on food accessibility	Bengali & Plainland (%)			Indigenous & Highland (%)			Bangladesh (%)		
	F	M	T	F	M	T	F	M	T
N=	35	37	72	18	18	36	53	55	108
Climate change has impact on food accessibility	31.4	24.3	27.8	38.9	11.1	25.0	34.0	20.0	26.9
N=	11	9	20	7	2	9	18	11	29
Type of impacts									
All crops are destroyed due to excessive rain & frequent drought	54.5	33.3	45.0	100.0	50.0	88.9	72.2	36.4	58.6
High prices of necessary goods	36.4	44.4	40.0				22.2	36.4	27.6
Food crisis	27.3	44.4	35.0				16.7	36.4	24.1
Water logging	9.1		5.0	14.3		11.1	11.1		6.9
Infertility				28.6	50.0	33.3	11.1	9.1	10.3

More than one-fourth (26.9%) of the poor farmers in Bangladesh have acknowledged the climate change impact on the food accessibility to their households because excessive rainfall & frequent droughts had destroyed their entire crop production.

Climate Change Impact on food security of the Poor Households	Bengali & Plainland (N=72)		Indigenous & Highland (N=36)		Bangladesh (N=108)	
	N	%	N	%	N	%
Farmers have faced climate change impact on households food security during the last year	40	55.6	29	80.6	69	63.9
Climate change indicators that hampers food security	***40***	***100***	***29***	***100***	***69***	***100***
Excessive rainfall	40	55.6	34	94.4	74	68.5
Droughts	35	48.6	34	94.4	69	63.9
Increased temperature	40	55.6	33	91.7	73	67.6
Seasonal change	36	50.0	33	91.7	69	63.9
Flood/ Flash flood	40	55.5	4	11.1	44	40.8
Cyclone	16	22.2	21	58.3	37	34.3
Increased salinity	10	13.9			10	9.3
Water logging	16	22.2	1	2.8	17	15.7
River erosion	9	12.5	11	30.6	20	18.5
Landslide	10	13.9	31	86.1	41	38.0
Tornado	9	12.5			9	8.3

Nearly two-thrids (63.9%) of the poor farmers have faced climate change impact on households' food security during the last year.

Indicators of climate change impacts on food security	Intensity of climate change impacts (Extreme/High Impact)					
	Bengali & Plainland (%) N=40		Indigenous & Highland (%) N=29		Bangladesh (%) N=69	
	Food security	bio-diversity	Food security	bio-diversity	Food security	bio-diversity
Excessive rainfall	52.5	65.0	11.8	11.8	33.8	40.5
Rainless/Droughts	42.9	45.7	32.4	14.7	37.7	30.4
Increased temperature	55.0	60.0	24.2	15.2	41.1	39.7
Seasonal change	50.0	61.1	27.3	3.0	39.1	33.3
Flood/ Flash flood	41.3	90.7			37.4	37.9
Cyclone	18.8	43.8		4.8	8.1	84.3
Increase salinity		30.0				30.0
Water logging	6.3	37.5			5.9	35.3
River erosion		55.6				25.0
Landslide	10.0	70.0	9.7	9.7	9.8	24.4
Tsunami		55.6				55.6
Increased sea level		55.6				55.6
Tornado	11.1	55.6			11.1	55.6

	impacts of climate change on water, forest resources, bio-diversity, accommodation, health, education and nutrition	Riverine Plainland	Highland	Deltaic Plainland
Water				
1	Reduction of water sources due to increased temperature		√	
2	Excessive rainfall causing unexpected flash flood	√		√
3	Loss of lives due to water borne diseases			√
4	Droughts are damaging agriculture			√
Forest resource				
1	Food crises due to excessive deforestation		√	√
2	Increased temperature are reducing forest resources	√	√	
3	Destruction of forest resources due to frequent cyclones			√
Biodiversity				
1	deforestation are destroying biodiversity	√	√	
2	Changes in biodiversity equilibrium due to due to flood, drought			√
Living arrangements, Health& Nutrition				
1	Loss of dwelling place due to flood, drought, river erosion etc.	√	√	√
2	Increased temperature, irregular seasonal changes are creating different types of diseases	√	√	
3	Food scarcity due to the abnormal behavior of climate on agriculture	√		
Education				
1	Destruction of educational institutions due to natural disaster like flood, cyclone, flash flood etc.	√	√	√
2	Damages of educational material due to flood		√	

Decreasing trend of food production due to climate change: All the indigenous poor households (100.0%) in the highland areas and more than one-third (37.5%) in the plainland areas have acknowledged that food productions have decreased in their locality within the last 3 years. More than half of the households (61.9%) in Bangladesh opined climate change impact as the reason for

the reduction of food production. One-third (34.9%) opined that modern techno-based cultivation is also responsible for the reduction of food production.

Food production trend of the last 3 years	Bengali & Plainland (%) N=72		Indigenous & Highland (%) N=36		Bangladesh (%) N=108	
	N	%	N	%	N	%
food productions decreased in the locality within the last 3 years	27	37.5	36	100.0	63	58.3
Reasons for decreasing food production						
Lack of Organic (cow dung) fertilizer	7	25.9			7	11.1
Climate change impact	8	29.6	31	86.1	39	61.9
Due to modern techno-based cultivation	8	29.6	14	38.9	22	34.9
Higher fertilizer prices	4	14.8	2	5.6	6	9.5
Loss of cultivable land	3	11.1	3	8.3	6	9.5
Deforestation			5	13.9	5	7.9
Total	27	100.0	36	100.0	63	100.0

4.11 Community Practices & Techniques for Climate Change Adaptation

The Bangladeshi farmers with their unique and innovative coping mechanisms have proven many times their resistance to recurrent natural hazards like floods and droughts, cyclones and tidal surges. For example, in the event of flood of greater magnitude, seeds of transplanted amancannotbe sown due to lack of nursery land or seedlings are damaged. In such situation, they raise the seedlings on floating rafts made out of water hyacinth. The farmers of the country are also capable of switching to local varieties in places of high yield varieties in case of drought or flood as local varieties are low water consuming and taller. Farmers are struggling to adapt with the capriciousness of the weather. Untimely rainfall has already been damaging crops. Within the last 10-15 years, farmers have witnessed drastic deviations in their traditional crop calendar. In Bangladesh there are many community practices & techniques have mitigation and adaptation potentials to cope with the impact of climate change on food and agriculture.

Indigenous landuse practice: The knowledge of the local population regarding land management is generally environment friendly. Many indigenous landuse practice increases moisture retention, improves soil fertility and crop yield; and reduces surface runoff and thus halts soil erosion. Homestead ash is used to supplement potassium in the soil and to keep insects away from crops. To mitigate crops loss, farmers have started cultivating more lands than before.

Plantation of trees that have extensive root systems: Banyan trees are considered as a symbol of preservation of ecosystem because through its extensive root systems it holds large chunk of soil and provides shelter and food for birds and other wild animals.

Homestead gardening practice: Home garden system provides healthy ecosystem for humans, animals, birds, livestock, and miscellaneous flora and fauna. Homestead bamboos are planted because these develop rapidly and are good soil binders.

Organic Farming Practices: Organic farming is one of the key adaptation measures of the community for achieving food self-sufficiency for the poor households. The community showed many example of victimization due to chemical based agriculture practice. Organic farming has great mitigation and adaptation potential, particularly with regard to topsoil organic matter fixation, soil fertility and water-holding capacity, increasing yields in areas with medium to low-input agriculture and in agro-forestry, and by enhancing farmers' adaptive capacity.

Types of technique used to face disaster	Bengali & Plainland (N=72)		Indigenous & Highland (N=36)		Bangladesh (N=108)	
	N	%	N	%	N	%
Take cash loans						
Take loans from neighbor/relatives	60	83.3	32	88.9	92	85.2
Take loans from money-lender	20	27.8	23	63.9	43	39.8
Take loans private organization	28	38.9	3	8.3	31	28.7
Take loans from Bank	27	37.5	3	8.3	30	27.8
Take food/crop loans						
Take crops loan from relatives	22	30.6	26	72.2	48	44.4
Take food by loan	30	41.7	31	86.1	61	56.5
Reduce quantity of taking food	16	22.2	13	36.1	29	26.9
Take food that usually do not eat	10	13.9	1	2.8	11	10.2
Reduce medical treatment cost	9	12.5	8	22.2	17	15.7
Mortgaged of agriculture land	8	11.1	11	30.6	19	17.6
Sells properties, labors & agriculture produce in advance/lower price						
Sells domestic animals	16	22.2	24	66.7	40	37.0
Sells livestock (hen, ducks)	28	38.9	33	91.7	61	56.5
Sells tree	11	15.3	31	86.1	42	38.9
Sells ornaments	2	2.8	6	16.7	8	7.4
Sells tin of home shade	3	4.2	1	2.8	4	3.7
Sells crop in advance	6	8.3	3	8.3	9	8.3
Sells fishes in lower price	4	5.6			4	3.7
Sells agricultural product in lower price	14	19.4	7	19.4	21	19.4
Sells fruits in low price	3	4.2	13	36.1	16	14.8
Sells labor in advance	2	2.8	8	22.2	10	9.3
Sells agricultural land	3	4.2	3	8.3	6	5.6
Sells of homestead	2	2.8	3	8.3	5	4.6
Take relief/aid	15	20.8			15	13.9
Temporary migration	5	6.9	1	2.8	6	5.6
Use savings	23	31.9	8	22.2	31	28.7
Engage children into income generating works	8	11.1	3	8.3	11	10.2

Soilless Floating Agricultural Practices in the Wetlands of Bangladesh

Floating agriculture such as baira, geto, dhap and bed is a way of utilizing areas in the production of food where agricultural land is inundated for extended periods during the monsoon season. The practice is similar to hydroponic agriculture whereby plants can be grown on the water on a floating bed of water hyacinth, algae or other plant residues. The technology is mainly aimed at adapting to more regular or prolonged flooding and helps farmers helps to mitigate land loss during flooding.The approach employs beds of rotting vegetation, which act as compost for crop growth. These beds are able to float on the surface of the water, thus creating areas of land suitable for agriculture within waterlogged regions. The area under floating cultivation is up to 10 times more productive than traditionally farmed land and no additional chemical fertilisers or manure is required. When the crops have been harvested and floating rafts are no longer required, they can be used as organic fertilisers in the fields or incorporated into the following years floating beds as a fertiliser. The approach uses water hyacinth, a highly invasive weed with prolific growth rates, in a highly beneficial way. By harvesting water hyacinth, areas covered by the weed are cleared, with the beneficial side-effect of reducing breeding grounds for mosquitoes and improving conditions for open-water fishing.

The practice of floating agriculture provides greater food security by increasing the land output and supporting capacity for poor and landless people. Because the system is fairly labour intensive, it also has the capacity to provide employment opportunities within communities. As both men and women can carry out the floating agriculture practices, it can also lead to improvements in gender equity. Although this technology provides the advantage of maintaining food production, it may be difficult to transport produce to market because the area remains waterlogged most of the time. Vegetables and spices produced on the floating beds can be sold at markets and since the approach is fully organic, the produce receives special attention from local buyers and consumers.

Saving crops in floating method of agriculture during flood situation: The advantage of saving crops in floating method of agriculture during flood situation at community level has been observed. Besides, this floating cultivation method provides more production with far less expenditure than traditional agriculture. Moreover, the residue of the floating cultivation can be used as good natural fertilizer for normal cultivable land.

Community Float Firm (CFF) could be an effective alternative option for fisher folk community though it is not yet explored. Government Fisheries Department barred fishermen for not catching fish in the rainy season (3 or 4 months). During this period, as the fisher folk community is not having any alternative livelihood option, floating cultivation could support their livelihoods.

Vegetables are often the only affordable source of micronutrients in the family diet of poor households. The production of vegetables provides the household with direct access to important nutrients that may not be readily available or within their economic reach.

Farmer's initiative for addressing Climate Change risks	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	%	N	%	N	%
Not specified	20	52.6	1	3.1	21	30.0
Build stronger house	9	23.7	3	9.4	12	17.1
Harvest earlier for avoiding excessive rainfall	3	7.9	3	9.4	6	8.6
Install easy irrigation system	3	7.9			3	4.3
Collect information from weather department	1	2.6	4	12.5	5	7.1
cultivate again, if crops are damaged	2	5.3	3	9.4	5	7.1
By selling household properties			4	12.5	4	5.7
Taking shelter in secured place			14	43.8	14	20.0
Taking support from relatives	3	7.9	7	21.9	10	14.3
Vegetables cultivation for drought areas			8	25.0	8	11.4
Total	**38**	**100.0**	**32**	**100.0**	**70**	**100.0**

Community devised Adaptation actions to overcome food crises at local level	Highland & Indigenous	Plainland & Bengali	
	Khagrachhari (Sadar)	Sirajgonj (Ullahpara)	Barisal (Banaripara)
1. Climate resilient sustainable food production system that maintain food quality and biodiversity	√	√	√
2. Cultivate different types of crops on same land	√	√	√
3. Provide training to farmers on modern cultivation	√	√	
4. Use high quality seeds that take minimum harvesting time	√	√	√
5. Reduce the use of pesticides and chemical fertilizer	√		√
6. Promote balanced use of natural fertilizer	√		√
7. Delivery modern agricultural equipments	√		
8. Modernization of Joom cultivation	√		
9. Stop conversion of the cultivable land for housing	√		
10. Potato cultivation	√		
11. Change food intake habit			√
12. Ensure farmers participation in food related programs			√
13. Use hanging cultivation system in wetlands/waterlogged areas			√
14. Crop production using integrated cultivation system		√	
15. Develop modern irrigation system by digging river and canals		√	
16. Establish secured shelter for fishes		√	
17. Provide loan to farmers on easy condition		√	
18. Develop a system for Fish production in the abandoned pond		√	
19. Proper implementation of the government "One House One Farm" project		√	

Taking very high interest loan from local money lenders (53.7%) and selling household assets like livestock, land, trees, and crops (48.1%) are the most common strategies of the poor households in Bangladesh to collect/ensure food during the crisis period. More than one-third households (35.2%) have also borrowed crops from relatives to overcome food crisis during the last 12 months. Although taking very high interest loan from local moneylenders is more common in the male-

headed Bengali & Plainland households, the opposite picture is found in the Indigenous & Highland households, where more female-headed households takes loan from moneylenders. Borrowing crops from relatives are more common strategy among the female-headed households (42.9%) than the male-headed households (24.3%) in the Bengali households of the Plainland areas. Nearly one-fifth (17.6%) of the households reported that their family members worked as short time migrant-worker in the urban areas to address food crisis.

Strategies to ensure food during the crisis period	Bengali & Plainland (%)			Indigenous & Highland (%)			Bangladesh (%)		
	F	M	T	F	M	T	F	M	T
N=	35	37	72	18	18	36	53	55	108
By selling household assets (livestock, land, trees, crops)	25.7	29.7	27.8	83.3	94.4	88.9	45.3	50.9	48.1
Take high interest-rate loan from local money lenders	40.0	67.6	54.2	66.7	38.9	52.8	49.1	58.2	53.7
By short-time/seasonal business	5.7	13.5	9.7	33.3	11.1	22.2	15.1	12.7	13.9
Migrates to urban areas for short time worker	14.3	18.9	16.7	27.8	11.1	19.4	18.9	16.4	17.6
By borrowing crops from relatives	42.9	24.3	33.3	22.2	55.6	38.9	35.8	34.5	35.2
By selling labor/crops in advance				11.1	11.1	11.1	3.8	3.6	3.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

None of the poor Bengali households in the Plainland areas has reported to sell advance labor/crops to ensure food during the crisis period. On the other hand more than one-tenth (11.1%) of the poor indigenous households in hilly regions of the Bangladesh had sold labor/crops in advance to overcome food crisis during the last 12 months.

4.12 Women's Struggles for upholding Domestic Food Security amidst the climate crisis

Roughly half of Bangladesh's population is made up of women (48.9 percent in 2004, according to the World Bank gender profile), 80 percent of whom live in rural areas. Climate change will adversely affect women more than men in Bangladesh. Women first address the needs of their families, particularly their children, whereas men are more likely to spend resources for their individual needs. Women and children are most vulnerable to hunger related deaths and illness which would be indirectly exacerbated by climate change through increasing food and water shortages. In Bangladesh, women are used to take food after all the family members had it. Consequently, all the time they are forced to eat less than men and they face the worst food insecurity during scarcity or natural disasters. Hence, it can be anticipated that if climate change negatively impacts on family food security, women will be malnourished. A large proportion of women enter pregnancy with poor nutritional status. Nutrition suffers when fuel wood shortages force rural poor households to economize on fuel by shifting to less nutritious foods that can be eaten raw or partially cooked, by eating partially cooked food that could prove toxic, by eating leftovers that could rot in a tropical climate. Shortage of safe drinking water, especially in the coastal belt and in drought-prone areas in the north-west of the country increasing hardship on women and children, who are responsible for collecting drinking water for their families.

Struggles of the Rural Women for Managing Domestic Food Security

Harinchara village is located in the Ramkrishna Union of Ullapara Upazilla under the Sirajganj District. Almost 90% of the houses are made of straw/leaf/polythene/bamboo/ damaged or old tin. People have been experiencing adverse symptoms of climate change for the last 7 years. Untimely excessive rain is continuously damaging their agriculture produce. Food insecurity due to crop loss or failure is a common incident for the villagers. During flood, villagers face prolonged & sever food insecurity. People get bewildered for survival. However, women stands firm against such calamity and work hard to maintain minimal domestic food security while minimizing the use of resources such as water and energy. Women's of the Harinchara village used to manage homestead vegetable gardening using all the available space of their homestead including roof. In this way they produce different types of vegetables for their household consumption. During flood or waterlogged condition due to excessive rainfall, they raise or shift their vegetable garden. They used to store one handful rice (around 25 grams) everyday intoan earthen pot for addressing future food crisis. They also try to store egg whenever they have the opportunity.

Women is yet virtually absent in the Climate leadership at all levels; whether it is local, national or international. Climate change adaptation is not just fulfilling women's needs, rather it is what women want and how they want to adapt. Women should recognize an important stakeholder for building local adaptive capacity to climate change and managing climate risks. Women can play the leadership role in conservation of plant genetic resources, seed exchange & seed management according to the cropping calendar and promote movement of seeds between villages.

Struggles of the Urban Women for Managing Domestic Food Security

Day labourers like Salma cannot afford beef or mutton because of their high prices. She can hardly remember the time other than Eid-ul-Azha when she and her family have eaten meat. Shahana feels frustrated and helpless every time she goes to a kitchen market or a grocery shop: food is becoming just too expensive. Shahana tries to adjust to the rise in food prices by being imaginative when preparing daily meals. She adds some mashed sweet potato in cooked pulses to make it thicker so that a less amount of pulses (which is costlier than the potatoes) is required. "*I need 500 grams of lentil daily for four of my family members. But I cannot pay Tk 60 daily for only 500g pulses. At the same time I cannot ignore its necessity in my daily menu, so I have to think smart*", says Shahana. Afsana Zaman, an English medium school teacher, has almost cut out vegetables from the daily diet altogether, due to the inordinate rise in their prices. She adds, *"A single brinjal for Tk 85, made me crazy while I was shopping at the kitchen market in my neighbourhood in Bashundhara. Although I draw quite a decent salary I cannot afford to buy vegetables at such a high price as I have to pay my bills and other utility charges. As a result I have given up on most vegetables altogether and just sticking to the basic items like meat, potato and rice. Isn't it the wise thing to do in this situation?*"

Source: http://www.thedailystar.net/magazine/2011/09/04/cover.htm

4.13 Biodiversity-based Organic Homestead Food Security Adaptation Model

The success of the women in climate adaptation needs to be highlighted in the international forums through real life evidence. For example, In the World Exhibition "Technologies For Climate Protection" which is a side event of the 14th United Nations Climate Change Conference (Cop 14, 2008), CDP exhibited a women-led innovative homestead-gardening practice (Hanging Vegetable Garden) to produce vegetables for reducing household food insecurity.

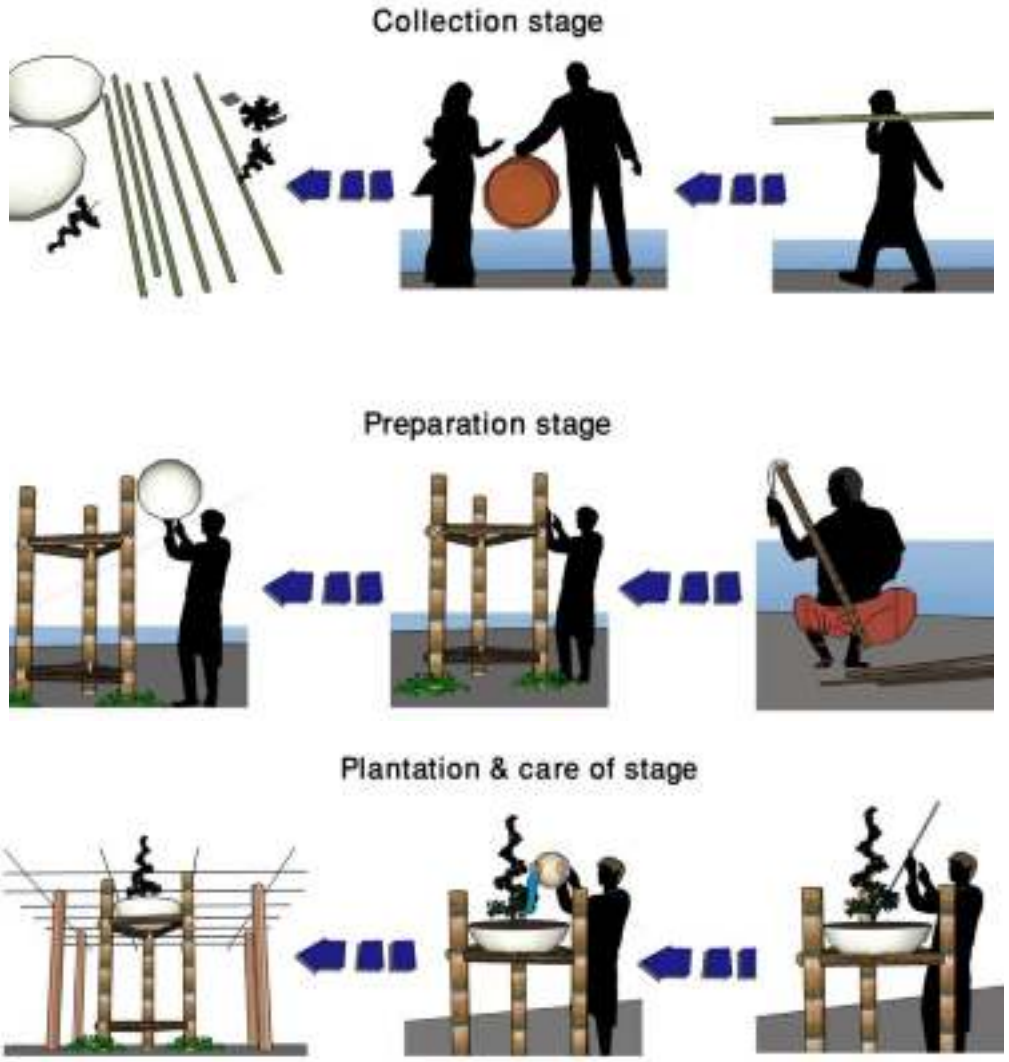
Biodiversity-based Organic Homestead Food Security Adaptation Model

Hanging Vegetable Gardening (HVG) System developed by the Coastal development Partnership (CDP)

In 2003, CDP had started the experiment of hanging vegetable production under Reducing Vulnerability to Climate Change (RVCC) project of CARE in the south west coastal area. In 2007, CDP has started a participatory action research involving 250 families from Kheshabpur Upazilla, Jessore District for developing appropriate methodology and feasibility of hanging vegetable gardening on

water logging areas in Southwest Coastal region. After 5 years, CDP was invited to exhibit as an adaptation model in the COP14-2008 in Poznan with the name of “Adaptation Technology Exhibition for Climate Change Protection”.

The water logged people of village Bagdanga under Keshabpur Upazilla of Jessore district have been suffering for two decades and at least six months their home yard is remains submerged under 4 feet water and in rainy season they have to leave their homestead as water gets into their home. They were not able to cultivate their land for the last fifteen years. The full grown up persons were used to take 30 to 70 grams of vegetables per day.



Three 6 feet long and three 2 feet long bamboo sticks are used for making the platform to keep the half oval shaved clay pot which is locally known as “Nada”. A 3 feet long rope and three iron pin are used to keep the bamboo platform. The radius of clay pot is 2 feet and depth of the clay pot is 1.5 feet. Three fourth of the Clay pot is filled up with 3:1 ratio by soil (75%) & cow dung (25%) for plantation. Before plantation of the bottle-gourd, Pumpkin and Cucumber seed in the HVG, it has to be kept under water for 24 hours.

The HVG uses bio-pesticides like cow urine. Cow urine are usually kept in a bottle for 10 to 15 days in to bottle and after that it mixed with water and sprayed over the plant. Five vegetables like Pumpkin, Chalkumra, Ustay, Puishak, and Jhinga are being cultivated. People recently started the cultivation of chili, tomato and been.

The cost of a single of HVG unit is around Taka 320 (USD 4) and provides an income of 800 (USD 10) after consuming a 5-members family demands in a year. The villagers sell the produced vegetables in the local market and earn Taka 800 (USD 10) after consuming their family demand in a year. A widow Purnima Sarker of Monohar Nagor has managed the demand of vegetables for her family by cultivating this way.

The waterlogged areas of the coastal region in Bangladesh could be considered as the ideal natural simulation of sea-level rise situation as a consequence of climate change. The water logged community is living such a way which is only possible through the transgression of coastline towards inland. They are not only imprisoned by surrounding water but also facing rapid increment of salinity. This envisages that livelihood innovation by the affected poor people could be very imperative to address climate induced livelihood vulnerability. The women-led innovative homestead-gardening practice in waterlogged people's struggle for survival in a very difficult condition might provide new thoughts to the global community and might offer ways to the global community about how to survive if sea level rises.

Chapter 5

Capacity of the Bangladesh for addressing climate crisis & food crisis together to achieve food self-sufficiency

5. Food Self-sufficiency of Bangladesh

According to the International Monetary Fund, Bangladesh ranked as the 43rd largest economy in the world in 2010 in PPP terms and 57th largest in nominal terms, among the Next Eleven (N-11) of Goldman Sachs and D-8 economies, with a gross domestic product of US$269.3 billion in PPP terms and US$104.9 billion in nominal terms. The economy has grown at the rate of 6-7% p.a. over the past few years. In the early 1990s, Bangladesh liberalized rice trade and allowed private sector importation. Following the large shortfalls in rice production in both 1997 to 1999, private sector rice imports, mainly from India, added a total of 4.6 million tons to the domestic supply. This precipitated domestic rice price increases, making large-scale private sector rice imports from India profitable.

Food consumption growth versus population growth Bangladesh

Average annual Rate of change (%)	*From 1990-92 to 1995-97*			*From 1995-97 to 2000-02*			*From 2000-02 to 2006-08*			*From1990-92 to 2006-08*		
	Food per person	**= Food**	**- Population**	**Food per person**	**= Food**	**- Population**	**Food per person**	**= Food**	**- Population**	**Food per person**	**= Food**	**- Population**
	-0.3	**1.7**	**2.0**	**2.3**	**4.1**	**1.9**	**0.8**	**2.4**	**1.6**	**0.9**	**2.7**	**1.8**

FAO recommends that the maximum contribution of cereals to total dietary calorie be 60%; diets having more than this is recognized as being monotonous, less diversified and deficient in essential nutrients including calories.

Average annual rate of change (%) in the Food consumption and food needs of Bangladesh (From 1990-92 to 2006-08)

Consumption	**Needs per person**	
Energy per person	Minimum Dietary Energy Requirement (MDER)	Average Dietary Energy Requirement (ADER)
0.9	0.3	0.4

According to the World Health Organization, food strategies must not only ensure food security for all, they must also guarantee the consumption of adequate quantities of the safe and high-quality foods that make up a healthy diet. Bangladesh would need to produce 30 million more tonnes of rice each year to achieve self-sufficiency in food production. To meet this goal, Bangladesh introduced an 'Input Distribution Card' to nine million smallholder farmers to obtain cash subsidies for electricity and fuel for irrigation, and fertiliser at fixed prices. Despite these initiatives, it is predicted that rice production will fall by 3.9 per cent each year due to a more erratic monsoon season caused by climate change. More than 80,000 hectares, which is approximately one per cent of arable land, is lost every year to climate change and urbanisation.

5.1 Capacity of the Communities to Achieve Food Self-Sufficiency

Food Production versus Food Demand: Nearly two-third (65.7%) households in Bangladesh consider that current food production system is unable to fulfill the overall food demand of the country. The climate change impact is identified as the key reasons for not fulfilling the overall food demand. More than one-third households in Bangladesh (35.2%) reported that climate change (heavy rainfall, drought) is destroying their crops.

Food Production versus Food Demand	Bengali & Plainland (%) N=72		Indigenous & Highland (%) N=36		Bangladesh (%) N=108	
	N	%	N	%	N	%
Current food production system cannot fulfill the overall food demand	38	52.8	33	91.7	71	65.7
Reasons for not fulfilling the overall food demand						
Climate change (heavy rainfall, drought) destroying crops	11	28.9	14	42.4	25	35.2
Production costs is very high	2	5.3	3	9.1	5	7.0
Higher prices of agricultural ingredient	5	13.2	5	15.2	10	14.1
Do not own any land	7	18.4			7	9.9
Can't produce more crops due to small size of land	13	34.2	3	9.1	16	22.5
Have no knowledge about proper method of cultivation	1	2.6	8	24.2	9	12.7
Use additional pesticides in modern cultivation method	1	2.6	10	30.3	11	15.5
Can't fulfill overall demand due to increased population			11	33.3	11	15.5
Total	38	100.0	33	100.0	71	100.0

Food Stocking Capacity: The poor households in Bangladesh can stock food in their households only for 96 days in a year. The average food stocking capacity is relatively better in the Plainland Bengali households than the poor indigenous highland households. The average stocking capacity of the PlainlandBengali households (average-stocking capacity is 105 days) is 25 days more than the indigenous highland households (average stocking capacity is 80 days). However, female-headed households have less stocking capacity than male-headed households in Bangladesh including both highland &Plainland areas.

Food Stocking Capacity of the Poor households (average days)	Bengali & Plainland (days)			Indigenous & Highland (days)			Bangladesh (days)		
	F	M	T	F	M	T	F	M	T
N=	35	37	72	18	18	36	53	55	108
Average duration (number of days) household can stock food in their own house	89	118	105	62	90	80	81	107	96
Average duration (number of days) household actually preserved food earlier	82	123	104	51	69	63	72	102	89

Purchasing Power to Buy Food: More than three-quarters (78.7%) of the poor households in Bangladesh does not have the purchasing power to buy food at the current market price even in the normal situation. It is very striking that virtually all the indigenous households (97.2%) in the highland areas does not have the ability to purchase necessary food at current market price.

Food Purchasing power of the poor households	Bengali & Plainland (N=72)		Indigenous & Highland (N=36)		Bangladesh (N=108)	
	N	%	N	%	N	%
Market price of necessary food is not within households purchase ability during normal condition	50	69.4	35	97.2	85	78.7
Market price of necessary food is not within households purchase ability during the Disaster	56	77.8	36	100.0	92	85.2

The rice and wheat prices in Bangladesh were 42 per cent higher in April 2011 than they were a year ago (April 2010).

5.2 Capacity of the Bangladesh Government to address Food Crisis

FAO & WFP reported that government and non-government safety net programmes were unable to reach a significant proportion of the vulnerable population in Bangladesh in 2008. An FAO mission visiting the country in April/May 2008 estimated that about 37 percent of households reported consuming less than three meals per day because of high food prices[1]. The 2008 Food Price Crisis has shown how speculation in commodity derivatives market can create global food insecurity. However, the World Bank is still promoting that the rise in food prices is driven in part by higher fuel costs connected to events in the Middle East and North Africa. If countries continue panic-buying approach like Bangladesh, then it may push world rice prices higher.

Key Government Institutions for addressing Food crisis

The Ministry of Agriculture (MOA) is one of the key ministries of the Government of the People's Republic of Bangladesh. The Department of AgriculturalExtension (DAE) is the largest public sector extension service provider in Bangladesh. The core functions of DAE include increasing agricultural productivity, humanresource development and technology transfer. The Department of Agricultural Marketing (DAM) of the Ministry of Agriculture, Government of Bangladesh has undertaken an e-government initiative that would utilize the power of ICT to develop and disseminate critical agricultural market information to farmers, traders, government, policy makers, development agencies and other stakeholders. The Food Planning and Monitoring Unit of the Ministry of Food and Disaster Management (MoFDM) is the Government unit responsible for monitoring the food security situation in Bangladesh and the implementation of related policies.

To provide programmatic guidance in implementing the National Food Policy, Bangladesh Government has formulated the National Food Policy Plan of Action (PoA). The Plan identifies 26 strategic areas of intervention and priority actions that cover all dimensions of food security. The Plan, which is in line with the Millennium Development Goals, stretches over the period 2008-2015.

Government Responses and initiatives towards Food Crisis & Food self-sufficiency: According to the Article15 (a) of the constitution of Bangladesh, the fundamental responsibility of the state is to ensure the basic necessities of food-needed for an active and healthy life by its population. However, the government responses on the on-going food crisis reveal panicked & distressed mind-sets. A confused minister Mr. Eat Less, not knowing exactly what to do to bridle the price hike, not being courageous enough to break the syndicate of the unscrupulous businessmen, and not being

1 FAO/GIEWS and WFP, Special Report, FAO/WFP Crop and Food Supply Assessment Mission to Bangladesh, August 28, 2008.

skilled enough to formulate the right strategy to maintain the balance of the prices of things, has unwittingly come up with a herbal solution to the sky-high prices of necessary commodities "eat less and keep sound[2]." And almost subsequently, when the finance minister was asked to comment on the reasons behind such rocket-high rise in the prices of essentials, he issued his own-styled carefree sermon to the nation of "s*kipping a day in the week from going to the market*."

> ***"People do not die taking less food. Rather they ran less risk of consuming adulterated food. If we can tame our gluttony, traders will find no profit in this business. They will be bound to lower the prices. You might get hurt. But as I personally practice, I would suggest you eat less. Everything will be all right"--***Commerce minister, FarukKhan, speaking at a discussion on 'Food adulteration: How to check it' organized by the Voluntary Consumers Training and Awareness Society at the National Press Club in Dhakaon August 4, 2011

> ***"We should not ignore the potential of the new GM technology for producing stress tolerant crop varieties."*** Agriculture Minister Begum Matia Chowdhury gave these remarks during the 6th International Plant Tissue Culture and Biotechnology Conference with the theme "Role of biotechnology in food security and climate change."

> ***"There's a huge mismatch between data of Bangladesh Bureau of Statistics (BBS) and the country's food grain reserve. According to BBS data, Bangladesh is a food surplus country. But the question is where does the food go,"*** Dr Mahabub Hossain, Executive Director, BRAC

Major irrigation projects of Bangladesh Water Development Board contribute only about 8% of the total irrigated area. The actual irrigated area seems to be about 30%. Only 7.65 per cent of the national budget is devoted to agriculture.

Bangladesh abandoned the neo-liberal prescription for a while to addressing food crisis: During 2007-08 when food prices in the international market had gone all-time high, Bangladesh had difficulty in procuring food becausea number of countries, including India, Russia, Argentina and Vietnam, imposed ban on export of food grains. Bangladesh had responded to the 2007/08 food crisis by abandoning the neo-liberal prescription of minimal state involvement in food markets. To keep the market prices of food grains stable, the government had expanded its cheaper outlets in seven major cities of the country through open market sales, especially for poor section of the people, each of whom can buy five kg rice at Taka 24 per kg under the open market sale (OMS) operation. Government has adopted a nearly $8.0 billion scheme to make food supply available, within the reach everybody by 2015. Donors will give financial assistance worth $5.0 billion while the rest of the fund will be sought from international donors.

Bangladesh is going beyond border to attain food self-sufficiency: Bangladesh has become a big rice importer recently. Experts opined that the growing population and shrinking farmland due to rapid industrialisation and urbanization is key obstacles for achieving food self-sufficiency. As arable land decreases by about 1 percent a year, more productive crops are urgently needed. Since

2 http://www.thedailystar.net/newDesign/news-details.php?nid=198888

expansion of land under cultivation is not a feasible option, Bangladesh government has started discussions with countries in Africa and with Myanmar & Cambodia with a view to leasing foreign land to grow food for import. Bangladesh officials are in talks with Ukraine for wheat production and are considering Cambodia and parts of sub-Saharan Africa for rice production. Bangladesh had first approached neighbouring Myanmar which has vast tracts of fallow arable land. But after showing some interest initially, Myanmar authorities turned lukewarm. Tanzania, Kenya and Uganda have agreed to lease their land to Bangladesh government for farming. Kenya will offer land on lease for 99 years at a cheap price of 99 cents per bigha annually while Uganda wanted 20 per cent of the produce, no annual fees. Bhati Bangla Agrotec is owned by the Al Falah Group in Bangladesh, intends to bring 4,000 Bangladeshi farmers to Tanzania to work on the 30,000-ha farm it intends to establish there.

Quality seed is insufficient in the public sector for achieving food self-sufficiency: Achieving food self-sufficiency requires availability of quality seeds to the farmers at all times. Quality seed is the basic input for achieving self-sufficiency in food production. Production and distribution of quality seed is insufficient in the public sector as compared to its demand in Bangladesh. The Seed Certification Agency (SCA) is the only authorized body to seed testing and certification of the seeds produced by Public, private and NGO sector is a very low profile institute. Recently, the Executive Committee of the National Economic Council (ECNEC) approved three (3) billion taka for an agricultural scheme to produce quality seeds in the country. Foundation seeds from breeder seeds and subsequently quality-certified seeds would be produced under the project. The project will also provide training and technical assistance to the public and private entrepreneurs, extension workers and farmers for producing quality seeds. Three state-owned agencies, Bangladesh Agricultural Development Corporation, Bangladesh Agricultural Research Institute and Bangladesh Rice Research Institute will simultaneously implement the project by June, 2013. In addition, government has also approved Taka 530 million for the production, preservation, processing and marketing of minor crops to reduce poverty.

Testing high yielding exotic rice seeds: The key policy approach in Bangladesh for food security is aimed at achieving 'self-sufficiency' in rice production. In its continuous efforts to boost rice production, the agriculture extension department distributed a new high yielding variety of Ugandan seeds among farmers for aus cultivation to test whether these were high yielding. The Bangladesh government is focused on making the country self-sufficient in food production through the introduction of hybrid technology. Permission has been granted to introduce fruit and shoot borer resistant eggplant, late blight resistant potato and golden rice which are now in contained and confined field trials.

Flood tolerant and drought resistan varieties for food self-sufficiency: Government is promoting Flood tolerant and drought resistan varieties for achieving food self-sufficiency. The farmers will not be affected economically any more if they cultivate flood tolerant variety BRRI dhan- 52 on the low lying land as the seedlings of the varieties are not damaged after remaining under flood water at a

stretch for 15 days. BRRI dhan 56, developed by IRRI, is the first drought-tolerant rice variety released in Bangladesh that can provide from 0.8 to 1.2 tonnes per hectare more yield than the presently cultivated varieties despite three weeks of no rain.

Government is happy with Three weeks of Food self-sufficiency: With a population of 160 million, growing at about 1.4 percent per year, Bangladesh produces about 30 million tons of rice each year - 2.5 million less than it needs to feed itself. The government goal of self-sufficiency in food grains production is focused on building up national food reserves to meet about 3 weeks' consumption. To attain this goal, the government is formulating all the agricultural related projects to increase productivity and growth of rice by using additional inputs (land, fertilizer and irrigation water), technical change or removing market distortions and a shift to higher-value crops. The government plans to increase and expand high yielding and stress tolerant varieties of crops for boosting food grains production by 2015 by converting the single crops land into double and triple crops land.

Food self-sufficiency for preventing political instability from food price shocks: Bangladesh food authorities have always been hunted by fears of shortage that arises regularly due to disruptions to domestic production caused by natural calamities and price-hike in the international market. Bangladesh consider domestic food grain production as an important factor for food price stabilization and food security, and food self-sufficiency policies aims to avoid macroeconomic and political instability from food price shocks. At local level, the government has been active in subsidizing improved seed varieties and fertilizer, contributing to the record harvest of staple rice in 2009 and again in 2010. The Ministry of Food and Disaster Management (MoFDM) estimated that food subsidy will require an additional Tk.1000 crore for the current fiscal year.

Civil Society Movement for Comprehensive Agrarian Reform

Campaign for Sustainable Rural Livelihoods (CSRL), an alliance of nearly 200 organizations spanning 30 agro-ecological zones within Bangladesh, proposed Comprehensive Agrarian Reform Programme (CARP). CARP has been developed through engaging small and marginalized farmers, political parties and their affiliates active in the agriculture sector, agriculturalists, CSO and NGO representatives and researchers in different consultations and taking up 4000 working hours. CARP is a coordinated and comprehensive policy framework based on the 30 agro-ecological zones of Bangladesh. The issues of climate change and trade have been at the heart of the CARP development process. In 2011, CSRLmembershaveorganized an Agricultural Long March to ensure commitment of national policy leaders for adopting and implementation of Comprehensive Agrarian Reform Programme towards a national consensus for incorporating CARP in national budget, Five-Year Plan etc.

Achieving transient food security through import: Government policies are more focused on achieving transient food security through price stabilization for the consumption of the vulnerable groups. Bangladesh, the biggest rice buyer in South Asia, has doubled its import target (1.2 million metric tons) for the year 2011 to prevent upsurge of domestic prices. The food grain imports in FY 2011 comprised 1.5 million tonnes of rice and 1.0 million tonnes of wheat.

Foodgrain Import Situation (in thousand M.T)

Type of import	Daily Import (10.10.2011)			Cumulative import upto October 08, 2011(01 July,2011 to 10 Octo.2011)			Cumulative import of Previous Year (01 July,2010 to 30 June 2011)		
	Rice	Wheat	Total	Rice	Wheat	**Total**	Rice	Wheat	**Total**
Public	2.56	1.59	4.15	327.99	108.12	436.11	1270.57	933.74	**2204.31**
Private	0.00	0.00	0.00	0.00	104.10	104.10	290.48	2818.43	**3108.91**
Total	**2.56**	**1.59**	**4.15**	**327.29**	**212.22**	**540.21**	**1561.05**	**3752.17**	**5313.22**

Source: http://www.fd.gov.bd/index.php?option=com_content&view=article&id=60&Itemid=69

The imports of wheat and rice are expected at 1.0 million tonnes and 400,000 tonnes respectively in FY 2012.

Historical Data on Foodgrain Import in Bangladesh *(000 m. tons)*

Fiscal Year	*Food Aid Arrival*			*GoB Commercial*			*Total GoB Import*			*Private Commercial*			*Total Imports*		
	Rice	Wheat	Total	Rice	Wheat	Total	Rice	Wheat	Total	Rice	Wheat	Total	Rice	Wheat	Total
1995/96	1	743	743	490	351	841	490	351	841	650	200	850	1141	1293	2434
1996/97	10	608	618	9	103	112	9	103	112	15	222	237	34	934	967
1997/98	0	549	549	92	156	249	92	156	249	993	142	1135	1085	848	1933
1998/99	59	1174	1233	345	429	774	345	429	774	2660	820	3480	3064	2423	5487
1999/00	5	865	870	0	0	0	0	0	0	428	806	1234	433	1671	2104
2000/01*	32	447	479	0	0	0	0	0	0	529	534	1063	561	981	1542
2001/02*	8	493	501	0	0	0	0	0	0	118	1171	1289	126	1664	1790
2002/03*	4	238	242	0	0	0	0	0	0	1553	1414	2966	1557	1652	3208
2003/04*	4	273	277	0	29	29	0	29	29	797	1684	2480	801	1985	2786
2004/05*	27	262	289	72	30	101	72	30	101	1196	1786	2982	1294	2078	3372
2005/06*	34	160	194	0	103	103	0	103	103	498	1767	2265	532	2030	2562
2006/07	25	66	91	0	121	121	0	121	121	695	1514	2209	721	1701	2421
2007/08	82	177	258	292	0	292	292	0	292	1681	1235	2916	2055	1411	3467
2008/09	30	98	129	386	298	680	386	98	680	187	2030	2217	603	2410	3013
2009/10	4	56	60	52	445	490	4	56	490	37	2863	2899	87	3362	3449
2010/11	6	157	163	1264	777	2041	1270	934	2204	291	2818	3109	1561	3752	5313

Liberalization on the import of seed and seed processing machineries: Government is serving Agri-business through liberalization on the import of seed and seed processing machineries. Agri-business agents are advertising that use of improved seed is still very limited in Bangladesh because seed production in the private sector not yet has the necessary support and public sector is unable to meet the demand of quality seed. As a response, government put provisions on the liberalization of import of seed and seed processing machineries.

5.3 *Farmer's needs for addressing Climate Change problems/risks*

According to the country's ministry of agriculture, every year the country loses about 80,000 hectares of arable land due to the impact of climate change such as droughts, salinity and floods. The cultivable land has been declining by almost one percent per year due to its demand for increased habitation, industrial and commercial establishment, transport infrastructure, river erosion and intrusion of saline water in the coastal areas.

food production systems can be adopted at national level to acquire food self-sufficiency	Plainland & Bengali		Highland & Indigenous
	Sirajgonj (Ullahpara)	Barisal (Banaripara)	Khagrachhari (Sadar)
Increase local high yielding cultivation			√
Proper usages of cultivable land			√
Use modern agricultural equipment	√		√
Mixed fruits garden establishment			√
Quick increasing fruits garden establishment			√
Increase the cultivation of ginger and turmeric			√
Increase the usages of organic and compost fertilizer	√		√
Arrangements of high quality training for farmers on agriculture			√
Increase local food storage system			√
Increase subsidy on agricultural	√		
Assure exact price of agricultural goods	√		
Protect agricultural land from urbanization and industrialization	√		
Transform uncultivable land into cultivation	√	√	√
Accelerate "One House One Farm" program		√	
Give more importance on poultry and aquaculture to fulfill protein demand		√	
More concentrate on flood tolerant agricultural crops		√	
Start cultivation system on roof of the house		√	
Increase food production by improving from 1-croped land to 2 or 3-croped land		√	
increase food production in drought and coastal area by using drought & saline tolerant seeds		√	
Motivate farmers to use organic fertilizer	√		
Promote Joom cultivation as a biodiversity-based agriculture			√
To arrange training for farmers	√	√	
Improve agricultural management system by cooperative way	√	√	
cultivate more vegetables in the locality		√	
replanting of different types of local fruits		√	
Improve crop marketing system	√	√	√
Provide shallow machine/irrigation materials with free of cost	√		

Only the rain can save their food

Farmers in the Sirajganj district are missing the expected production of boro paddy due to irrigation problem. Due to unusual load shedding and low voltage, most of the power-run pumps have remained inoperative. Many pumps are out of order, as the water level has gone down due to lack of rain. Farmers have already noticed cracks in the boro field due to lack of water. Experts have feared that if it does not rain soon, it will be disastrous for boro cultivation. Many farmers are feeding their damaged boro plants to cattle.According to the Irrigation experts, 1,500-2,000 litres of water is enough to produce one kilogramme of rice but farmers use 3,000-4,000 litres, making farming expensive and overusing ground waterunneccessarily.

The farmers need orientation training for generating mass awareness on climate change. Farmers also need training for adaption of agriculture, Livestock Rearing in the changing climate, Climate compatible calendar/guidelines for crops production and Vegetable cultivation.

Twin (food & Climate) Crises	Ways to address the twin crises
Food crisis	
food insufficiency due to less production in agricultural land	✓ Transform abandoned land into cultivable land ✓ Use appropriate technology to produce more crops ✓ Assist farmers with modern knowledge, irrigation & quality insecticide ✓ Reduce food insufficiency by potato cultivation
High yielding seeds problem	✓ Supply climate resilient high yielding seeds by the government
Decreasing trend of soil fertility	✓ Take necessary steps to increase fertility of soil ✓ Use organic fertilizer
Loss of crops due to drought	✓ Invention and cultivation of drought tolerant crops
Unavailability of agricultural tools	✓ Deliver agricultural tools at low cost ✓ Need government support for agricultural tools
Decreasing trend of production in joom (traditional highland) cultivation	✓ Modernalization of joom cultivation
Lack of storage system of farmer's produced goods	✓ Proper storage/crop stocking system for produced goods ✓ Cold storage and food processing arrangements in every Upazilla
Lack of access to technology & information	✓ Regular dissemination of different types of research findings on agriculture, water resources and fishes to the people ✓ Have to spread technologies to the farmers by training and workshop
Unavailability of adequate water for production	✓ Digging river, repairing embankments to accelerate water flow ✓ Ensure uninterrupted supply of electricity for Irrigation system
Food crises	✓ Arrange adequate monitoring and supervision for market monitoring ✓ Take quick steps to ensure food at cheaper price to the poor ✓ Ensure proper price for the farmers goods ✓ Establish efficient & speedy food distribution system
Marketing problems for produced goods	✓ Assist farmers for better market linkage
Lack of access of capital for food production	✓ Increase food production by providing adequate subsidy to the marginalized farmers ✓ Start capital support programs for women
use of illegal fishing net damaging natural breeding grounds for the fish	✓ increase public awareness about the damage and ensure punishment for any use the illegal fishing net
Climate crisis	
Climate crises	✓ Initiate continuous public awareness project
Lack of adequate trees	✓ Government have to take preparation for tree plantation in every village
Loss of bio-diversity due to deforestation	✓ To conserve forest resources local people should be aware along with forest department
Ground water level is going downward due to lack of rain	✓ Devise appropriate policy on deep and non-deep tube well establishment ✓ Build water reservoir by digging river, canal etc.
River erosion	✓ Government must take necessary steps to stop river erosion ✓ Increase public awareness about the harmful human activities linked with river erosion

Farmer's training needs for addressing Climate Change risks	Bengali & Plainland		Indigenous & Highland		Bangladesh	
	N	**%**	**N**	**%**	**N**	**%**
Needs training for addressing Climate Change risks	52	72.2	35	97.2	87	80.6
Types of training for addressing Climate Change risks (multiple responses)						
Climate Change Awareness	22	42.3	20	57.1	42	48.3
Adaptation of agriculture (farming/cultivationetc)	18	34.6	13	37.1	31	35.6
Livestock Rearing in the changing climate	2	3.8	8	22.9	10	11.5
Climate compatible calendar/guidelines for crops production	6	11.5	2	5.7	8	9.2
Vegetable cultivation	10	19.2	1	2.9	11	12.6
Total	**52**	**100.0**	**35**	**100.0**	**87**	**100.0**

Agriculture is the largest employment sector of the country. More than 48.1% of the national labour force is involved in agriculture. There fore farmer's capacity building to address multiple crises is inevitable.

The study identified the following capacity building demand of the Farmers in Bangladesh:

a) Conservation agriculture, integrated pest management or integrated crop management
b) Improve Water management at farm level
c) Improvement of rural roads and markets
d) Group marketing and training at community level
e) Private Storage, value chain facilitation, information provision
f) Integrated and real time information on price & market opportunities through electronic and mobile communications
g) Development of small scale food processing enterprises

Chapter 10

Conclusions & Recommendations

The poor households in Bangladesh are living with severe food crisis for half of the year. Nevertheless, indigenous poor households in the hilly regions are living repeatedly in famine situation from February to July. Most of the landless small and marginal farmers have no food security. Majority of the poor households were forced to reduce food intake to survive amidst the sever food crisis. The study envisaged that in every five poor households at least one household has family member with disability or differently able person. Although the study was not focused on person with disability or differently able person, the findings seems alarming and requires more research.

The study recognized that any natural disaster has a profound influence on the food consumption pattern of the poor households in Bangladesh. Food productions have decreased in all the study areas within the last 3 years and the same land area currently produces less food than 10 years ago. The study identified dramatic changes in food intake pattern in the poor households in Bangladesh between harvesting period and crisis period due to food availability. Nearly two-third households used to reduce their food intake to adjust with any crisis. One striking feature is observed among the indigenous households in the highland areas where none of the female-headed households consume normal food during any natural disaster. Well-structured food distribution mechanism is very poor in Plainland and virtually absent in Highland areas.

More than half of the farmers had preserved seeds last year for selling in the market & growing their own food. The seed preservation practice is more common among the indigenous farmers of the Highland than Bengali farmers of the Plainland. More than half of the farmers do not know how much pesticide is required for specific crops and yet uninformed about the various methods of handling pests/insects without using chemical pesticides. The agriculture production without irrigation is more common in the indigenous highland areas than the Plainland areas. In fact, irrigation of lands for growing food is almost six (6) times larger in the Plainland areas than the Highland areas. The scope of irrigation for hilly areas is decreasing gradually and highland farmers are very worried about food production at future.

Farmers do not get fair price of their products as big merchants controls the market and sets the price of the products. In every stage of rice production, from land preparation to rice grain production farmers have to spend more money than the previous year. Farmers are paying 40% more for diesel and 66% more for fertilizer than previous year. Every year farmers are cultivating less land to adapt with higher price of agricultural inputs. The farmers were not happy even after producing bumper boro paddy in 2011 because of the exploitation of the multiple syndicates within the agricultural value chain of Bangladesh.

More than three-quarters of the poor households in Bangladesh does not have the purchasing power to buy food at the current market price even in the normal situation. It is very striking that virtually all the indigenous households in the highland areas does not have the ability to purchase necessary food at current market price. Taking very high interest loan from local money lenders and selling household assets like livestock, land, trees, and crops are the most common strategies of the poor households in Bangladesh to collect/ensure food during the crisis period. More than one-third households have also borrowed crops from relatives to overcome food crisis during the last 12 months. Female-headed households have less stocking capacity than male-headed households in Bangladesh including both highland &Plainland areas.

The climate change impact is identified as the key reasons for not fulfilling the overall food demand. Seasonal variations of different climate variables (temperature, rainfall, humidity, day-length etc) control the agriculture of Bangladesh. More than half of the farmers opined climate change impact as the reason for the reduction of food production in Bangladesh. One-third farmers have opined that modern techno-based cultivation is also responsible for the reduction of food production. Nearly two-thirds farmers in Bangladesh have experienced climate change related problems (cyclone, rainfall, drought, flood, overflow, and tornado) during growing foods and also faced climate change impact on households' food security during the last year. Untimely excessive rainfall, frequent flood, cyclone, tornado & drought are continuously damaging their agriculture produce. Food insecurity due to crop loss or failure is a common incident for the villagers. Traditional forecast methods are unable to predict current climate behavior. More than two-fifth farmers who have experienced climate change impacts now a days, had not experienced such climate change problems in 10 years ago. More than one-third of the poor farmers have reported that climate change (heavy rainfall, drought) is destroying their crops.

Agricultural land is decreasing gradually to accommodate the increasing population. Many productive agricultural lands have already converted into factories, brickfields, roads and other infrastructures. Consequently, cultivable land for food production has substantially been reduced. Land grabbing is key factor for food insecurity of the indigenous highland population. Many lands grabbed by the influential Bengali people in the hilly regions remain fellow which earlier were used by the indigenous people for food production.

The Bangladeshi farmers with their unique and innovative coping mechanisms have proven many times their resistance to recurrent natural hazards like floods and droughts, cyclones and tidal surges. The advantage of saving crops in floating method of agriculture during flood situation at community level has been observed. The farmers of the country are also capable of switching to local varieties in places of high yield varieties in case of drought or flood as local varieties are low water consuming and taller. Within the last 10-15 years, farmers have witnessed drastic deviations in their traditional crop calendar.

Recommendations

Community Food Economy should be the foundation of Food Self-Sufficiency

Our food is gradually being taken over by a few transnational corporations monopolization. A democratic food system is urgently needed so that farmers can grow the crops they want and sell them wherever they want. Community Food Economy should be the foundation of Food Self-Sufficiency. Community Food Economy is the system where local farmers; local markets and local farms can grow food for their communities, not for global commodity markets. Food self-sufficiency must integrate Food Availability, Food Access, Dietary Diversity and Food Frequency components.

Ensure agriculture as a viable and profitable livelihood option for the poor & landless farmers

Poor and marginalized sections of society have been facing not just one but multiple crises simultaneously in terms of livelihood crisis, food crisis, health crisis, water crisis, deforestation, hunger and desertification for years, decades. The poor farmers (mostly cultivate others' land) had to take informal loans from moneylenders at a very high interest rate that are at times 10 times higher than commercial Banks' interest rates. Making agriculture a viable and profitable livelihood option for the poor & landless farmers is the cornerstone for food self-sufficiency.

Chronic food insecurity of the poor deserves more attention

The problem of chronic food insecurity of the poor needs more attention. Safety net programmes are necessary to protect the poor people from price shocks and help them to be food secure. Increase in income of the poor household means greater access to food and thus can positively influence food security at the household level. The poor do not have adequate purchasing power to buy required food, even when food is available in the market.

Train Farmers to protect their crops and prevent insect invasion without using chemical pesticides

Farmers from both Plainland and highland reported that it would be very helpful for them if they receive training to protect their crops from climate change risks and prevent insect invasion without using chemical pesticides. They are more interested about the various methods of handling pests/insects without using chemical pesticides.

Middle wealth group is the unseen vulnerable group due to food crisis

The middle wealth group is the hardest hit by price hike and price volatility. This group is not directly benefiting from targeted safety net programs and health care services that cover the low wealth group. Similarly, the middle wealth group might have had low coping ability compared to the higher purchasing power to access a variety of food.

Safe storeage for reserving the crop surpluses and reduce post-harvest crop loss

Household or village-level storage is a viable alternative to large-scale warehouse storage for smallholder farmers. If farmers have access to simple storage tools (e.g., actellic dust, storage bags)

and training on how to store safely, household-level storage can be a cost-effective and simple method for smallholder farmers to safely store their crop surpluses and reduce post-harvest crop loss.

Urgent intervention from the government is required for better irrigation system and quality seeds for achieving food self-sufficiency

Achieving food self-sufficiency requires availability of quality seeds to the farmers at all times. Quality seed is the basic input for achieving self-sufficiency in food production. Highland farmers have demanded urgent intervention from the government for providing better irrigation system.

Promote biodiversity-based smallholder organic agriculture for Food self-sufficiency

The floodplains of Bangladesh are one of the regions where the rice plant was first domesticated around the fifth millennium B.C. Biodiversity-based smallholder agriculture reflects the interactions between people, their environment and their available biological diversity. Organic farming is one of the key adaptation measures of the community for achieving food self-sufficiency the agroecologically complex conditions of Bangladesh. Organic farming has great mitigation and adaptation potential, particularly with regard to topsoil organic matter fixation, soil fertility and water-holding capacity, increasing yields in areas with medium to low-input agriculture and in agro-forestry, and by enhancing farmers' adaptive capacity.

Marketing strategies for community products have to be devised

Nearly half of the farmers have no way to get information for marketing their products in the right time and at fair prices. Due to inadequate communication system in farmers are bound to sell their products in the local markets where usually market is very small. If they would get scope to send their products in bigger market, then they would get good price and might increase the production. This imposes that marketing strategies for community products have to be devised.

Abandon the neo-liberal prescription of minimal state involvement in food markets

The 2008 Food Price Crisis has shown how speculation in commodity derivatives market can create global food insecurity and availability of food in the market has nothing to do with the access or right to food of the poor. However, the World Bank is still promoting that the rise in food prices is driven in part by higher fuel costs connected to events in the Middle East and North Africa. If countries continue panic-buying approach like Bangladesh, then it may push world rice prices higher. Bangladesh had responded to the 2007/08 food crisis by abandoning the neo-liberal prescription of minimal state involvement in food markets. Government is again started serving Agri-business through liberalization on the import of seed and seed processing machineries.

Holistic and long-term policy approach is required for Bangladesh

Government policies are more focused on achieving transient food security through price stabilization for the consumption of the vulnerable groups to avoid political instability from food

price shocks and also achieving 'self-sufficiency' in rice production. However, the government goal of self-sufficiency in food grains production is focused on building up national food reserves to meet about 3 weeks' consumption.

Pro poor Land reform is much needed

According to the prevailing land laws in the country, a family can own a maximum of 100 bighas (33 decimals) of land as inherited property and can acquire a maximum of 60 bighas or 19.8 acres by purchase. But this law has not been enforced strictly. Moreover, the definition of "Family" is also not sufficiently clear. Making use of this lack of clarity, many families own large areas of land. Although there is a policy for the distribution of khas land of the country among the landless and marginal poor, the implementation of the policy has yet to be satisfactory.

Farmers Field School for addressing Climate Change risks & vulnerabilities for growing foods

More than three-quarter of the poor farmers (80.6%) in Bangladesh reported that they need training for addressing Climate Change risks & vulnerabilities for growing foods. Bangladesh government should promote Farmers Field School-based farming systems approaches to assist farmers in risk-prone areas to adapt to climate change.

Community Float Firm (CFF) could be an effective alternative option for fisher folk community

Community Float Firm (CFF) could be an effective alternative option for fisher folk community though it is not yet explored. Government Fisheries Department barred fishermen for not catching fish in the rainy season (3 or 4 months). During this period, as the fisher folk community is not having any alternative livelihood option, floating cultivation could support their livelihoods.

Women-led domestic food self-sufficiency should be a priority

Vegetables are often the only affordable source of micronutrients in the family diet of poor households. The production of vegetables provides the household with direct access to important nutrients that may not be readily available or within their economic reach. The women-led innovative homestead-gardening practice in waterlogged people's struggle for survival in a very difficult condition might provide new thoughts to the global community and might offer ways to the global community about how to survive if sea level rises.

Empower women for building local adaptive capacity to managing climate risks

Women should recognize an important stakeholder for building local adaptive capacity to climate change and managing climate risks. The success and vulnerabilities of the women in climate adaptation has to be highlighted in the national & international forums through real life evidence. Women can play the leadership role in conservation of plant genetic resources, seed exchange & seed management according to the cropping calendar and promote movement of seeds between villages.