Crop Insurance as a Risk Management Strategy in Bangladesh

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Climate Change Cell
Department of Environment

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Foreword

The impacts of global warming and climate change are worldwide. For Bangladesh they are most critical because of its geographical location, high population density, high levels of poverty, and the reliance of many livelihoods on climate-sensitive sectors, such as agriculture, fisheries.

To address current impacts and manage future risks of climate change and variability towards development of a climate resilient Bangladesh, the government has established the Climate Change Cell (CCC) in the Department of Environment (DoE) under the Comprehensive Disaster Management Programme (CDMP). Climate change research, covering modeling and adaptation is one of the major activities of the Cell.

CCC in association with its Technical Advisory Group (TAG) and other stakeholders identified a set of research activities related to climate change in Bangladesh through a number of consultations. The activities have been prioritized and a number of projects have been commissioned in last few years.

Cell is facilitating adaptation research in order to, fill knowledge gaps in the arena of adaptation to climate change and its impacts on the life and livelihoods; explore options to adapt with the climate change; and contribute in better understanding of adaptation options. In this regard, a number of projects have been commissioned in the field of Crop agriculture, Crop insurance, Health, Gender and disadvantaged groups.

Agriculture, the main economic sector of Bangladesh, is one of the sectors that will be affected most due to extreme weather events like cyclone, flood or drought. Some other impacts of climate change like, change in average temperature, precipitation pattern and timing, sea level rise and resulting inundation or salinity level - all of these factors are related to the agriculture sector affecting crop production as well. Along with the structural or technical measures, adaptive measures like crop insurance would be a means to address risks of crop damage of the poor people resulting from climatic changes.

The research analyzed past/existing crop insurance schemes and success/failure of such schemes, in Bangladesh as well as identified how crop insurance fits in with people's livelihoods and existing risk management strategies.

The research revealed that farmers' response to crop Insurance is quite positive and the conventional problems of crop insurance could be minimized by introduction of area based index, especially weather index-based crop insurance.

It is expected that the research will create a strong link between farmers, insurance provider and other stakeholders to share research results and needs. Piloting weather index-based insurance at several locations to demonstrate and test the policy and institutional framework, methodology, and applicability will enable policy makers and planners to formulate viable adaptation policies, strategies and action plan.

Zafar Ahmed Khan, Ph.D
Director General
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Acronyms and Abbreviations

ADB	Asian Development Bank
AIDA	Agricultural Income Disaster Assistance
ASCA	Accumulating Savings and Credit Association
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BBS	Bangladesh Bureau of Statistics
BIA	Bangladesh Insurance Academy
BKB	Bangladesh Krishi Bank
BRAC	Bangladesh Rural Advancement Committee
BRDB	Bangladesh Rural Development Board
BWDB	Bangladesh Water Development Board
CAPM	Capital Asset Pricing Models
CAT	Catastrophic Insurance Options Contract
CBN	Cost -of-Basic Needs
CBOT	Chicago Board of Trade
CCCM	Canadian Centre for Climate Modelling
CCE	Crop Cutting Experiment
CCIS	Comprehensive Crop Insurance Scheme
CI	Crop Insurance
CNRS	Centre for Natural Resource Studies
CRED	Center for Research in the Epidemiology of Disasters
CV	Contingent Valuation
DCI	Direct Calorie Intake
DESM	Department of Environmental Science and Management
DMC	Disaster Management Committee
DoE	Department of Environment
EMT	Ennatien Moulethan Tchonnebat (“local rural credit" in English)
ENSO	El Nino Southern Oscillation
ERD	Economic Research Division
FAO	Food and Agricultural Organization of the United Nations
FCIP	Federal Crop Insurance Program
FGD	Focus Group Discussion
FINCA	Foundation for International Community Assistance
GCES	General Crop Estimation Survey
GCM	General Circulation Model
GDA	Ganges Dependent Area
GDD	Growing Degree Days
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFDL	Geophysical Fluid Dynamics Laboratory
GIC	General Insurance Corporation of India
GO	Government Organization
GRET	Groupe de Recherche et D'échanges Technologiques (Research and Technological Exchange Group)

ILO	International Labor Organization
IPCC	Intergovernmental Panel on Climate Change
IRRI	International Rice Research Institute
LDC	Least Developed Country
LG	Local Government
LGRD	Local Government and Rural Development
MFI	Micro Finance Institutions
MoEF	Ministry of Environment and Forests
NAIS	National Agricultural Insurance Scheme
NGO	Non-Governmental Organization
NHHP	Nsambya Hospital Healthcare Plan
NISA	Net Income Stabilization Account
NSU	North South University
PCIS	Pilot Crop Insurance Scheme
PCS	Property Claim Services
PDSI	Palmer Drought Severity Index
PGDD	Personal/Group Discrimination Discrepancy
PKSF	Palli Karma-Sahayak Foundation
PMO	Prime Minister Office
PRSP	Poverty Reduction Strategy Paper
RICS	Rainfall Insurance Contracts
RMA	Risk Management Agency
ROSCA	Rotating Savings and Credit Association
RWS	Reference Weather Station
SBC	Sadharan Bima Corporation
SEWA	Self-Employed Women's Association
SMRC	SAARC Meteorological Research Centre
SPARRSO	Space Research and Remote Sensing Organization
SUC	Standard Unit Contract
ToR	Terms of Reference
UMASIDA	Umoja wa Matibabu Sekta Isiyo Rasmi Dar es Salaam (Cooperative Health Care for the Informal Sector of Dar es Salaam)
UNCTAD	United Nations Commission on Trade and Development
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USDA	U.S. Department of Agriculture
UTs	Union Territories
WB	World Bank
WDB	Water Development Board
WFP	World Food Programme
WMO	World Meteorological Organization
WTO	World Trade Organization
WTP	Willingness To Pay

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Executive Summary

In recent years, natural disasters, particularly climate-related ones, have increased both in frequency and magnitude. Scientists the world over have agreed (IPCC AR4, 2007) that human-induced climate change is exacerbating this impact. Agriculture sector is likely to be affected most due to extreme weather events like cyclone, flood or drought. So, the farmers are hit hardest. For floodplain countries like Bangladesh, structural measures for management of disaster risk and its consequences often were found less effective. So non-structural measures like micro-insurance or crop insurance are being suggested as a risk management strategy. The rationale is that poverty and vulnerability to climate change feed each other, and this nexus warrants that climate change policies work in concert with poverty reduction policies. However, traditional micro-credits and savings are inadequate when poor farmers with no safety or security nets are exposed to risks beyond their means to cope with. Therefore, micro or crop insurance (CI), customized to specific needs of the poor, may be an effective instrument for the purpose. UN Climate Convention and the Kyoto Protocol have included the provision of insurance as a mechanism to address the risks from climate change.

Keeping this in view, the Climate Change Cell of the Department of Environment has commissioned this study to the Department of Environmental Science and Management (DESM), North South University.

As it is known, insurance is a financial instrument of buying potential risks. But the size of insurance market can be viewed not only as an indicator of development, but also as an indicator of social & cultural fabric of any society. The question of premium cost apart, there is the general expectation that the Government or NGOs will come forward to rescue in the aftermath of any disaster. The question of the hard-core poor is different. But the non-payment of bank loans or indemnifying them has become a culture in Bangladesh. What is being referred to is a culture of moral hazard. Against this trend, the Government spends huge money for ex-post disaster management, which again has political overtones. On the other hand, private sector to a large extent in Bangladesh continues to live with the idea that any kind of public welfare program is a government business. The concept of corporate social responsibility (CSR) is yet to be internalized by the larger segment of the private sector in our society.

In many developing countries including Bangladesh, crop insurance has been introduced about 3 decades ago. Some of these countries are continuing, while in some others, it has stopped functioning, because of incurring heavy losses. As a stand-alone instrument, CI is not financially viable anywhere in the world. Even in the industrial countries, it continues functioning as a public welfare program. In fact, agriculture sector is subsidized in all countries in many different ways. This happens more when a natural disaster hits the farmers. Therefore, CI as an instrument of adaptation has to be seen from a wider angle, not just from conventional cost-benefit analysis. The Sadharan Bima Corporation of Bangladesh has again taken initiative in the form of a proposal to introduce CI, this time in partnership with other stakeholders. But the private sector is yet to respond. Good news is that the prospect of microinsurance is improving day by day and many of the private insurance companies are considering it as an option.

Therefore, the main objective of the study was to develop a realistic framework and concrete roadmap for introducing crop insurance as a risk management strategy for the farmers in Bangladesh. Of course, this was to be based on an extensive review of literature and experiences of crop insurance around the world, including Bangladesh. A correct diagnosis of the failed attempts of the past would lead to realistic prescriptions. In this context, some of the challenges related to CI that raised in the course of the study are:

- Is the probability of loss from climate disasters adequately calculable?
- If CI cannot be made at least financially viable, how can the loss be minimized to a maximum level?
- How to reduce the problems of adverse selection & moral hazard/corruption?
- How to spread the risks on a wider scale? How could the private sector & NGOs be involved in CI ?
- Are there ways & means of policy & voluntary-based cross-subsidization?
- Is it viable to create insurance funds with premiums in kind by local small groups?
- What is the policy-institutional framework and models that can make CI a sustainable venture?

The study is based on both secondary and primary data and information. The vast literature on theoretical aspects of crop insurance and its experiences worldwide served as the database for the content analysis. This included the literature on past experiences of crop insurance in Bangladesh. The primary data and information were collected through different instruments, such as survey questionnaire, FGDs, interview schedule, inception workshop and roundtable discussions with stakeholders at different levels. Based on comments from the inception workshop, 450 farmers were selected for survey from three districts: 150 farmers from each district, with 50 each from three groups of farmers – small, medium and large. The three survey districts were: Sunamganj (as a flashflood area, northeast of Bangladesh), Lalmonirhat (as a drought & monga-prone area, north of Bangladesh) and Pirojpur (as a cyclone and flood-prone area, south of the country). The survey villages again were divided into three groups, based on the severity of natural hazards: extremely disaster-prone, moderately-disaster prone and less disaster-prone villages. The purpose of these different levels of segmentation was to see the difference in responses of farmers at different levels of risk to the survey questionnaire.

Farmers' Response to CI

Farmers' response to CI is quite positive. Even though they have difficulty in understanding CI processes, they are familiar with life insurance. Handling of micro-credit by the farmers created a confidence that micro-insurance might bring in good for them as well. If the farmers see that the money they are paying returns and help them during crisis, surely it will become popular. For CI, the readiness of farmers to pay premiums vary, depending on the size of the farms and the level and prospect of disaster, causing harm to their crops.

As seen from the review of experience in the world, in the developing countries public sector mostly offers CI, while in the developed countries, it is offered by private insurance companies. For Bangladesh, in view of past experiences, there needs to be a partnership between private and public sectors and NGOs to implement CI. Reputed insurance companies can offer CI, where SBC can serve as a re-insurer and Directorate of Insurance can regulate and monitor the process, including dispute resolution. NGOs can serve as the go-between, as the local mobilizer of communities. But farmers were worried about the direct involvement of government organizations because of bureaucratic process, and showed preference for an organization which is close to them like those of NGOs.

Whether CI is financially viable?

First of all, losses in CI should not be considered in isolation, but compared with the amount of money usually spent by the government in subsidizing the agriculture sector losses for weather disasters. It includes relief and rehabilitation expenditures, and distribution of huge amount of Bank loan and exemption of its interest or indemnifying of the whole loan itself. Introduction of CI will reduce such subsidy requirement to a great extent. For example, if CI is made mandatory for Agri-credit takers, the outstanding loan can be collected from indemnities of CI directly. India is already practicing this method, where the indemnity is directly paid to the credit organization. Considering the example of Sidr 2007 impacts, a quantitative calculation of government expenditure in disaster management purpose in the agriculture sector has been compared to the expenditure/indemnity payment expected under a CI programme. This shows that when the likely indemnity payments are compared to the totality of government and farmers' expenditures, and the indemnifying of loans or their interests, CI becomes a financially viable venture.

How can the problems and losses be minimized?

To minimize the losses derived from the conventional problems of insurance, such as moral hazards, adverse selection, imperfect indemnity and high administrative costs, the study team proposed the following suggestions:

Globally, around 80% of disaster-related losses remain uninsured. There are many reasons, as discussed in the report. The cost of coverage can be disproportionately high due to market inefficiencies, such as high administrative costs – up to 30% of the premium. Demand for insurance coverage by those at risk is really low, or the risk may be so high that it is uninsurable in a country like Bangladesh. The expectation of government and international aid is a big factor behind the low demand. On the other hand, pure private sector crop insurance solutions are not feasible. In view of the above, CI can be made viable along the following lines:

Introduction of Weather Index: Introduction of Weather Index can reduce adverse selection and moral hazards to a great extent. Details about it have been discussed in Chapter 3 and a model for application in Bangladesh is proposed in the last chapter. Adverse selection is reduced because it is not the crop type or land type, but a specified level of weather variable is considered here for indemnity. Loss is considered same for entire region if it does not witness pre-fixed weather index. So the question of moral hazard is eliminated as well. It reduces huge administrative cost as well as it does not require plot to plot investigation.

Defining variation in risk and varying premium levels: Last time SBC introduced uniform premium level, which encourages adverse selection, because both the high risk and low risk farms have to pay the same premium, so that the risky ones prefer to take insurance policy. Under weather index program the risk level for different unit areas under one weather stations can be classified under different risk categories. Methodology for such risk quantification based on historical climatic time series data is explained in the study. Even the risk level in near future under climatic changes can be predicted here as well based on future prediction of climate attributes by different GCM or other predictions. Within a unit area variation in risk level is possible, like the inundation height for different land segments might be different even though they are within one unit. Problems like this can be solved by including the elevation of each segment of land in the contract, etc as explained in detail in next chapter. However, this might be complicated and may not be practiced in the initial years. Rather a farmer's risk pooling technique can be applied as explained in the next paragraph.

Less number of perils to cover and provision for multi-peril: In a weather insurance contract, it is actually impossible to cover all perils if it is not related to climatic attributes. Again, including all perils in the contract make it highly vulnerable to high losses. Instead, there should be provision that someone might take wider coverage of 2-3 perils, but have to pay more for it. It also reduces administrative and technical complexity.

Risk pooling among the farmers and formation of cooperatives: Community or cooperative formation among the farmers within a homogeneous unit area and introducing provision of risk pooling among the farmers is possible to reduce the local variation of risk level among the farmers living within a homogenous unit area defined by Weather Index Approach. It means for a unit area if flood is defined as water level above 10m MSL, the entire region will get indemnity. However, say 10% of land was not flooded. Similarly, if the water level is below 10 m MSL, no one will get compensation. In that case when the entire land gets compensation, there should be provision that farmers themselves have a cooperative and re-collect the indemnity bills from those who are not affected at all, and later compensate it to those who were affected due to flooding in a normal year but not having indemnities because that year does not satisfy weather index level. Such a cooperative can be free of influence by the insurer, but can be introduced and formed at the beginning of the contract with the support of insurer, local govt. and the government cooperative authority.

When crop production is not affected, such a cooperative can collect certain quantity of crops in kind from all the member farmers and put together as a deposit. This can be utilized later to pay premium for a season while a situation occurs that most of the farmers are affected by some other disaster, which was not insured.

Varying weather index value: Instead of defining just one value of climatic attribute as the index level, a varying loss of crops can be defined based on variation in that climatic attribute. For example if precipitation is below 25%, 50% or 75% below average level, the indemnity might vary as well.

Wider coverage: Insurance works based on the laws of large numbers. But usually, the farmers along the risky zones like highly prone to flood, drought and cyclone will only like to take CI, but no agent can show interest because of the potential of heavy losses. Therefore, a wider risk pooling is needed. To overcome the problem, government can make CI mandatory for all farmers taking Agri-loan. In that case CI policy holders will be distributed over different regions ranging from low to high risk areas. Micro-credit organizations can help as well. If the Credit is related to crop production, CI should be made mandatory. Otherwise, farmers can be encouraged to take CI by offering low interest loans for those who will take CI, etc. Varying premium level for varying risk will encourage low risk farmer to take a policy as well as because in that case he has to pay less amount of premium. Varying terms or duration of contract such as 1 season, 1 year, 2 years, 3 years or even 10 years contract can be made, otherwise it will be like a gambling if it is only for one season. Premium level should vary among different contract duration as well, like higher premium for lower period and lower premium for longer contract period. Increase in number of policyholders depends on motivation and marketing as well as performance in the initial years.

Public-Private-NGO Partnerships can overcome the reasons for market failure in CI: from the insurers' point of view, these include high risk or small scale, absence of reliable risk data and volatility in the event costs; from the at-risk population, these include high prices, a misperception of the true risk, and above all, an expectation of the government aid after disasters, and exclusion of financial services. Therefore, a public-private partnership (PPP) can resolve this. The public sector sets a framework to reduce the physical risks, provides cover for high-risk segments and regulates market for other risks. The Indian Government, for example, allows private insurance companies to operate once they cover a certain percentage of poor, rural population in their business activities. These companies cross-subsidize this likely losing concern with their profits earned in other insurance markets. Thus the private sector may provide technical assistance and administrative services in covering lower-risk segments. Likewise, NGOs also can on compulsory basis undertake some responsibility of paying premiums on behalf of its beneficiaries. This payment can be covered from its interest earning from other loan activities. Also NGOs would be more effective in mobilizing the farmers within their area of operations. Competition will reduce administrative costs and fraud.

What kind of CI methodology is the most appropriate for Bangladesh?

Based on experiences elsewhere, and in view of the social conditions in Bangladesh, it is suggested that area based index, especially weather index-based crop insurance might be the best approach. The land distribution pattern, tenant farming, and the inherent problems of insurance, such as moral hazard, adverse selection and huge administrative costs favor such an index-based CI. While administrative cost is minimized in weather index method, it however, requires a large network of hydro-climatic data stations with data of good quality or accuracy. Along with this, detailed land classification and elevation map is also required, especially for assessment of flooding and salinity intrusion. So, proper technical expertise is required. The Malawi case illustrates a large potential for donor-supported, index-based schemes that can be designed to provide needed liquidity after major disasters. In India, for example, international technical assistance has been instrumental in the current success of index-based crop insurance programmes, and similar schemes have been implemented or are under way in Mongolia, Ukraine, Peru, Thailand and Ethiopia. Unless supported by technical assistance, national subsidies (cross-subsidies, as in India), or international donors, these schemes are out of reach for very low-income smallholder farmers. As mentioned above, public-private-NGO partnership is what may make the CI a viable and sustainable venture. Here it is to note that while applying weather index method, it requires a multi-disciplinary approach and team including meteorologist, hydrologist, agriculture specialist and insurance expert together. A detailed plan for introducing index-based CI has been added in the last chapter.

National Reinsurance Scheme: The public sector company, the SBC can serve as reinsurer to the CI schemes, covered by the private companies. In this case, India can again serve as an example: the Infrastructure Regulatory and Development Authority (IRDA) established under the 1999 Act has been charged with overseeing and regulating the insurance industry and named the General Insurance Company (GIC) as the national reinsurer to which all the country's direct insurers must cede 20% of their business. This kind of provision for the private companies can be introduced in Bangladesh, where they also have to cover a certain percentage of small-holder farmers and other rural poor. Besides, the non-insurance firms like banks and hedge funds are getting involved in this area, and they can also be persuaded to contribute to this reinsurance coverage, as a part of their corporate social responsibility.

International Financing: Financial support from the international community would be required either to subsidize CI schemes and/or to provide risk capital to finance their costs for reinsurance and consequently the costs of premiums. The existing *ex-post, ad-hoc* model of financing natural disaster losses in developing countries by the development partners fails to provide disaster-prone countries with sufficient incentives for mitigation and risk reduction. As donor-funding arrives in the aftermath of catastrophic events, such cyclone Sidr, and by and large is used for emergency relief and reconstruction purposes, very little of this aid is invested in long-term mitigation projects. As opposed to commercial property insurers, which frequently link the very availability of insurance coverage to the implementation of concrete risk reduction measures by the insured, donors require nothing of this sort. As a result, countries at risk see little economic or political benefit from investing in mitigation or better enforcement of construction codes or land-use policies that would restrict construction activities in harm's way. Besides, there is uncertainty in the quantum of aid, which depends often on the media exposure of the events. For example, international support for the Indian Ocean Tsunami was exceptional, with estimates of about US$7,000 per affected victim, which can be compared, for example, with the devastating floods affecting Bangladesh in 1998, where support was estimated at about $3 per affected victim (Tsunami Evaluation Coalition, 2006). Besides, less dramatic, slow-onset climate disasters cumulatively affect the developing countries in bigger ways, which remain unnoticed and neglected. So this culture of funding *ex-post* needs to be changed a little, and more money should be made available for *ex-ante* financing. Therefore, international financing can create either an International Insurance Pool (IIP), as suggested by the AOSIS, or a Climate Impact Response Fund (CIRF), as suggested by Muller, or the Climate Change Funding Mechanism (CCFM), as proposed by the Germanwatch. The funds in such instruments can be mobilized through the following means:

- The first source can be the financial contributions by Annex-B (industrial country) Parties to the UNFCCC. These contributions could be based on the criteria of capability (e.g. GDP/person) and/or the aggregated amount of emitted CO_2 (per person) since a specified point in time (say since 1990). However, from the political point of view, the latter criteria will be a sensitive issue. But the persuasion for this has to be based on the application of the accepted principle of common, but differentiated responsibilities.

- Some additional revenue-generating approaches can be explored by the developed countries that, in turn, can set incentives for their own citizens to limit GHG emissions. These may include imposing climate fees on aviation (as proposed by Muller), or a general CO_2 fee. To finance such an international fund, countries may also consider using at least a part of the income generated by auctioning emission rights within national emissions trading schemes. If the income generated by auctioning were used to set up regional or national adaptation funds, a window of these funds could be used for contributing to the proposed international pool. One main benefit from these contributions would be a reduced vulnerability of the poor in the developing countries to climate disasters, and hence the ability to avoid diverting a growing percentage of development aid for emergency and disaster relief. For example, in 1987/88, the share of disaster assistance from ODA was 1.61%, while it increased to 8.51% in 2003. Such a reduction to vulnerability of the poor would also contribute towards reaching the MDGs.

- Among other potential contributors to the international insurance fund are global and regional financial institutions, and bilateral donors, such as the World Bank, Inter-American and Asian Development Banks, DFID, and the German Ministry for Economic Cooperation and Development (BMZ), which have made the reduction of physical vulnerabilities in developing countries and their adaptation to climate change an integral part of their development agenda. Their financial support to such an insurance scheme could become an effective vehicle to promote hazard mitigation and risk awareness in their member countries.

- Two recent projects by the World Bank are specially promising as a potential link with the broad programme of funding support for insurance. The Global Fund for Disaster Risk Reduction and Recovery (GFDRR) will provide technical assistance for mainstreaming disaster risk and serve as a stand-by facility to provide quick relief funding. A Global Insurance Index facility (GIIF) sponsored by, among others, the EC, is in the planning stage. This facility, as envisaged, will provide backup capital for index-based insurance covering weather and disaster risks in developing countries to assure financial protection for small risk-transfer transactions. By constructing a diversified portfolio of developing country risks, the facility would leverage risk transfer and thus jump-start the development of risk transfer markets in countries with underdeveloped insurance markets (World Bank, 2005c). It is anticipated that other donor and financial institutions will join the GIIF initiative.

Together with governmental sources, the international reinsurers, such as Munich Re, Swiss Re and the international NGOs, such as Red Cross/Red Crescent, Oxfam, Care, etc. can join hands in piloting the CI schemes, particularly in the LDCs like Bangladesh. Malawi and India have already set precedents in micro-and index-based crop insurance. These initiatives need to be scaled up.

Chapter 1: Background and Introduction

1.1 Statement of the Problem

In recent years, natural disasters, particularly climate-related ones, have increased both in frequency and magnitude. Scientists the world over have agreed (IPCC, 2007) that human-induced climate change is exacerbating this impact. Findings show that economic losses from disasters are rising dramatically – almost nine-fold in real terms from the decade of the 1960s to the 1990s, and insured losses more than 15-fold. Of these, losses due to extreme precipitation events, floods and storms increased most (Munich Re, 2003). The IPCC also concluded that at least part of the increase in economic losses is due to changes in climatic conditions (IPCC: 2001). Another factor behind this increase in losses is viewed to be increasing concentration of people and capital in vulnerable areas. The poor and the marginalized of the developing countries are the worst victims to these disasters (POVCC, 2003; UNDP, 2005). On the other hand, they have the least capacity to adapt. For some low-income countries, losses due to climate disasters account for several percentage points of their GDP. Per capita loss in relation to GDP is at least 20 times higher in developing countries than in the industrial world. Agriculture sector is likely to be affected most due to extreme weather events like cyclone, flood or drought. So, the farmers are hit hardest.

For floodplain countries like Bangladesh, structural measures for management of disaster risk and its consequences often were found less effective. So non-structural measures like micro-insurance or crop insurance are being suggested as a risk management strategy. The rationale is that poverty and vulnerability to climate change feed each other, and this nexus warrants that climate change policies work in concert with poverty reduction policies. However, traditional micro-credits and savings are inadequate when poor farmers with no safety or security nets are exposed to risks beyond their means to cope with. Therefore, micro or crop insurance (CI), customized to specific needs of the poor, may be an effective instrument for the purpose.

UN Climate Convention and the Kyoto Protocol have included the provision of insurance as a mechanism to address the risks from climate change. What remains from the insurance discussions prior to 1992 is reflected in Article 4.8 of the UNFCCC, which calls upon Parties to ‘consider’ actions, including those related to insurance, to meet the specific needs and concerns of developing countries with respect to both the adverse impacts of climate change and the impact of the implementation of response measures. Article 3.14 of the Kyoto Protocol calls for the implementation of Articles 4.8 and 4.9 of the UNFCCC in fulfilling obligations of the Kyoto Protocol, and explicitly calls for the consideration of the ‘establishment’ of insurance. The term ‘insurance’ is not defined in either treaty or in COP decisions and thus, the term does not refer to any specific kind of risk transfer or collective loss sharing instrument.

The following are the main decisions and actions taken by the UNFCCC Parties :

- The Conference of Parties Four (Cop-4) decision 5/CP.4 establishes a framework for further analysis for the implementation of Articles 4.8 and 4.9 of the UNFCCC and 2.3 and 3.14 of the Kyoto Protocol : a) identification of the adverse effects of climate change;

b) identification of the impacts of the implementation of response measures; c) identification of the specific needs and concerns of developing country parties; and d) identification and consideration of actions, including actions related to funding, insurance and transfer of technology. Following Decision 1/CP.4, these issues became part of the Buenos Aires Plan of Action. An expert workshop (Annex to decision 5/CP.4) was held during 21-24 September 1999 (Report in FCCC/SB/1999/9).

- Decision 5/CP.7 mandated the UNFCCC Secretariat to organize two workshops - one on insurance and risk assessment in the context of climate change and extreme weather events (para.34) and the other on insurance-related actions to address the specific needs and concerns of developing country parties arising from the adverse effects of climate change and from the impact of the implementation of response measures (para.35). The decisions called upon the SBSTA and SBI to review the progress of these activities and make recommendations thereon to the COP at its eighth session (para.9). The workshops were held in May 2003 and the reports were forwarded to Cop-9 for consideration.
- COP-10 requests the Secretariat to ensure that the issue of risk assessment & microinsurance for the LDCs in the context of extreme weather events is covered in the workshops referred to in the Buenos Aires Plan of Action on adaptation and response measures.

As it is known, insurance is a financial instrument of buying potential risks. But the size of insurance market can be viewed not only as an indicator of development, but also as an indicator of social & cultural fabric of any society. The question of premium cost apart, there is the general expectation that the Government or NGOs will come forward to rescue in the aftermath of any disaster. The question of the hard-core poor is different. But the non-payment of bank loans or indemnifying them has become a culture in Bangladesh. What is being referred to is a culture of moral hazard. Against this trend, the Government spends huge money for ex-post disaster management, which again has political overtones.

On the other hand, private sector to a large extent in Bangladesh continues to live with the idea that any kind of public welfare program is a government business. The concept of corporate social responsibility (CSR) is yet be internalized by the larger segment of the private sector in our society.

In many developing countries including Bangladesh, crop insurance has been introduced about 3 decades ago. Many of these countries are continuing, but in some others, it has stopped functioning, because of incurring heavy losses. For example, since 1981, the Sadharan Bima Corporation (SBC) has initiated crop insurance several times, but incurred losses over 500%. As a stand-alone instrument, CI is not financially viable directly anywhere in the world. Even in the industrial countries, it continues functioning as a public welfare program. In fact, agriculture sector used to be subsidized in all countries, more or less. If CI is introduced and eventually the subsidy in other sectors decrease, or the risk management in the agriculture sector is more formalized and systemized - that will be a value addition no doubt. So, CI loss and profit should be seen from a critical point of view, not the direct loss and profit calculation as it is done for other insurance cases. The SBC has taken initiative in the form of a proposal again to introduce CI, this time in partnership with other stakeholders. But the private sector is yet to respond. Good news here is that prospect of Microinsurance is improving day by day and many of the private insurance companies are considering it as an option.

1.2 Terms of Reference (ToR) of the Study

This project was commissioned by the **Climate Change Cell (CCC)** of the Department of Environment (DoE) as an adaptation strategy for climate change impact in the agriculture sector. In view of this, the end product of this research project was expected to be analyzing the viability of crop insurance introduction in Bangladesh, farmer's response, insurance providers response, identification of stakeholders and developing a framework and strategies for CI schemes. This is evident from the ToR of this study, as mentioned below:

- A review of micro-insurance in general and CI in particular and analysis of its success and failure elsewhere and in Bangladesh.
- Identification of Stakeholders at Local, National and International levels and their role.
- Analysis of demand and supply sides of the CI schemes.
- Developing a framework and concrete strategies and guidelines for CI schemes.

A correct diagnosis of the past attempts will lead to realistic prescriptions. In this context, some of the challenges related to CI that have been raised in the course of the study are:

- Is the probability of loss from climate disasters adequately calculable?
- If CI cannot be made at least financially viable, how can the loss be minimized to a maximum level?
- How to spread the risks on a wider scale?
- How to reduce the problems of adverse selection & moral hazard/corruption?
- The Govt cannot do it alone. How could the private sector & NGOs be involved in CI ?
- Are there ways & means of policy & voluntary-based cross-subsidization?
- Is it viable to create insurance funds with premiums in kind by local small groups?
- What is the policy-institutional framework and models that can make CI a sustainable venture?

Based on the above queries, this study report contains the following chapters: Chapter two deals with the models, methods and experiences of microinsurance and CI schemes in other countries and in Bangladesh. Chapter three lays down the framework of CI schemes as a guide to studying the problem. Chapter four explains the methodology of the study, followed by findings from primary data (Chapter five). Chapter six is devoted to analyzing the findings from the local and national levels. The final Chapter concludes with a suggested framework and strategies for a viable CI scheme in Bangladesh.

Chapter 2: Crop Insurance - Conceptual Framework and Methodology for the Study

2.1 Conceptual Framework of Crop Insurance Programme

To conceptualize the processes of Crop Insurance in general and different components in it, a Conceptual Framework of CI programme is discussed as the first step. Crop insurance programme in different countries varies based on the agricultural situation, dominant socio-economic conditions and available administrative infrastructure. But in general, the broader perspectives of the insurance scheme should be covered. There are some critical elements which determine the basic structure and some key elements which shape the ultimate scheme. In addition to these elements, there are some essential requirements which create the operational viability and sustainability of the scheme. The elements and requirements of the crop insurance scheme are presented in Table 2.1.

Table 2.1: Conceptual framework for crop insurance Programme (adapted from Jain, 2004)

Determination of Basic Structure	→	Critical Elements	→	Perils to be covered, Public/Private Involvement, Individual/Area Approach, Voluntary/compulsory participation
Super Structure of Programme	→	Key Elements	→	Coverage of farmers, Coverage of Crops, Determination of Sum Insured & Loss Assessment, Determination of Premium, Loss Adjustment Mechanism, Organization Structure, Financing of the Scheme, Communication with Farmers, Reinsurance Arrangements
Operational Sustainability of the programme	→	Other Requirements	→	Availability of Adequate Data, Availability of Trained Personnel, Evaluation and Monitoring

2.1.1 Critical Elements:

Critical elements determine the basic structure and lay foundation of the cheme. The elements that are critical for structuring the scheme are:

Perils to be covered: This fundamental issue determines whether to cover all or certain specified risks. In place of yield insurance, where insured farmer gets the indemnity if the yield is below some specified level; insurance coverage against crop losses caused by specific perils (e.g. drought, storm, flood) are more effective. Insurance scheme based on perils can be of specific perils (e.g. Mauritius, Cyprus) or multi-perils (e.g. USA, India, Sri Lanka).

Involvement of public or private sector: Most of the crop insurance schemes are developed in the public sector. The basic advantage of public sector insurance is that it can access government budget and support from other public institutions and banks. On the other hand, private crop insurance is in place mostly in developed countries in specific weather risk management (e.g. hail insurance in USA, Canada, and Europe).

Individual or area approach: To determine the indemnity of crop insurance, losses of individual farmer are assessed separately under individual approach. On the contrary, indemnity of a group of farmers on the basis of average loss experienced by a specified homogeneous area (e.g. district, village) are covered under area based approach. As both of the methods have pros and cons, selection of the method for the target insurance scheme should be based on: target farmers, farm size, crop insured and communication facilities.

Voluntary or compulsory participation: A crop insurance programme may envisage voluntary or compulsory participation. In voluntary participation, farmers who are eligible for insurance can opt to be or not to be a part of the scheme (e.g. USA, Canada). In compulsory participation, either based on certain categories of farmers (e.g. India, Philippines) or certain categories of crops produced (e.g. Japan, Cyprus); farmers have to automatically participate in the scheme. The compulsory approach reduces significantly the problem of adverse selection and the cost of sale of insurance. Though there may be dissatisfaction among low-risk farmers for cross-subsidizing high-risk farmers.

2.1.2 Key Elements

Key elements shape the structure and influence the working of a crop insurance scheme is discussed below:

Coverage of Farms and Farmers: Farms with specialized activities (horticultural, aquaculture, poultry) adopts specialized technology and have access to institutional finance. Private sector insurance has already shown interest in these specialized firms. Medium and large size firms are commercially viable and the risks are insurable. The semi-commercial and emerging sectors refers to firms are in a state of transition from traditional to commercial agriculture. Both private and public sector insurers have scope of participation in this sector.

Farmers with small holdings are in the traditional and subsistence sector. They are most vulnerable to agricultural risks and need insurance the most. In developing countries, addressing this sector is of greatest challenge.

Coverage of Crops: Though the objective of crop insurance is to stabilize farmer's income, it is not feasible to cover all crops grown by a farmer. In the beginning, the coverage can be limited and extended gradually to achieve the desired goal.

Determination of Sum Insured and Loss Assessment: Sum insured coverage is usually based on cost of production, part of the value yield and amount of crop loan. In most cases, sum insured is based on cost of production due to it's simplicity to assess and availability of information. But this assessment faces some theoretical and practical problems (eg, variable cost vs fixed cost, imputed value of family labor). The assessment of losses of agricultural insurance is more difficult than other insurance schemes (eg, fire, property). Crop insurance relates to something yet to come into existence. The deductible level and its nature and application in relation to the risks insured are also important for determining the loss.

Determination of the Premium: For a viable crop insurance scheme, the premium rate needs to cover the following: pure risks, administration cost, contribution to catastrophe reserve and a reasonable return. The insurance premium may be on a net or gross basis. Net premium covers only the average loss over a period and possible an additional amount to accumulate a small reserve. Gross premium involves some 'loading' to include cost of administration and some return or profit.

Loss Adjustment Mechanisms: The loss adjustment mechanism should be effective enough to minimize spurious claims and at the same time fair to the insured. The procedure will depend on the approach of the scheme (area or individual). In case of the area approach, indemnity will be based on the average crop yield. In case of individual approach, field inspections are necessary to estimate yield through eye estimation and crop cutting procedure.

Organizational Structure: There is diversity of organizational structure across countries. It may be a private organization (China), private organization with government support (Japan), parastatal organization with minimal government control (Mauritius) or a public sector organization (India). The administrative structure chosen by a country depends on socio-economic infrastructure, type of insurance schemes, target farmers and crops, comprehensiveness of its coverage and size of operation.

Financing of the Schemes: Financing is important to insurance programs as in times of disaster the requirement of funds are very large. A scheme will be self financing if the premium rates are correct and the loss adjustment mechanisms are properly structured. In practice, there may be at times imbalance between the premium income and fund required to pay the indemnity (eg, catastrophic events). Thus, building a reserve is required during the early years of a program. The size of the reserve should be based on realistic estimate of the maximum possible loss.

Reinsurance Arrangements: Reinsurance provides access to larger reserves by spreading the risk wider. It can take various forms like: reinsurance support from the government (Japan, Canada), loans/funds from the government (Japan, Canada), budgetary fund from the government (India) and private insurance in the international market (Mauritius).

Communication with Farmers: In case of mandatory participation in the scheme, the farmers must be convinced that the program is of their interest to avoid dissatisfaction. In case of voluntary participation, the coverage will depend on how and to what extent farmers perceive it is beneficial to them. Farmers should believe that the terms and conditions are fair and have confidence on claim settlement issues. Communication with farmers can be done through media, education programs and group interactions.

2.1.3 Other Requirements

Other requirements (adequate data, trained personnel and monitoring and evaluation) will make the scheme operationally sound.

Adequate Data-base: To work out the financial implications of a possible crop insurance scheme, availability of data is crucial. Data is required to form the basis for determining the premium, guaranteed yield, indemnity etc. Moreover, information on climatic conditions (eg, frequency of flood, drought), land tenure, land record systems, cropping pattern, availability of agricultural inputs including credit and other infrastructure in an area are essential. This information facilitates realistic assessment of exposure of various crops to the perils to be covered.

Availability of Trained Personnel: Trained personnel are required to operate an insurance scheme both at headquarters and filled level. Due to complexity of agricultural schemes, specialized training on theory, techniques and practice is a must.

Monitoring and Evaluation: Monitoring and evaluation on a regular basis is required to take remedial measures on time, if necessary.

2.2 Methodology for the Study

As it is mentioned in Chapter one, as per ToR the entire study was divided under four major objectives or tasks as review of crop insurance experience, identifying stakeholders, gather farmer's response and exchange views with prospective insurers. To achieve the objectives to be done, the methodology proposed for the study with the activities in sequence was as follows;

- Extensive review of crop insurance experience at different parts of the world as well as in Bangladesh. Critical analysis of the methodologies to Crop Insurance, their success and failure.
- Identification of Stakeholders at National, International and local levels and their role.
- Conducting an Inception Workshop with the stakeholders to finalize methodologies.
- Secondary data collection and analysis on climate, disaster and agricultural losses and activities of microfinance organizations.
- Field survey through questionnaire and FGD in three districts among the farmers with topography and economic condition.
- Semi-structured interview and round table discussions with stakeholders and prospective insurer.
- Analysis of data and suggestion on the problems and prospect of CI implementation in Bangladesh and a proposed structure of CI program.

The following sections detailed about different activities briefly;

2.2.1 Collection of Secondary Data and Information

2.2.1.1 Review of Micro-Insurance and Crop Insurance Experience Worldwide and in Bangladesh

A review of micro-insurance schemes in Bangladesh in general and crop insurance schemes in particular were conducted to ascertain the success/failure of such schemes in the past. Experience of Crop Insurance at different parts of the world and pros and cons of different methodologies were also conducted. To perform the above mentioned tasks the following steps were undertaken by the project team :

- Identification of the GOs, NGOs and private financial organizations which had been or are currently marketing different products of micro-insurance in general and crop insurance in particular.

- Review of past experience on crop insurance introduced in Bangladesh by Sadharan Bima Corporation (SBC) – methodology adopted, organizational structure, causes of failure and loopholes.
- Collection of relevant documents about experiences of micro / crop insurance in other countries, and reviewed them.
- Based on all these reviews, an analysis was done to identify the success or failure of such schemes.
- In addition, to corroborate these analyses, interviews & discussions was held with some key personnel of organizations including Shadharan Bima Corporation (SBC).

2.2.1.2 Assessing the risk level in the agriculture sector under future climatic changes

The project team in close cooperation with people in selected project areas identified how crop insurance fits in with people's livelihoods and existing risk management strategies and whether there is an actual demand in project areas for crop insurance. The task was performed by completing the following steps:

- Based on historical data an analysis on the crop production, natural disaster and associated losses affecting farmers' income and livelihood over the last decades.
- Trend and future prediction of climate change and its ultimate effects on the agriculture sector either directly or indirectly like increased frequency of natural disaster.
- Development of a methodology to quantify risk for actuarial analysis under future climatic changes.
- Existing government support, income security and credit schemes for farmers and their effectiveness.

2.2.2 Primary Data Collection and Analysis

2.2.2.1 Questionnaire Survey and Focus Group Discussion (FGD)

The main purpose of the questionnaire survey and FGDs were to identify in close cooperation with people in selected project areas how crop insurance fits in with people's livelihoods and existing risk management strategies and whether there is an actual demand in project areas for crop insurance. Specifically it is intended to answer the questions like whether farmers are able and/or willing to actually contribute to an insurance scheme and what premium would be reasonable and acceptable for them.

Questionnaire survey was conducted at several levels. The *first level* of the questionnaire survey was designed to get response from the farmers, i.e. to understand the demand side of the program - how demandable crop insurance is and how much the farmers can contribute, or their preference of organizational structure, etc.

The *second level* of the questionnaire survey was for the prospective insurer and policy makers, i.e. Private and public insurance companies, Bank, NGO and govt. officials about their response to Crop Insurance implementation.

FGD was mainly conducted among the farmers to assess their response. It was conducted among three groups of farmers as small, medium and large farmers. The methodology here was to gather people at a place and discuss the matter so that they can freely express their opinions and put suggestions.

2.2.2.2 Field Survey among Farmers

Site Selection

A number of factors were considered while determining the sites for field survey. **Three major criteria** were considered here, which were expected to have significant impact on choice of adopting different components of a Crop Insurance Program. The criteria were as follows;

- *First criteria*: the survey sites should cover different types of disasters that can affect agriculture. Three major disasters Flood, Drought and Cyclone or Salinity intrusion were considered in this case which mostly affect agriculture sector in Bangladesh. The nature and magnitude of the three disasters vary widely, for example while cyclone or flash flood occurs in a sudden onslaught with high magnitude, drought used to appear slowly and continue for a longer period. The farmer's response to each of the disasters used to be different as well. While deciding about crop insurance program, it is expected that the response from the farmers from different disaster prone regions will be different. Sites were selected accordingly to capture this variation in responses to CI program for variation in disaster type. Tentatively three sites were selected initially as;
    1. Flood: Flash flood affected district Sunamgonj was selected under this criteria.
    2. Drought: Rajshahi was selected as drought prone district.
    3. Cyclone and salinity affected Area: Satkhira was selected as a field site affected by cyclone and salinity intrusion.
- Second *criteria:* the survey sites should cover variation in vulnerability level for a particular disaster at a particular site as highly vulnerable, moderately vulnerable and least vulnerable. Rational behind such selection is quite straight forward as vulnerability level should be directly related to farmer's willingness to adopt CI.
- *Third criteria:* the survey sites should include farmers of different economic conditions. Economy is an important factor determining farmer's adaptation capacity. Marginally poor farmers, even though exposed to natural disasters but can not adopt a formal credit or insurance scheme as it is difficult for him to manage the premium or installments. Whereas, rich farmers are seen to be taking most of the advantages of such credit or other formal schemes. It was assumed here that the response about the willingness to adopt CI will vary significantly among different groups of farmers under varying economic conditions.

To allow variation in farmer's group, here 3 categories were considered as big, medium - size & small farmers (based on the BBS criteria: > 7.5 bigha (bigfarm), 2.5 to 7.5 bigha (medium) & up to 2.5 bigha (small farm); these farmers to be surveyed are to be divided equally for most vulnerable, moderately vulnerable & less vulnerable areas.

Sampling and field survey: Questionnaire and FGD

A sample size of 450 farmers based on purposive, but sequential sampling in three project districts – Satkhira, Rajshahi & Sunamganj (150 farmers from each district, with 50 from each category of big, medium & small farmers for capturing their varying perspectives on the issue); further, three most vulnerable groups were selected under each economic classes. The following activities were conducted at each field sites as;

1. Conducting the field survey in the form of filling up the Bangla Survey Questionnaire, while talking one-to-one. These questionnaires were supplied by DESM, NSU.
2. Conduct 3 FGDs with each group & one FGD in a combined group.
3. Conduct interviews/discussions with LG officials, Key Informants, etc.
4. Collection of local climatic data & natural disasters including rainfall for the last 10 years.

2.2.2.3 Semi-structured interview and Round Table Discussion

The purposes here were to identify, in close cooperation with potential crop insurance providers, what obstacles there are to the introduction of crop insurance and how these obstacles could be addressed.

- Based on findings from farmer's survey, a general set of Questionnaire, with appropriate variations targeted at public sector, private sector & MFI-NGO insurance providers were developed for collection of information through interview and discussion; the Questionnaire will cover, among others, queries on their experience in crop insurance, if any, on market potential of crop insurance, their supply potential & types of products, their ability for actuarial analyses of disaster risks and economic damages, obstacles faced in the process, and suggestions for overcoming them.
- Another set of Questionnaires were developed for discussion with donor representatives including FAO, UNDP and World Bank to gauge their perspectives including the possibility of international fund mobilization for the purpose.
- Together, discussions were conducted with selected policy-makers from the ministries of Agriculture, Finance including ERD and Planning Commission.
- As the final step for data collection, a group of national academicians and international experts (some of whom the project team leader knows well were interviewed personally).

2.2.2.4 Individual Interview

Individual interview was made especially among the experts and SBC official at different level. At the beginning of the program several such meetings were arranged with SBC officials to investigate about the past experience of Crop Insurance implementation. Later personal communications were conducted with experts from Bangladesh Insurance Academy, Microfinance Institute and Controller of Insurance, and BARC.

2.2.2.5 Analysis of Data

Field survey data were analyzed by using some statistical tools and graphical methods. Correlation between different factors were established. Secondary data and discussion outputs were critically analyzed and presented in a comprehensive manner that might help deciding CI structure and methodologies.

2.2.3 Development of a Model and structural arrangement for Crop Insurance application in Bangladesh

- Based on the questionnaire survey, secondary data analysis and discussion with policy makers and insurance providers a comparison was made matching the demand and supply sides of crop insurance; the findings in the form of gaps then were reviewed for final analysis and developing realistic policy recommendations for introducing crop insurance.
- The draft findings were presented in a Roundtable discussion meeting to incorporate their inputs.
- A tentative method and structure of Crop Insurance scheme with probable methodology and organizational structure was proposed.

2.2.4 Identification of stakeholders and their role

Identification of stakeholders at local, regional and national levels (including farmers), Disaster Management Committees (DMCs), other local government institutions, relevant private sector entities such as banks and insurance companies, cooperative groups and associations) was the main purpose at this stage. For the purpose, contacts have been established with the BIA, SBC, BARC and other relevant institutions/organizations to describe their particular roles in crop insurance schemes based on discussions & intelligence gathering. The project team also invested much time to look for the stakeholders involved in micro and crop insurance schemes or its thinking processes. Before Inception workshop identification of stakeholders were required to invite people from all sectors who can contribute to the methodology and later to interview and question them. However, after fixation of a model for CI, the prospective stakeholders, specifically related to the model CI application were mentioned and their roles were described.

2.3 Inception Workshop to Finalize Methodology

Once the project team tentatively identified the stakeholders at local, regional and national levels, a half-day **Inception Workshop** was arranged inviting all the above mentioned stakeholders for discussion of the proposed draft methodology for the study, to collect and incorporate their views and ideas in designing the research outline. At the beginning of the programme the Team Leader of the CI project introduced the topic and its objective based on ToR of the project and invited comments and discussion on the topic, specifically on the methodology of the study. Comments and discussions by the participants are summarized in the following sections;

Comments in general:

- One policy alone might not be enough, but a multilevel approach so that the system become more robust, i.e. CI in the form of a package rather than just one policy.
- A number of participants supported the idea of making Linkage between CI and government bank loan to farmers like making it mandatory for Agri-loan.
- At the same time, NGOs practicing microcredit alone can offer microinsurance as well, which may be a more sustainable approach.
- CI process should be made easy and understandable
- Formation of groups instead of individual policy
- Recalling the failure of CI scheme introduced by SBC during 1977-1985, some participants opined that SBC might not be the right authority to offer CI again, but other GO, NGO or private entities. Also CI scheme should not be implemented again without redesigning it.
- Provision for including agricultural experts in the process of CI.
- Proper statistical analysis at different stages of CI risk assessment should be made, loss assessment should be more scientific rather than ocular method.
- Inclusion of Bangladesh Meteorological Department and SPARSO in the risk assessment as well as loss assessment process.
- Who will fund or subsidize CI program if implemented, whether there is any possibility of international funding?
- Need adequate institutional supports in the field of micro-insurance as well as further research.

Figure 2.1 Inception Workshop (**Dr. Mizan R. Khan**, Chairman, DESM, NSU; **Mr Das Deba Prasad,** Managing Director, Delta Life Insurance; **Mr. Md. Humayun Kabir**, Secretary-in-Charge, Election Commission (immediate-past *Managing Director, Sadharan Bima Corporation*); **Dr. Hafiz G.A. Siddiqi**, Vice Chancellor, North South University; **Mr Benajir Ahmed,** Chairman, NSU Foundation; **Dr Mahfuzul Haque,** Chief Controller of Insurance, Government of Bangladesh; **Mr. Ian Rector**, Chief Technical Advisor, CDMP, Ministry of Food & Disaster Management; Mr. **Iqbal Ahmed**, Managing Director, Podokhep.

Comments specifically related to methodology of the study:

- Some participants argued that other than crop insurance it would better be Agri-insurance including livestock and poultry. Especially, in the context of epidemic breakout like Bird flue in recent years poultry industry is becoming highly vulnerable to such risk.
- Some participants raised the issue of project sites, such as Satkhira, which seemed to be not much appropriate as a site from crop insurance perspective, because cropping is not a very dominant activity in the coastal district. Some other comments also related to site selection. A control site, without or less disaster risk can be considered as well.

2.4 Finalizing the Methodology in Response to the Comments in Inception Workshop

- Including livestock and poultry under the insurance scheme along with crop and defining it as *Agricultural Insurance* might be a big job to be done. Again the nature of risk from Crop and livestock or poultry differs so that methodology will be different. Especially, because the project is specifically aimed at risk management from Climate Change, it was assumed that climate change will leave more significant effect on crop yield than poultry and livestock. A separate study is possible to address livestock and poultry, especially to address problems like Bird Flue.
- Initially, Satkhira and Rajshahi were selected as two districts for field study. However, after discussion and comments from the Inception Workshop, the team re-investigated the matter and finally changed two sites as Pirojpur and Lalmonirhat. Compared to Satkhira, Agriculture land coverage is higher, also more expose to coastal flooding and cyclonic storm surges. It is true that Rajshahi is more prone to drought than elsewhere in Bangladesh and probably a over-studied region. However, recently Rangpur and Lamonirahat regions are frequently suffering from a seasonal disaster known as MONGA, which is a combined effect of disasters like flood or Drought, unemployment and food shortage. Actually, the regions are vulnerable to multiple disasters, as well as low income level due to lack of industries. Monga affected regions and their sufferings used to frequently appear in newspaper so that it became a sensitive issue for government as well. In the context, along with few other measures, government had already taken initiatives to introduce Crop Insurance in the region.

Chapter 3: Crop Insurance - Theories and Experience Worldwide

3.1 Risk in the Agriculture Sector in General

Agriculture has always been a risky business. As shown in Table 3.1 the risk and uncertainties in the agricultural sector might be derived from a number of causes. Uncertainty of crop yield is one of the basic risks, which every farmer has to face, more or less. While production risk cannot be totally eliminated, it can be reduced and managed and producers have historically relied on a variety of strategies and coping mechanisms that can be categorized into three general classes: risk mitigation, risk transfer, and risk retention. Insurance can be considered as a means of risk transfer in that case.

Among the numerous sources of production or yield variability, weather is universally recognized as the dominant one. Figure 3.1 lists the principal sources of yield variability—quality of soil, planting date, genetic potential of the plant or animal, application of fertilizer, husbandry practices. Recent research from the Baltic states show that weather differences alone explained 35% of the variation in yield for a representative sample of farmers as shown in the figure. The relative importance of the factors, however, may vary from place to place and with the level of technology employed. Sometimes two factors might interact with each other as well or its temporal scale at which the effect are observed. But what distinguishes climate risk from the other listed factors, however, is the degree of human control possible. The non-weather factors can be significantly reduced or mitigated with on-farm strategies, with the principal constraints being farmer knowledge and financial resources. In contrast, weather cannot be controlled and Risk in the agriculture sector can be grouped under several headings as;

Table 3.1 Risk in the agricultural sector

Production or yield risk: loss of production or lower yield of crop due to disaster or other causes.

Price or market risk referring to uncertainties about prices producers will receive for commodities or prices they must pay for inputs;

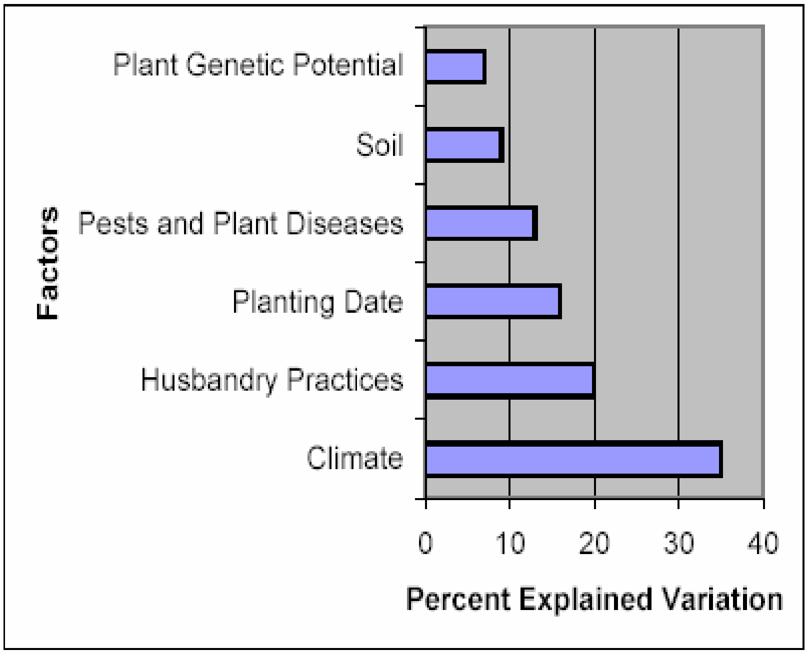
Asset risk referring to the potential loss or damage to physical buildings, equipment, vehicles, and implements due to fire, theft, water damage, or accidents;.

Institutional risk referring to unexpected changes in government regulations governing taxes; environmental protection, employment rules, workplace conditions, price or income supports, repatriation of profits, support payments, other subsidies, property confiscation, and the like;

Operational risk referring to uncertainties in scheduling or using equipment at critical times, making or receiving shipments of critical inputs/outputs, and handling of labor disputes;

Financial risk referring to rising costs of capital, exchange rate movements, insufficient liquidity to meet liabilities, loss of equity, and the prospect of loans being called by lenders;

Personal risk refers to uncertainties and risks connected to health and personal relations such as accidents illness, death, and divorce.



Source: Jacob Lomas work on Baltic agriculture op. cit. Eduardo Zegarra, 2003

Figure 3.1: Factors causing variation in crop production

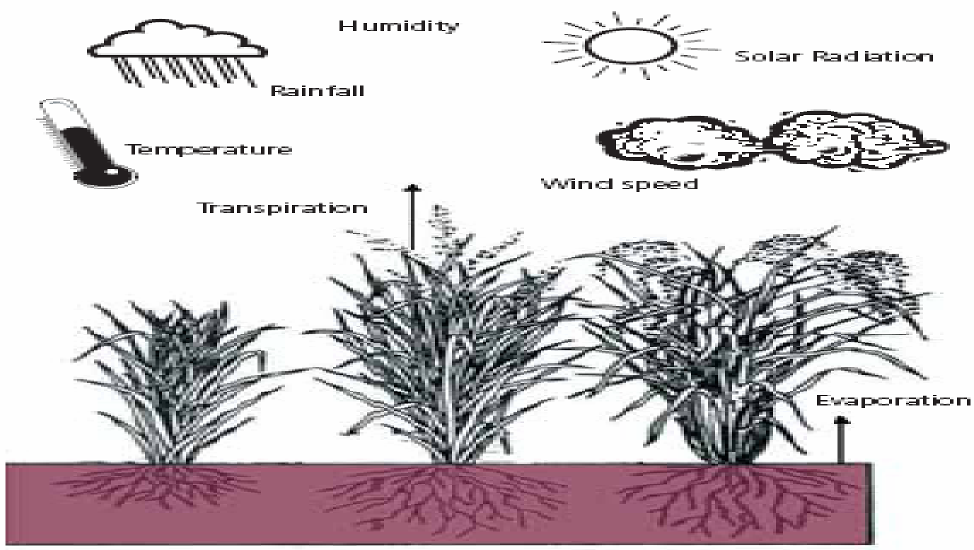


Figure 3.2: Climatic factors influencing crop production

There might be a number of phenomena which contribute to yield risks in agriculture: hydro-meteorological, geological, and biological origin which can be grouped as follows;

- Extreme natural hazards like flood, drought, cyclone and storm surges, hails storm, etc. farmers have little to do against such natural calamities and they are mostly uncertain.

- Pests, plant disease and microbial contamination. It might have significant impact on agri-based industries like poultry, fisheries, cattle, etc. Crop failure might also result in due to breakout of such hazards.
- Climate change and environmental degradation. The effect might be direct like change in temperature that might affect crop planting, flowering and harvesting time or slow but steady processes like degradation of land fertility, salinity intrusion, or increase in extreme weather events and other calamities.

Globally significant amount of agricultural production being lost every year because of different calamities derived from the above sources. The trend is increasing day by day and compared to developed countries developing countries seem to be more prone to such calamities because of their lower ability to adjust. By the year 2050, the United Nations estimates that natural disasters will cost 300,000 lives and approximately \$250 billion in economic losses per year worldwide, if more measures are not taken to mitigate risks and reduce global warming (UNISDR, 2002).

3.2 Climate Change and Risk in the Agricultural Sector

Climate change might further aggravate crop yield, either directly or indirectly. As shown in Figure 3.3 & 3.4, according to IPCC 4th Assessment Report, change in temperature and CO_2 level will directly affect crop production depending regional climatic condition. On the other hand, indirect effect like increased disaster incidents or extreme weather events or pest attack will affect crop production as well.

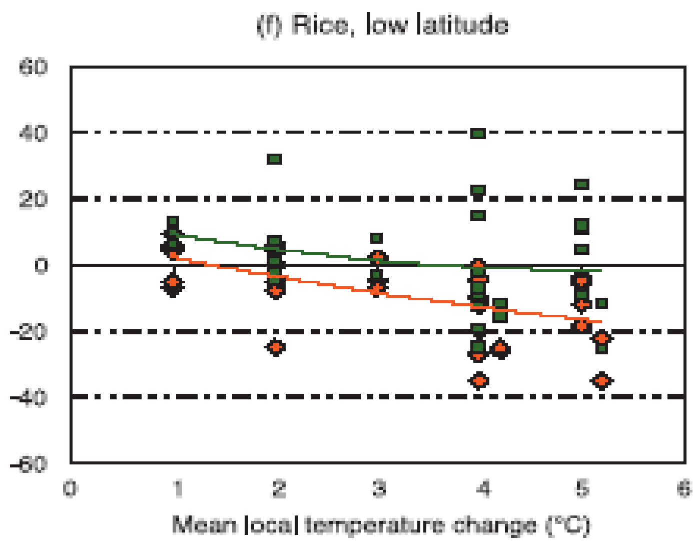


Figure 3.3: Impact of climate change in the agriculture sector (IPCC AR4, 2007)

It has been calculated that the economic losses (adjusted for inflation) of weather-related events in the period 1985-1999 amounted to some US\$707 billion. Over a longer period, 1950-1999, the average annual losses (again adjusted for inflation) have increased by more than ten times, while the global population has increased by a factor of 2.4. It is estimated that the costs associated with crop damaging weather events are doubling each decade.

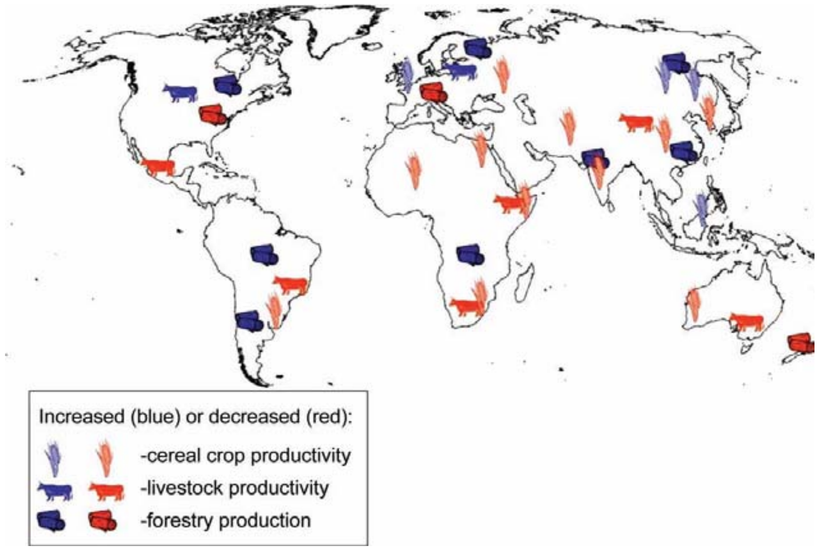


Figure 3.4: Change in agricultural production expected under future climatic changes (IPCC AR4, 2007)

The scientific community is not unanimous in attributing the increases in extreme weather events to global warming. However, there is a strong body of opinion which holds that this is the case. Their thesis is that global warming means more energy in the system. A consequence of this is a rise in the frequency and magnitude of extreme weather events. As shown in Figure 3.5, historically the frequency of extreme climatic event has increased significantly over the period 1900-2000. From the figures it is also evident that South Asia, especially Bangladesh use to be one of the most affected regions with high frequency of extreme events.

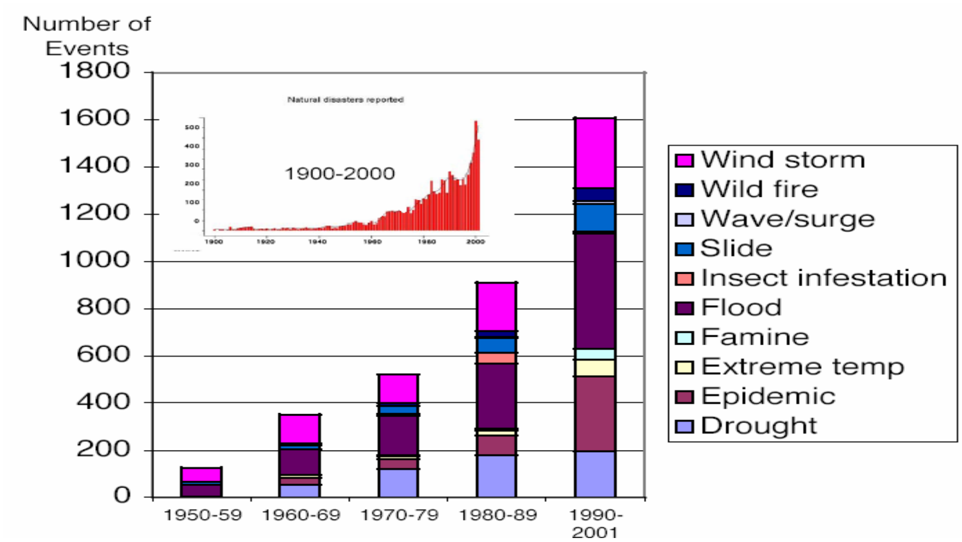


Figure 3.5: Changing nature and structure of global disaster events

Sources: OFDA / Center for Research in the Epidemiology of Disasters (CRED) Intl. database of Disasters

As per projection of IPCC, the scenarios for global temperature increase is shown in Figure 3.9, explain how it translates an increased frequency of weather extremes. Figure 3.10, on the other hand shows that such a trend of increase in average temperature has already leaded to increased frequency of extreme temperature events.

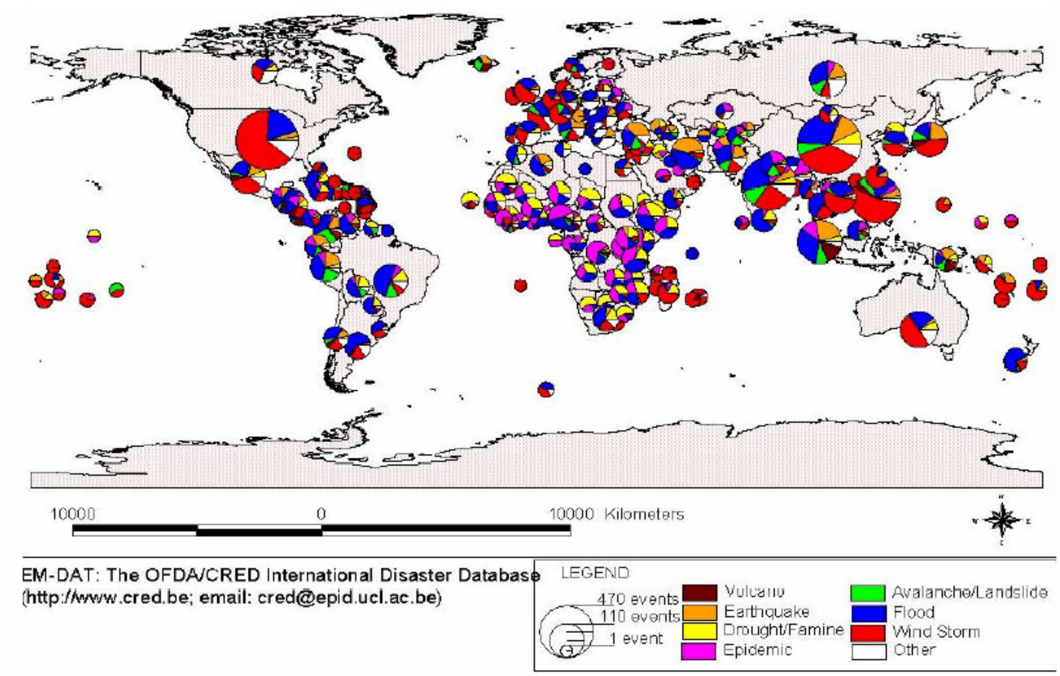


Figure 3.6: Global variability of disasters from 1975 – 2001 (South Asia-highly prone)

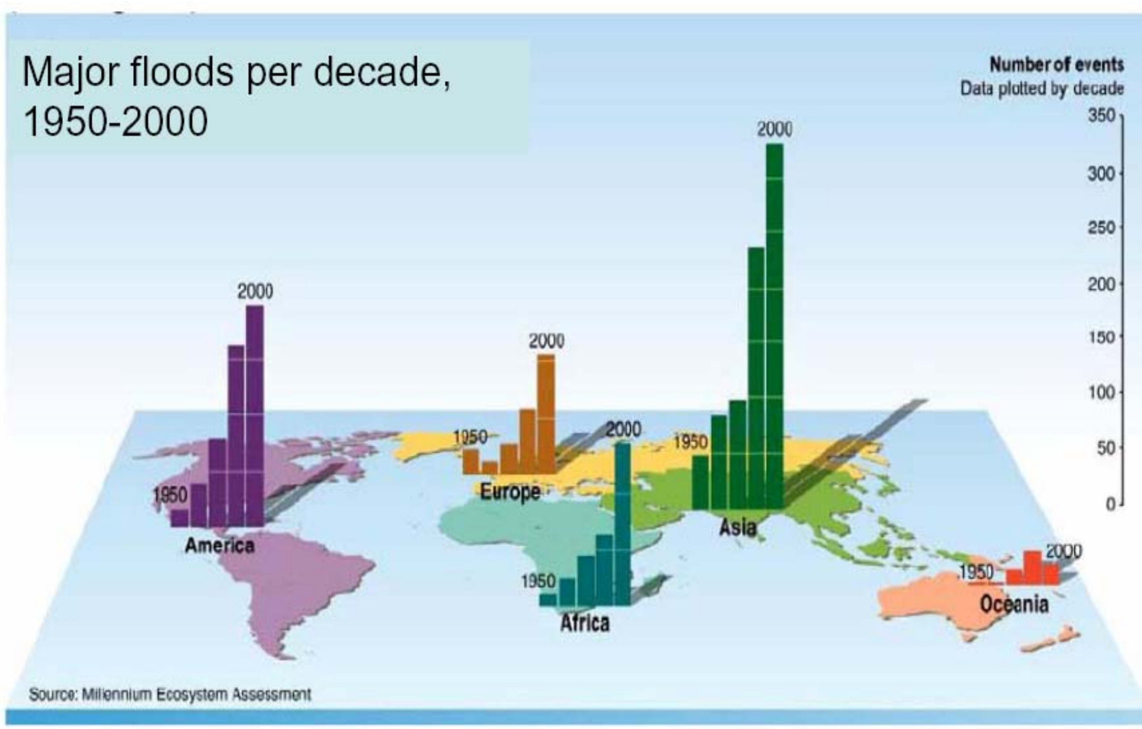


Figure 3.7: Climate change and probable impact on flooding (IPCC 4th Assessment, 2007)

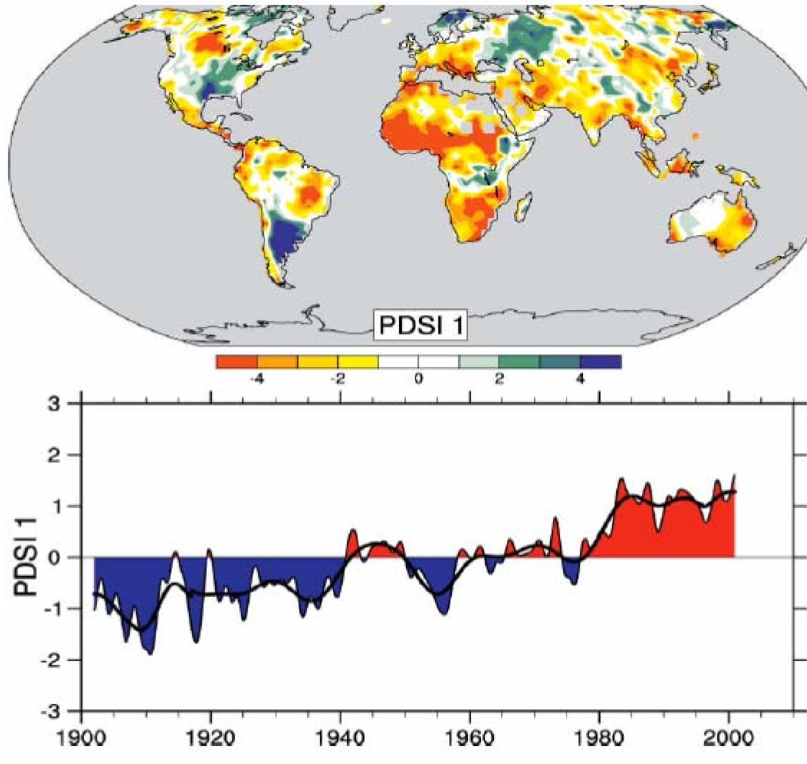


Figure 3.8: Change in Palmer Drought Severity Index (PDSI) for 1990 – 2002
Source: IPCC 4th Assessment, 2007

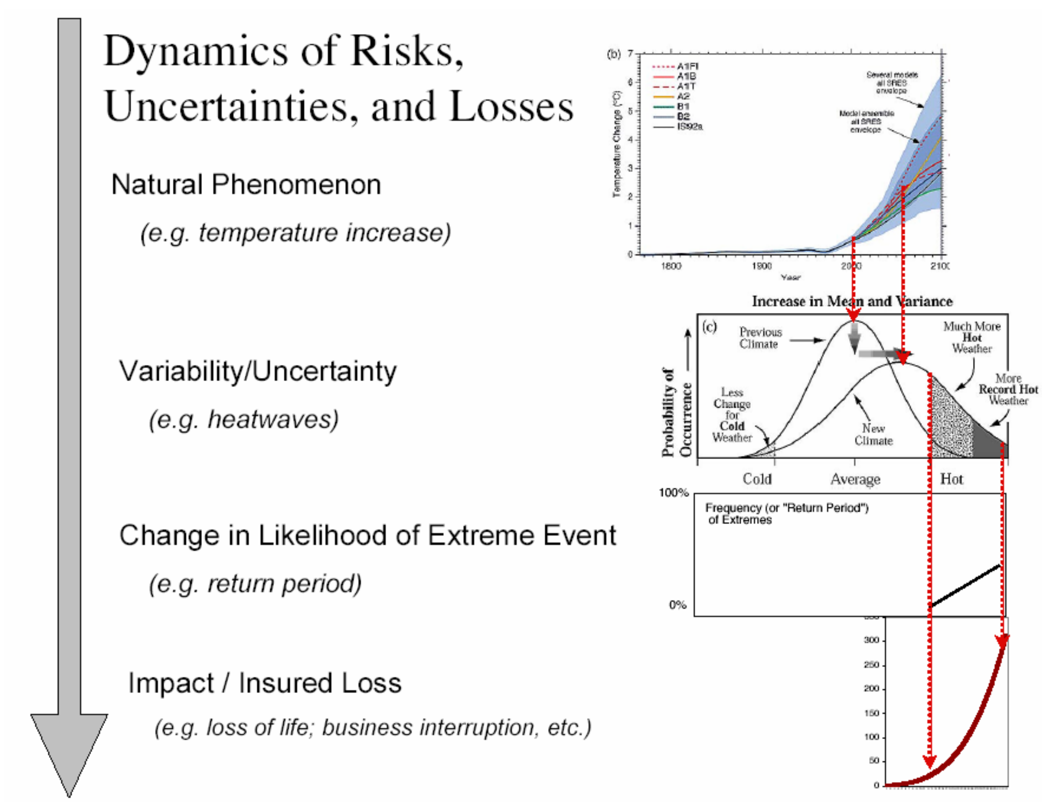


Figure 3.9: Dynamics of risks, uncertainties and losses (Source: IPCC AR4, 2007)

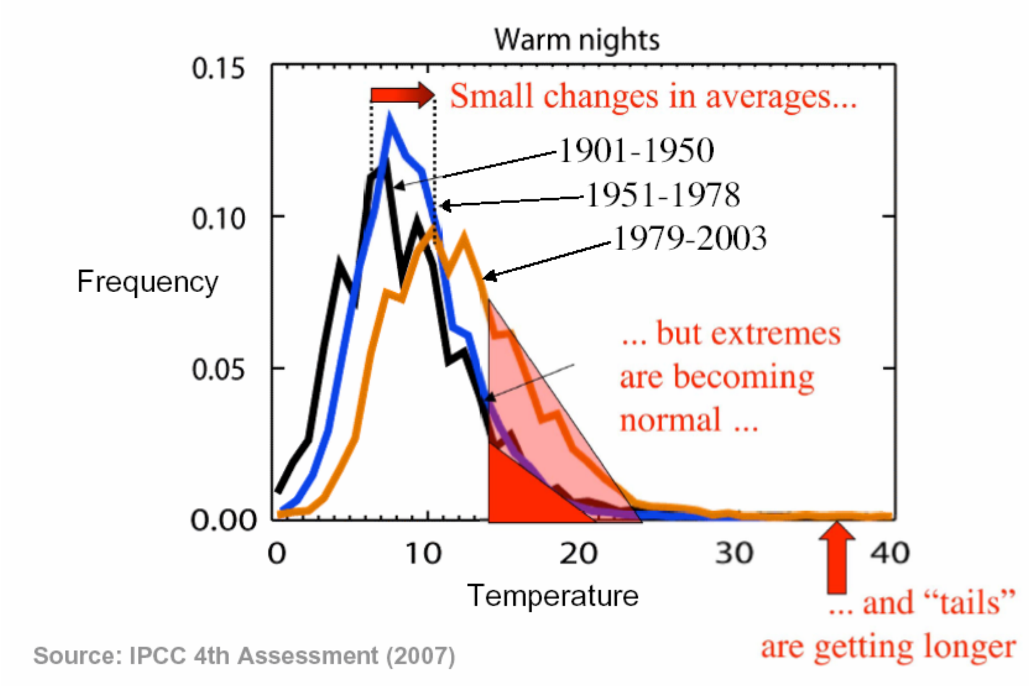


Figure 3.10: Historical change in climatic extreme events

3.3 Typical Measures against Agriculture Risk

Technical measures – Dykes or embankment to protect from flood, assured irrigation from surface or groundwater sources, use of pesticides, fertilizer, judicious use of land, crop rotation/mixed cropping, choice of plant varieties and animal breeds, crop and animal husbandry practices, genetic modification of crop pattern to adjust to the calamities, etc.

Other than these, economic measures like diversification of farm enterprises and by improvements in marketing and institutional set-up might also work there. In many countries the state provides aid or relief to the agricultural sector in the event of a natural catastrophe as a matter of Public Policy. In some countries this is done on an ad hoc basis while in others there are formal arrangements and even legislation for this purpose.

It is true that globally agricultural production could be significantly improved adopting such measures but the residual risk from the natural hazards still affecting agricultural sector enormously. As already mentioned, in the changing climate it might aggravate further. Moreover, the technical measures sometimes found to be not effective like some of them might be counter-productive.

3.3.1 Public Policy Implications of Inadequate Traditional Risk Management and Coping Strategies

While some of the on-farm, risk mitigation practices are time tested and highly recommendable such as crop diversification, intercropping, soil humidity management, integrated pest management, irrigation, and accumulating savings. Many of the other practices such as plot fragmentation, economizing on purchased inputs, and the use of low-yielding but drought resistant varieties, represent production efficiency losses (Rosenweig and Binswanger, 1993; Morduch, 1995; and Kurosaki and Fafchamps, 2002). By foregoing specialization, farmers' tradeoff income variability for lost profitability and reduced future earning ability. Others such as reciprocal lending, gift giving, and co-operative formation may be overwhelmed and useless if the risk is covariant, that is affecting with more or less equal severity all the households in a particular community or region. Consequently, these costly risk mitigating techniques and can contribute to chronic poverty and increased vulnerability**.**

Table 3.2: Risk management strategies in agriculture

			Formal Mechanisms	
		Informal Mechanisms	Market Based	Publicly Provided
EX ANTE STRATEGIES	*On-farm*	Avoiding exposure to risk Crop diversification and intercropping Plot diversification Diversification of income source Buffer stock accumulation of crops or liquid assets Adoption of advanced cropping techniques (fertilization, irrigation, resistant varieties)		Agricultural extension Pest management systems Infrastructures (roads, dams, irrigation systems)
	Sharing risk with others	Crop sharing Informal risk pool	Contract marketing and futures contracts Insurance	
EX POST STRATEGIES	*Coping with shocks*	Sale of assets Reallocation of labor Mutual aid	Credit	Social assistance Social funds Cash transfer

(Source: Anderson 2001; World Bank 2001)

When crop insurance does not exist or is not used to an appreciable extent in an agrarian economy, the central government and international donors are relied upon to provide **relief** in the case of very severe disasters. While it can not be denied that central governments and international organizations must respond and play a role in the case of massive catastrophes, the use of ad hoc, ex post interventions sets dangerous precedents and tends to have four negative consequences if the role of government is not clear and actions are not well designed.

First, ad hoc emergency programs disrupt budget planning and administration. Funds often time have to be diverted from other ongoing and approved government programs to attend to the agricultural emergency. In the absence of a well-established emergency disaster fund with transparent rules and adequate funding, governments can easily fall into the trap of "robbing Paul to pay Peter." If the country in question is under budget stress, it may have to engage in deficit financing and as a consequence contribute to upward pressure on interest rates in the banking system. Higher lending rates reduces the demand for loans and makes agricultural financing ever more problematic, since as a whole agriculture is a sector noted for smaller profit margins than others.

Second, the knowledge that the government is likely to "bail out" affected parties creates moral hazard conditions and depresses the market for private crop insurance. Farmers do not do all that they can do to reduce individual vulnerability to adverse climatic conditions and other biological threats. Similarly, insurance companies have little incentive to enter rural markets and offer costly insurance products since they fear that demand for their products will be weak since farmers would prefer free ex post assistance from the government as opposed to paying a premium ex ante. The negative results are represented in Figure 3.13. Central governments should provide disaster assistance but should set rules of eligibility so as to encourage the purchase of private insurance and/or precautionary actions to reduce vulnerability to losses.

Third, well-organized groups of farmers have a strong incentive to lobby the government for relief from a wide and varied number of adverse climatic and price effects. Thus, government can be called upon to provide relief for non-catastrophic events, which normally should be in the domain of private insurers. Many times, the farmers that are more organized and most influential tend not to be the poorest. Political motivation might be there as well. Thus, non-poor farmers and a group with vested interest might be the beneficiary there.

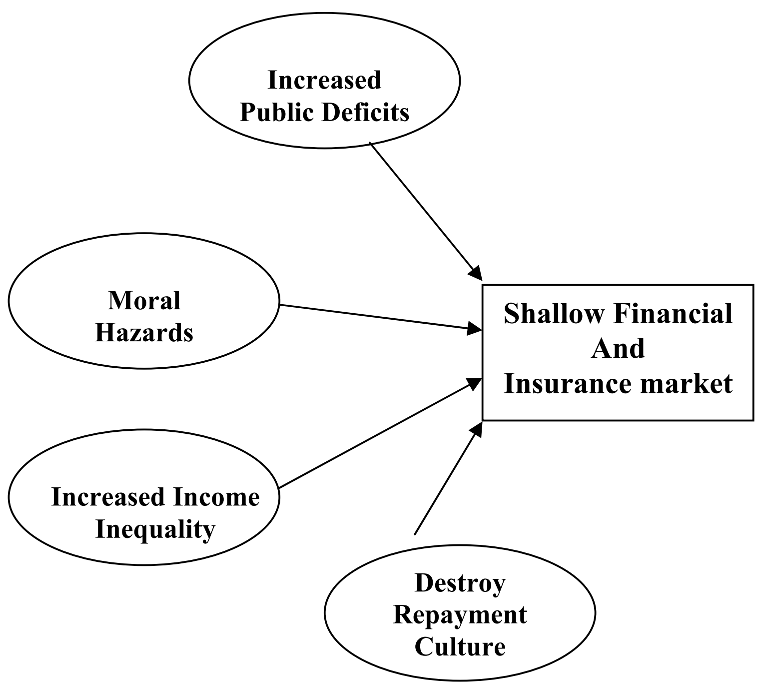


Figure 3.11: Unintended consequences of ex-post emergency disaster programs

Fourth, the ready willingness of central governments to use debt forgiveness of formal agricultural loans undermines the solvency of banks, destroys repayment culture and dampens the willingness of financial intermediaries to expand and innovate in rural areas. Financial intermediaries tend to retreat from the agricultural sector after such an event, and if they stay, they only lend to collateral rich and well-known clients. Thus, financial markets remain shallow, noncompetitive, and incomplete. Debt forgiveness, while timely and easy to implement from the perspective of politicians, also tends to be regressive in nature. It benefits larger farmers much more so than smaller one because they tend to have more access to formal credit and take out on average larger loans.

3.4 Rationale of Crop Insurance and increasing Demand

As discussed in last section, the modern insurance sector can play a major role to solve the problems mentioned there, and considerably strengthen the financial security of farmers. Agricultural Insurance is a more efficient instrument and an effective institutionalized mechanism for dealing with the problem. It helps to streamline the relief efforts and reduces the direct and indirect costs on the national economy. (Jain, 2004). For a number of reasons demand for crop insurance is increasing day by day, which can be grouped as;

- Evidence is accumulating of connections between climate change, and the increasing incidence of crop damaging weather events of extreme severity.
- Farming is becoming steadily more commercialized, with greater financial investment. Farmers / investors and their banks frequently examine the feasibility of using a financial mechanism i.e. insurance, in order to address part of the risk.
- The World Trade Organization (WTO) regulations generally forbid governments from subsidizing agriculture directly; however, they permit the subsidization of agricultural insurance premiums. In the case, demand for crop insurance will increase in those economies that wish to implement a policy of permitted subsidization of their farmers.
- Insurance can also assist in managing the on-farm production risks consequent to changes in pest management practices. Such changes are increasingly required in order to address environmental protection and food safety concerns. This is that any insurance arrangement will involve not only the farmer and the insurer, but also important third parties. Consideration is now given to these changes to the business of farming.

Table 3.3: Agricultural Insurance at a Glance

Region of the World	**Share of Agricultural Insurance Premiums, 2001**	**Cumulative Share**
North America (US & Canada)	55	55
Western Europe	29	84
Australia & New Zealand	3	87
Latin America & the Caribbean	4	91
Asia	4	95
Central & Eastern Europe	3	98
Africa	2	100

Source: Schuetz, 2005

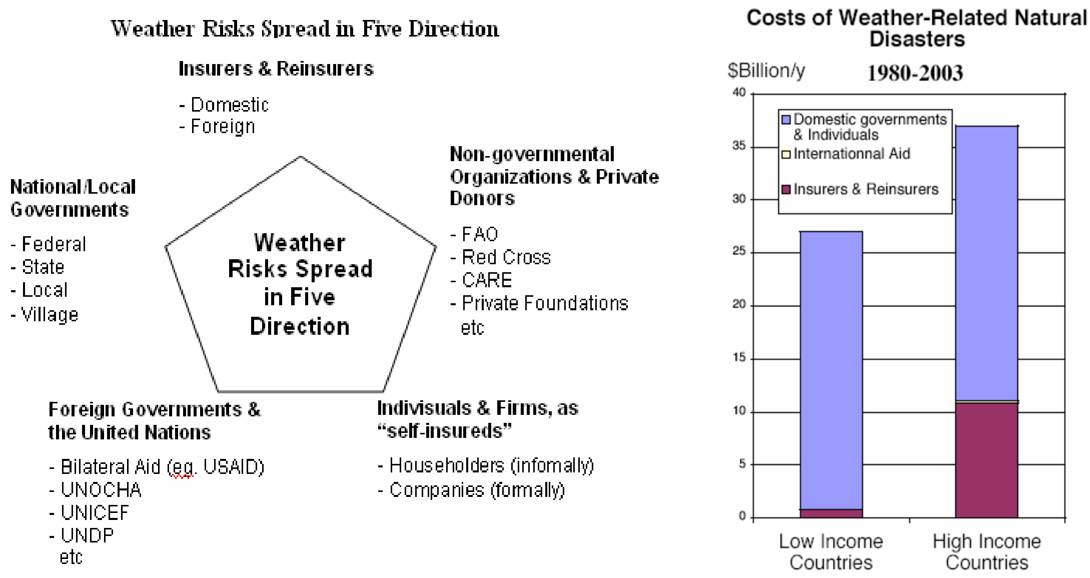
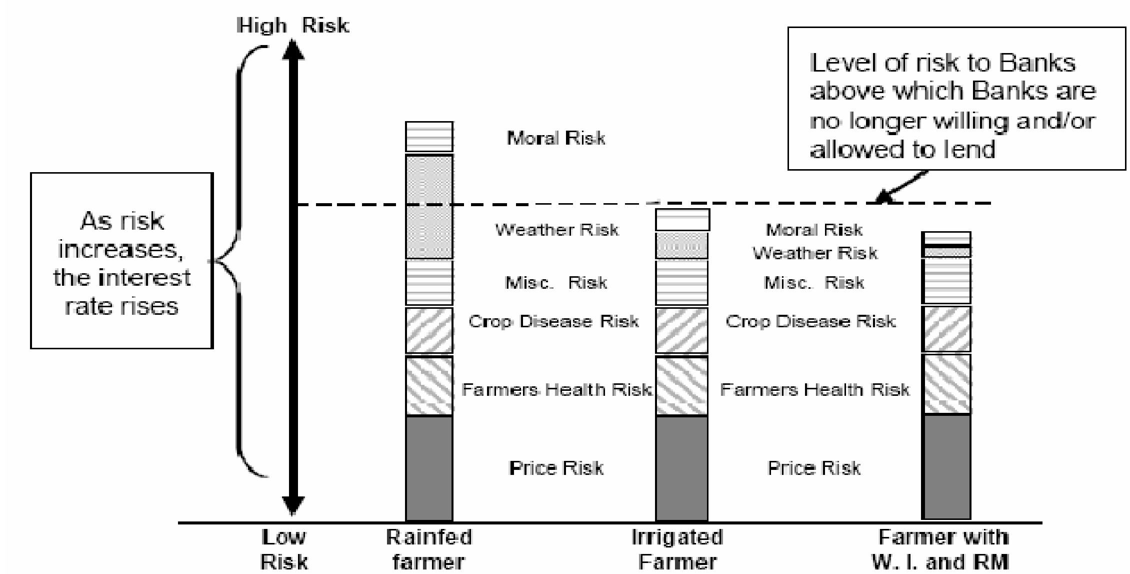


Figure 3.12: Parties involved in weather related risk management & costs



Legend: W.I. = Weather Insurance, RM = Risk Management
Source: CRMG, World Bank. "Commodity Price Risk Management for Producers, A Training Guide, modified

Figure 3.13: Systematic risks and rural lending (Source: Hess, 2003)

Table 3.4: Present status of disaster and insurance

Disaster and Insurance: Present Status

Insurance = Adaptive Capacity
• Major (and growing) means of spreading and managing the risks of extreme weather events -- today covers 20% of all weather-related damages

• Rapidly growing in developing world and economies in transition

Importance

– World's largest industry: $3 trillion/year in revenues (= 3x "oil")
– Mechanism for risk averaging (financial)
– Mechanism for risk management (physical)
– Provides a global "observing" system
– Complements science

Concerns

– Vulnerability to climate change; dangerously uses past as proxy for future
– Increased losses threaten affordability (more uninsured)
– Health/life risks largely unknown; unaddressed
– Insurability/solvency in

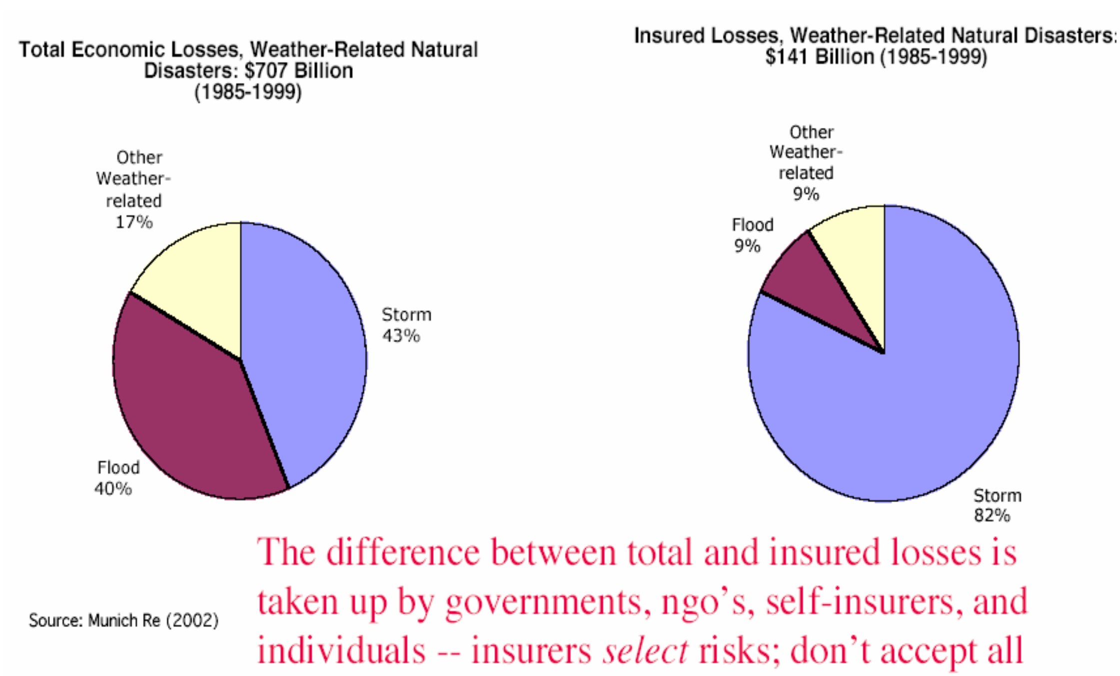


Figure 3.14: Total and insured losses of weather related natural disasters for 1985 - 1999

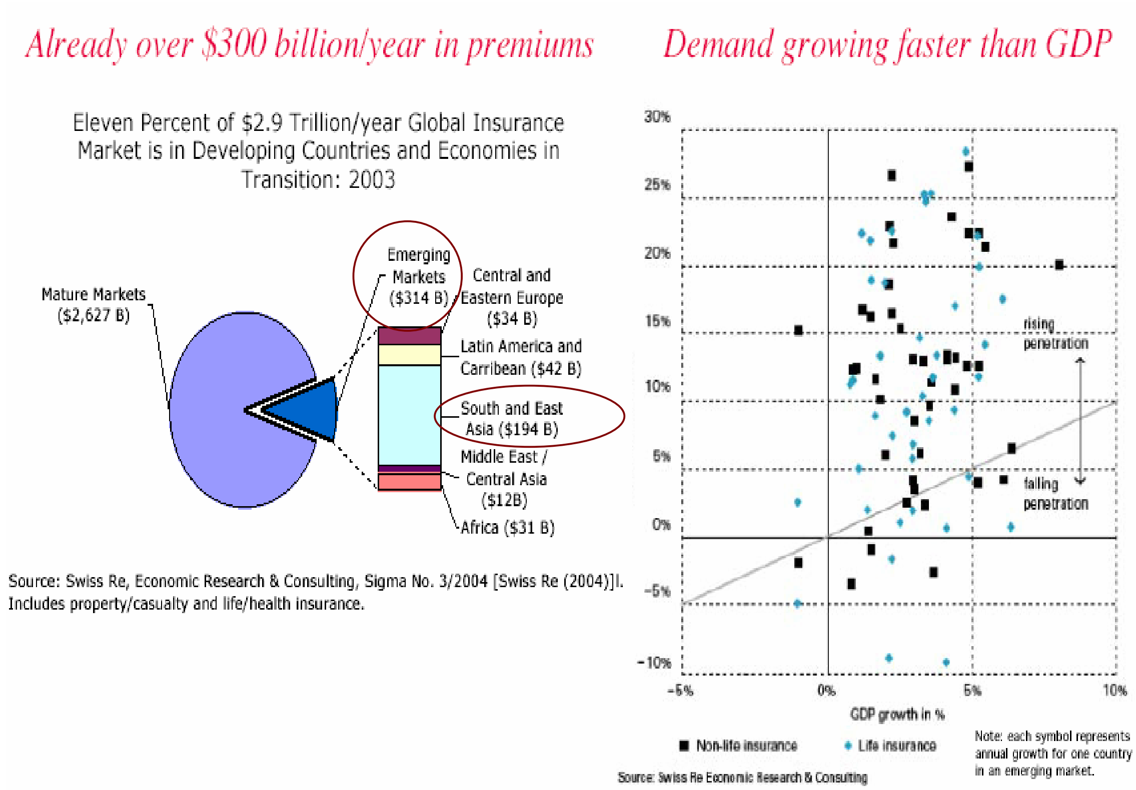


Figure 3.15: Growing global demand for insurance as a risk management strategy-South and East Asia highly prospective

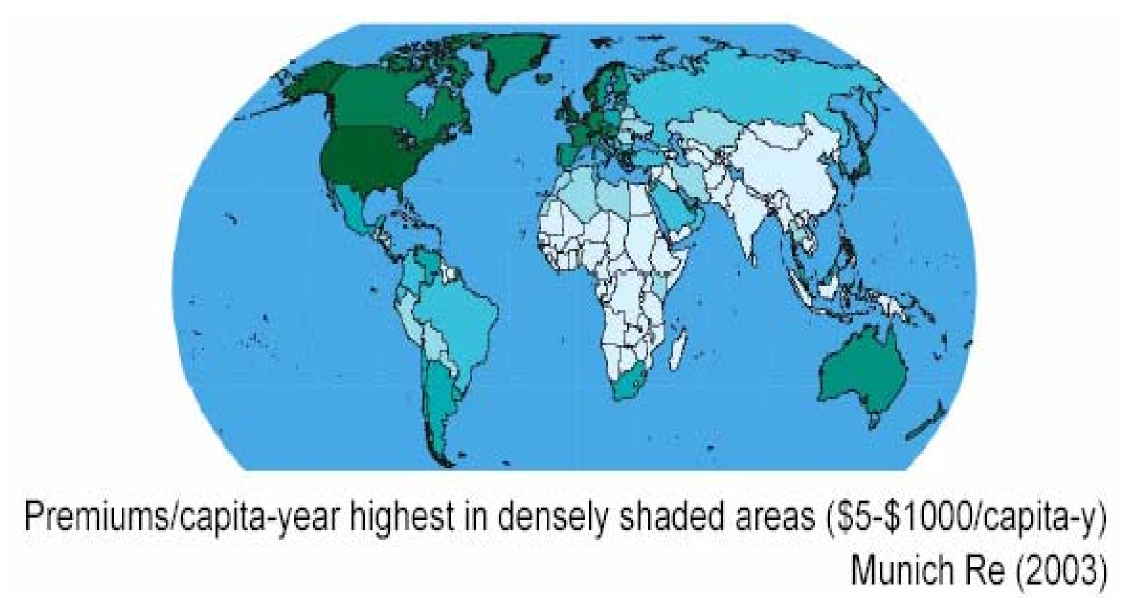


Figure 3.16: Variability in global per capita premium in insurance

3.5 Limitation of Crop Insurance: Points to ponder

Agricultural insurance, although one of the most often quoted tools for risk management, can only play a limited role in managing the risks related with farming. The acid test of developing and operating an insurance program to complement other risk management measures depends on the cost/benefit ratio - to the farmer and to the potential insurance providers.

Agricultural insurance is nevertheless a growing business driven by increasing commercialization of agriculture, international trade, and foreign direct investment, and the development of new insurance products. The changing economic environment has also triggered a renewed interest in crop and agricultural insurance programmes and products among governments and development practitioners. (Roberts, 2005)

There are a few points worthwhile noting about insurance. First, and basic to the understanding of insurance, is the reality that *insurance does not and cannot obliterate risk. It spreads risk. There are two dimensions to this spread. The first dimension is the spread across an industry or an economy, extended in the case of international reinsurance to the international sphere. The second dimension of spread is through time*. The important fact to note is that insurance does not directly increase a grower's income. It merely helps manage risks to this income.

Second, insurance is a business. An insurance indemnity only becomes payable in the event of a claim under a policy. In any business arrangement, both sides of the transaction must expect to benefit. Crop insurance transactions are no different. This defines the first boundary: crop insurance is sold and bought in a market. The purchasers must perceive that the premiums and expected benefits offer value; the sellers must see opportunity for a positive actuarial outcome, over time, and profit.

Table 3.54: Obstacles to implement Crop Insurance in Developing countries

Obstacles to implement Crop Insurance in Developing countries
▪ Lack of reliable long period data on crop yields and losses ▪ Wide variety of agricultural practices ▪ Existing land tenure and land record systems ▪ General ignorance and poverty of farmers ▪ Lack of trained personnel ▪ Limited financial resources of the countries ▪ Lack of insurance consciousness amongst farmers ▪ Lack of Reinsurance support from professional reinsurer

3.6 Crop Insurance: some Terminologies

Actuarial

Describes the calculations made by an actuary. Essentially this is a branch of statistics, dealing with the probabilities of an event occurring. Actuarial calculations, if they are to be at all accurate, require basic data over a sufficient time period to permit likelihood of future events to be predicted with a degree of certainty.

Adverse selection

The tendency of individuals with poorer-than-average risks to buy and maintain insurance. Adverse selection arises when insured select only that coverage which is most likely to result in losses. In agricultural insurance, this can arise when:

- High-risk farmers or farmers using backward practices participate, while other farmers, with more certain production expectations, do not;
- Farmers apply for insurance only on their high-risk crops or plots, withholding other units. An example would be buying insurance only for crops grown on flood-prone areas of a particular property. Crop insurance models can be broadly categorized into two categories: traditional crop insurance and index based insurance.

Basis risk

This is the potential mismatch between insurance payout and actual insurance losses.

Franchise

An amount of loss that has to be reached before the insurer will pay a claim. Once this threshold is met, the insurer has to pay the claim in full. e.g. A farmer insured his crop for US$1000 with a franchise of US$100. If the claim is for US$99, then this is borne by the farmer. If the claim is for US$101, however, then the whole amount of the US$101 is paid by the insurer.

Guaranteed yield

The expected physical yield of a crop stated in the insurance policy, against which actual yields will be compared when adjusting any losses.

Index Insurance

This is a very new type of crop insurance in which an indemnity becomes payable upon the certified occurrence of the weather event to which the insurance relates. This is also known as "Coupon insurance" since coupons or tickets replace the normal insurance policies. The main difference between this and standard crop insurance is that crop losses are not measured, either on individual insured farms or on an area basis. Rather, reliance for triggering the coupon is based upon data generated by weather recording instruments, with the possibility of verification of the occurrence of the insured weather event by recourse to aerial or satellite photography.

Insured

The person or business entity covered by an insurance policy.

Insurer

The company which issues an insurance policy and is named in the policy as being responsible for paying a claim should a loss event result in damage to the insured property.

Indemnity

The amount payable by the insurer to the insured, either in the form of cash, repair, replacement or reinstatement in the event of an insured loss, is termed the indemnity. The amount is measured by the extent of the insured's pecuniary loss. It is set at a figure equal to but not more than the actual value of the subject matter insured just before the loss, subject to the adequacy of the sum insured. This means for many crops that an escalating indemnity level is established, as the growing season progresses.

Multi-Peril Crop Insurance (MPCI)

A type of crop insurance in which a number of perils are covered and where the basis for establishing the sum insured is the expected yield, as determined by production history over a number of years.This type of policy is known as "yield-based".

Peril

A potential cause of loss or damage to the property. Perils can be insured or uninsured, both are normally named on the insurance policy. It is therefore important that loss adjustment procedures enable distinction to be made between damage caused by insured and by uninsured perils respectively. The main natural perils mentioned in agricultural insurance policies include: fire, flood, freeze, hail, wind, excess rain and drought.

Premium

The monetary consideration payable by the insured to the insurers for the period (or term) of insurance granted by the policy.

Reinsurance

When the total exposure of a risk or group of risks presents a hazard beyond the limit which is prudent for an insurance company to carry, the insurance company may purchase reinsurance i.e. insurance of the insurance. This purchase is also known as 'ceding'. Reinsurance has many advantages including (i) levelling out the results of the insurance company over a period of time; (ii) limiting the exposure of individual risks and restricting losses paid out by the insurance company; (iii) may increase an insurance company's solvency margin (percent of capital and reserves to net premium income), hence the company's financial strength; and (vi) the reinsurer participates in the profits of the insurance company, but also contributes to the losses, the net result being a more stable loss ratio for the insurer over the period of insurance.

Moral hazard

The risk or danger to look for from human nature, both individual and collective. Moral hazard depends mainly on the character of the society, the character of the insured, and on the character of his employees and the manner in which they work and behave at work. Examples resulting from moral hazard include: carelessness, fraudulent claims, crime or arson, irresponsibility, gross over-insurance, general decline in moral climate due say to a period of recession, and unreasonable demands over claims settlements.

3.7 Models of Crop Insurance

3.7.1 Traditional Approaches of Crop Insurance

There are two main approaches of crop insurance: **individual and area approach** (Figure 3.17). In general, different models in practice or applied in the crop insurance arena falls under these two approaches. In one way or the other all the approaches fall under these two categories. The choice of either the individual or the area approach depends on the nature of the agricultural insurance program and the agro-economic conditions: target farmers, farm size, crop insured and even communication facilities. (Jain, 2004).

Individual approach

In case of the individual approach, assessment of loss is made separately for each insured farmer. It could be for each plot or for the farm as a whole (consisting of more than one plot at different locations). (Jain, 2004). Farmers may be less interested to buy insurance if individual farm yields are not adequately correlated with the average area yield of the region. Further, it may be difficult to insure damage, which affects an area smaller than the specified area unit. (Jain, 2004)

Area approach

In the case of area approach, indemnity is estimated for a group of farmers in an area basis. The compensation of the insured farmers is paid on the basis of average loss experienced by a specified homogeneous area like a district, a block or even a village (Jain, 2004).

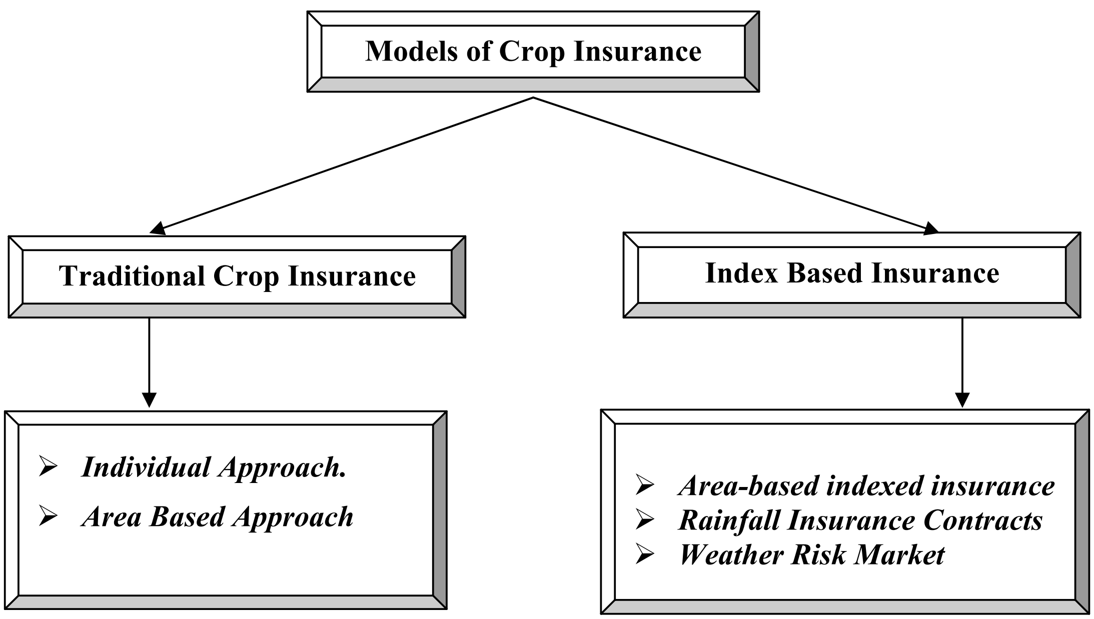


Figure 3.17: Models of crop insurance

3.7.2 Index Based Insurance

Indexed based insurance are of three major types: area-based indexed insurance, rainfall insurance contracts and weather risk markets

Area-Based Indexed Insurance

The essential principle of area-based index insurance is that contracts are written against specific perils or events (e.g. area yield loss, drought, or flood) defined and recorded at a regional level (e.g. at a local weather station). Insurance is sold in standard units (e.g. $10 or $100), with a standard contract (certificate) for each unit purchased called a Standard Unit

Contract (SUC). The premium rate for a SUC is the same for all buyers who buy the same contract in a given region, and all buyers receive the same indemnity per SUC if the insured event occurs. Buyers are free to purchase as many units of the insurance as they wish.

Area-based crop yield insurance is a good example of such a scheme. In this case the insurance is written against the average yield for a region (e.g. a county or district), and a payment is made whenever the measured yield for the region falls below some pre10 defined limit (say 80 percent of normal). Such schemes already exist in the US, India, Sweden, and the Canadian province of Quebec. In the U.S., the Group Risk Plan uses county yields to trigger a payment, and coverage up to 90 percent of the county yield is available. Payments are made based on the protection (liability) selected by the farmer and the percentage below the trigger yield (coverage times the expected county yield). Since county yield data are available for long periods of time, adjustments to the trigger yield are made for technical advances.

Area-based yield insurance requires long and reliable series of area-yield data, and this kind of data is not available in many countries. Hence alternative indices may be more attractive, such as area rainfall or soil moisture indexes. Rainfall and soil moisture contracts could effectively protect against crop losses due to drought or excess rainfall. Improved ground instruments coupled with satellite and remote sensing technologies make measuring rainfall and soil moisture less expensive than in years past. These technologies can also be used to add credibility to the measurement so that those outside the country have confidence in the numbers.

Features of Area-Based Indexed Insurance

1. It is affordable and accessible to all kinds of rural people, including the poor.
2. It compensates for catastrophic income losses to protect consumption and debt repayment capacity.
3. It is practical to implement given the limited kinds of data available.
4. It can be provided by the private sector with little or no government subsidies.
5. It avoids the moral hazard and adverse selection problems that have bedeviled CI.

Advantage of Area-Based Indexed Insurance

Area-based index insurance has a number of attractive features:

- Because buyers in a region pay the same premium and receive the same indemnity per contract, it avoids all adverse selection problems. Moreover, the insured's management decisions after planting a crop will not be influenced by the index contract, eliminating moral hazard. A farmer with rainfall insurance possesses the same economic incentives to produce a profitable crop as the uninsured farmer.
- It could be very inexpensive to administer, since there are no individual contracts to write, no on-farm inspections, and no individual loss assessments. It uses only data on a single regional index, and this can be based on data that is available and generally reliable. It is also easy to market; SUCs could be sold rather like travelers' checques or lottery tickets, and presentation of the certificate would be sufficient to claim a payment when one is due.

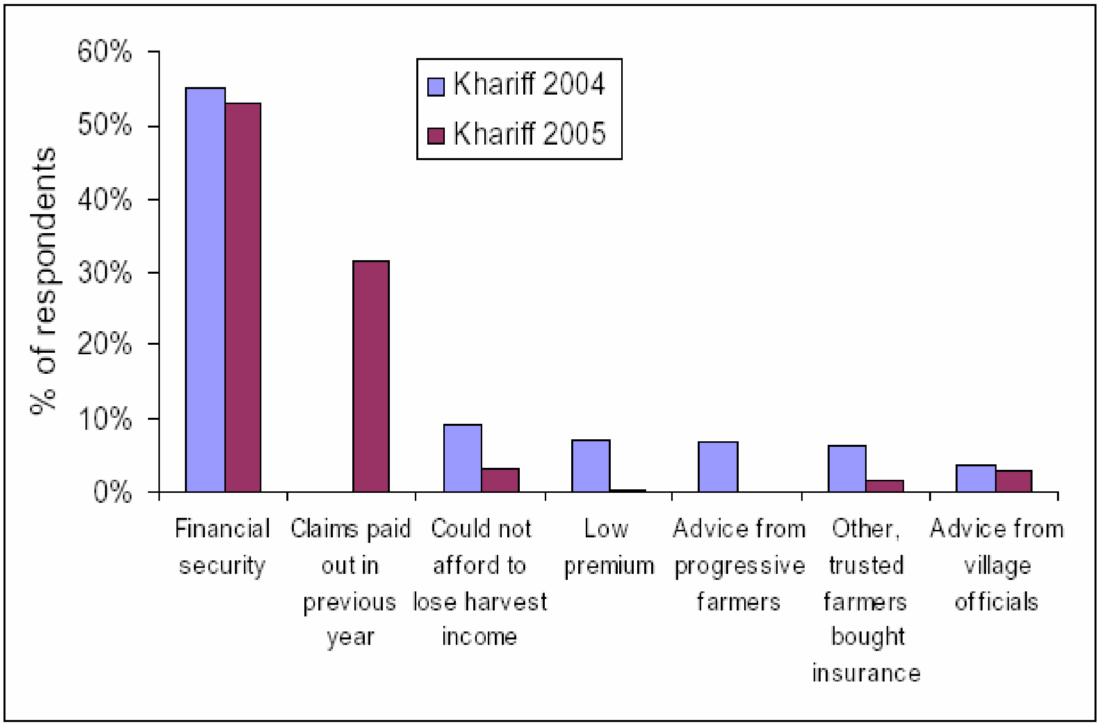


Figure 3.18: Reasons for buying weather-index insurance in India (Source: Gine, 2005)

- The insurance can be sold to anyone. Purchasers need not be farmers, nor even have to live or work in the region. The insurance should be attractive to anybody whose income is correlated with the insured event, including agricultural traders and processors, input suppliers, banks, shopkeepers, and laborers. Defining SUCs in small denominations would raise their appeal to poor people.
- It would be easy for the private sector to run, and might even provide an entry point for private insurers to develop other kinds of insurance products for rural people. For example, once an area-based index removes much of the co-variate risk, an insurer can wrap individual coverage around such a policy to handle independent risk (i.e., certain situations where the individual has a loss and does not receive a payment from the area-based index).
- As long as the insurance is voluntary and unsubsidized; it will only be purchased when it is a less expensive or more effective alternative to existing risk management strategies.
- A secondary market for insurance certificates could emerge that would enable people to cash in the tradable value of a contract at any time.
- Recent developments in micro-finance also make area-based index insurance an increasingly viable proposition for helping poor people better manage risk. The same borrowing groups established for micro-finance could be used as a conduit for selling index insurance, either to the group as a whole, or to individuals who might wish to insure their loans.

Box 3.1: Examples of Parametric or Index Insurance

Index products use any independent random variable measurement that is readily observable, protected from tampering, and is highly correlated with agricultural or livestock losses. Four examples are:

- Weather based index uses a specific amount of rainfall or a certain number of days with temperature in a particular range as a trigger. If the trigger is struck a payment is made. IT is in use in Morocco, Mexico and India.
- Area yield index uses the average crop yield in a country or particular jurisdiction as a trigger. If an individual farmer has a yield less than the reference average, an indemnity payment is made as a function of the degree of deviation from the norm. It is in use in the USA, India, Brazil and Quebec, Canada.
- Satellite vegetative index uses satellite images to calculate the health of a pasture based on 'previous' normal years and payment is made to the rancher based on degree of deviation. It is in use in Alberta, Canada and Spain.
- Mortality rates of livestock: A yearly census of livestock is used as a reference point to estimate 'annual average death rates' from yearly census comparing end of year to mid year points. The trigger will be a certain pre-fixed percentage of average mortality. When death rate surpasses the 'trigger' payment will be made. It isunder design in Mongolia.

(Source: Skees *et al*. 2005)

Disadvantage of Area-Based Indexed Insurance

- It is crucial that reliable and verifiable data are available on weather patterns. There are two aspects to this. First, there is a need for reliable historical data covering a period of at least 30 to 40 years (daily observations). The availability and cost for obtaining such data may be an important issue in several developing countries. Second, tamper-proof weather stations must be established to ensure reliable readings on insured events. New hardware systems, such as optical precipitation sensors, can eliminate any direct human involvement in the recording process. Readings can also be verified by comparing with adjacent stations or with remote sensing data taken from satellite images. At present, an important constraint with satellite measurements of rainfall is that there is little history compared to conventional measurements.

Table 3.6: Advantages and challenges of index insurance

Advantages	Challenges
Less moral hazard The indemnity does not depend on the individual producer's realized yield	**Basic risk** Without sufficient correlation between the index and actual losses, index insurance is not an effective risk management tool. This is mitigated by self-insurance of smaller basis risk by the farmer; supplemental products underwritten by private insurers; blending index insurance and rural finance; and offering coverage only for extreme events

Less adverse selection The indemnity is based on widely available information, so few informal asymmetries to be exploited	**Precise actuarial modeling** Insurers must understand the statistical properties of the underlying index
Lower administrative costs Underwriting and inspections of individual farms are not required	**Education** Users must be able to assess whether index insurance will provide efficient risk management
Availability and negotiability Standardized and transparent, the contacts may be traded in secondary markets	**Market size** The market is still in its infancy in developing countries and has some start-up costs
Reinsurance function Index insurance can be used to transfer the risk of widespread correlated agricultural production losses more easily	**Weather cycles** Actuarial soundness of the premium could be undermined by weather cycles that change the probability of the insured events, such as El Nino
Versatility Index contracts can be easily bundled with other financial services, facilitating basic risk management	**Microclimates** These production conditions market rainfall or area-yield index based contracts difficult for frequent and localized events

.

- A problem with index contracts is that an individual can suffer a loss and not be paid because the major event trigging a payment has not occurred. For example, a farmer with rainfall insurance could lose his/her crop to drought at a microlocation, but not receive an indemnity if the rainfall at the region's weather station remains above the trigger point. With index contracts it is also possible for an individual to be paid when they suffer no losses. In future markets, this type of risk is referred to as basis risk. Index contracts essentially tradeoff basis risks for transaction costs, and the insurance will not be attractive if the basis risk becomes too high. To minimize such events, Index should be defined for an area where the topography and climatic condition is almost same.
- For a rainfall index, the degree of correlation between net receipts from the index and farm income will play a large role in the effectiveness of the risk protection offered to a farmer. With higher correlation there will be less basis risk. Understanding income rainfall correlation requires crop yield modeling. Further, it is possible that a set of rainfall indexes may fit best for different farming systems. Farm income risks for certain crops may be most sensitive to rainfall shortfalls at different times during the season (e.g. planting and blooming). Income may also be at risk during harvest if there is excess rain. Having a high covariate risk improves the efficacy of an index insurance contract.

Therefore, index products are a bit different than traditional insurance in that the very presence of high levels of covariate risks improves their attractiveness.

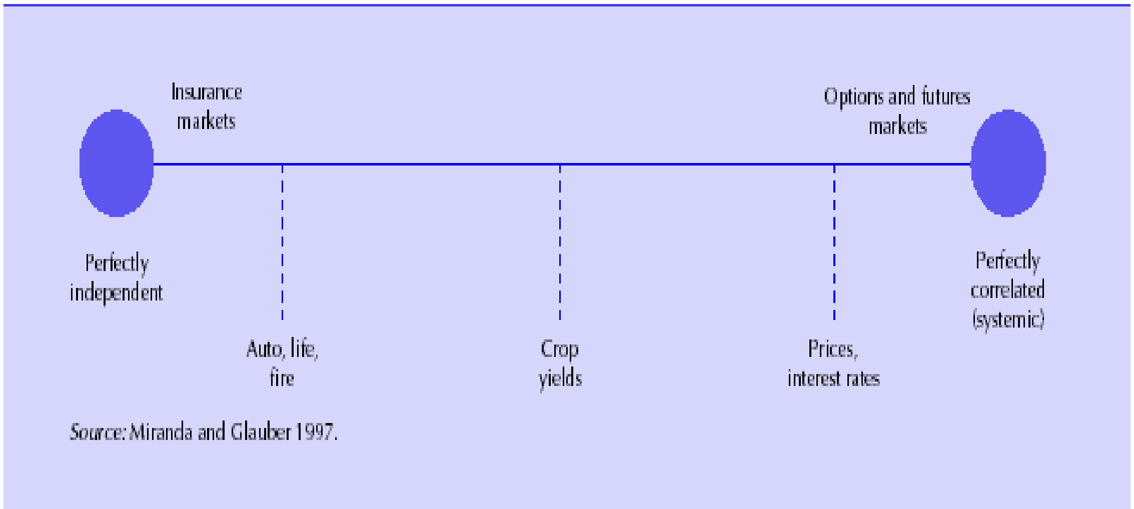


Figure 3.19: Independent versus correlated risk

3.8 Microinsurance: Delivery models

There are four general models of insurance provision, especially for the poor, which is applicable for Crop Insurance as well (ADB, 2003):

1) Partner-Agent Model: Insurers and microfinance institutions (MFI) are beginning to team up for reciprocal advantage. Insurers utilize the efficient delivery mechanism of the MFI agent, which provides the sales and basic services to the client in the field. MFIs use the relationships to get health care financing to their clients with limited administrative burden and no risk. One example of a partner-agent model is the relationship between the Nsambya Hospital Healthcare Plan (NHHP) and FINCA Uganda, an MFI. The latter provides NHHP with access to its clients with the objective of improving borrower retention and portfolio quality through better health services.

2) In a community-based insurance model, the policyholders are the owners and managers of the scheme. Policyholders elect a group of their members to act a volunteer manager, who are responsible for all aspects of insurance operations. They design, develop, service and sell the product, and are responsible for negotiating coverage contracts with external health-care providers. Volunteer management must manage the risks, maintain the books, collect the premiums, and review the claims from the provider for both accuracy and quality of care. This model requires a significant investment in training and capacity building in order to develop the volunteers' ability to manage the scheme. One example of the community-based insurance model is the Cooperative Health Care for the Informal Sector of Dar es Salaam (UMASIDA) program in Tanzania. This program was started after an ILO study (1993-95) showed that poor people around Dar es Salaam wanted better health-care services. UMASIDA generated specific demand among several local groups and followed the ILO community-based approach in training them to insure themselves.

3) The full-service model operates in many ways like any formal sector insurer. Here, a single entity is responsible for everything related to the insurance product, from product concept development through marketing, servicing and claims assessment. The insurer assumes all of the insurance-related risk and receives any profits. To manage this risk and avoid losses, full-service insurers have to have a competent staff, build and maintain adequate reserves and adhere to regulatory requirements. The Self-Employed Women's Association (SEWA) of India is an example of the full-service model. SEWA saw improved health care as crucial to their strategy of improving the quality of life, ensuring that women's health needs are met, and enhancing member empowerment.

4) The last model is the provider model, in which the provider and the insurer are one. These providers, usually doctors, clinics or hospitals, offer policies to individuals or groups. The policies cover general ranges of care limited by the services available within the provider's unit. An example of the provider model is the GRET program in Cambodia. EMT, GRET'S microfinance program in Cambodia, recognized that although their credit products were assisting clients to improve income levels, illness could rapidly negate any improvements. At the same time, EMT management realized that the risks and expertise required to offer insurance were formidable, and they wished to concentrate on their credit and savings product. Therefore, they requested that GRET create another entity to develop and test health insurance products in an overlapping client market.

Importantly, and in contrast to the contractually defined services provided by insurance and microinsurance, disaster cover can and often is also be provided as a public good in the form of social protection. National or state governments often underwrite disaster risks (i.e., they compensate victims after a disaster) from their budget or from a designated catastrophe reserve fund. There are no premium payments on the part of the insured, as taxpayers absorb the costs.

3.9 Participation in Crop Insurance Program – Compulsory Vs Voluntary

A crop insurance scheme may envisage voluntary or compulsory participation. In case of the voluntary approach, participation is optional for a farmer who is eligible to be insured. Such schemes are in Canada, USA and Chile. As regards the compulsory participation, certain categories of farmers who are eligible to be insured or who grow specified crops participate automatically. The work compulsory implied that there is a system of automatic insurance for a group of farmers. In Japan crop insurance is compulsory for all farmers who grow the insurable crops over more than a minimum prescribed area. The Mauritius, Cyprus and Windward Islands schemes are compulsory for all growers of certain JANUARY - JUNE 2004 17 crops. *In India and Philippines crop insurance is compulsory for farmers who borrow from banks and other financial institutions*. The compulsory approach has two advantages. The problem of adverse selection is reduced significantly, and there is reduction in the cost of sale of insurance. There may, however, be dissatisfaction among low-risk farmers who will have to cross-subsidize high risk farmers.

3.10 Crop Insurance Experience at Different Parts of the World

The financial experience with publicly provided, multiple-peril crop insurance has been disastrous. In all cases, programs are heavily subsidized and governments not only pay part of the premium, but also most of the delivery and service costs, and they cover aggregate losses even when the losses exceed targeted levels over long periods of time. In order to be profitable, a purely private insurer would have to structure contracts so that premiums collected exceed the average payouts (indemnities plus administrative costs). Hazell quantifies the condition for sustainable insurance as follows:

$$(A + I)/ P < 1$$

Where, A = average administrative costs

I = average indemnities paid

P = average premiums paid

Hazell reports experience with public crop insurance programs in seven countries (Table 3.7). The loss ratio exceeds 2 in every case. Two extremes are noteworthy: in Brazil the ratio of indemnities to premiums is very high while the ratio of administrative cost to premiums was relatively low; while in Japan the situation is reverse. The lesson to be drawn is clear: one must invest a great deal in administrative cost and monitoring before having a crop insurance program that will be actuarially sound.

Table 3.7: Financial Performance of crop insurance programs in seven countries

Country	Period	I/P	A/P	(A+I)/P
Brazil	75-81	4.29	0.28	4.57
Costa Rice	70-89	2.26	0.54	2.80
India	85-89	5.11	n/a	n/a
Japan	47-77	1.48	1.17	2.60
	85-89	0.99	3.57	4.56
Mexico	80-89	3.18	0.47	3.65
Philippines	81-89	3.94	1.80	5.74
USA	80-89	1.87	0.55	2.42

Source: Hazell

3.11 Experiences of Selected Countries with Well Developed Insurance Programs

3.11.1 Experience from USA

In the U.S. crop insurance is offered through the Federal Crop Insurance Program (FCIP), a public-private partnership between the federal government and a number of private sector insurance companies, created in 1938. FCIP is a wholly owned corporation administered by the Risk Management Agency (RMA), an affiliate of the U.S. Department of Agriculture (USDA). The program officially aims to improve the social welfare of farmers as well as deliver insurance products in an actuarially sound manner. RMA helps design products and administer subsidies while the private insurance companies sell the products.

The government provides subsidies to farmers to pay the premium. In 2004, the average premium subsidy was 59%. In addition, the government reimburses administrative and operating expense for private insurance companies that sell and service FCIP policies. The reimbursement is approximately 22 percent of total premiums. Lastly, the government provides reinsurance to the private insurance companies at an estimated subsidy rate equivalent to 14 percent of total premiums. *In total, the government is subsidizing 70 percent of the total cost for the FCIP.* Net government costs for administering the program (total costs less premium paid by producers) have ranged from $1.1 billion in 1995 to $1.7 billion in 2000(EU, 2001). Recent estimates put the cost of crop insurance subsidies (2004-05) at approximately $3 billion.

Commodity coverage is extensive. Policies cover over 100 commodities in 2004, up from 59 in 1994. However, four crops-- corn, soybeans, wheat, and cotton—accounted for 79 percent of the $4 billion in total premiums collected in 2004. Six different yield and revenue insurance products are offered, with the most popular being the revenue ones. Approximately 70 percent of the nation's crop acreage (excludes pasture, rangeland, and forage) is insured, yielding a high penetration rate. The participation rate, however, is not so high. Approximately, 400,000 farmers out of 2 million farmers or 20% participate in the program. Actuarially, the programs are not sound and represent more of an income transfer program than a risk management tool. Over the period of 1980-98, the average loss ratio was 1.88, meaning that for every dollar in premium cost; a farmer was receiving a $1.88 (Goodwin, 2001). Also because of the high degree of variation in the distribution of subsidy benefits, cropping and acreage decisions seem to be have been affected. Some crops are being grown in high-risk areas than should be the case if subsidized insurance were not available (EU, 2001). One such example is cotton in Texas.

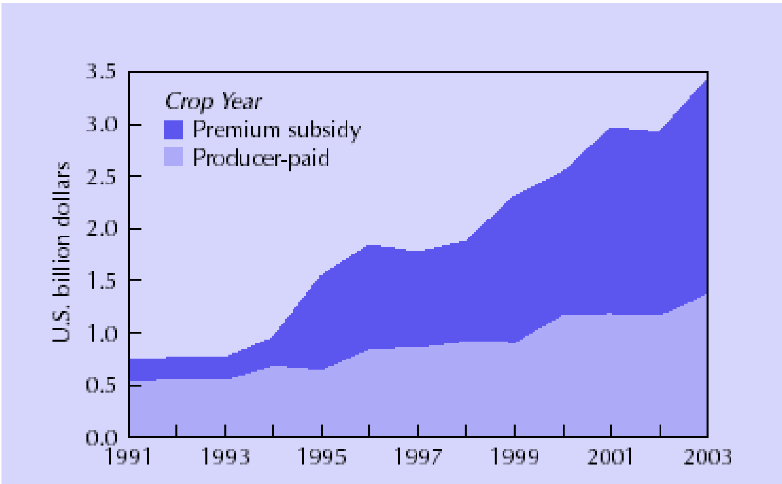


Figure 3.20: Crop insurance premiums and indemnities in the United States (Source: Babcock *et al.* 2004)

The program objective of promoting social welfare clearly outweighs the efficiency objective. Premium rates tend to be very stagnant and farmers with long loss histories cannot be excluded from the program by law. *Even with such a huge subsidy, participation rate is still low and approximately 20%.*

3.11.2 Canadian Experience

Crop insurance in Canada dates back to 1939 when the federal government started to provide disaster assistance to grain producers on the prairies. Since then, a tripartite system has evolved that consist of three separate programs: Crop Insurance (CI), the Net Income Stabilization Account (NISA), and the Agricultural Income Disaster Assistance (AIDA). *The programs are administered at the level of provincial governments and no private insurance companies are involved*. The Federal government sets general frameworks and shares program costs with provincial governments, but the latter have flexibility to modify the products to suit the specific needs of farmers in their jurisdiction. In addition, programs are highly participatory with farmers, provincial governments, and federal government participating in discussing surrounding product designs, rate setting, and performance feedback.

The Crop Insurance Program (CI) providing a *yield guarantee* based on historical yield data for the farm. If production falls below a yield trigger an indemnity will be paid covering 80-90% of the difference between the trigger and realized yield. The product is multiple peril, covering all losses due to natural hazards, excessive moisture, uncontrollable diseases, and pests and even damage caused by protected migratory waterfowl. In 1999, 100,000 or *50% of all farmers participated* and 50 million acres where insured, constituting 55% of all crop and forage acreage (EU, 2001). For most of the 1990s, the loss ratio was favorable, less than one, except for 1992-93. The Federal and provincial governments each pay *25% of the total premium and 50% of the administrative costs*. The combined cost to the Federal and provincial governments has been trending upward sharply, rising 34% from US$338 million in 1995 to US$454 in 1999 (EU, 2001). In addition to these costs, the *Federal government has reinsurance agreements* with four provinces and subsidies the reinsurance premium for two other provinces that purchase it in the private reinsurance market.

3.11.3 Experience from Caribbean and South America

Table 3.8: Performance indicators for Central American Countries for 2004

Variable/Country	El Salvador	Guatemala	Honduras	Nicaragua
No. of countries/ Agricultural Portfolio	2	2	3	1
Premiums			$793,900	
No. of policies		267	2160	7
Hectares insured	2289	3242	11780	927
Penetration ratio	0.34%	0.23%	1.33%	0.09%
Indemnities/Premiums			61.49%	

(Source: Etide Economique Counsel, May 2005)

3.11.4 Crop Insurance – India

Earlier attempts:

The idea of crop insurance emerged in India during the early part of the twentieth century, in around 1920. Yet it was not operated in a big way till recent years. Crop insurance received more attention after India's independence in 1947. Different experiments on crop insurance on a limited, ad-hoc and scattered scale started from 1972-73. The first crop insurance program was on H-4 cotton in Gujarat. *All such programs, however, resulted in considerable financial losses.* The program(s) covered 3110 farmers for a premium of Rs. 4, 54,000 and paid claims of Rs. 3.79 millions. It was realized that programs based on the individual farm approach would not be viable in the country.

Individual farm based approach

Obviously, "individual farm approach" would reflect crop losses on realistic basis and hence, most desirable, but, in Indian conditions, implementing a crop insurance scheme at "individual farm unit level" is beset with problems, such as:

(i) Non availability of past record of land surveys, ownership, tenancy and yields at individual farm level
(ii) Large number of farm holdings (nearly 116 millions) with small farm holding size (country average of 1.41 hectares)
(iii) Remoteness of villages and inaccessibility of farm-holdings
(iv) Large variety of crops, varied agro-climatic conditions and package of practices
(v) Simultaneous harvesting of crops all over the country
(vi) Effort required in collection of small amount of premium from large no. of farmers
(vii) Prohibitive cost of manpower and infrastructure

Later a 'homogeneous area' approach for crop insurance was suggested, after a review in the mid-seventies. The General Insurance Corporation of India (GIC) prepared a Pilot Crop Insurance Scheme (PCIS) based on the area approach that was operated from 1979. In all 13 States implemented it by 1984-85. Participation was voluntary. The scheme covered cereals, millets, oilseeds, cotton, potato, gram and barley. The GIC and the State government in the ratio of 2:1 shared the risk. The insurance premium ranged from 5 per cent to 10 per cent of the sum insured. *The scheme covered 6,27,000 farmers for premium of Rs. 19.7 millions against claims of 15.7 millions.*

Comprehensive Crop Insurance Scheme (CCIS)

The Government of India introduced the CCIS during the year 1985-86. GIC operated it with the assistance and involvement of the respective State governments. The CCIS envisaged the following objectives:

(i) To provide a measure of financial support to farmers in the event of crop failure as a result of drought, flood etc;

(ii) To restore the credit eligibility of farmers, after a crop failure, for the next crop season; and

(iii) To support and stimulate production of cereals, pulses and oilseeds

The scheme covered cereals, millets, pulses and oilseeds. The particular crops to be covered by insurance in different areas were notified by the State governments subject to availability of historical yield data. The coverage was linked to institutional credit and farmers who took crop loans for the specified crops were eligible for coverage of insurance. The scheme was optional to States. Once the State opted, *the participation of farmers who took short-term crop loan from cooperative credit institutions, commercial banks and regional rural banks was compulsory*. GIC on behalf of the Government of India and the State government in the ratio of 2:1 shared the claims and premium. In the original scheme the sum insured for the farmer was 150 percent of the crop loan disbursed to him for growing the insured crop; it was reduced to 100 per cent of the loan, subject to a cap of Rs. 10,000 per farmer in 1988. The rate of premium was uniform all over the country; it was 2 per cent of the sum insured for cereals & millet crops, and 1 per cent for pulses and oilseeds. For small and marginal farmers there was a premium subsidy of 50 per cent, shared equally by the Government of India and the State governments.

CCIS was based on the 'homogenous area approach'. Area units called 'defined areas' were identified for the purpose of assessment of claims. The defined area could be a district, a taluka, a block or any other smaller contiguous area. *The indemnity (coverage) limit originally was 80%, which was changed to 60%, 80% & 90% corresponding to high, medium & low risk areas.* Actual average yield per hectare for the defined area was determined on the basis of Crop Cutting Experiments (CCEs). These CCEs were the same conducted as part of General Crop Estimation Surveys (GCES). If the actual yield of an insured crop for the defined area falls short of the specified guaranteed yield or threshold yield, all the insured farmers growing that crop in the area are entitled for claims. The claims were calculated using the formula:

(Guaranteed Yield – Actual Yield) * Sum Insured of the farmer / Guaranteed Yield

Claims were paid to the credit institutions from which the insured farmer had borrowed. Credit institutions would adjust the amount against the crop loan outstanding and pay the residual amount, if any, to the farmer.

The scheme till 1999 was implemented in 16 States & 2 Union Territories (UTs) and in all insured 76.3 million farmers for a premium of Rs. 4.04 billions and paid claims of Rs. 23.19 billions. Deficit rainfall accounted for 75 percent of claims, followed by cyclones / floods (20 percent). The claim ratio (claims: premium) was 5.75 and loss cost (claims: sum insured) was 9.29 percent.

National Agricultural Insurance Scheme (NAIS)

National Agricultural Insurance Scheme (NAIS) was introduced from R*abi* 1999-00 season by expanding the scope and content of CCIS. The NAIS is, like the CCIS, primarily based on the homogenous area approach. *It covers all farmers: borrowing and non-borrowing farmers*. It envisages coverage of cereals, millets, pulses, oilseeds and annual commercial / horticultural crops for which adequate yield data are available. Under annual commercial / horticultural crops, presently 13 crops are covered. These are sugarcane, potato, cotton, ginger, onion, chilly, turmeric, cumin, coriander, jute, tapioca, annual banana and annual pineapple. During 2005-06, 23 States & two Union Territories are implementing the NAIS.

NAIS envisages area approach for widespread calamities and individual farm approach for localized calamities such as hailstorm, landslide, and flooding. However, individual approach to begin with, is implemented in limited areas on experimental basis. Each participating State/UT is to ensure in three years that the unit of insurance is lowered to village panchayat (group of 2 to 4 villages). However, because of infrastructural and financial constraints States could not lower the unit to village panchyat till Kharif 2006.

Sum insured for *borrowing farmers* is the amount of loan availed which can be increased to value of guaranteed yield and further up to value of 150 per cent of the average yield. For *non-borrowing* farmers the sum insured is value of guaranteed yield, which can be extended up to value of 150 percent of the average yield.

Premium rates during Kharif are 3.5 per cent of the sum insured or actuarial rate whichever is less for pearl millet and oilseeds, 2.5 per cent for other Kharif crops (June to October); 1.5 per cent for wheat, and 2 per cent for other Rabi crops (November to March). In case of annual commercial/horticultural crops, actuarial rates are applied. The sum insured beyond value of 100 percent of guaranteed yield attracts commercial rates of premium for all crops. The premium in case of small and marginal farmers is subsidized by 50 per cent, which is shared equally by the Government of India and the State/UT. The premium subsidies to be phased out on sunset basis, over a period of five years, and at present it is 10%.

Table 3.9: Crop Insurance under NIAS program in India

Season	No. of covered States/UTs	Farmers covered (millions)	Area cover (mln. Hec.)	Sum Insured (Rs. Blns)	Premium (Rs. Blns)	Claims (Rs. Blns)	Farmers Benefited
Kharif							
2000	17	8.41	13.22	69.03	2.07	12.22	3635252
2001	20	8.70	12.89	75.02	2.62	4.93	1741873
2002	21	9.77	15.53	94.32	3.25	18.22	4296882
2003	23	7.97	12.36	81.14	2.83	6.50	1704419
2004	25	12.69	24.27	131.70	4.59	10.36	2659376
2005	25	12.64	20.84	134.54	4.48	9.78	2448065
TOTAL		**60.18**	**99.11**	**585.75**	**19.84**	**62.01**	**16485867**

Three levels of indemnity, i.e. 90 per cent, 80 per cent and 60 per cent respectively for low risk, medium risk and high-risk areas, are available for different crops. The insured farmers of a unit area may opt for a higher level of indemnity on payment of additional premium.

As regards sharing of risks, till transition to actuarial regime is made in a period of five years, all claims above 100 per cent of the premium in case of cereals, millets & pulses will be borne by the Government of India and the States on a 50:50 basis. In case of annual commercial / horticultural crops, all claims above 150 per cent of the premium in the first three years will be paid out of Corpus Fund to which contributions are made by central & State governments on 50:50 basis. This would be above 200 per cent of claims thereafter.

3.11.5 Whether Developing Countries should adopt Model of Developed Countries?

For various reasons, developing countries should avoid adopting approaches to risk management similar to those adopted in developed countries. Clearly, developing countries have more limited fiscal resources than do developed countries. Even more importantly, *the opportunity cost of those limited fiscal resources may be significantly greater than in a developed country.* Thus, it is critical for a developing country to consider carefully how much risk management support is appropriate and how to leverage limited government money to spur insurance markets. In developed countries, government risk management programs are as much about income transfers as they are about risk management. However, Developing countries cannot afford to facilitate similar income transfers, given the large segments of the population often engaged in farming. Again, farms in developing countries are significantly smaller than the farms in countries like the United States and Canada. For traditional crop insurance products, smaller farms typically imply higher administrative costs as a percentage of total premiums. A portion of these costs are related to marketing and servicing (loss adjustment) insurance policies. Another portion is related to the lack of farm-level data and cost effective mechanisms for controlling moral hazard.

Developing countries also have far less access to global crop reinsurance markets than do developed countries. Reinsurance contracts typically involve high transaction costs related to due diligence. Reinsurers must understand every aspect of the specific insurance products being reinsured (for example, underwriting, contract design, rate making, and adverse selection and moral hazard controls). Some minimum volume of business, or the prospect for strong future business, must be present to rationalize incurring these largely fixed transaction costs. For a global reinsurer to be willing to enter a market, the enabling environment must foster confidence in contract enforcement and institutional regulations. An enabling environment is, in fact, a prerequisite for effective and efficient insurance markets, and these components are largely missing in developing countries. Setting rules assuring that premiums will be collected and that indemnities will be paid is not a trivial undertaking.

3.11.6 Summary of Experiences from Other Countries

Agricultural insurance is a complex and difficult product to deliver in a sustainable manner. In the region, the agricultural insurance market is nascent but there are encouraging signs. More and more policymakers and farmers recognize the need for more modern risk management systems in order to stabilize incomes, prevent asset depletion, and to enhance competitiveness. Traditional risk management systems sometimes are not sufficiently robust to deal with the vagaries of weather and disease and as a result these uncontrollable events cause significant economic losses that negatively affect households, communities, and government themselves.

Nonetheless, yield insurance must be kept in perspective. It should not be seen as a substitute for unprofitable farms, failures of farm management, changes in technology innovations, market access, disaster aid, or government policies that suddenly affect the rate of return. Neither should the provision of insurance be seen as a sufficient condition in order to improve agricultural competitiveness. If other necessary investments are not made in rural infrastructure, market information systems, and production support services, competitiveness will not improve.

Insurance, however, can be beneficial in improving access to credit by serving as a guarantee against involuntary default. On the other hand, whether insurance policies should be made a mandatory condition to access credit is of doubtful wisdom as because invariably such a dictum undermines both the bank's and insurance company's capacity to evaluate creditworthiness, measure risk, and assess farmer management capacity. Some farmers may have adequate on-farm risk management strategies and will be forced to bear additional financial costs in order to access credit. Many others will have no incentives to engage in on-farm risk management activities and will increase the loss probabilities of the insurance company. However, if government classify land based on risk level., the moral hazard and adverse selection might decrease to some extent in that case. Actually, markets that evolve spontaneously and are based on solid fundamentals tend to be deeper and more efficient in the long-run.

Last but not least, developing countries should not convert crop insurance into an entitlement or disguised income transfer tool. Many do not have the economic wherewithal and it would be more advisable to keep insurance as a risk management tool.

In developing agricultural insurance markets, the role of governments is crucial. An action agenda should be laid out—adjusting legal and regulatory frameworks, if necessary; developing public information depositaries easily accessible by insurance companies and others; training staff; educating farmers, policymakers, and superintendents; conducting pilot experiments; scaling-up activities; designing catastrophic disaster relief programs that do not undermine incentives to undertake on-farm risk management activities and/or to purchase formal insurance---that could serve as a model for operations. Moreover, it was argued that in this model, all public money should be spend on creating public goods and sustaining favorable conditions and not necessarily on subsidizing the insurance premium. The principal reasons for this allocation are based on efficiency and sustainability. Regardless of the product, the guiding criteria for design and implementation of products should be based on achieving the lowest administrative cost possible, pricing for actuarial soundness, fostering transparency, and maintaining affordability.

A tradeoff, however, does seem to exist between actuarially fair crop insurance schemes and the limited financial means of farmers in developing countries. Farmers prefer individual, multiple risk coverage but an actuarially fair premium would be unaffordable for most. Parametric products (indexes based on area yield averages or weather triggers) are less costly but imply basis risk and would be attractive to less risk adverse farmers. The historical record for writing multiple peril products is generally unsatisfactory and great caution should be exercised in expanding these products unless historical data exist that would permit reliable loss estimations and actuarially sound premiums are charged (UNCTAD, 1995; Hazell, 1992, Just, et. al, 1999).

Greater emphasis and government support should be given immediately to developing information systems, modeling yield losses, quantifying degrees of risk aversion, determining better fits between individual losses and aggregate triggers so that less costly insurance schemes can be introduced that are attractive and of interest to low-income farmers. In short- to medium-term, more attention should be paid to promoting better on-farm risk reducing and risk coping strategies through better extension services and the use of single peril and parametric products. Ripe areas for research and pilots include eliciting farmer risk attitudes, blending crop insurance with other financial products; using modern information technology to reduce costs; better modeling and understanding of weather phenomena and the impact of climate change; and improving reinsurance capabilities.

Chapter 4: Crop Insurance - Bangladesh Context

4.1 Status of Insurance Business in Bangladesh

Insurance is not a new business in Bangladesh. Almost a century back, during British rule in India, some insurance companies started transacting business, both life and general, in Bengal. Insurance business gained momentum in East Pakistan during 1947-1971, when 49 insurance companies transacted both life and general insurance schemes. These companies were of various origins British, Australian, Indian, West Pakistani and local. Ten insurance companies had their head offices in East Pakistan, 27 in West Pakistan, and the rest elsewhere in the world. These were mostly limited liability companies. Some of these companies were specialised in dealing in a particular class of business, while others were composite companies that dealt in more than one class of business.

The insurance industry is regulated under the provisions of the Insurance Act, 1938, by the Chief Controller of Insurance, acting under the purview of the Ministry of Commerce. The Insurance Act, read with the Insurance Rules promulgated thereunder provides extensively for various aspects of insurance companies, and regulations of the insurance business. However, without going into the provisions themselves, it may be said that the insurance sector is plagued by many inefficiencies, which the Department of Insurance alone is unable to address.

The government of Bangladesh nationalised insurance industry in 1972 by the Bangladesh Insurance (Nationalisation) Order 1972. By virtue of this order, save and except postal life insurance and foreign life insurance companies, all 49 insurance companies and organisations transacting insurance business in the country were placed in the public sector under five corporations. These corporations were: the Jatiya Bima Corporation, Tista Bima Corporation, Karnafuli Bima Corporation, Rupsa Jiban Bima Corporation, and Surma Jiban Bima Corporation. The Jatiya Bima Corporation was an apex corporation only to supervise and control the activities of the other insurance corporations, which were responsible for underwriting. Tista and Karnafuli Bima Corporations were for general insurance and Rupsa and Surma for life insurance. The specialist life companies or the life portion of a composite company joined the Rupsa and Surma corporations while specialist general insurance companies or the general portion of a composite company joined the Tista and Karnafuli corporations.

The basic idea behind the formation of four underwriting corporations, two in each main branch of life and general, was to encourage competition even under a nationalised system. But the burden of administrative expenses incurred in maintaining two corporations in each front of life and general and an apex institution at the top outweighed the advantages of limited competition. Consequently, on 14 May 1973, a restructuring was made under the Insurance Corporations Act 1973. The Insurance Corporations Act 1973 set up two state-owned insurance corporations, namely Jiban Bima Corporation (dealing with life insurance), and Shadharan Bima Corporation ("SBC" - dealing with general insurance). Until the mid-1980s, by mandate of this law, only these two corporations were permitted to transact insurance business.

The Insurance Corporations Act 1973 was amended in 1984 to allow insurance companies in the private sector to operate side by side with Sadharan Bima Corporation and Jiban Bima Corporation. The Insurance Corporations Amendment Act 1984 allowed floating of insurance companies, both life and general, in the private sector subject to certain restrictions regarding business operations and reinsurance. Thanks to the process of liberalization, today there are about 40 general insurance companies and 14 life insurance companies. This resulted in a substantial growth of premium incomes, competition, improvement in services, and introduction of newer types of business in wider fields hitherto untapped. Prior to privatisation, the yearly gross premium volume of the country was approximately Tk 900 million in general insurance businesses and approximately Tk 800 million in life insurance business. In 2000, premium incomes raised to Tk 4,000 million in general insurance business and Tk 5,000 million in life insurance business.

Section 23 of the Insurance Corporation Act, 1973 provides that fifty per cent of all insurance business relating to any public property or to any risk or liability appertaining to any public property shall be placed with the SBC and the remaining fifty per cent of such business may be placed either with that Corporation or with any other insurer in Bangladesh.

Section 23A of the Act further provides regarding re-insurance, that every insurer registered and carrying on insurance business in Bangladesh shall re-insure, on generally acceptable terms and conditions, such portion of his insurance business as he cannot retain on his own account. Fifty per cent of the re-insurable general insurance business shall be re-insured with the SBC and the remaining fifty per cent of such business may be re-insured either with that Corporation or with any other insurer whether in or outside Bangladesh. The whole or any portion of the reinsurable life insurance business may be re-insured with any insurer outside Bangladesh.

Section 27 of the Insurance Act as amended in 2000, limits the investment of insurance company funds by providing that at least 30% of the funds of life insurance companies must be invested in government securities and the balance may be invested elsewhere, including in the capital market. The Chief Controller of Insurance has notified a list of eligible investments other than government securities in 2002. Insurance companies are allowed to invest in shares and debentures of companies of which at least 25% is owned by the Government, or of public listed companies that have a record of dividend payments of more than 10% in at least five out of seven years preceding the date of investment.

Generally, private insurance companies provide a narrow range of products and the service quality is alleged to be low. It is very difficult to obtain payment of insurance claims, either at all or within a limited time. These delays or defaults are blamed on the delayed or erroneous survey reports, delays from SBC in settling reinsurance claims, and funding shortfalls by the companies. Limited access to actuarial data results in setting of unreasonable or unrealistic premium for insurance products. Other problems include inadequate or non-existent assessments for insurable risks, issuance of policies without payment of premium, payment against false claims, failure of payment against genuine claims, personal cash incentives demanded for processing documentation, tax evasion on underwriting. The Department of Insurance lacks sufficiently trained staff and infrastructure, providing no leadership or incentive to take a more active role in monitoring and intervention in its supervisory capacity. Numerous institutions, associations and professional groups work to promote the development of insurance business in Bangladesh. Prominent among them are the Bangladesh Insurance Association and Bangladesh Insurance Academy. Bangladesh Insurance Association was formed on 25 May 1988 under the Companies Act 1913. It is registered with the Registrar of Joint Stock Companies and has 30 members. It aims at promoting, supporting and protecting the interests and welfare of the member companies.

It may therefore be seen that by law, the state-owned general insurance corporation has been given a substantial protection in terms of market share. It is arguable that this has prevented the insurance market from achieving depth. For many years, discussions have been ongoing on the policy front to open up the insurance market to direct foreign investment and internal competition, but in the absence of an effective regulatory framework, this has not taken place and is not likely to take place in the near future.

One thing worth noticing is that the above insurance provisions do not have anything specific about microinsurance. The provisions also do not include anything about coverage of rural poor by the insurance industry. It may be mentioned that the Government of India has introduced provisions for the private insurance companies that they have to have certain percentage of their business devoted to covering the rural poor. These companies in their coverage of this market segment are subsidized by profits earned in other segments of the insurance market.

4.2 Micro-insurance in Bangladesh

The section describes the experience of Microinsurance in general and Crop insurance in particular in Bangladesh and their related products. A number of prospective stakeholders and organizations are contacted to gather information regarding their experiences. Specifically, the experience of introducing Crop Insurance in Bangladesh was of great importance – i.e. the causes of failure, structural arrangements, institutional requirements, and financial viability, etc. In near future, in the changing climate with increased disaster possibility whether crop insurance can be introduced again and in what form - are the questions here to discuss with.

Microinsurance in Bangladesh is introduced very recently. However, it sounds a prospective field and flourishing at a very fast rate. Among the NGOs, the following are found to be involved in micro insurance: BRAC, Grameen Bank, ASA, Grameen Fisheries Foundation, Grameen Kalyan, Earth Foundation, Gono Sasthya, Padakhep and Ghasful. All these organizations have branches at regional and local levels. Among the commercial insurers, the following are found to be involved in micro insurance: Delta life, National Life and Homeland Life. Earth Foundation, an NGO, has introduced crop insurance, though in just beginning stage. Only Sadharan Bima Corporation (SBC), a government insurer, was involved with crop insurance since 1981. Though earlier initiatives failed, SBC has taken another initiative to introduce crop insurance, this time with involvement of partners from the private sector. The reaction from the latter is not known yet. Besides, the Department of Insurance, GoB is an important stakeholder, with whom contact has been established. The public sector Krishi Bank is another organization involved in credit disbursement to rural people for agriculture. Besides, the ministries of Commerce, Agriculture, LGRD and Department of Agri Extension, etc. are important stakeholders of crop insurance. Together, the private insurers and micro-finance organizations are being consulted. The academic departments of Economics and Development Studies are also regarded as important stakeholders in articulating the issues of crop insurance. .

The data and information on microinsurance is still scanty in Bangladesh. Discussions over the issue were held with some national and private sector insurance and NGO leaders including Prof. Yunus, Managing Director of the Grameen Bank. It was found that some MFI-NGOs and commercial insurers have initiated microinsurance on a limited scale.

Tables 4.1 and 4.2 show the products of microinsurance undertaken by the NGOs and the private sector in Bangladesh. The tables show that both the MFI-NGOs and the commercial insurers have started microinsurance schemes mainly in the 1990s. However, the Government-owned SBC initiated non-life insurance products, such as crop, cattle and prawn culture in the early 1980s. The main findings from Bangladesh are the following:

- The scale of microinsurance is extremely limited, which is focused on life and credit insurance; limited health coverage of some MFI clients has been initiated.
- Microinsurance under the MFI-NGOs are kind of Self-Insurance, which defeats the principle of wider risk pooling, the foundation of insurance schemes; existing microinsurance delivery takes place under the Full-Service Model, where the insurer carries out the designing, risk assessment, marketing and distribution of their products; no system of Partner-Agent model is yet there; so there is no system of mutual insurance and reinsurance.

Table 4.1 Products of Microinsurance under the MFI-NGOs

Insurer	Products	Targets	Year started
BRAC	Life	Own members	1990
Grameen Bank	Life, Loan	Members	Early 1990s
ASA	Life (Endowment)	Micro-credit users	1993
Grameen Fisheries Foundation	Livestock (all risks)	Borrowers	Late 1990s
Grameen Kalyan	Health	Members & family	
Gono Sasthya	Health	Suburban poor	
Padakhep	Life, Fire, Livestock (partial)	Members	
Ghasful	Life (Endowment)	Urban poor	1999
Earth Foundation	Crop Insurance	Farmers	2007 proposed

(Source: Information supplied by Padakhep, a MFI-NGO in Dhaka, May 2003)

- Crop insurance initiated by the state insurer SBC in the early 1980s is already non-functional, because of its being an extremely losing venture (SBC incurred about 500% losses); the reasons that have been ascribed to its failure are moral hazard based on individual loss assessment, adverse selection, bad program design (like provision of multiple perils and crops, uniform level of premium across the board, high percentage of insured sum, lack of integration of the project with the mainstream agricultural development strategy), covariant risks typical of rain-fed agriculture dependent on one or two crops, advent of intermediaries and in some cases, unanticipated catastrophic natural calamities. A detail evaluation of the CI programme introduced is explained in the next section.

- MFI-NGO insurance funds are not sufficient to meet the large/unusual losses; therefore, sustainability of microinsurance is a big challenge.
- However, from the climate disaster point of view, the major lacunae in the existing microinsurance system is the lack of cover of risks to assets and economic outputs of the poor that they build either from their own savings or from the micro-credits of MFIs.

Table 4.2: Microinsurance Products under the Commercial Insurers

Insurer	Type	Targets	Products	Year started
Delta Life	Life (Endowment)	Low-income rural poor	Grameen & Gono Bima	1988
National Life	Life (Endowment)	Rural/Urban poor	Jano Bima	1994, 1996
Homeland Life	Life (Endowment)	Urban poor	Palli Bima	1996
Sadharon Bima Crop (SBC)	Non-life	Rural	Crop	1977
			Cattle, prawn	1977, 1981, 1994, 1997

Source: Information supplied by Padakhep, a MFI-NGO in Dhaka

4.3 Crop Insurance Past Experience in Bangladesh

Bangladesh introduced Crop Insurance through the state owned insurance company Sadharan Bima Corporation (SBC) in 1977 as a pilot project. The main objectives of the programme were as follows (Rahman, 2000) ;

- To indemnify farmers against crop loss, stabilize farm income and promote agricultural growth; and
- To undertake research necessary for promotion and development of such crop insurance programme.

A brief description of the programme with different terms and conditions are given below (SBC, 2000):

Underwriting Principles

Insurer	:	Sadharan Bima Corporation
Insured	:	Krishak Samabaya Samity registered with BRDB and some Irrigation Projects. Later farmers availing institutional credit were also included there.
Subject matter insured	:	Paddy (IRRI/BORO, Aus, Aman, Jute, Wheat)
Sum insured	:	80% of the last five years' average production in the concerned field.

Premium	:	IRRI/BORO	@ 3% per season of 120 days
		AUS	@ 4% per season of 120 days
		AMAN	@ 5% per season of 120 days
		WHEAT	@ 3% per season of 120 days
		JUTE	@ 3% per season of 120 days
Perils covered	:	Flood, Cyclone, Hailstorm, Windstorm, Drought, Plant Disease, Pest and Insects.	
Attachment of Risk	:	Risk attaches from the time of plantation / sowing subject to the growth of 75% of the plants.	

Some other conditions were as follows;

- crops were insured against variation in yield, not prices
- insurance covered 80% of the expected value of production
- premium rate was uniform throughout the country for a particular crop
- Holding of an individual was treated as an unit of insurance; and
- Taking insurance policy was voluntary

Operation of the program

A Crop and Cattle Insurance Department has been established at the head office of the SBC in Dhaka which has been entrusted with the responsibility and authority to execute the programme. Crop Insurance policies could be taken by two groups of farmers – those belonging to agricultural cooperative societies under BRDB and individual farmers taking loans from commercial banks and BKB. The SBC official reported that the majority of policy holders were from cooperative societies.

Insurance premium was determined on the basis of information on area of crop, expected production, expected price, and rate of premium. The information on area in crop was provided by the farmer, rate of premium was fixed and expected price was usually the government procurement rate. The expected production per acre was determined by a team consisting of the manager of cooperative society, the extension officer and the upzilla officer of BRDB / the manager of credit giving bank.

After necessary forms were filled up, they were sent to the local office of the SBC which in turn used to send them to the crop insurance wing of the head office. Other than this, the local office has no other involvement in the process. They did not even keep the record of insurance holders. In case of crop damage, policy holders had to directly correspond with the head office of the SBC which used to estimate the extent of crop damage and settle the payment of claims. The assessment of loss is made by a consensus of opinions of the representatives of the Insurer, the insured, loan giving agency and the agriculture department after an ocular view of the affected crop land. The difference between the actual and the expected yield form the basis of the claim. An excess of 10% is imposed in all cases. The whole insurance period is divided into six equal stages of investment values determining maximum loss at each stage as under:

1st stage ………………………..	20%
2nd stage ………………………..	30%
3rd stage ………………………..	50%
4th stage ………………………..	70%
5th stage ………………………..	85%
6th stage ………………………..	100%

The scheme started with 2 (two) selected Thanas of 2 (two) districts, and later expanded up to 56 Thanas in 1981. Overall SBC received premium of Tk. 39,62,337.50 and provided cover of Tk. 11,05,20,277.40 against 23,794.43 acres. However, SBC paid claims to the tune of 1,97,66,802.84. After a continuous operation of around 19 years, the scheme came to a temporary stop in 1996 registering an adverse loss experience of about 500% on average.

While the project was suffering from continuous losses, government had taken several initiatives to review it as well. In 1993, a parliamentary standing committee on the Ministry of Commerce decided to reinvigorate the scheme and directed the ministry to take steps. Accordingly the Ministry constitutes a committee on Crop Insurance. The committee later submitted a report to the government in 1994, major recommendations of which were;

- Government and credit agency concerned must bear part of the premium;
- Total administrative and operational expenses shall be borne by the government;
- An agricultural Insurance Fund shall be created;
- Methods of underwriting the risks and settling losses shall be changed. Area approach is specifically recommended to replace the Individual Approach as practiced in Bangladesh.

4.4 Causes of failure of the CI project in Bangladesh (1977 – 96)

- The program was introduced hastily without adequate preparation like a clear policy and well defined structure and proper training of the SBC staff and other relevant people. Including SBC officials, the other people involved in the processes were seriously lacking adequate understanding on CI process.
- The CI project was not integrated with the mainstream agriculture development policy, rather a discrete effort by SBC simply as an insurance scheme. It could be integrated with other agri-credit systems like those of Krishi Bank and BRDB as a package program. Later it could be integrated with micro-credit programs as well. There was no appreciation and support from Central Bank. Actually, instead of a simple insurance scheme, it should be introduced as a means of supporting farmers to recover from disaster, which required integrating different agencies involved in the matter.
- Later the program was also expanded abruptly without evolving any workable models and finetuning of the programme packages and delivery mechanism. At the beginning two Thanas were selected as pilot project sites to experiment, and later its expansion should be based on the experience gathered at two sites with proper research and evaluation. However, the expansion was made as usual with the same structure adopted from the very beginning.

- There was no grassroot level monitoring of the programme at all, which is a must for either microfinance or microinsurance. Rather, the SBC head office controlled the programme, which was totally irrational.
- The program was made voluntary and based on individual approach. This leads to adverse selection, i.e. only the more risky lands were preferred for insurance. Uniform premium rate for all types of land farther aggravated the problem. The approach was totally contrary to the principle of risk pooling, where the farmers should be selected from diverse agro-ecological zones so that not all the insured suffer from disaster at the same time.
- It became a culture in Bangladesh to exempt Agri-loan to farmers, especially after a disaster. Political parties take it as a cheap means of popularity and sometimes use it for their own vested interest like giving loan to own people, etc. However, if Crop Insurance was made mandatory for those who are taking Agri-loan, there should not be any scope for such irregularities. Loss of crop due to disaster could be compensated by indemnity gain and there could be a provision of automatically repaying the Agri-loan from it. In that case, the loss in indemnity payment by SBC could at least be compensated by loan repayment to Bangladesh Krishi Bank. Even though the farmers having credit from Bangladesh Krishi Bank (BKB) and BRDB were allowed to participate in the program, but only a few of this type took policy. At least government could make it mandatory that those who are taking Agri-credit must take a CI policy as well.
- Peril covered for the programme was too many. At the initial stage of introducing crop insurance in Bangladesh, the peril covered should be limited to one or two.
- The sum insured as 80% of the average yield was too high. A common figure in individual based programmes in the region during 1980s was around 50% (De Mel, 1980).
- Weak and unscientific ocular or eye estimation method of damage calculation made ample scope of moral hazards, inaccuracies and anomalies among different assessors.

4.5 Disaster and Subsidy in the Agriculture Sector in Bangladesh

After a disaster, along with disaster relief, a large amount of credit disbursement scheme used to be taken after a flood. At the same time, it became a tradition to exempt outstanding loans or at least the interest of the loan. Figure 5.14 shows the yearly disbursement of agri-credit and the outstanding amount remaining.

Around 75% of Bangladeshi people depend on Agriculture. So, the loss in the agriculture sector going to be one of the major concerns, and political government always take it as a means to increase their popularity to exempt Agri-loan. However, many of the economists believe that agricultural lending agencies need to be kept out of political influence. Politically motivated decisions to write off agricultural loans not only reduce the capital base of lending institutions but also discourage borrowers to repay loans in time. Box 5.1 shows the total loss in agriculture sector and government plan to disburse agri-loan. NO doubt, it’s a huge amount and will be a big burden for the lending Banks if exempted later.

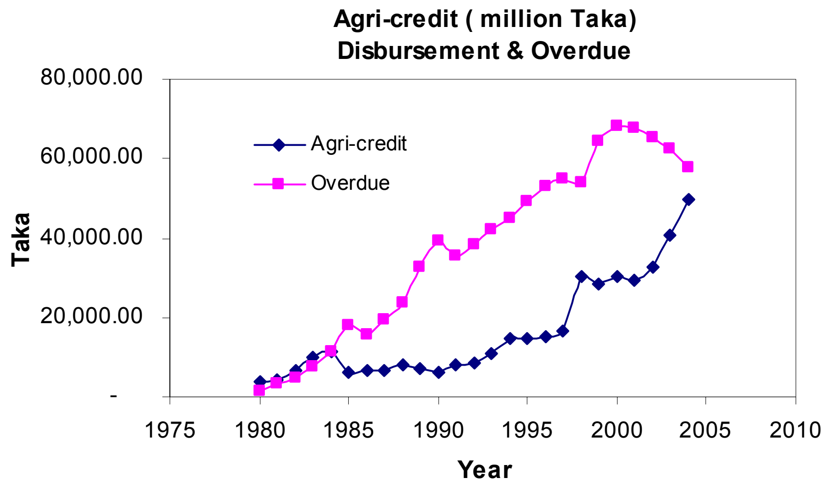


Figure 4.1: Agri-credit disbursement and overdue in Bangladesh from 1980 – 2005

In fact, sometimes it might go beyond the capacity of the government to waive loan for years with repeated disaster like that of 2007. As it is clear from the Box that while the government was sincere and deliberately waived certain amount of loan after flood in 2007, later it announces that the government is unlikely to waive any agriculture loans of the cyclone-hit farmers but would let them reschedule their loans without any down payments. More than 30 per cent of agricultural loans are classified. It would be tough for the banks to cope if the loans are waived right away.

4.6 Increased demand for Agri-credit: Agri-bond Disbursement by BRAC

Increasing disaster and growing demand for agri-credit in Bangladesh, some new ideas are coming in the market to support farmers as well. BRAC, one of the country's leading micro-finance institutions, is planning to launch a Tk 700 crore agricultural bond in an effort to increase much needed financing to the agricultural sector.

The agricultural bond, the first ever of its kind in Bangladesh, could be issued by the year 2008. If successfully received by investors the amount may be increased to Tk 1000 crore. It will also be the country's first 'zero coupon' bond, a financial instrument that pays no direct interest but is sold at a heavy discount to its face value. The government has made such bonds tax free in an effort to encourage the use of bond financing. Citibank, N.A. Bangladesh will be the lead arranger of the bond. Local commercial banks and insurance companies have already responded positively to joining the bond financing.

4.7 Crop Insurance: Plan to Re-introduce by the Government

In a bid to facilitate most vulnerable populace of the country the government has initiated a move to introduce crop insurance policy in the most calamity prone areas of Bangladesh. A recent directive of Prime Minister Office (PMO) has asked the Ministry of Commerce to conduct a feasibility study of introducing crop insurance policy. The proposal has been made

Box 5.1 Case study: Year 2007 - Disaster and Agri-credit disbursement

- Year 2007 Bangladesh was severely affected by both flood and Cyclone.
- The devastating floods in 2007 have damaged crops worth about Tk 2,000 crore in 262 upazilas of the 39 flood-hit districts.
- The damaged crops include rice, jute, vegetable and spices around 4.69 lakh hectares of land, which is about 26 per cent of the total cultivated crops in the affected areas. Production of these crops will now reduce by 16.67 lakh tonnes, according to an estimate by the Department of Agricultural Extension (DAE).
- Around 95 per cent standing crops in 11 coastal districts have been affected badly by the hurricane Sidr in the same year, agriculture ministry sources said. The agricultural ministry has estimated that Sidr has caused a loss of at least 6 lakh metric tons of aman crops in the coastal areas.
- Agriculture credit disbursement by banks will be increased by Tk 2406 crore or 45 per cent in the current fiscal year for post-flood rehabilitation. The banks have set a target of distributing Tk 7698 crore in agricultural loans in the current fiscal. Of it, Tk 1078 crore will be disbursed by private commercial banks. Agricultural loans amounting to Tk 5292 crore were disbursed in the last fiscal year.
- Bangladesh Krishi Bank (BKB) has fixed up an enhanced disbursement target of Tk 35.50 billion (3,550 crore) for agricultural loans for the current financial year in the context of the recent flood.
- Sonali Bank, a state-owned commercial bank, declared to waive all interest payments on agricultural loans in flood affected areas of the country. The bank will also allow farmers to reschedule their previous loans and allocate fresh loans in order to aid production and allow them to get back on their feet.
- However, due to repeated disasters, the government was unlikely to waive any agriculture loans of the cyclone-hit farmers but would let them reschedule their loans without any down payments. Already more than 30 per cent of agricultural loans are classified. It would be tough for the banks to cope if the loans are waived right away," said Finance Adviser Mirza Azizul Islam at a meeting with Bangladesh Bank governor and heads of five state-owned banks. Instead of waiving the loans the government would extend the timeframe for repayment of loans so that farmers can recover the crop losses.

under a project titled 'Multi-dimensional and integrated plan for creating job opportunity for the poor and vulnerable'. Nearly 1.3 million people in 12 districts under greater Rangpur Rajshahi, Jamalpur, Sherpur and Faridpur are expected to be benefitted if the project gets nod from the authorities concern. The project pro-forma found that people of these areas are underdeveloped due to lack of industrialisation and hostile weather condition including Monga (near famine situation), draught, flood and river erosion. It may be mentioned here that in the chapter nine and 10 of the Poverty Reduction Strategy Paper (PRSP), the necessity and requirements of the insurance has been described. Ministry of Commerce had already held several meetings with insurance sector leaders in connection with viability of crop insurance. But the outcomes of the meetings were mostly against the concept due to non-viability and lack of guarantee in re-insurance. They said that the government has to come forward first with fund to introduce as well as implement such crop insurance policy.

4.8 Recent Study by Economics Department of NSU: Demand assessment and test of commercial viability of crop insurance in Bangladesh

A study (Sonia and Roy, 2006) conducted by the economics department, NSU to assess the demand for and test the commercial viability of a crop insurance scheme in different natural disaster-prone areas in Bangladesh, as an alternative poverty alleviation and natural disaster mitigation strategy. In a large scale household survey carried out at the end of 2006, 3600 riverine and coastal floodplain residents in Bangladesh were asked for their preferences for crop insurance schemes using the double bounded contingent valuation (CV) method. For example, asking them for their willingness to pay (WTP) for crop insurance schemes to eliminate future catastrophe risks. The study found crop insurance demand to be positively correlated with household head's primary occupation, land ownership and size of agricultural farm land. The study further reveals that crop damage cost and households' willingness to pay to reduce damage vary significantly across the nature of the disaster risk. Using the data collected through household survey, the analytical model of commercial viability of a crop insurance scheme was tested by comparing the future value of expected premium receivable by insurer, with the expected indemnity payable to the insured. Assuming zero administrative cost and 10% interest rate per annum, they found crop insurance schemes are marginally viable in riverine flood plain areas (both embanked and unembanked). The difference between the average expected indemnity payment and the future value of expected insurance premium is way too high for the nature of risk and amount of damage cost faced by households living in haor basin and coastal floodplain areas.

The main limitation of the study, however, was a narrow concentration of simply comparing farmers Willingness to Pay to Cost or indemnity, instead of an in depth study on the porspect of CI in the context of increased disaster risk in near future. Other than such simple financial viability assessment, CI should be looked as an integral part of the disaster management approach, especially under climatic changes. Also there are a number of approaches of CI suitable for different regions which can reduce financial losses to a great extent.

4.9 Climate Insurance Proposals and its Rationale in the Context of Bangladesh

4.9.1 AOSIS Proposal

Introducing the term `insurance' for the first time, the Alliance of Small Island States (AOSIS) suggested in 1991 that an `international insurance pool' funded by Annex II countries be established under the control of the COP to compensate the small-island and low-lying developing nations for the uninsured loss and damage from slow-onset sea-level rise. The Pool would compensate developing countries (i) in situations where selecting the least climate sensitive development option involves incurring additional expense and (ii) where insurance is not available for damage resulting from climate change (Intergovernmental Negotiating Committee, 1991).

Mandatory contributions to the fund would be made to an administrative authority, which would also be responsible for handling claims made against the resources of the fund. As a basis for settling the claims, the proposal contemplated that assets in developing countries potentially affected by sea-level rise would be valued and registered with the authority. Trigger levels (levels of SLR that would legally require the payment of claims) would be subject to negotiation between individual countries and the authority. In assessing claims, the authority was to determine whether and to what extent the loss or damage could have been avoided by measures which might reasonably have been taken at an earlier stage, thus avoiding the moral hazard of not taking appropriate preventive measures. Assets covered by commercial insurance would not be compensated by the scheme.

There are difficult challenges in implementing the AOSIS proposal. Valuing all properties and verifying loss claims in countries with no indigenous insurance structures would impose large transaction costs on the system. Determining `reasonable' loss-reduction measures is also problematic. Nonetheless, the proposal was, and remains, a valuable first step in presenting concrete ideas on how developed countries could take financial responsibility for climate change impacts accruing to vulnerable developing countries.

4.9.2 Muller Proposal

Whereas the AOSIS insurance proposal addressed the gradual onset of SLR, subsequent proposals have turned to sudden-onset weather events, such as floods, tropical cyclones and sea surges (worsened by SLR). Muller (2002) advocated a switch from the current international disaster relief system characterized by voluntary, media-driven and uncoordinated donations to a Climate Impact Relief Fund (CIRF), which is regularly funded up-front and centrally admistered by the UNFCCC in order to increase efficiency and fairness. No `new money' would be needed, since OECD or Annex II countries would donate to the fund proportionally to their current average post-disaster assistance spending. According to Muller, further options for such a fund could be to provide disaster preparedness support and adopt burden-sharing criteria, such as based on financial ability or a CO_2-emission-based system.

4.9.3 Germanwatch Proposal

The Germanwatch proposal for a Climate Change Funding Mechanism (Bals et al., 2006) builds strongly on the AOSIS and Muller proposals. The authors propose a global catastrophe insurance program funded by developed countries and administrated by a public/private entity. The scheme would be limited in scope by indemnifying only public infrastructure damage in the LDCs and offering cover only for rare, high-consequence, climate risks. As an interesting innovation, there would be in-kind premium payments in the form of implemented loss-reduction measures by public clients who voluntarily join the scheme: the CCFM would define minimum risk reduction measures to be undertaken by the country where the annual cost to the country is commensurate with the level of imputed risk-based premium.

Defining risk-reduction measures by an outside authority (for example, requiring squatters to evacuate areas targeted for flood-control measures dams) may be problematic, especially if not subject to government and stakeholder involvement. Moreover, LDCs may find it difficult to finance mitigation measures that cover the imputed risk-based premium. For highly exposed LDCs, this premium can be quite substantial. For example, in the recently introduced drought insurance program in Malawi, annual premiums amounted to 6-10% of the insured crop value (Opportunity International, 2005). Finally, the strategy can be inefficient if the required measures are not cost-effective or high priority in the country.

4.9.4 Towards A Complementary Strategy for Implementing Article 4.8

In a background paper prepared for a UNFCCC meeting on climate change and financial adaptation (Linnerooth-Bayer et al., 2003; see also Linnerrooth-Bayer and Mechler, 2003) the authors suggest that implementation of Article 4.8 could be based on Annex II country support for developing country insurance initiatives. In this article, we elaborate on this earlier concept by proposing a two-tiered climate insurance strategy. The first tier would take the form of a climate insurance program that provides support to nascent (climate-related) disaster insurance systems in highly exposed developing countries. The second tier would provide post-disaster relief to countries that demonstrate credible efforts in managing their risks.

Tier 1: Climate Insurance Program	Tier 2: Disaster Response Program
Support for nascent disaster risk financing mechanisms for climate-related risks at the local and national levels	Relief for: - Climate-related disasters not (yet) financially protected - Uninsurable climate-related disasters

In contrast to the Germanwatch proposal, which advocates the creation of a global insurance scheme with full responsibility on the relevant authority for underwriting risks and administering an insurance system, the first tier of this strategy would be based on shared responsibility at the local, national and global levels.

4.10 Donor-supported Disaster Insurance Schemes

There are quite a number of cases of recent donor-supported insurance initiatives in the world. These are: 1) assisting index-based insurance for crops and livelihoods, 2) assisting microinsurance schemes for property and life in low-income countries (India), 3) assisting insurance schemes for private property in middle-income developing countries (Turkish Catastrophe Insurance Pool), and 4) assisting insurance mechanisms for public sector liabilities (Mexico's Cat Bond).

More than 40% of farmers in developing countries face threats to their livelihoods from adverse weather (World Bank, 2005a). Weather risk destabilizes households and countries and creates food insecurity. In the Southern African Development Community (SADC), as a case in point, floods, cyclones and droughts have been a major cause of hunger affecting more than 30 million people since 2000. Governments and donors react to these shocks rather than proactively managing the risks. These emergency reactions have been criticized for being *ad hoc*, sometimes untimely, and destabilizing local food markets (Hess and Syroka, 2005).

Novel insurance instruments are emerging to address problems of food insecurity, even for high-frequency, slower onset disasters, such as droughts. Affordable insurance can provide low-income farm households with access to post-disaster liquidity, thus securing their livelihoods and avoiding famine. Moreover, insurance improves their credit worthiness and allows smallholder farmers engage in higher-return crop practices.

4.10.1 Index-based Insurance in Malawi

In Malawi, where the economy and livelihoods are severely affected by rainfall risk, resulting in drought and food insecurity, groundnut farmers can now receive loans that are insured against default with an index-based weather derivative (Hess and Syroka, 2005). This is a contingent contract with a payoff determined by weather events, in this case a specified lack of precipitation recorded at a specified weather station. Farmers collect an insurance payment if the index reaches a certain measure or `trigger,' regardless of actual losses.

The Malawi pilot project offers a packaged loan and index-based microinsurance product to groups of groundnut farmers organized by the National Smallholder Farmers Association. Accordingly, the farmer enters into a loan agreement with a higher interest rate that includes the weather insurance premium, which the bank and rural finance institution pay to the insurer, the Insurance Association of Malawi. In the event of a severe drought (as measured by the rainfall index), the borrower pays only a fraction of the loan due, and the rest is paid by the insurer directly to the bank. Without this insurance, banks rarely loan to high-risk, low-income farmers, which means they cannot obtain needed credit to invest in the seeds and other inputs necessary for higher-yield crops. Moreover, because of the physical trigger, there is no moral hazard; on the contrary, farmers will have an incentive to reduce potential losses, for example, by diversifying their crops. Nor is there a need for expensive individual claims-settling, and expedient payments will reduce the need for farmers to sell their assets and livestock to survive the aftermath of a disaster. One drawback of index insurance, however, is `basis risk,' which means that payouts may not be fully correlated with losses.

The World Bank has provided technical assistance and training in developing this weather insurance product. By reducing loan repayments in the case of drought, the Malawi scheme only indirectly protects farmers from loss of livelihood and food insecurity.

Chapter 5: Climate Change and Agricultural Risk in Bangladesh Future trend and Methodology to quantify Risk

5.1 Agriculture Risk in Bangladesh

In general the risks in the agriculture sectors are described in section 3.1. Bangladesh is highly vulnerable to all sorts of the risks mentioned there. However, risk derived from extreme climatic events, especially flood is one of the most dominant causes devastating crop production in Bangladesh almost every year (Table 5.1). Drought occurrence during dry season, which is further aggravated nowadays due to water withdrawal among the trans-boundary rivers with India. Coastal regions on the other hand is vulnerable to saline water intrusion and coastal flooding either due to water shortage along the major rivers during dry season as an effect of u/s water withdrawal or increased intensity of cyclonic storm surges. High growth rate of population, for which, more and more cultivable lands are encroached for residential purposes, ultimately putting huge pressure on available agriculture land. The country's population is growing at the rate of 1.6 per cent per year; demographic pressures and increased urbanization have caused cultivated area to decline at a rate of 1 per cent per year. For the reason, in many cases people are now trying to cultivate in areas which used to be considered unsuitable or highly risky for cultivation. All the factors mentioned thus increasing the risk of crop failure in the agriculture sector.

Climate change has relationship to all the three major disasters, which will significantly affect agriculture sector of Bangladesh. The following sections describe the scenarios for climatic changes in Bangladesh and their relevance to loss of agricultural production in Bangladesh. *A sound understanding of future risks involved in the agriculture sector is very important for actuarial analysis of Crop Insurance programme. Both the prospective insurers and insured need to have clear idea about the future risk probabilities to decide on the nature of insurance contract including premium level, per cent coverage, and peril to cover, etc.*

5.2 Climate Change and its probable impact on the agriculture sector

5.2.1 Climate Change Scenario for Bangladesh

Bangladesh is at great risk from global climate change (WB 2000, SMRC 2000a, 2000b, MoEF 2002, Agrawala *et.al.* 2003) because of its unsuitable geographic location like very low elevation and exposure to various water related hazards. Efforts have been made to quantify climatic changes in Bangladesh (SMRC 2000a, 2000b). From an analysis of 22-year data (1977-1998), sea level rise has been estimated as 7.8mm/year, 6.0 mm/year and 4.0 mm/year at Cox's Bazar, Char Changa (Hatiya) and Hiron Point, respectively (SMRC 2000a). The effect of tectonic subsidence may be more pronounced in this much higher rate of sea level rise. Further, an analysis of monthly and annual mean data on maximum temperature, minimum temperature at 24 stations for a period of 30 years has been done (SMRC 2000b). The study revealed a statistically significant increasing trend of annual mean maximum temperature, slightly decreasing trend of annual mean minimum temperature and a slight increasing trend of annual mean temperature.

Table 5.1 Agricultural losses due to natural disaster in different years

Sl. No	Year	DISASTER	No. Affected		Crops damaged Fully (Acre)	Crops damage Partially (Acre)	No. of Dead Livestock	Embankment Damages
			District	Upazila				
1	1987	FLOOD/ERROSION	50	347	2983362	1873207	370129	1272
2	1988	FLOOD/ERROSION	23	165	755740	90469	49976	67
3	1988	FLOOD/ERROSION	52	345	364258	9902967	348042	1651
4	1989	FLOOD/ERROSION	27	70	58568	102716	51548	
5	1990	FLOOD/ERROSION	17	58	37987	125089	8716	125
6	1991	FLOOD/ERROSION	7	35	276896	117795	5551	339
7	1991	FLOOD/ERROSION	23	97	160549	239024	6428	124
8	1991	FLOOD/ERROSION	28	170	782780	708225	34327	186
9	1993	FLOOD/ERROSION	33	224	778513	521204	29512	1013
10	1994	FLOOD/ERROSION	15	40	55325	48133	8666	18
11	1995	FLOOD/ERROSION	40	259	1369358	986754	14221	2398
12	1995	FLOOD/ERROSION	22	88	598808	229216	41816	211
13	1995	FLOOD/ERROSION	14	100	855585	807344	2063	267
14	1996	FLOOD/ERROSION	48	222	404456	605312	47946	448
15	1997	FLOOD/ERROSION	37	180	167586	384666	4726	586
16	1970	CYCLONE	5	99		3350000	-	-
17	1985	CYCLONE	9	30	39500	86590	2020	10
18	1986	CYCLONE	7	30	17800	84837	1050	1
19	1988	CYCLONE	21	131	2316042	1597780	386766	18
20	1989	CYCLONE	33	71	38712	38629	2065	

21	1990	CYCLONE	39	127	171099	242897	5326	
22	1991	CYCLONE	33	100	11760	8725	25	
23	1991	CYCLONE	19	102	133272	791621	1061029	707
24	1994	CYCLONE	2	8	23986	57912	1296	97
25	1995	CYCLONE	28	67	2593	42644	1838	
26	1996	CYCLONE	2	9		2431	4933	
27	1997	CYCLONE	10	66	254755	59788	7960	122
28	1997	CYCLONE	12	61	16537	72662	3196	280
29	1998	FLOOD/ERROSION	52	366	1423320	1808401	26564	4528
30	1999	FLOOD/ERROSION	28	-	150515	290923	137	-
31	2000	FLOOD/ERROSION	9	40	14262	438016	1643	118
32	2002	FLOOD/ERROSION	36	209	321355	521742	25237	4734
33	2003	FLOOD/ERROSION	36	209	373376	504983	7197	1535
34	2004	FLOOD/ERROSION	39	265	1605958	1038176	15143	3158
35	2007	LANDSLIDE	1	15 (Places)				
36	2007	FLOOD/ERROSION	46	263	890898	1335382	1,459	88 (Fully)
37	2007	CYCLONE (SIDR)	30	200	461819	1027399	467469	614

Source: DMB

Although the magnitude of the changes in climate may appear to be small, they could substantially increase the magnitude of existing climatic disasters like floods, droughts and cyclones, and decrease their return period. For example, a 10 per cent increase in precipitation may increase runoff depth by one-fifth and the probability of an extremely wet year by 700 per cent. The likely climate change scenarios for Bangladesh are provided in Table 5.2.

Table 5.2: Climate Change Scenarios for Bangladesh

Year	Sea Level Rise (cm)	Temperature Increase (^{0}C)	Precipitation fluctuation compared to 1990 (%)	Changes in evaporation
Based on 2nd IPCC projections (WB 2000)				
2030	30	+0.7 in monsoon; +1.13 in winter	-3 in winter; +11 in monsoon	+0.9 in winter; +15.8 in monsoon
2050	50	+1.11 in monsoon; +1.8 in winter	-37 in winter; +28 in monsoon	0 in winter; +16.7 in monsoon
Based on 2nd IPCC projections (Agrawala *et al*. 2003)				
2030		+0.8 in monsoon; +1.1 in winter	-1.2 in winter; +4.7 in monsoon	
2050		+1.1 in monsoon; +1.6 in winter	-1.7 in winter; +11.8 in monsoon	
2100		+1.9 in monsoon; +2.7 in winter	-3.0 in winter; +11.8 in monsoon	

Source: Where Land Meets the Sea – A profile of the Coastal Zone of Bangladesh, 2004

5.2.2 Effect on the Agriculture Sector: Direct effect

Agriculture is considered as one of the major vulnerabilities that the country might face due to climate change. Yet IPCC (Lal *et al*., 2001) and other studies (e.g., Karim *et al*., 1996) show crop yields *potentially increasing* at a few degrees Celsius increase in temperature. Beyond that, particularly as the CO_2 fertilization saturates, yields could decrease. For example, Karim *et al*. (1996) estimated that rice yields would increase for about a 1.5^{0}C increase combined with higher CO_2 levels.

Table 5.3: Change in rice yields in Asia under increments of temperature and CO_2 level

Model used and ambient CO_2 levels	% change in mean potential rice yield in Asia resulting from surface air temperature increment of			
	0^{0}C	+1^{0}C	+2^{0}C	+4^{0}C
ORYZA1 Model				
340 ppm	0.00	-7.25	-14.18	-31.00
1.5 X CO_2	23.31	12.29	5.60	-15.66
2 X CO_2	36.39	26.42	16.76	-6.99
SIMRIW Model				
340 ppm	0.00	-4.58	-9.81	-26.15
1.5 X CO_2	12.99	7.81	1.89	-16.58
2 X CO_2	23.92	18.23	11.74	-8.54

Source: Matthews *et al*. 1995

Results reported by Karim *et al*. (undated) for Bangladesh's Country Study are consistent as shown in Tables 3. They estimated that rice yields would decline under two GCM scenarios (GFDL and CCCM). They estimated increased yields for higher CO_2 alone (580 and 660 ppmv), higher CO_2 combined with a 2^{0}C increase, positive and negative changes in yields for a 580 ppmv of CO_2 combined with a 4°C increase, and mostly increased yields for a 660 ppmv of CO_2 combined with a 4^0C increase. The marginal effect on yields of increasing temperatures (i.e., holding CO_2 constant) was negative.

However, the above studies did not consider the effect of precipitation change appropriately. For example, reducing precipitation had a further negative effect on yields. As it is seen from Table 5.2, the precipitation in Bangladesh will decrease in winter or dry season and increase in monsoon. Both the incidents will have a negative effect on agriculture. Reduction in dry season precipitation will cause significant reduction in crop yield as because as a flood plain country most of our lands are underwater during monsoon and productions are mostly during dry season. On the other hand, higher precipitation in monsoon will only increase the magnitude and frequency of flooding affecting crops again.

5.2.3 Climate change and Disaster: Indirect effect on agriculture sector

Flooding

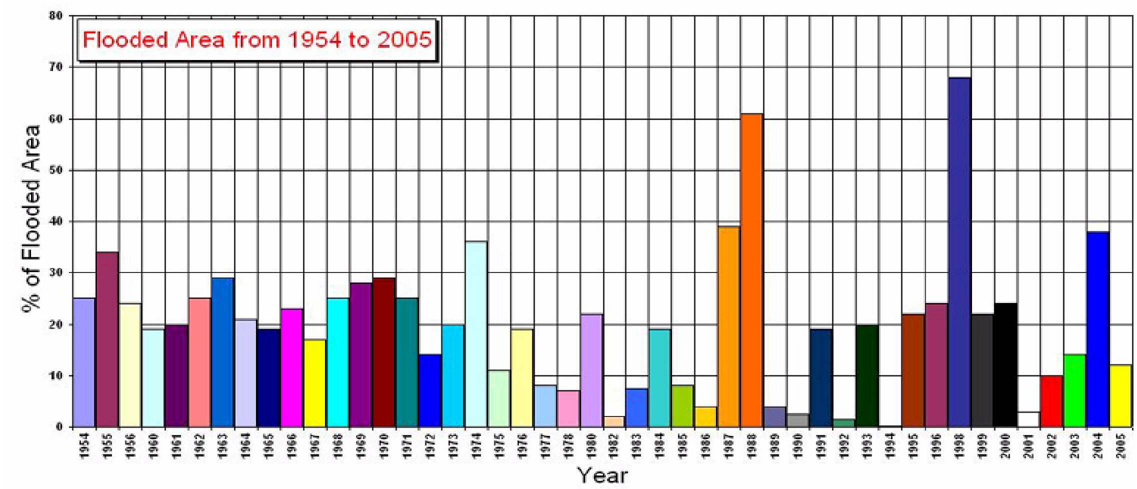


Figure 5.1: Flooded area in Bangladesh from 1954 to 2005

Flooding in Bangladesh is a regular feature and has numerous adverse effects, including loss of life, destruction of crops and livestock, increased prevalence of disease, and destruction of property. This is because much of Bangladesh is located on a floodplain of three major rivers and their numerous tributaries (Figure 5.1). One-fifth of the country is flooded every year, and in extreme years, two-thirds of the country can be inundated (Mirza, 2002). This vulnerability to flooding is exacerbated by the fact that Bangladesh is also a low-lying deltaic nation exposed to storm surges from the Bay of Bengal. Among the percentages of the loss of agricultural products due to natural disasters, effects due to flooding used to be the highest. As shown in Table 5.3, economic losses in the agriculture sector are increasing day by day due to flooding compared to loss of lives.

As shown in Figure 5.2, according to IPCC 4th Assessment Report, climatic changes might contribute to significant increase in flooding intensity in Bangladesh. This might be due to a number of reasons as increased glacier melt, increased precipitation, sea level rise and cyclonic storm surges. Higher temperatures will result in more *glacial melt*, increasing runoff from the neighboring Himalayas into the Ganges and Brahmaputra rivers. Given the altitude of the mountains and the enormous size of the glaciers, this problem will most likely continue over the century. The problem could be of even greater concern as there is evidence to show that temperatures in the Himalayas (where the glaciers are located) are rising at higher rates, thereby contributing to enhanced snow melt.

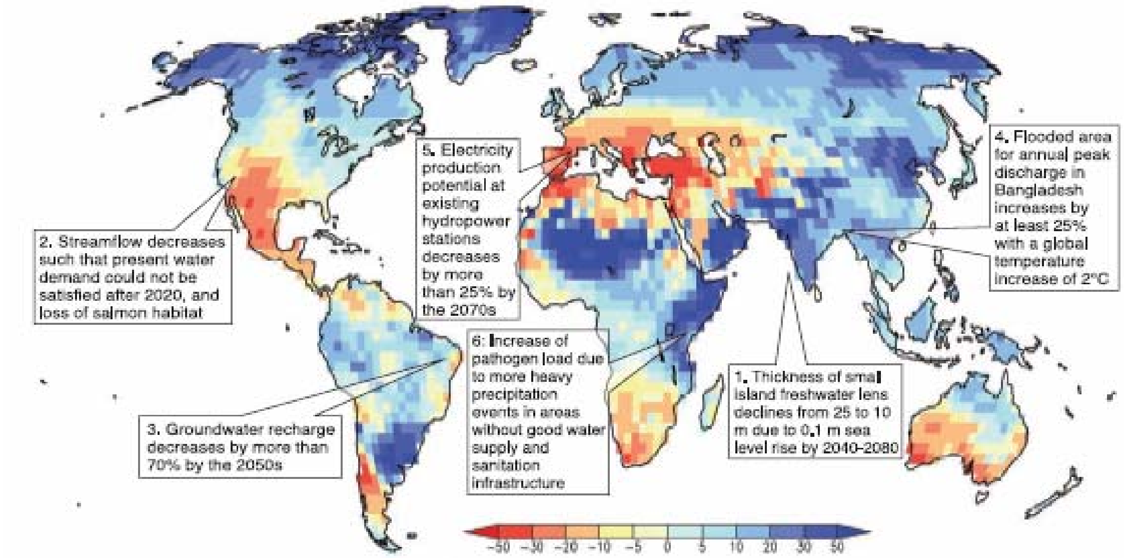


Figure 5.2: Climate change and probable impact on flooding in Bangladesh (IPCC AR4, 2007)

Table 5.4: Sector-wise flood damages (Flood of 1998 and 2004)

Sector	1998 Flood		2004 Flood	
	% of total damage	% of GDP	Total damage (%)	% of GDP
Infrastructure	**38.6**	**1.8**	**69.7**	**2.36**
Roads, Railways, Institutions	18.2	0.85	37.2	1.26
Residential Sector	20.4	0.95	32.6	1.10
Industrial Sector	**12.0**	**0.56**	**4.7**	**0.16**
Agricultural Sector	**49.4**	**2.31**	**25.6**	**0.87**
Crop Sector	42.8	2.0	22.2	0.75
Non-crop Sector	6.6	0.31	3.4	0.12
Total	**100.0**	**4.7**	**100.0**	**3.4**

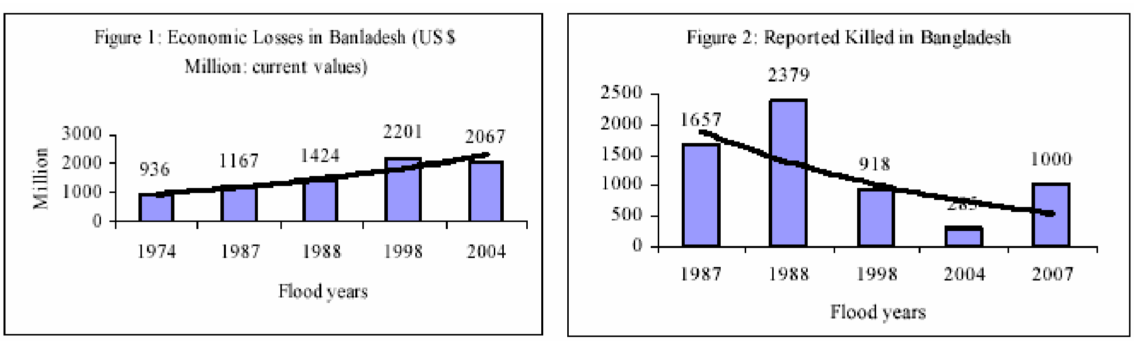
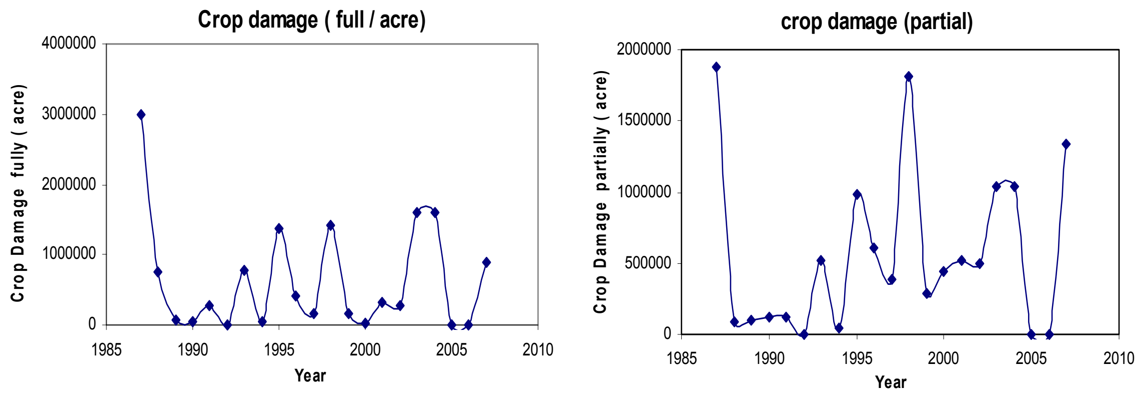


Figure 5.3: Economic losses and reported kills from floods in Bangladesh



(a) (b)

Figure 5.4: Crop damage (a) full and (b) partial due to flood in Bangladesh

Climate models tend to show an *increased precipitation*, particularly during the monsoon season. This will contribute to increased runoff. For example, Mirza and Dixit (1997) found that a 2^0C warming with a 10% increase in precipitation (close to the mean GCM projection for 2100 June-July- August) would increase runoff in the Ganges, Brahmaputra, and Meghna rivers by 19%, 13%, and 11%, respectively.

Sea level rise will result in coastal flooding both under ambient conditions (given the low elevations of the coast), and even more so in the event of storm surges. It will also indirectly cause riverine flooding by causing more backing up of the Ganges-Brahmaputra- Meghna rivers along the delta.

Cyclone

Bangladesh currently has extreme vulnerability to cyclones, both on account of its somewhat unique location and topography (that creates an inverted funnel effect), and because of the low (though growing) capacity of its society and institutions to cope with such extreme events. Along with the loss of life and property, agriculture is another important sector used to be seriously affected due to such cyclonic event.

IPCC concludes that there is evidence of a 5-10% increase in intensity (wind-speed) that would contribute to enhanced storm surges and coastal flooding. IPCC also projects a 10-20% increase in intensity of associated precipitation that would contribute to (rain-water) flooding both in the coast and inland as the cyclone makes landfall. These estimates, however, are for tropical cyclones in general and are not location specific. Assuming a positive correlation between sea surface temperature and tropical cyclone intensity, Ali (1996) calculated the effect of a repeat of the 1991 cyclone with a 2^0C increase (which causes a 10% increase in wind speed) and a 0.3 m sea level rise. He estimated that this would result in a 1.5 m higher storm surge that would inundate 20% more land than the storm surge from the 1991 cyclone. Recent cyclone SIDR was one of the worst examples in that case. The intensity, especially the wind speed was much higher. Around 95 per cent standing crops in 11 coastal districts have been affected badly by the hurricane Sidr, according to agriculture ministry sources.

Figure 5.5: Effect of recent cyclone SIDR 2007

A partial listing of major cyclones and accompanying surge heights is given in Table 5.5. Given that over two-thirds of the country are less than 5 m above sea-level and densely populated, storm surges contribute to flooding far beyond the coast. The intense precipitation that usually accompanies the cyclone only adds to the damage through inland and riverine flooding. Agriculture used to be seriously affected due to flooding and prolonged congestion of salt water afterwards. As it is seen from the figure that most of the floods occur either pre or post monsoon period, which is the harvest period for Boro or Aman rice. Although in recent years greater success in disaster management has significantly reduced the lives lost (World Bank 2000). Nevertheless, the potential for infrastructural and agricultural damage remains very significant.

Figure 5.6: Relative vulnerability of coastal cities as shown by the indicative population potentially displaced by current sea level trends to 2050

Table 5.5: Partial listing of cyclones along coastal Bangladesh and respective surge heights

Cyclone Event	Season	Storm Surge Height (in meter)
November 1876	Post-monsoon	3.0 ~ 10.0
May 1941	Pre-monsoon	4.0
May 1960	Pre-monsoon	3.2
October 1960 (1st event)	Post-monsoon	5.1
October 1960 (2nd event)	Post-monsoon	6.6
May 1961 (1st event)	Pre-monsoon	3.0
May 1961 (2nd event)	Pre-monsoon	6.0 ~ 8.0
May 1965	Pre-monsoon	7.6
December 1965	Post-monsoon/winter	8.8
October 1967	Post-monsoon	7.6
May 1970	Pre-monsoon	5.0
October 1970	Post-monsoon	4.7
November 1970	Post-monsoon	9.0
September 1971	Monsoon	5.0
December 1973	Post-monsoon/winter	4.5
August 1974	Monsoon	6.7
November 1975	Post-monsoon	3.1
May 1985	Pre-monsoon	4.3
November 1988	Post-monsoon	4.4
April 1991	Pre-monsoon	4.0 ~ 8.0

Note: Surge height varies based on location, modified from Ali, 2003)

Drought

Drought is a recurring problem in Bangladesh : 19 occurred between 1960 and 1991. Drought is typically caused when the monsoon rains, which normally produce 80% of Bangladesh's annual precipitation, are significantly reduced. The climate change is thought to increasing the frequencies of droughts, as only five devastating droughts occurred in the hundred years during the period of 1800-1900, yet since 1981, four major droughts have occurred in the last 35 years mostly in northwestern Bangladesh.

The southwest and northwest regions of the country are most vulnerable to drought. The estimates from the climate models do not yield a clear picture of how droughts will change. The estimated changes in precipitation are not significant. The models tend to show increased monsoon precipitation and annual precipitation, which could mean fewer droughts. But, a number of climate models estimate decreased annual precipitation, and the models tend to show reduced precipitation in the winter months.

The reduction in rainfall in Bangladesh during winter will reduce the annual refilling of groundwater storing aquifers and a direct impact on rain-fed agriculture. This has huge implications for groundwater based irrigation which is already experiencing difficulties in different parts of the country in sustaining supply due to over-extraction of water and insufficient refill in the monsoon. The Survey and Monitoring of Groundwater Project has shown that the reduction in groundwater levels mean that 46% of cropland irrigated through shallow-tubewells can not draw enough water to supply farms in the dry season.. The area affected is also expected to get larger during droughts, for example the area severely affected by *Rabi* droughts could increase from 4000 km² to 12000 km² as global warming increases.

Table 5.6 Chronology of Drought events in Bangladesh and its impact on the agriculture sector (Ramamasy and Baas, 2007)

Year	Details
1791	Drought affected Jessore district, prices doubled or tripled.
1865	Drought preceded Dhaka famine.
1866	Severe drought in Bogra, rice production of the district was hit hard and prices tripled.
1872	Drought in Sundarbans, crops suffered greatly from deficient rainfall.
1874	Extremely low rainfall affected Bogra, great crop failure.
1951	Severe drought in Northwest Bangladesh substantially reduced rice production.
1973	Drought responsible for the 1974 famine in northern Bangladesh, one of the most severe of the century.
1975	Drought affected 47 percent of the country and more than half of the total population.
1978-79	One of the most severe droughts in recent times with widespread damage to crops reducing rice production by about 2 million tonnes, directly affecting about 42 percent of the cultivated land and 44 percent of the population.
1981	Severe drought adversely affected crop production.
1982	Drought caused a loss of rice production of about 53 000 tonnes while, in the same year, flood damaged about 36 000 tonnes.
1989	Drought dried up most of the rivers in Northwest Bangladesh with dust storms in several districts, including Naogaon, Nawabganj, Nilpahamari and Thakurgaon.
1994-95 and 1995-96	The most persistent drought in recent times, it caused immense crop damage, especially to rice and jute, the main crops of Northwest Bangladesh and to bamboo clumps, a main cash crop in the region.

Other than change in precipitation, change in temperature might be an important factor as well. An estimated change in temperature along the drought prone region of Bangladesh clearly shows that the temperature will increase in near future (Figure 5.7).

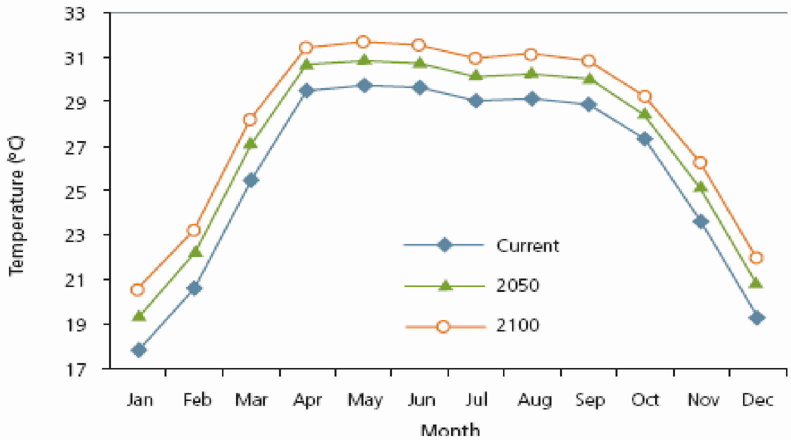


Figure 5.7: Monthly mean temperature for current period (1964-2003) and projected for 2050 and 2100 in drought prone areas of Bangladesh (Ramamasy and Baas, 2007)

5.3 Development of a Methodology for Quantification of Risk: Historical and Future Risk from Climate Change

5.3.1 Risk Indices

There are several risk indices in this case to define risk or vulnerability level of a system;

- Risk
- Reliability
- Resiliency
- Vulnerability

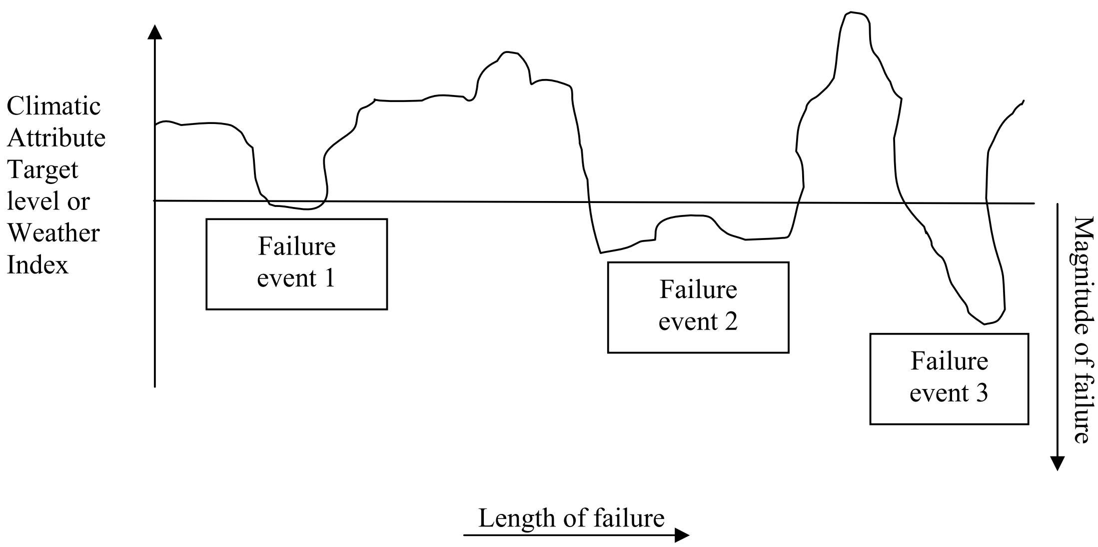


Figure 5.8: Time series analysis of a climatic attribute to quantify risk indices

Hashimoto et al., 1982 introduced the above risk indices for water resources availability study. This study adapted the methodology to apply in quantifying risk derived from climatic changes. This part should be considered as an important value addition of the project output as because quantification of risk is a very important for a sound actuarial analysis. Especially, in the case of Index based Crop Insurance like Weather Index Insurance, this methodology can be used effectively to quantify risk at both present and future scenarios.

Risk is the term defined here as the probability of the system in failure state. The term *Reliability,* on the contrary is the ability of the system to be within target level, i.e. it is the probability of the system being in a satisfactory state. The relationship between risk and reliability is thus established as:

Risk = 1- Reliability

i.e if Reliability, $\alpha = P\{X_t \in S\}$,

Risk = 1- $P\{X_t \in S\} = P\{X_t \in F\}$

Here, S and F are respectively sates of satisfactory and failure condition.

Resiliency is the capability of the system to recover from a failure, i.e. return to a satisfactory state after a state of failure. It can be defined as the conditional probability:

$$\beta = P\{X_t \in S / X_{t-1} \in F\}$$

Vulnerability on the other hand is defined as the severity of the damage that might cause while the system is in failure. It is actually related to the deficit occurs during a failure as:

$$\gamma = \sum s_j e_j \; ; \; j \in F$$

Where, e_j is the probability of the system is in failure state,
s_j as the estimation of deficit.

Figure 5.8 explains the risk indices in a simple manner. Assume the climatic attribute as *Rainfall*. In that case, if the rainfall is below the target level, it can be said as drought condition. Now, assume that historically out of 100 days 30 days the precipitation was below the target level, so the *Risk* of drought occurrence is 30%. In other way the *Reliability* of the system that there will be no drought is 70%.

As it is seen from the figure 5.8, 30 days of failure occurred in 3 failure events, i.e. on an average the length of each drought period was 10 days. Now assume another system where for the same total days of drought condition, i.e. 30 days, there were 10 failure events, which mean on an average the length of each drought period was 3 days. The later system can be said to be more *Resilient* as it can recover from a failure within a shorter period of time. The index is important to quantify as because the loss amount usually multiplies quickly for prolonged climatic extreme events other than shorter ones.

Other than length of failure, as shown in Figure 5.8, another information might be important as magnitude of failure, i.e. for a failure event, the observed value was below the target level by what per cent or magnitude. The magnitude of failure determines the severity of the event, like the height of storm surge or the water level for flooding, which actually determines the *Vulnerability* level from the disaster. Whether a prolonged drought or flood of moderate magnitude or an intense or high magnitude drought or flood of shorter period is more harmful for agriculture, actually depends on crop type.

5.3.2 Characterizing future changes: Risk from Climate Change

5.3.2.1 Components of future changes: Mean and Standard Deviation

As shown in Figure 5.9, actually the component of the future changes can be either change in mean or change in fluctuation or variance. For the case of climate change actually a range of future possibilities are possible, rather than a fixed value (Figure 5.9). In this case, in a changing climate whether the attributes exceed the coping range is the main concern. For example, if the climatic attribute here is rainfall, if the rainfall event is beyond the straight line above, it may be considered as an extreme weather event, namely Flood. Likewise, if the rainfall amount is lower than the line below, it is a drought event. In between the two lines the system is robust enough to absorb shocks and can be considered as its coping capacity. So, along with the prediction of future changes in mean values, prediction of the future scenarios of fluctuation range is important as well.

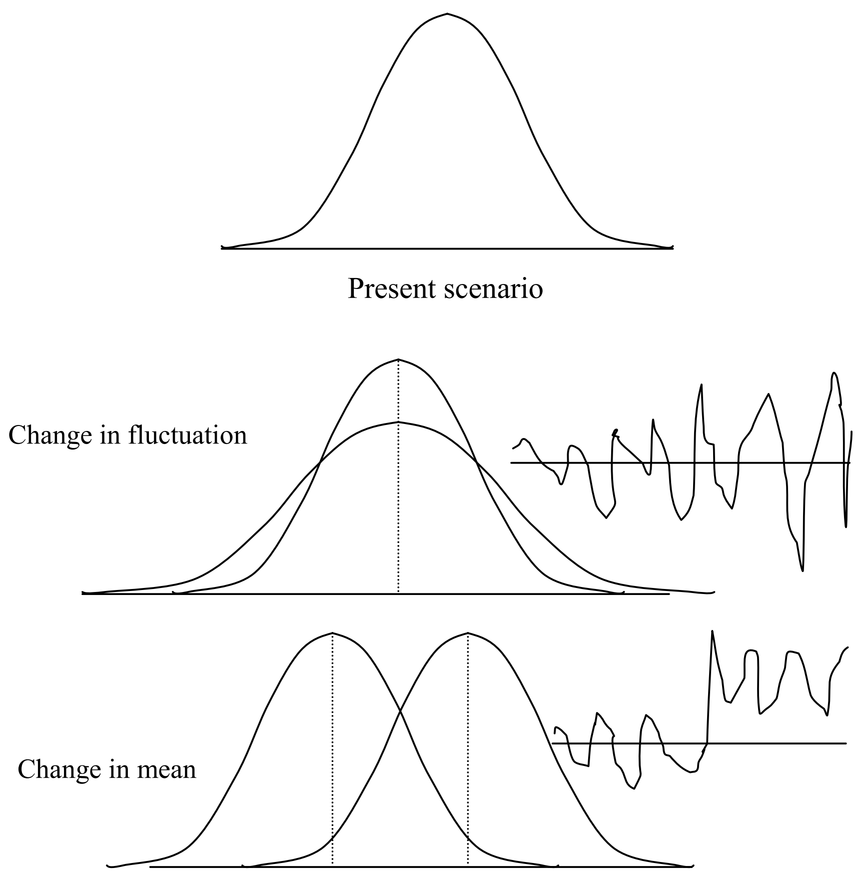


Figure 5.9: Characterizing future changes in climatic attributes.

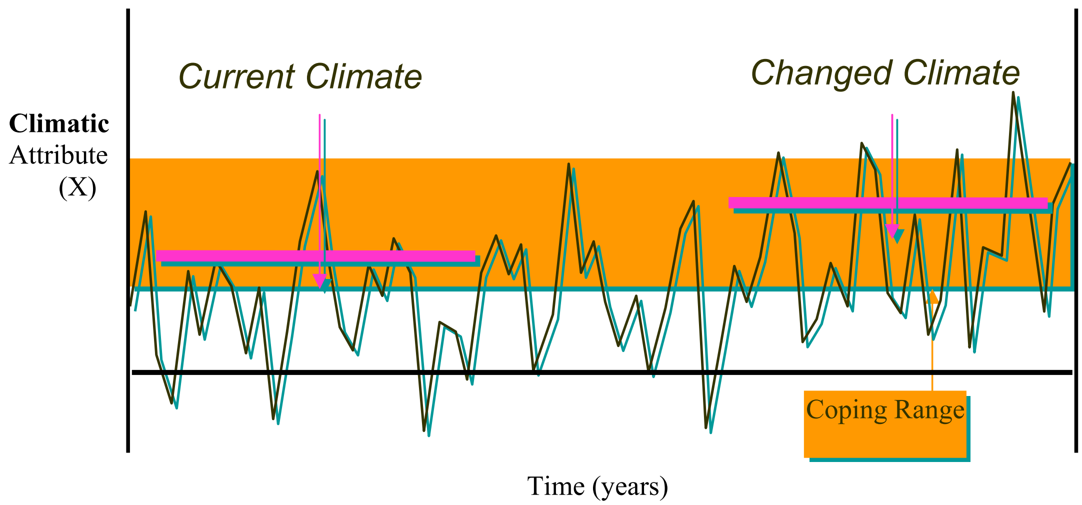


Figure 5.10: Assessment of climate change impact on the water resources
(Modified after IPCC, 2001)

5.3.2.2 Synthetic generation of future climatic attributes for risk quantification: Monte Carlo Simulation

A Monte Carlo simulation is an analytical technique of simulating a large number of different sets of future climatic scenarios, based on future prediction of mean and fluctuation nature and generating random numbers. The synthetically generated sets of output later can be utilized to estimate different risk indices as described in section 5.1. While applying this Monte Carlo simulation for climate change study, one important problem is to predict the magnitude of future fluctuation, i.e. standard deviation. Most of he GCM outputs do not calculate standard deviation of the monthly values over a year under future climatic changes, rather only the change in mean temperature and precipitation. Through downscaling or further statistical analysis of GCM values one can have idea about future variation nature of a climatic event as well. In other case, historical correlation between the mean and standard deviation of a climatic attribute can be extended for future scenarios. However, a number of studies are available nowadays which addressed the issue at global and regional levels, so that at least a qualitative information about the nature of change in magnitude of fluctuation or variance change of a climatic attribute at a particular region is still possible. Figure 5.11 shows a typical model for Monte-Carlo simulation.

Provided the mean and standard deviation of a future climatic variable is known, using normal distribution, the value of a variable, X can be calculated as;

$$X = \mu + \sigma Z$$

Here Z is the standard normal variate, which can be calculated from a standard normal distribution probability plot. The standard normal distribution is a normal distribution with a mean of 0 and a standard deviation of 1. Normal distributions can be transformed to standard normal distributions by the formula:

$$z = \frac{X - \mu}{\sigma}$$

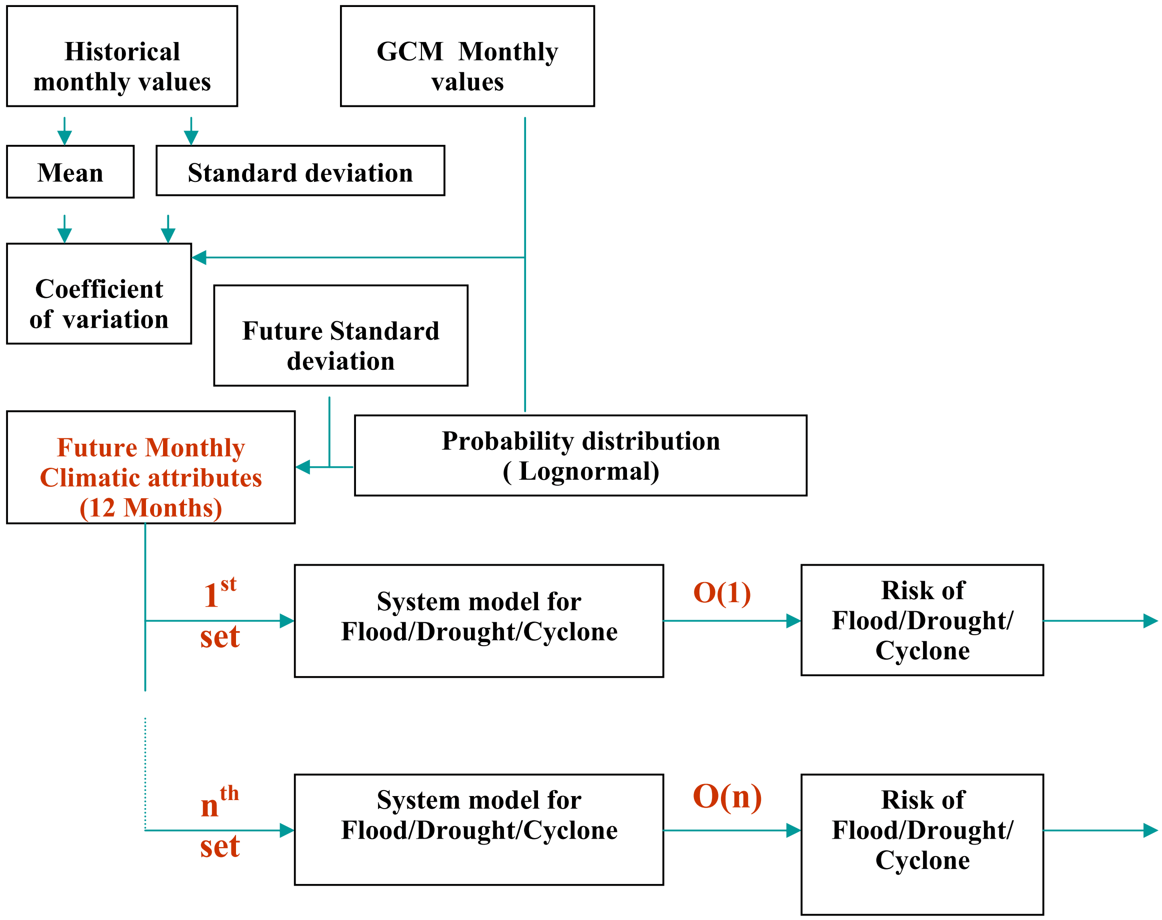


Figure 5.11: A conceptual model for risk analysis by generation of synthetic future climatic attributes under changing climatic condition

Where, X is a score from the original normal distribution, μ is the mean of the original normal distribution, and σ is the standard deviation of original normal distribution. The standard normal distribution is sometimes called the z distribution. If the value of μ and σ is known, for a set of random number generated the Z values can be estimated for the normal probability plot. Figures 5.12 (a) and (b) show an example of generating 100 sets of monthly precipitation values for future scenarios of doubling CO_2 level, based on GCM predicted change in precipitation amount.

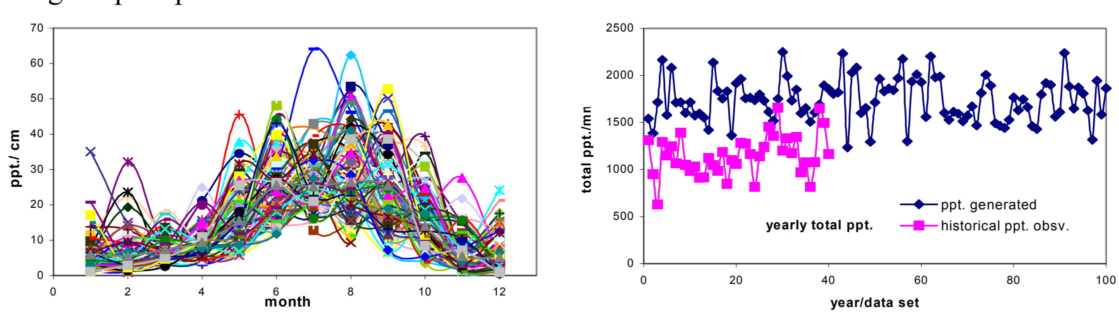


Figure 5.12: (a) Generation of synthetic monthly data set for the Monte Carlo Simulation, and (b) Yearly total amount of the historical observed and generated synthetic precipitation data

Use of First order *two-states Markov chain approach* can further regenerate synthetic data of daily precipitation sequences like rainy or non-rainy day, which might be important for drought assessment.

5.4 Data Required for Risk Assessment and Availability

1. *Historical Data on Hydro- climatic parameters* like Tempoerature, Precipitation and river runoff: The data is available for a number of stations covering the entire country up to last 60 years, which would be good enough to assess the historical mean and standard deviation. If future sequence of daily rainy and non-rainy day data is required to generate synthetically, daily data of past 40 to 50 years is required, which can be used in a first-order two-states Markov chain model.
2. *Future climatic data*: can be derived from GCM model and downscaled for Bangladesh. A study by a BUET professor is undergoing on the topic of downscaling climatic data for Bangladesh. This can be used to get the future climatic scenario of Bangladesh.
3. *Schoastic model:* The methodology described in the previous section can be modeled either in an excel spreadsheet environment or written by a programming language. Both the Monte-Carlo Simulation and Markov Chain model is quite familiar in hydro-climatic analysis, which can be classified as a schocastic model as it includes probabilistic components.
4. *Risk Assessment*: The generated values can be used to estimate the risk indices for future climatic condition and compared with present to quantify changes is risk level, which can be an important information for both insurer and insured.

Chapter 6: Crop Insurance - Data Collection and Analysis

6.1 Field Survey

As it is mentioned in the conceptual framework of CI that the key elements of the program are to determine the Coverage of Farmers, Coverage of Crops, Determination of Sum Insured and loss assessment, Determination of Premium, Loss Adjustment Mechanism, Organization Structure, Financing of the Scheme, Communication with Farmers, Reinsurance arrangement. Most of the issues are related to farmer's response i.e. how they like it to be. Considering the nature and magnitude of disaster the response will vary among farmers. At the same time individual farmer's understandings about disaster phenomenon, climate change mechanism and future trend and its probable effect on the agriculture sectors - will determine how seriously they will take the issue. Economic level of farmers also affects their choice in many ways like level of premium and the number of perils they like to cover.

Considering all the above issues, the first part of the questionnaire survey was designed to get response from the farmers, i.e. to understand the demand side of the program - how demandable crop insurance is and how much the farmers can contribute, or their preference of organizational structure, etc. A number of factors were considered while determining the sites for field survey as well. **Three major criteria** considered here were as follows;

- First criteria: the survey sites should cover different types of disasters that can affect agriculture.
- Second criteria: the survey sites should cover variation in vulnerability level for a particular disaster at a particular site.
- Third criteria: the survey sites should include farmers of different economic condition.

6.1.1 Selection of Survey Sites

Identification of Region with different types of disasters affecting Agriculture

As it is already mentioned that the climatic disaster that mostly affect agriculture production in Bangladesh are Flood, Drought, Tropical storms, Hail storm, salinity intrusion and Cyclonic storm surges. Among these disasters three of them as flood, drought and cyclonic storm surges have the most severe impact and cause for maximum amount of losses (Table 5.1). Also these particular disasters have direct relationship with climate change. As it is already seen from the IPCC assessment of future trend in precipitation and temperature (Table 5.2) in Bangladesh that both the flooding and drought intensity will be intensified with the change in climate. Increased intensity of cyclone and storm surges are also expected as the sea surface temperature used to rise (above 26 deg C) with global warming. As of first criteria, three sites were thus selected to cover the range of disasters affecting agriculture sector as;

- Flood
- Drought
- Cyclone and storm surges

Disaster type: Flood

Flood affected site selected: Tahirpur thana of Sunamgonj district

Around 80% of Bangladesh is floodplain. Flood is almost a recurring event and agriculture is probably the worst hit due to flooding. As shown in Figure 6.1 flood used to affect almost all the country more or less. However, there are regions specifically vulnerable to flooding. Figure 6.1 shows different regions of Bangladesh vulnerable to different types of flooding. Sunamgonj is one of the regions highly vulnerable to flooding of flash flood type and used to be affected almost every year. Tahirpur Thana of Sunamgonj district is again a region located along the Haor region.   As it is seen from Figure 6.2 and Table 6.1 that almost every year water level crosses the danger level along the region.

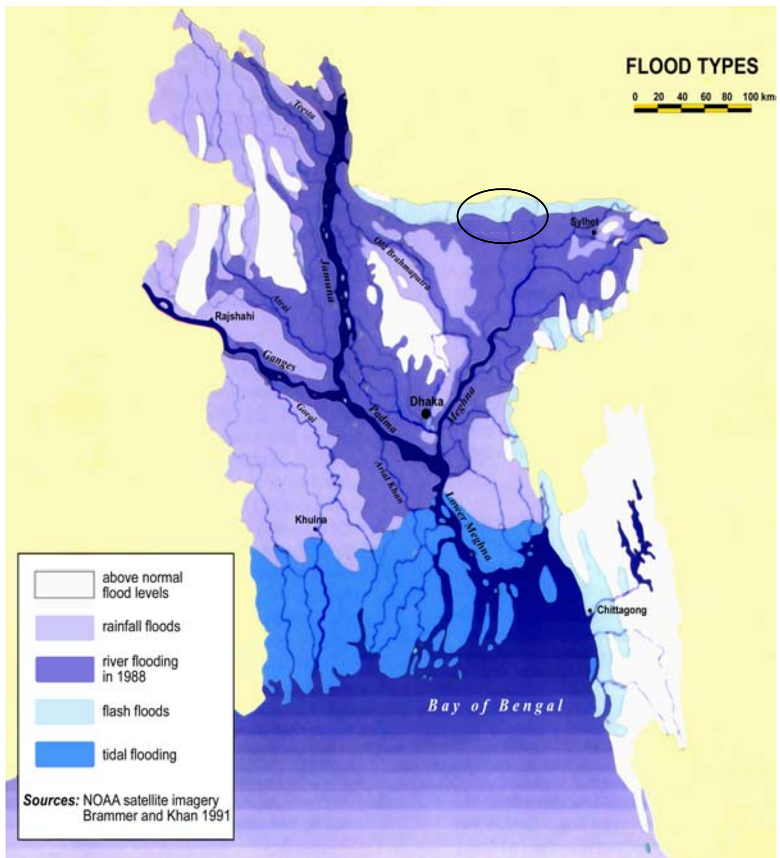


Figure 6.1: Major flood types in Bangladesh

The flash flood causes huge destruction for the *Boro* crop only when it onslaughts earlier. This early flood not necessarily because of water level above danger level, but damage the Boro crops ready to harvest during April and May. A special type of submergible embankment used to be constructed to protect crops from early flood, which later washed away with increase in water level in the mid of monsoon. known Another substantial damage occurs in the month of *Kartik-Agarahayon* due to the late flash flood. Among all, *Boro* crop damage is the most severe because most of the people of the study area grow *Boro* paddy extensively. After flash flood deposition of huge amount of silt over the land or increased sedimentation of river also affect agriculture.

Son of* BoroBari *now day labor (Curtesy: CNRS)

A Kader (65) S/O, Late Hazi Habibullah having education at literacy level belongs to village horinagar of beheli union under jamalgonj upazila.

In 1964 he owned 18.00-acre land from his fathers' property. Inspite of flood damage at that time he was able to maintain a large family of 12-member. But some unlucky incident took place subsequently which made his life miserable.

1984 flash flood damaged his crops heavily. Moreover he had to offer bribe to a local matobbor to secure his possession of a shop in sachna bazaar. He managed this money (Tk. 15000) by selling 1.00 acre of land because all his crops were damaged due to flash flood. In 1985 again he faced flash flood crop damage. But he had to sell more 1.00 acre of land (Tk 9000) for his eyes treatment. Again in 1990, flash flood damaged his crops to an extent that he could not manage money for family maintenance and daughter's marriage. For this reason he had to sell 3.00 acres of land.

By this time he lost one son and other two preferred separation and they were given 3.30 acres of land. Now this old man has only 3.00 acres of land under his possession.

He himself and his sons had to go for work as day labors to cope in crisis period due to last consecutive three years (2000-2002) flash flood damage. He could manage only 4-5 months food demand from own yields and have to work as day labor, fishing and sand labor with his sons to maintain family over rest period of the year. Once upon a time, this family was called as 'Baro Bari' (big house) in this village' though they are now labors.

According to a study by CNRS, the paddy yield per acre (mounds, md) along the Haor areas of Sunamgonj have been estimated and compared between normal season and the affected year is given in figure-6.3 below. It reveals from the figure that there is significant difference of paddy yield found in normal year and flashflood affected year. The variation found with a range of (15-29 mounds/acre).

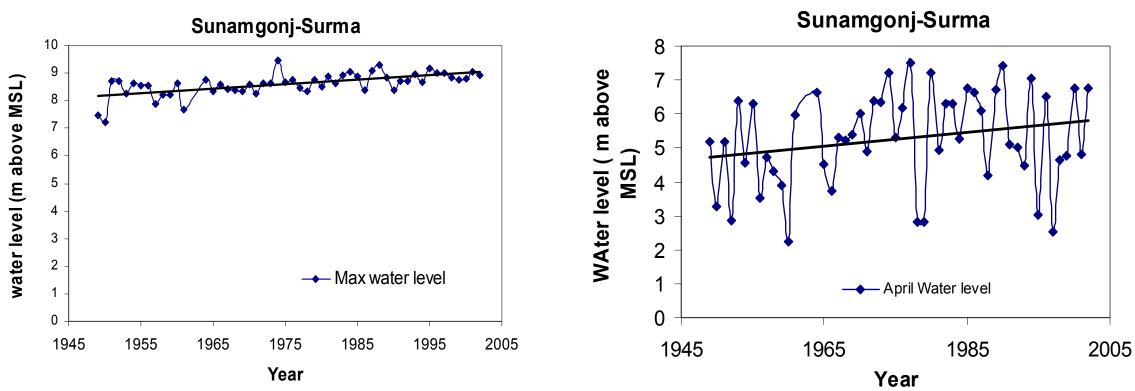


Figure 6.2: Historical time series of water level for the river Surma at Sunamgonj

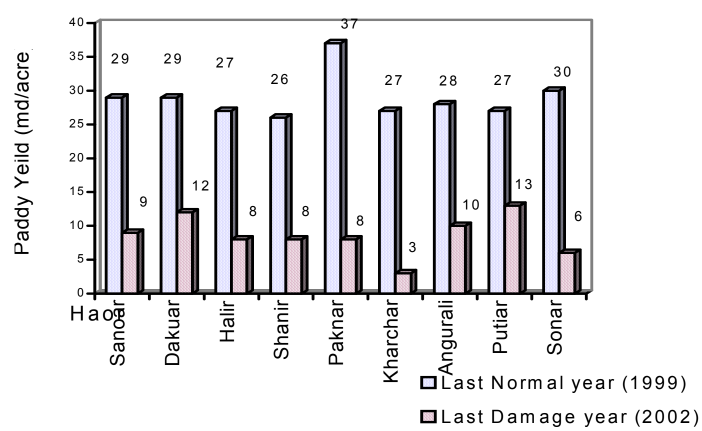


Fig 6.3: Paddy yields (md/acre) of normal and damage year in some Haor area of Sunamgonj

Table 6.1: Last 10 years Maximum water level of Sunamgonj area (BWDB Station)

Year	Maximum from Mean Sea Level	
	Height (meter)	Recording Month
1988	9.30	July
1989	8.92	July
1990	8.13	August
1991	8.80	June
1992	8.81	July
1993	9.02	June
1994	8.72	June
1995	8.66	August
1996	9.04	July
1997	9.03	July
1998	8.90	August
1999	8.80	July
2000	8.85	August
2001	9.10	August
2002	9.00	June

Drought and Manga

The north-west region tends to be disaster prone, which has a substantial impact on food security. It is particularly susceptible to flooding during the monsoon season. When the river overflows, the area floods, due to the slope of the land, the water does however drain quite quickly. However the flooding usually destroys crops and poorly built houses almost every year to varying degrees. More often drought causes damage of crops and reduce yield in the area.

Drought and Manga affected site: Hatiabandha Thana of Lalmonirhat

To address the changing pattern of crops in the disaster prone area of north-west Bangladesh, a study was undertaken at Lalmonirhat district considering most disaster prone North-west district in the country. Transitory food insecurity is associated with seasonal variation in food production and natural hazards such as flood, cyclone and draughts. The extreme form of transitory food insecurity in the district is near-famine is more visible in the name of Monga in the area.

The district demarcated as an Active Tista Floodplain zone in the country and the crops patterns are mostly characterized with Tista basin area. As per vulnerability and poverty mapping of the country (BBS, WFP – 2004) the following key factors are comparatively high in the district. Those are main consideration for selecting the area for study. The key factors are:

1) Proportion of population below the lower poverty line
2) Resource allocation required per upazila to eliminate extreme poverty / vulnerability
3) Range and number of extreme poor by district
4) Monga-hit area in the region
5) Anticipate climate change impacts on crop pattern and productions
6) River eroded area

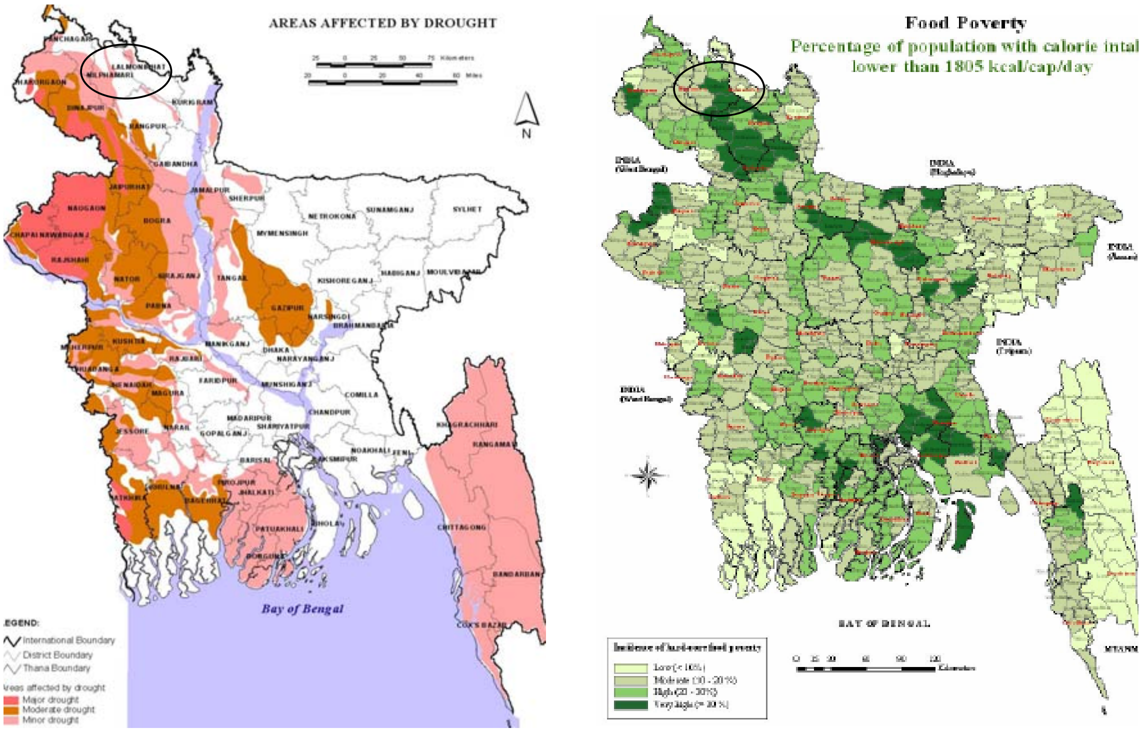


Figure 6.4: Drought prone regions of Bangladesh

In order to produce a clustering and ranking of most vulnerable upazila in terms of there relative vulnerability status, an index to be derived based on the Direct Calorie Intake (DCI) & Cost -of-basic Needs (CBN) method considering above key factors. By summing the rank / clustering values of each upazila a total score to be derived and Hatibandha upazila under Lalmonirhat district to be the most appropriate for both its location and geo-ecological characteristics also considering key factors as per food security atlas of Bangladesh (Towards poverty and hunger free Bangladesh – 2004, WFP). A most vulnerable union among all unions of Hatibandha upazila was selected for sampling for the study.

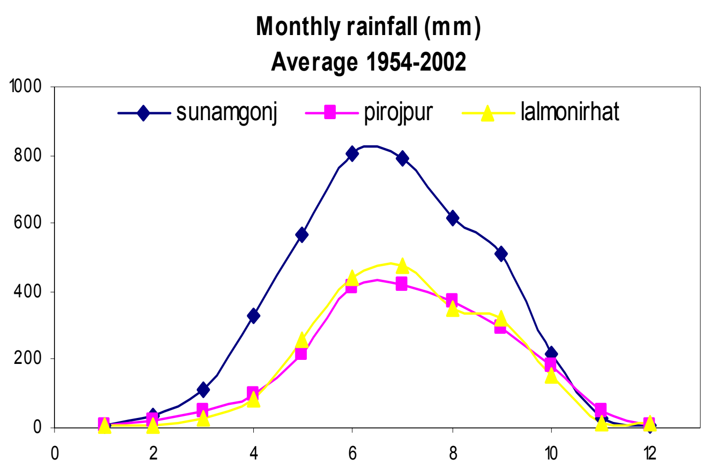


Figure 6.5: Monthly rainfall variation among three field survey sites

Cyclonic Storm Surge and salinity intrusion

Incidence of disasters like floods, cyclones and land erosion significantly affect lives, agriculture and properties of the coastal region. Cyclone accompanied by tidal surge is the most damaging natural disaster, which takes a heavy toll on life and property. For example, 59 major cyclones hit the coastal belt of Bangladesh during 1795-1991 (CERP, 1999). An analysis based on the occurrence of cyclones over a 50-years time interval shows an increasing trend of cyclone occurrence (see Figure 6.6). It is expected that climatic changes will further result in increased incidence of cyclones and related storm surges.

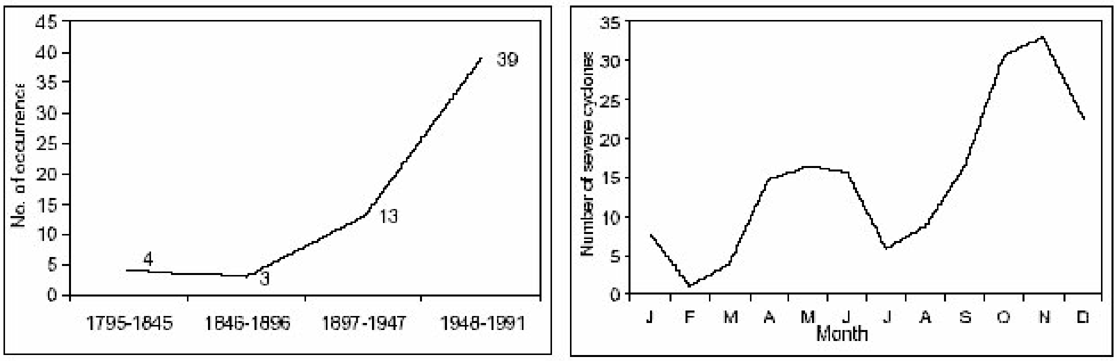


Figure 6.6: Trend occurrences of Cyclone and time

Cyclones mostly occur in the pre-monsoon and post-monsoon months (CDL, 1992: 16). This has been shown in Figure 6.6. Incidentally, main rice crops are at the ripening stage or are ready for harvest during those months (Boro in April-May and *T.Aman* in October-November). Salt water intrusion is another problem, contributed by both natural and anthropogenic effects. Lowering of flow along the Ganges river due to upstream water withdrawal at Farakka ultimately affecting the rivers fed by Ganges in the area known as Ganges Dependent Area or GDA. Figure 6.9 shows the intrusion of slat water along GDA after the construction of Farakka. Other than this, trapping of salt water for commercial production of brackish water shrimp or salt production also affected large coastal area increasing salinity level in soil, groundwater and surface water.

Households adopt a wide range of strategies to cope with crises. According to the *Poverty Monitoring Survey 1999* (BBS, 2002b), major coping strategies are: borrowing from different sources; sale/mortgage of land and other assets; and using up savings. Credit is a critical resource, as it helps households to recover from or to cope with crises. This is even truer for poor households. Access to institutional sources of credit is a limiting factor. According to data of the *Poverty Monitoring Survey 1999* (BBS, 2002b), the majority of households still depend on various non-institutional sources of credit (poor households 58% and non-poor households 52%). Among the institutional sources, commercial banks are a major source for the non-poor (21% of the households); while *Grameen Bank* is a major source for the poor (16% of the households). NGOs cater only three percent of the poor and four percent of the non-poor households (BBS, 2002b).

Source of credit	Percentage of households		
	All	Poor	Non-poor
Institutional sources			
Bank	17	11	21
Grameen Bank	14	16	13
Co-operative	10	11	10
NGO	4	3	4
BRDB/Youth Development	1	1	1
Sub-total	45	42	48
Non-institutional Sources			
Relative	23	24	23
Non-relative	14	17	13
Money lenders	11	12	11
Others	6	6	6
Sub-total	55	58	52
Total	**100**	**100**	**100**

Components may not add to totals due to rounding.

Source: BBS, 2002b

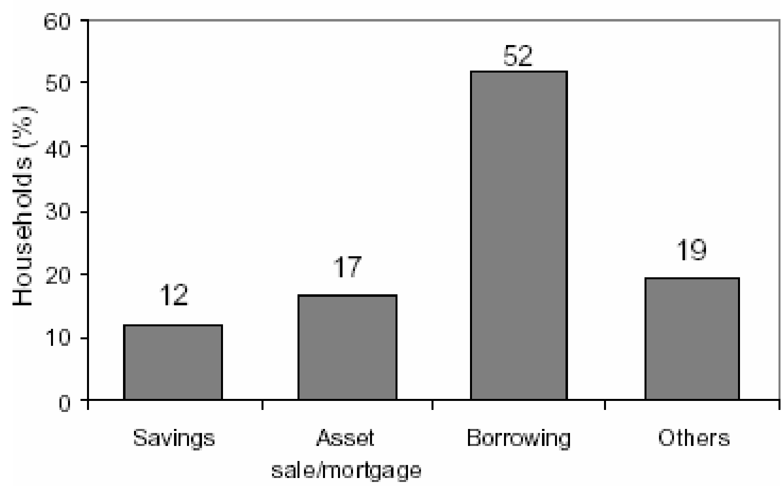


Figure 6.7: Response to disaster along the coastal region

Cyclonic Storm Surge and salinity intrusion affected site: Mathbaria of Pirojpur district

As per definition of coastal zone, shown in Figure 6.8, Pirojpur is located mostly within the interior coastal zone. Compare to exposed zone, interior zones are more important from agricultural production point of view as because the salinity level there is still tolerable for traditional agriculture production. As shown in Figure 6.11 land classification of Pirojpur is grouped under non-saline non-calcerios type, which is suitable for two crops as Aus and Aman (Figure 6.10). However, gradual intrusion of saline water either due to sea level rise (Figure 6.9) or upstream water withdrawal along the Ganges (Figure 6.9), the agricultural production of the region is under serious threat. Apart this, significant damage in agriculture is still possible in the region because of Cyclone and storm surges, as it was evident during recent cyclone event the SIDR.

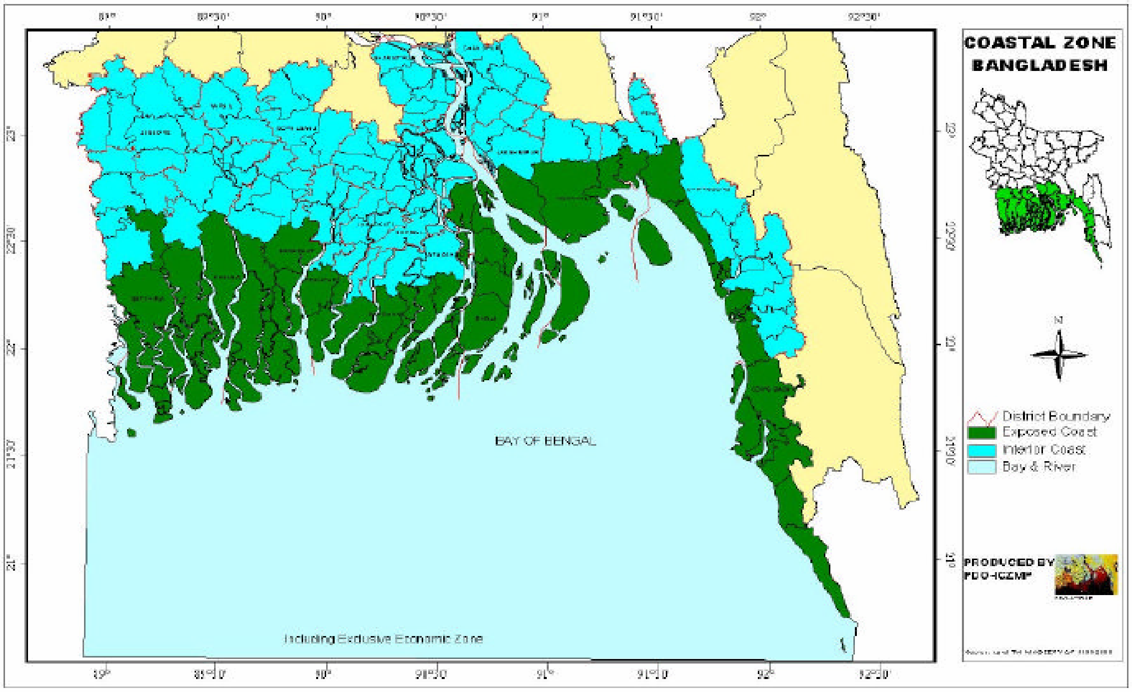
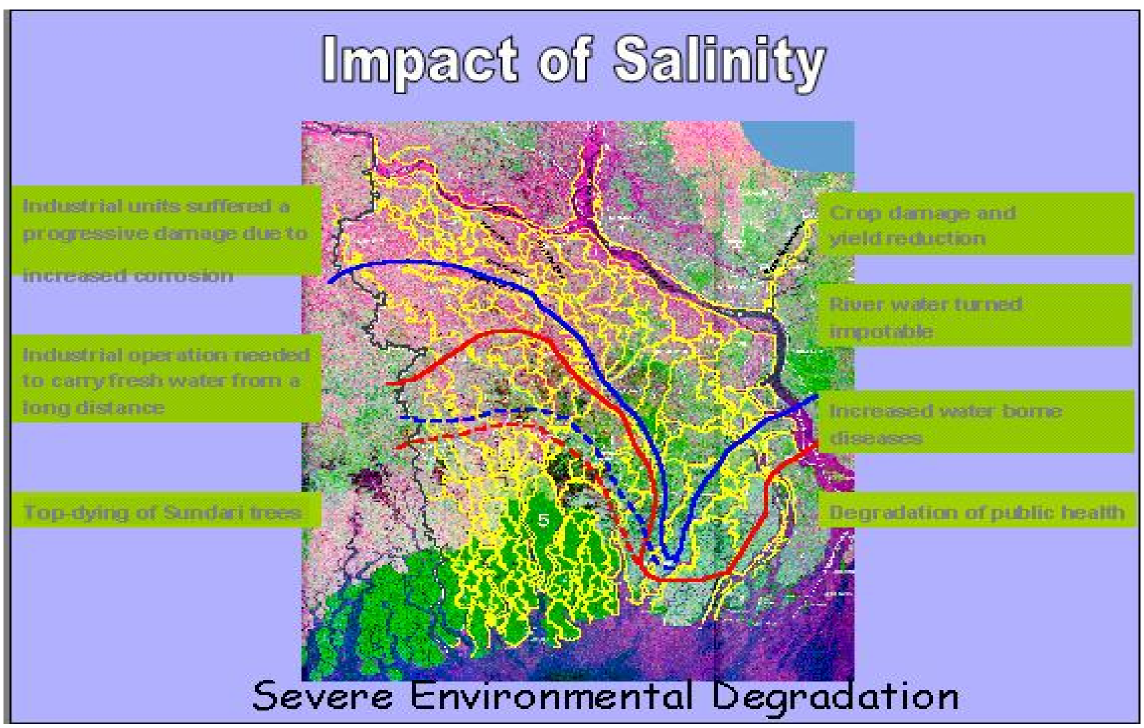


Fig 6.8: Delineation of coastal zone of Bangladesh



Note: *Red - 10 ppt line*
Blue - 5ppt line;
Dotted lines - Before construction of Farakka Barrage
Solid lines - After construction of Farakka Barrage

Figure 6.9: Salinity intrusions along the coastal region of Bangladesh

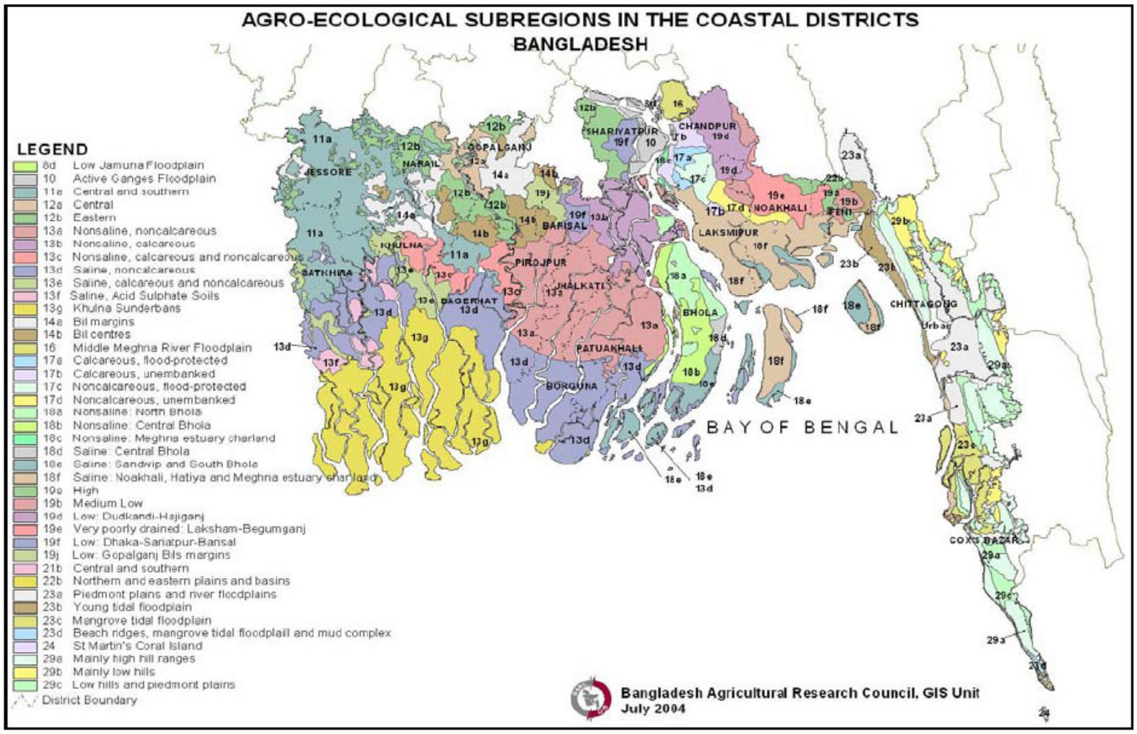


Figure 6.10: Agro-ecological sub-regions in the coastal districts of Bangladesh

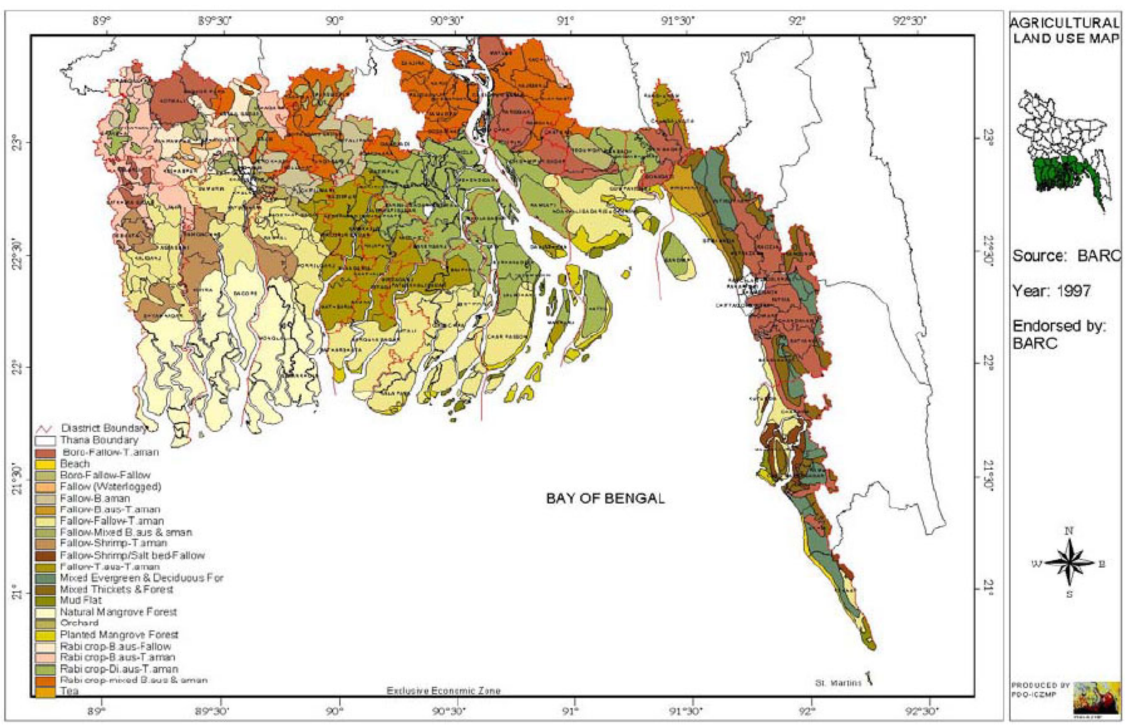


Figure 6.11: Agricultural land use map of the coastal zone of Bangladesh

6.1.2 Selection of Sample and Survey of Farmers

Identified and made a list of 150 farmers, whose primary source of income is agriculture cropping. The list included 50 farmers each from 3 categories: big, medium-size & small farmers (based on the BBS criteria: > 7.5 bigha (bigfarm), up to 7.5 bigha (medium) & up to 2.5 bigha (small farm). These farmers were then divided equally for most vulnerable, moderately vulnerable & less vulnerable areas.

- Conducted the field survey in the form of filling up the Bangla Survey Questionnaire supplied by DESM, NSU, while talking one-to-one.
- Conducted 3 FGDs with each group & one FGD in a combined group.
- Conducted interviews/discussions with LG officials, Key Informants, etc.
- Collected data on local climate and natural disasters including rainfall for the last 10 years.

6.2 Survey Results

Understanding about climate change, disaster types and frequency: Surprisingly, it was found that almost all the respondents were quite aware of the fact that climate or surrounding environmental factors are changing and affecting crop production adversely. At Sunamgonj the farmers are mostly affected by flood. They also noticed change in amount and frequency of rainfall events. Unusual climatic phenomenon like untimely cold and warm spell was also occurring frequently nowadays, which they never encountered even 10-15 yrs. back. At Pirojpur, salinity intrusion is increasing day by day and land fertility decreasing. Lalmonirhat is affected by both Flood, drought and along with another as hailstorm. Unusual weather spell also affecting there. At an interval of 3-5 yrs. all the regions are suffering from disasters affecting agriculture production.

Existing disaster management or support scheme: Existing disaster management mostly includes relief distribution by government, not necessarily for agri-damage but for overall losses. Distribution of bank loan is another means. Corruption and bureaucratic delay hamper farmers having relief or Bank loan. Local government bodies are involved in distributing relief but no farmer's representative. In some places local NGOs support farmers, even by distributing relief.

Self reliance of people to recover from disaster: Farmers take a number of measures which vary among economic level. As shown in figure 6.12, rich farmers mostly can get the advantage of Bank loan and Micro-credit, while the small and medium farmers have to depend on personal lending or from Mohajans. Rarely the farmers have co-operatives or saving culture for disaster recovery.

Understanding about Crop Insurance and its acceptability: Even though most of the farmers are not aware of the Crop Insurance scheme, but they have idea what insurance means. Many of the NGOs offering Micro-credit offer life insurance. Most of the farmers agreed to be part of the CI programme. However, they need to be further clarified about the scheme in detail.

Premium level: Premium level for crop insurance used to be selected as percentage of crop yield per season. However, to make it understandable to farmers, question was asked as what monthly amount they are willing to pay. The amount might be taken in installment or per season. Sunamgonj, as Haor region, mostly produce one crop in a year. Farmers willing to pay minimum amount compared to other two regions and within Tk. 50 to 100 per month. While in Lalmonirht, they can produce 2-3 crops. Premium willing to pay there varies from Tk. 50 to 300 per month. At Pirojpur mostly produce two crops. Premium level varies around Tk. 50 to 200. On an average the willingness to premium payment rate is around 3-6% of yield value per season. The amount varies among rich, poor and medium farmers as well as high, low and medium risk zones. At Sunamgonj it is evident that the rich people like to pay more, likewise the highly vulnerable group.

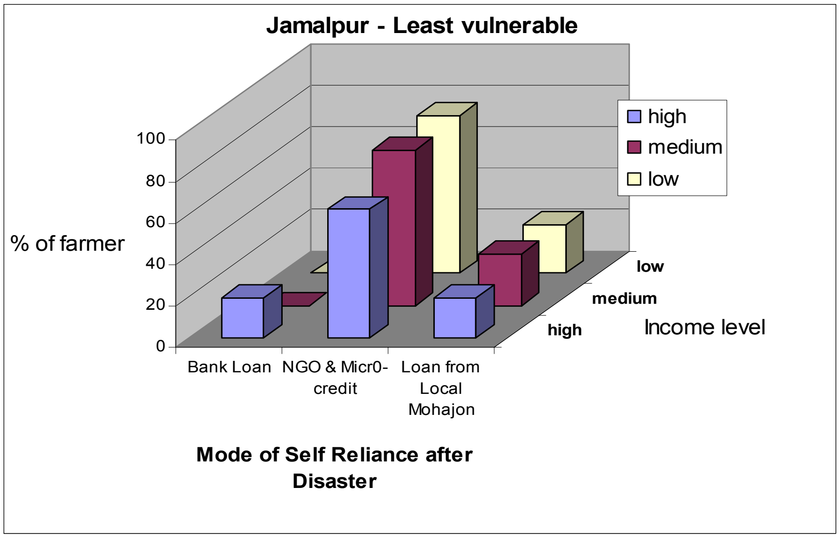
Organizational structure preferred: About the choice of organizational structure, there are mixed reaction. Farmers from Sunamgonj and Pirojpur preferred NGO as the most suitable for CI programme. However, farmers from Lalmonirhat preferred Bank. Probably it is because of the confidence level. For some reputed NGOs people have confidence, as it is better than bureaucratic harassment and corruption of government bodies. However, the sustainability of NGOs in the long run is crucial question as well. In Lalmonirhat it happened that an NGO took money for Crop Insurance purposes but later became bankrupt and went in hide. There is no such problem for government organization or large insurance companies or Banks.

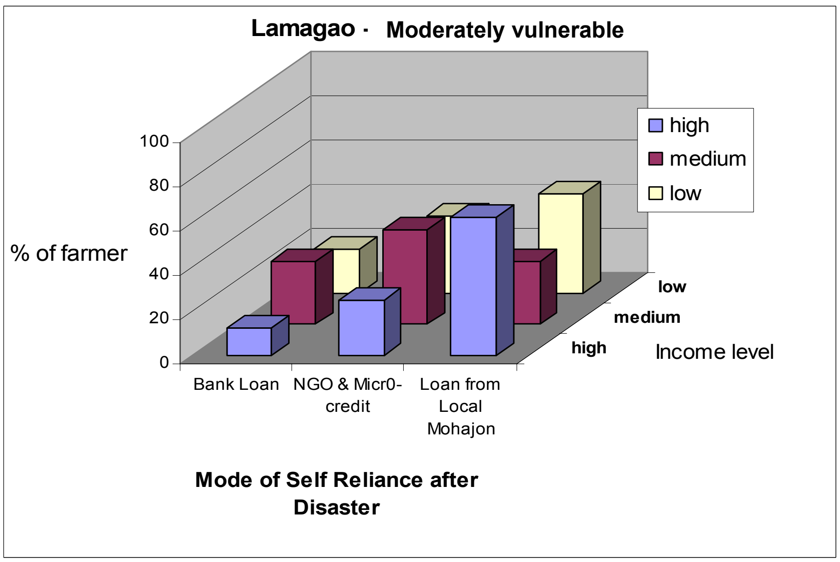
Other concern regarding CI implementation: In most cases farmers want them to be protected from all sorts of disasters, i.e. multi-peril. Regarding adverse selection and moral hazards, their answer implies no such intention. It may be true for some initial years as because they might not abruptly change their cultivation practice simply because they are under crop insurance program. With the progress of CI programme, whether they will indulge in such adverse selection and moral hazards depends on the administrative quality or integrity level. At present they are rather suspicious that whether they will get adequate compensation in the long run.

Table 6.2: Farmer's response to CI

Mode of Self Resilience	**Land ownership**			**Vulnerability level**		
	Low	Medium	Large	Low	Medium	high
	%	%	%	%	%	%
Bank Loan	14	25	22	10	27	20
Micro Credit	20	17	19	38	3	3
Assistance from NGO	43	41	38	37	51	53
Loan from Local Mohajon	22	17	20	14	20	24

Premium (willing to pay)	**Land ownership**			**Vulnerability level**		
	Low	Medium	Large	Low	Medium	high
	%	%	%	%	%	%
Tk. 50	61	50	27	53	53	20
Tk. 100	14	35	40	29	31	36
Tk. 200	23	11	15	11	8	17
Tk. 300	2	2	12	5	7	16
Tk. 400	0	0	4	1	1	5
Tk. 500	0	2	4	1	0	5





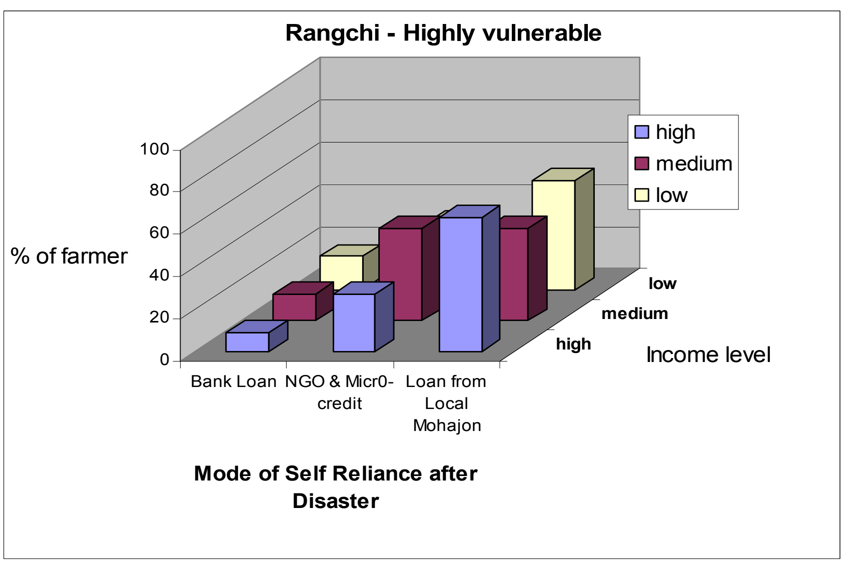


Figure 6.12: Mode of resilience after disaster for low, moderately and highly vulnerable areas of Sunamganj

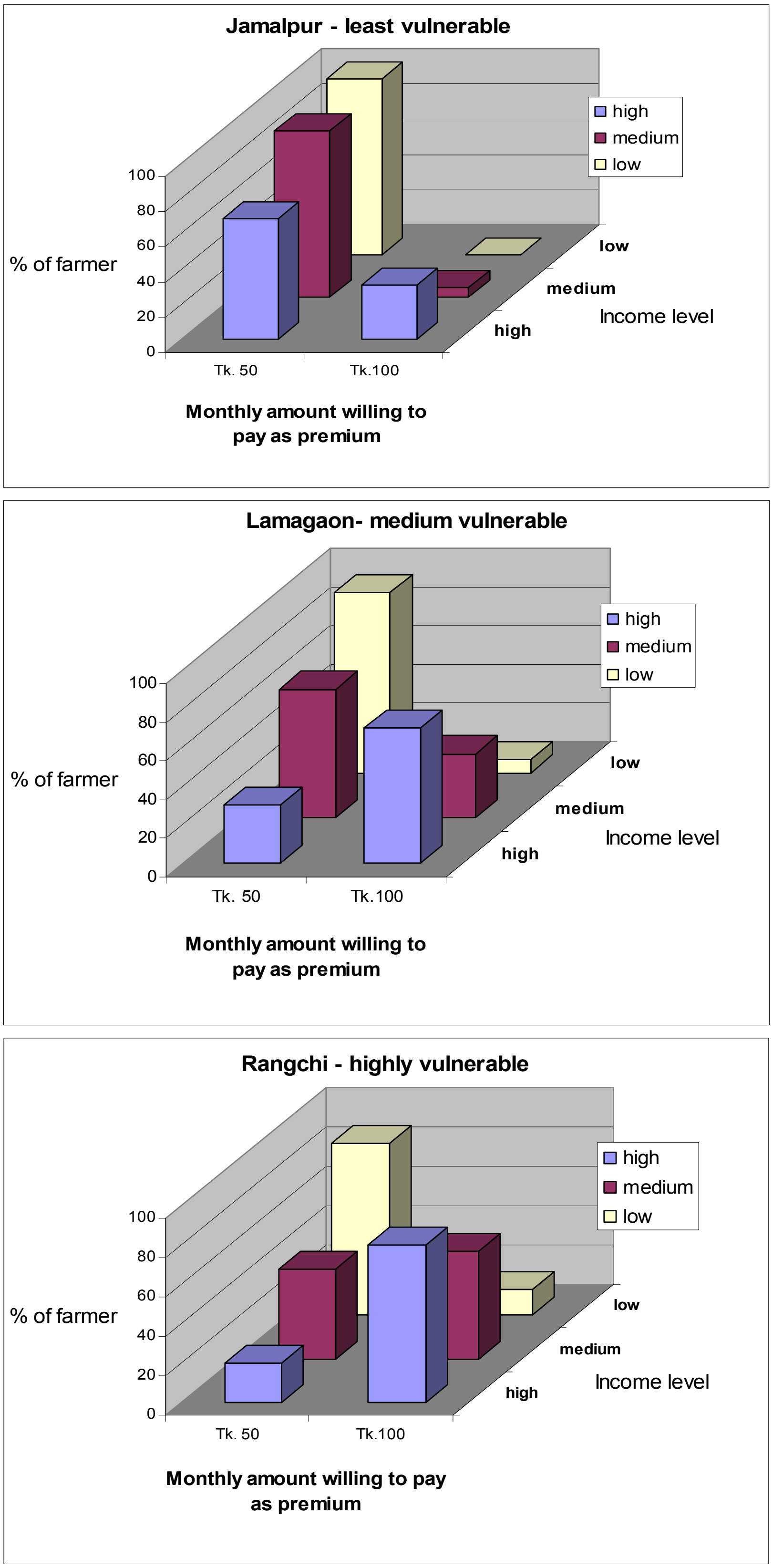
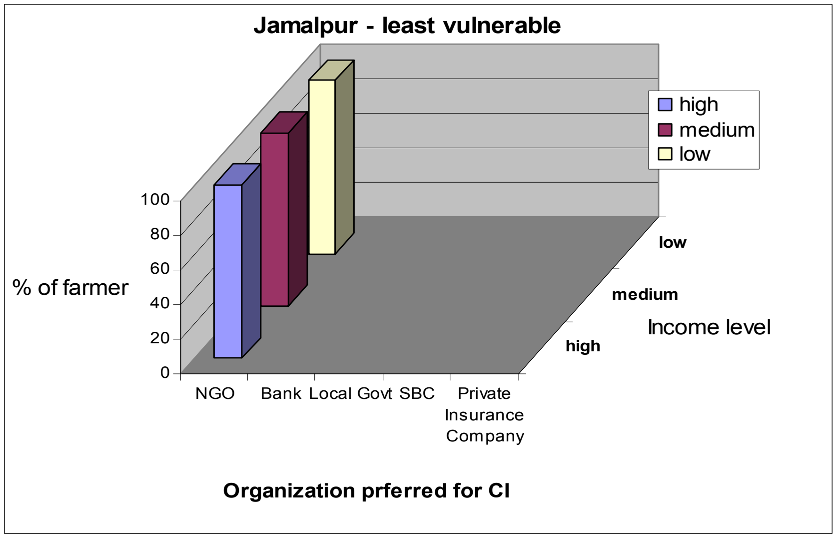
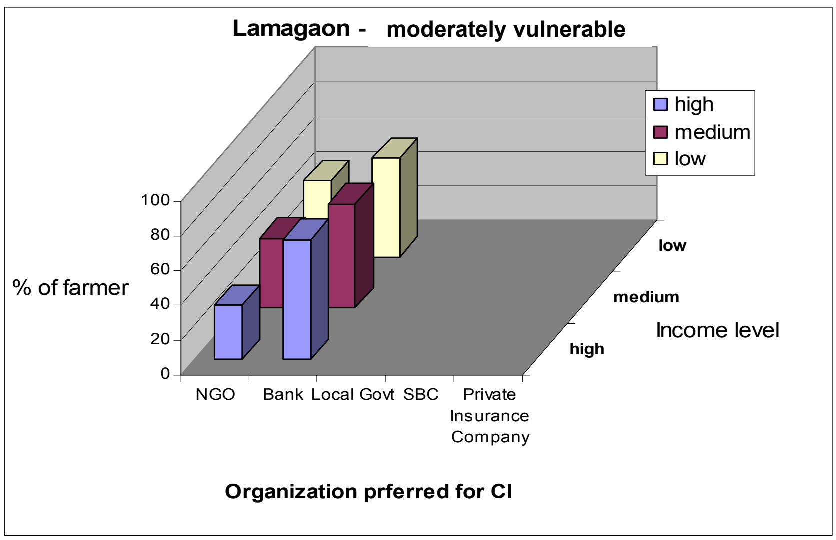


Figure 6.13: Monthly WTP as a premium in low, medium and highly vulnerable areas of Sunamganj





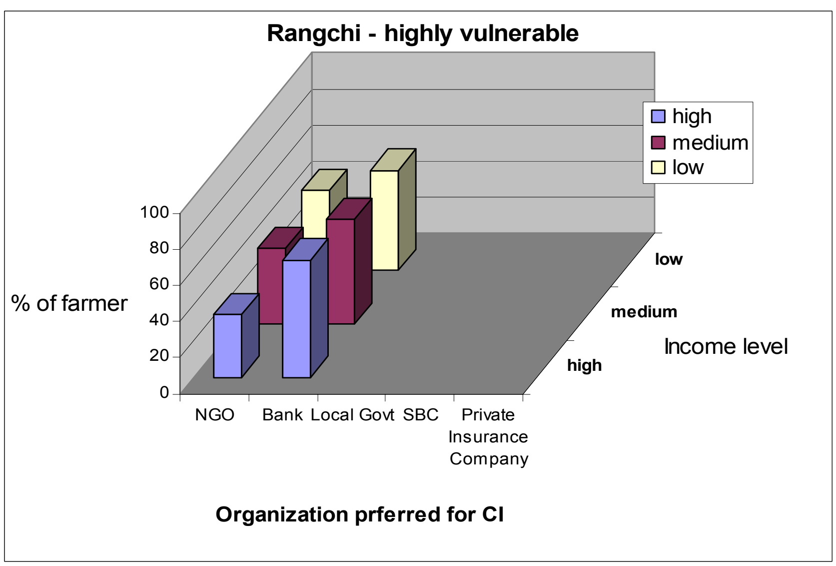


Figure 6.14: Organizational preference for CI by the respondents in Sunamganj

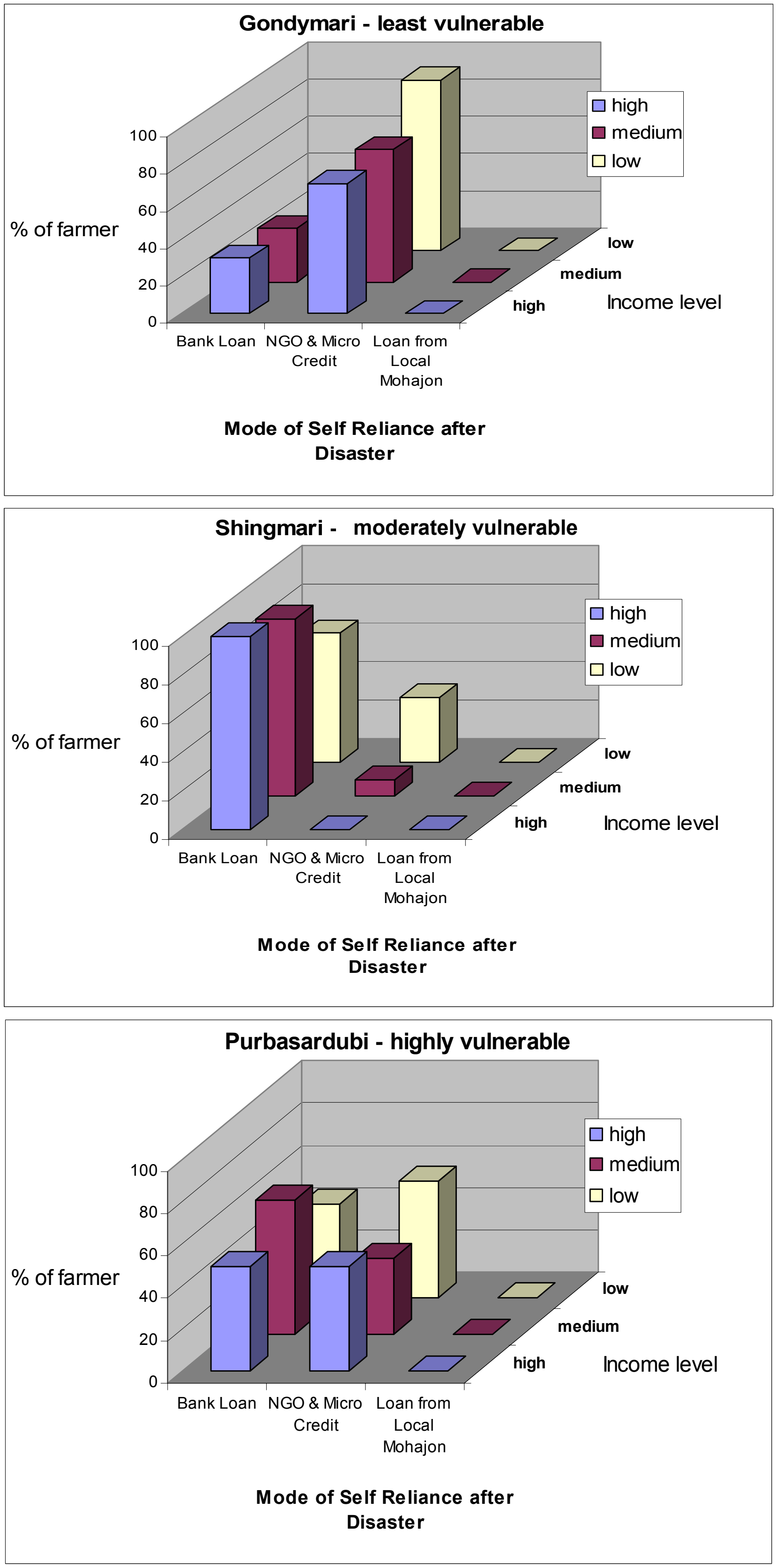


Figure 6.15: Mode of resilience after disaster for low, moderately and highly vulnerable areas of Lalmonirhat

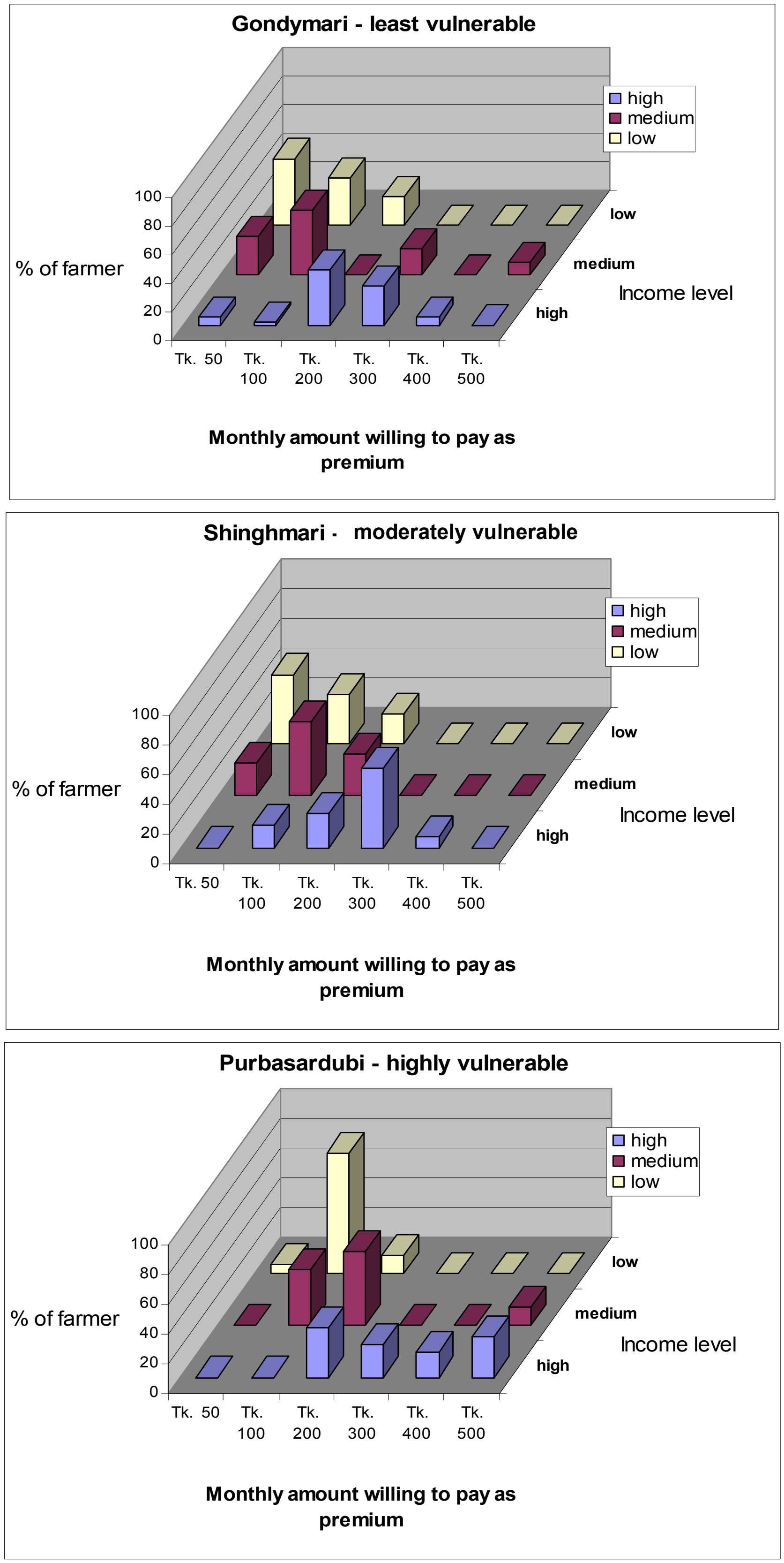


Figure 6.16: Monthly WTP as a premium in low, moderately and highly vulnerable areas of Lalmonirhat

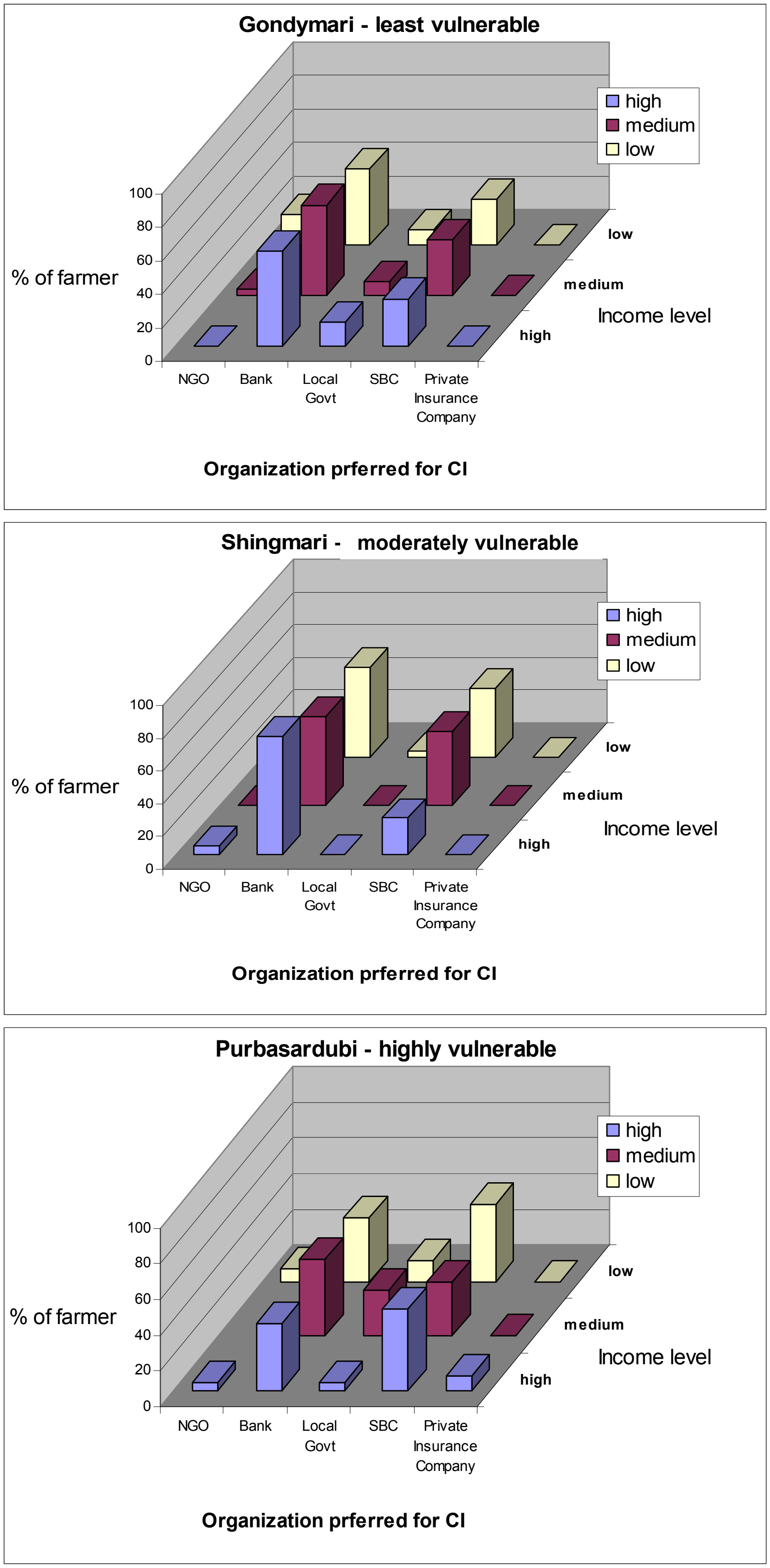


Figure 6.17: Organizational preference for CI by the respondents in Lalmonirhat

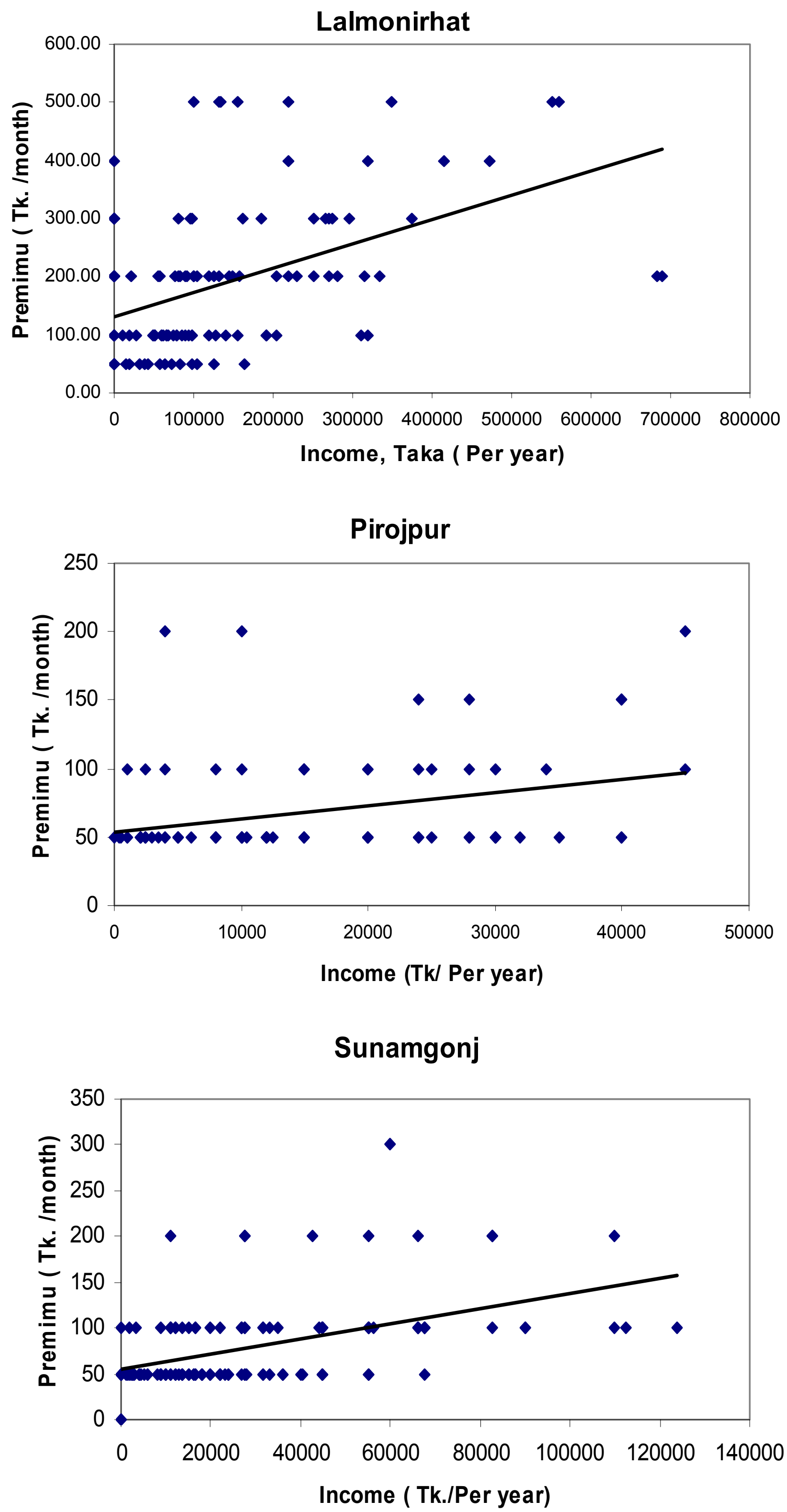


Figure 6.18: Relationship between premium and income level

6.3 Farmer's Views on Climatic Effects, Risk Mitigation and Crop Insurance: Focus Group Discussion (FGD)

The research carried out discussions (FGDs) with the farmers groups in all the three study sites. Farmers described their own observations on the effects of climate change on agriculture (especially on cropping practices) in the recent years as opposed to their historical experiences. Because of the distinct nature of each field sites e.g. drought prone (Lalmonirhat), salinity prone (Pirojpur), and flood prone (Tahirpur) the nature and dimension of climatic effects as expressed by the farmers are different and so is the causes of risk. However, the common perception in all of them is that climate is changing and that change has already posed a significant risk to the agriculture as well as to their livelihoods. Therefore, all the groups feel the necessity to address such risk. The views and opinions of the groups from each study area on climatic risks and crop insurance scheme as coverage to such risk are summarized here:

6.3.1 FGD in Lalmonirhat: Farmers in this area believe that the climate is changing and temperature is rising day by day. These farmers, regardless of category (high, medium, and low), therefore, feel that crop production in the area is gradually reducing due to changed climatic conditions e.g. drought is causing disaster more frequently in the recent years than it used to do in the earlier decades. Due to such unfavorable climate and resultant soil conditions the production volume of many crops like Wheat and Mango has declined significantly. They are also observing that such changed climate are affecting the crop seasonality and cropping practices (pattern) e.g. Wheat producers are switching to Maize etc.

Meanwhile, against such backdrops set by the climate-induced natural disaster, these farmers are not well aware of agricultural risk coverage. Moreover they are also not reliant on government bodies or local government agencies like agricultural department due to their insignificant cooperation after natural disasters. "*Agricultural officer does not visit us and government does not take required initiative after disaster*" as mentioned by a discussant. They, therefore, like the idea of adopting Crop Insurance scheme as a disaster risk mitigation measure upon clear understanding on the premium rate per acre, duration, and other related procedures.

Notwithstanding adoption of such scheme, however, the farmers are suspicious of getting compensation after disaster (especially drought) from insurance company as an NGO earlier started such scheme in the area and lastly disappeared with the money without any notice. As a result now they suspect the very existence or authenticity of such companies and therefore they propose that if the policy is arranged by local bank they will have more confident to go with such scheme than with the NGOs.

As far as the affordability of such CI policy concerns, extreme poor and marginal farmers would even fail to pay a premium of Tk. 50 per month while the middle and higher category farmers intend to buy it. The major concern of the majority of the farmers is that they badly need financial help after disaster. Many of them think that fertilizer is the much needed item for them as the fertilizer crisis is very common in the area. Since the price of the fertilizer is a great problem to them during their bad times the insurance money will help them in buying fertilizer to restart their cropping and recovering from disaster.

Besides, the groups in this study area also put forward some policy oriented suggestions and actions for respective bodies to be by implement the crop insurance scheme. These are mentioned as follows:

i. Education, capacity building and awareness raising among the farmers about Crop Insurance

ii. Guarantee about financial assistance during drought and other natural disasters, and above all about the very existence of insurer

iii. Develop a training plan to increase farmers' ability to use insurance money properly and to learn about other alternative agricultural activities

iv. Helping in improving crop production and agro infrastructure development such as cold storage facility and deep tube well installation etc

6.3.2 FGD in Pirojpur

Figure 6.19: Focus Group Discussion (FGD), Nazirpur, Pirojpur

Farmers in this study site reported that they have been experiencing lower yield in the recent times as crop production diminishes every year mainly due to three reasons: i. scarcity of sweet water ii. gradual increase of salinity over the recent years, and iii. frequent and lingering floods. They believe both temperature and precipitation have increased in the recent years and mentioned untimely raining as another phenomenon. Excessive salt and prolonged flood causing total damage to their rainy season paddy crops more frequently in the recent years. Consequently, to mitigate the impact of salinity in the field they need to use Zipsum fertilizer and the requirement of Zipsum per acre is going up every year due to salinity accretion and gradual land fertility loss.

The farmers mentioned that the post disaster assistance from concerned government bodies is scanty. Only in 2002 they got fertilizer and seeds, however, again in most cases, those who had good relations with agricultural officers and local influential political elements were able to receive such assistance. They also said that getting agricultural loan from bank is a difficult task for them due to documentary complicacies and vested quarters. Under such circumstances, they borrow from local money lender (*Mohajan)* or NGOs to recover from disastrous affect as such mode of lending is free of documentary (paper) requirement and intricacies as required by Govt sources.

Meanwhile, they were almost ignorant of Crop Insurance but upon briefings from the facilitator NGO of this study and discussion they are convinced that it would be a good policy to adopt to recover from crop damage out of aforesaid disasters. Moreover, they prefer NGOs over other organizations in operating the crop insurance policy as they belief NGOs are more transparent and cooperative. With respect to monthly premium, marginal farmers expressed their ability to pay 50 tk. while the others (medium and high) replied they might pay higher premium based on the compensation package they would receive per acre after disaster. With crop insurance in operation and adopted by them, these farmers are willing to go for more profitable cropping even it is riskier.

6.3.3 FGD in Sunamganj

Unlike the two other study sites this area is relatively less populated and most farmers have space around their house to utilize for agricultural purposes, therefore agricultural activities are taking place both in the fields and homesteads. The farmer groups in this area report that being in the low lying area i.e. *haor* they are not able to produce more than one crop in a year i.e. they cultivate only in the dry season. However, this only yearly cultivation is affected now a days due to unfavorable climatic behaviors. Prolonged water logging to their fields debar them from in time cropping which impact the production and harvest. Another important observation of them is excessive rainfall and hailstorms in the recent years that occasionally damage their crops. All these are happening due to climate change, as they believe. They also mentioned that the dry season are gradually commencing at a delayed time and there are late rainfalls that damage just showed crops. They also notice drought in some years. All these combined, have been impacting their traditional cropping practices badly.

Figure 6.20: Focus Group Discussion in Tahirpur, Sunamganj

In coping with these disasters, some farmers of medium and large categories mentioned they go for either bank loan or NGO assistance (most medium farmers rely on NGO assistance) whereas the lower category farmers report that they depend on local *Mohajan*. They believe that the government measure in assisting them in the face of disaster is inadequate and there is a need for alternative arrangement to coup with such events.

Though most of the farmers are unaware of crop insurance they are familiar with life insurance policy. They suppose crop insurance policy with the NGO assistance can be a viable approach for them to cover the disaster risk if the premium amount becomes nominal.

6.4 Roundtable Discussion with Policy-makers and Prospective Insurer for CI Program

Feedbacks from different stakeholders of micro insurance schemes e.g. private insurance company managers, government policy operators, NGOs dealing with poor farmers, experts associated with insurance related policy and management institutions, and researchers of micro insurance policies elucidated their insights and experiences at a round table discussion.

The collective wisdom from the discussants revealed significant information and offered important policy direction and strategies, which might be instrumental in adopting crop insurance as an agricultural risk mitigation measure for the climate change victims. Most noteworthy and conceptually stimulating suggestions are described as below.

Figure 6.21: Roundtable discussion on Feasibility of Crop Insurance as a Risk management Strategy in Bangladesh. Dr. Mizan R. Khan (left), Managing Director, PKSF (middle) and Dr. Mahfuzul Haque, Chief Controller of Insurance (Right).

Bank-NGO Nexus is necessary to widen operational coverage of the traditional insurance companies especially the micro insurers. As almost all of the insurance companies are operating mainly in the metropolitan areas and the banks are not adequately looking after the interest of the farmers (though many of them have operation in the peripheries), an obvious gap exists keeping farmers literally away to have access to finance and risk coverage. The traditional notion of the micro financer that the loan repayment ability of the farmers are low has been proved wrong by a Bangladesh Bank pilot scheme under which agricultural loans were disbursed to small and marginal farmers and had a cent percent recovery. PKSF supposes NGOs can play a vital role to persuade its member to adopt insurance policy while borrowing from them. In this regard, PKSF plans to advise its partner NGOs to start micro-insurance as pilot schemes soon. Meanwhile, development of closer relation between bank and NGOs over the time is offering a new scope of collaboration between them in order to assist farmers financially and in the event of disasters. However, the mechanism as to how such approach may work has to be worked out.

Insurance Company-NGO Nexus can be an effective approach to address the plights of the poor farmers in the face of climatic disasters. As the NGOs who are already lending money to them can not get involved in providing risks for life, livestock or crops unless they are registered with the Department of Insurance as per the Insurance Act 1938 and Insurance Rules 1958. However, as regards crop insurance, micro-finance funding agencies should popularize the idea to its partner NGOs. PKSF can play a significant role by expanding its services having obtained needed regulatory permission for insurance, for example- in the recent (Nov 2007) cyclone CIDR among 23 districts 32 partner organizations of PKSF are affected, insurance cover for the borrowers could save both the partners and PKSF from the financial stalemate they are experiencing now.

A Nexus between Bank, Insurance Companies and NGO is thought to be a more comprehensive approach in the sense that fund flow from Bank to NGO will enable disbursement and Insurance Company can cover the risk. As the access to bank finance for funding by the poor farmers is difficult because of documentary requirement, procedural complicacy, and other reasons caused by unscrupulous elements and as they are more reliant on NGOs for borrowing such arrangement would work better if the insurance companies also become party to the arrangement. Meanwhile, if decided by the government or other funding authority, insurance coverage as a mandatory precondition to agricultural loan either from BKB or other sources would also necessitate such arrangement.

Cross Subsidization for the insurers is advocated by the experts as there is no reinsurance facility available in the existing market system. Government should come up with a significant subsidy package for the insurers in order to minimize their risks and offset the operational unattractiveness. At the initial stage government should create a 'contingency fund' to help the insurers to settle claims due to damages from extreme weather events. Moreover, international insurers e.g. Swiss Reinsurance, Munich Reinsurance can join in an effort to access 'LDC fund' being maintained by UNFCC secretariat to meet climate related disasters.

Pool of Insurers and Common fund can help materializing the cross subsidization policy. If government creates a pool of insurers upon receiving grant from WB, ADB or other donor agencies/countries to subsidize the insurance premium through BKB then the insurer can produce an umbrella coverage package for the farmers. Such pool may be formed by SBC, private insurance companies, NGOs and other interested agencies.

Inclusion of donors is necessary for both financial and technical assistance. Especially the countries who are more responsible for global warming has to be made morally obligated in extending such assistance to the victims like Bangladesh.

Index-based weather insurance as is done in many other countries is another mechanism to proceed with crop insurance as it enables area wise risk assessment. In India such scheme is in operation and having success.

Overcoming the moral hazards emanating from unscrupulous elements and political pressure is necessary in order to make such insurance scheme as a viable one. Earlier initiated crop insurance scheme failed because of lack of commitment, lack of focus and for unscrupulous elements. The middlemen between SBC and farmers hampered the efficacy of the earlier scheme by creating moral hazards. Undue political influence caused to waste up much of insurers money at that time. Many Bank Officers used to defraud both farmers and SBC with fabricated papers. They tagged insurance with farmers loan package, which in most cases farmers were ignorant of and consequently insurers' money went to the bank officers pocket.

Lessons from past limitations deem to be an imperative in order to proceed with crop insurance scheme further. Besides the aforesaid limitations, other shortcomings as experienced by the actors associated with the then crop insurance scheme and as they narrated are as under:

- Huge loss of SBC out of Crop Insurance was mainly due to afore-mentioned moral hazards that caused many framed and exaggerated claims.
- Crop insurance at that period of time did not have area-wise operation; area wise or weather index based operation could have minimized the loss significantly.

- Mismanagement and lack of coordination among the decision makers and practitioners of crop insurance also contributed to the failure of the scheme. SBC managers were not experienced at that time, therefore, knowledge (both insurance and agricultural), expertise, and training of the managers and policy operators are the perquisites for such scheme to succeed.
- Precise weather and meteorological data were scanty at that time. Therefore, availability of relevant weather data and area wise risk assessment are crucial to determine the crop insurance policy.
- The analysis of crop damage and calculation of compensation used to be done on the basis of average productivity per acre as per Ministry of Agriculture assessment, which was not an acceptable way for most cases. Therefore accurate assessment, equitable distribution of loss, and accurate premium rate determination all are very important for the policy to succeed.

Awareness building and demand generation

One of the main arguments is that crop insurance failed due to attitude of the people as they think risk might happen or not. Moreover, lack of knowledge about such policy among the potential policyholders is another obvious reason. On the other hand, there is no any significant promotional drive like advertisement or other awareness building measures for such policy.

Apart from awareness, trust building is necessary in order to offset the suspicion among the potential policyholders on the authenticity of the insurers.

As regards the present scenario arising out of climate change, the policy makers and the practitioners have to be very much aware of the climate change and related disasters. In this respect liaising with the UNFCC secretariat and Kyoto Protocol body who are key players in this respect could be very useful. And most importantly the climate change science has to be made available to the people. Moreover, new policy on climate-induced micro- credit needs to be developed. In this respect proposed new Insurance Ordinance (Drfat) that is to replace the 1938 Act will help improving the situation.

Being a new product CI would require extensive marketing and rapid and fair settlement of claims can earn confidence of the farmers. Besides, rigorous monitoring to offset the moral hazards will be required in this respect. Experts also suggest having or creating crop variety as opposed to the risk variety.

Reinsurance

Availability of re-insurance is one very important limitation. International re-insurance companies are always reluctant to provide re-insurance facilities to poor countries, and especially very risky and unstable business like crop insurance. As it is explained in the third chapter, for a global reinsurer to be willing to enter a market, the enabling environment must foster confidence in contract enforcement and institutional regulations. An enabling environment is, in fact, a prerequisite for effective and efficient insurance markets, and these components are largely missing in developing countries. SBC can play a very important role here. If SBC assure the re-insurance contract, many of the private insurance companies involved in microinsurance, argued that they will be interested to go for crop insurance even.

Chapter 7: Summary Findings & Demonstration of a Model of CI for Bangladesh

7.1 Summary Findings

There are a number of critical questions need to be answered while analyzing the findings. The following sections analyzed the questions in detail;

Which method of CI is most appropriate for Bangladesh?

It is true that last time while introducing CI in Bangladesh, SBC was in hurry without adequate training and understanding of the process. Because there are a number of methodologies for CI as applied in different parts of the world, a suitable methodology could be found out there. In this study, after an intense review of CI methodologies elsewhere in the world and their pros and cons, it has been confirmed that individual approach of loss assessment might not be a perfect method for Bangladesh. In Bangladesh lands are divided into small pieces, which require huge administrative effort to assess individual plots. It is susceptible to adverse selection and moral hazards as well. Area based Index, especially weather index might be the best approach.

While administrative cost is minimized in Weather Index method, it however, requires a large network of hydro-climatic data stations with data of good quality or accuracy. Along with this, detail land classification and elevation map is also required, especially for assessment of flooding and salinity intrusion. So, proper technical expertise is required in that case. Too much complication of the process will further result in inefficiency and moral hazard. The methodology adopted should be clear and easily understandable.

In this method an area of almost homogenous climatic and topographic condition is placed under one climate station as Unit Area. Loss is assessed for entire unit area as same. The number of climatic stations and river gauge stations in Bangladesh found to be good enough. Agriculture department has land classification map and some other organizations including LGED has GIS based maps up to Thana level.

The Malawi case illustrates a large potential for donor-supported, index-based schemes that can be designed to provide needed liquidity after major disasters. In India, for example, international technical assistance has been instrumental in the current success of index-based crop insurance programmes, which have increased penetration from 230 farmers to over 250,000 over a 3-year period, and similar schemes have been implemented or are under way in Mongolia, Ukraine, Peru, Thailand and Ethiopia (Mechler et al., 2006). Unless supported by technical assistance, national subsidies (cross-subsidies, as in India), or international donors, these schemes are out of reach for very low-income smallholder farmers.

With the available resources and technical expertise it is still possible to introduce Weather Index Crop Insurance in Bangladesh. Again our neighboring country has already introduced it with almost same capabilities. Tentative methodologies to be applied in Bangladesh for three disasters are proposed in the next Chapter. The methodology of the Weather Index method needs to be fixed further after a pilot scale study at some districts with detail quantification of different parameters.

Here it is to note that while applying Weather Index method, a multi-disciplinary approach including meteorologist, hydrologist, agriculture specialist and insurance expert is it required.

Is the probability of loss from climate disasters adequately calculable?

Calculation of the probability or risk level, especially under future climate change is another important issue. Time series analysis of past climatic record can give the existing risk level of the region, while GCM based future climate model output can be compared to conclude future risk level. Flood, drought and salinity intrusion or cyclonic storm surges are some major climatic events which will be directly affected due to climate change. This study has already reviewed the disaster scenarios for Bangladesh under climatic changes. There are a large number of global scale studies regarding and the predictability of the models or understandings of the phenomenon is improving day by day. So, it should not be a problem at all to quantify future disaster risk with fair accuracy. General methodology of such risk quantification is explained in the next chapter.

Farmers Response to CI

General impression

Farmers response to CI is quite positive. Even though they have difficulty in understanding CI processes, however, they are familiar with life insurance. Most of the farmers in the study area were also familiar or involved with Micro-credit and they have a good impression about it. In fact, it is true for all over the country as because micro-credit has been spread over entire country and most of them are doing well. Success of Micro-credit at least created a confidence among them that Micro-insurance might bring good for them as well. The initial stage of implementing Micro-insurance here is very important to create a positive image there. If the farmers see that the money they are paying returned back and helping them during crisis, surely it will become popular soon.

Organizational preference: Private or Public - **Difference between Micro-credit and Micro-insurance**

Because of confidence in Micro-credit, most of the farmers preferred NGOs to offer CI again. However, there are significant differences between the process of micro-credit and micro-insurance. In micro-credit system, farmers get the money first and then it is the headache of NGOs to collect the money back, irrespective of the quality of NGO. For Micro-insurance, the system is completely reverse, where the farmers will give the money first and insurance organizations will pay it back after a disaster as indemnity. So, for Micro-credit they have less scope for exploiting farmers, but in the later, i.e. in case of Micro-insurance they have enough scope like this. Here the quality of NGO is thus important, otherwise, they might bankrupt or leave the spot after collecting premiums or harass farmers in disbursing indemnities. Consciously or unconsciously farmers could realize the fact, and it is reflected in their choice.

Actually, there should be some sort of involvement of government in the process of micro-insurance, at least to monitor the process, otherwise there are always chances that the insurance companies might try to exploit the poor farmers, and they have little means to bargain or employ an actuarist, in case of dispute. If a few incidents like this happen, confidence about CI among the farmers will drastically reduce. In the lalmonirhat region such an incident occurred and farmers were scared about crop insurance as well. So, a sort of confidence building is necessary. Even though government organizations used to be corrupted and less efficient, but farmers are confident that at least they will not disappear without paying indemnities. Directorate of insurance and SBC might play important role in this regard. Bangladesh Krishi Bank as a major credit provider in the agriculture sectors, can also open a section as crop insurance.

As it is seen from the review of experience elsewhere in the world, in the developing countries public sector mostly offer CI while in the developed countries, it is offered by private insurance companies. For Bangladesh, in the context of reality there need to be a nexus between both private and public sector to implement CI. Reputed insurance companies and NGOs can offer CI, where SBC can serve as a re-insurer and Directorate of Insurance can regulate and monitor the process, including dispute resolution. But farmers were worried about the direct involvement of government organizations because of bureaucratic process of government organizations and prefer an organization which is close to them like those of NGOs. It is true that if NGOs have no intention to exploit the farmers, they will be the best option as because they have a large network rooted mostly in the rural areas. Like Micro-credit, Micro-insurance needs to be closely monitored as well, for its success.

Whether CI is financially viable?

First of all, losses in CI should not be considered alone, but compared with the amount of money government already subsidizing in the agriculture sector for disaster management purposes. It includes relief and distribution of huge amount of Bank loan and exemption of its interest or mercy of the loan itself. Introduction of CI will reduce such subsidy requirement to a great extent. For example, if CI is made mandatory for Agri-credit takers, the outstanding loan can be collected from Indemnities of CI directly. India is already practicing this methodology, where the indemnity is directly paid to the credit organization.

Considering the example of 2007, a qualitative calculation of government expenditure in disaster management purposes in the agriculture sector can be compared to the expenditure expected under CI programme.

- After 2007 flood, agriculture credit disbursement by banks will be increased by Tk 2406 crore or 45 per cent in the current fiscal year for post-flood rehabilitation. The banks have set a target of distributing Tk 7698 crore in agricultural loans in the current fiscal year. Of it, Tk 1078 crore will be disbursed by private commercial banks. Agricultural loans amounting to Tk 5292 crore were disbursed in the last fiscal year.
- In another estimate, already more than 30 per cent of agricultural loans are classified. In that case, it is expected that around Tk. 750 crore loan amounts is going to be classified or defaulter which was disbursed extra because of flood.
- The damaged crops area during the same period was around 4.69 lakh hectares of land, which is about 26 per cent of the total cultivated crops in the affected areas. Production of these crops reduced by 16.67 lakh tonnes, according to an estimate by the Department of Agricultural Extension (DAE).

- Comparing extra Agri-loan of 2406 crore with 4.69 lakh ha of affected land, it means government distributed an extra amount of loan around Tk 20717/= per acre of land as post flood rehabilitation. Out of this 30%, i.e. around Tk. 6300/= will be classified or non-recoverable.
- Now compare it with the premium earnings and indemnity payment under Crop Insurance program. As per questionnaire survey, it can be roughly estimated that the willingness to pay by farmers for one acre of land / season is around Tk. 1000. According to the expert, the flood in 2007 was a flood of return period around 20 years. It means a flood like this will occur once in 20 years. So the earning from a farmer during 20 years. time is Tk. 20,000/= after which a disaster might occur. In that case the indemnity need to be paid per acre land is around Tk. 25,000/=. Now as it is mentioned this year flood affected around 26% of total cultivated lands in the affected area, means in the affected areas, you have to pay indemnity to one fourth farmers. So indemnity should be around Tk. 6000/= only on an average per acre of land. So, it is quite comparable to the amount Tk. 6300/= as classified agri-loan for per acre of land. Introduction of Crop Insurance will reduce the number of defaulters of agri-loan holders if it is made mandatory for agri-loan takers, i.e savings of Tk. 6300/=.
- Now, within the 20 years there will be flood of different magnitude like 15,10,5 years return period, and one can fairly assume that for a 10 year. return period flood, the indemnity payment is around say Tk.3000/= and save in defaulters amount as Tk. 3150/=. It is always like the indemnity payment is compensated by save in loan defaulter. In that case the entire premium earning will be intact, which can be considered as administrative cost as well as re-insurance cost, etc.
- Even if we assume that the flood in 2007 is a 10 years return period flood, the amount of losses still can be comparable to that of subsidy in the agriculture sector in other forms.

How can the problems and losses be minimized?

Investigation about the last experience of CI in Bangladesh and reviewing experience elsewhere in the world, the **sources of losses** in the sector has been identified as follows;

Adverse selection: Only the risky lands or land of lower productivity are preferred to take CI policy. Similarly, if crops are fixed for CI than people prefer to take CI for those crops and use to cultivate it at lower quality lands. Renewal of insurance for the next year is another issue. If the decision is left open to farmers for quite a longer period that they may decide whether they will take a policy depends on the prediction whether a drought is likely or not.

Absence of Risk pooling: The major differences between CI with other insurance is that little advantage is possible from risk pooling as the risk here is highly correlated among a large number of insurers. For example, for other insurance like automobile accidents, individual car accident is uncorrelated to other car accidents so that it is almost impossible that all cars will suffer from an accident in one time. However, for crop insurance as it relate to natural disasters, an entire district or region used to be affected in one time so the loss at one time used to be huge.

Moral hazards: Theoretically moral hazard means all sorts of immoral acts by which a farmer try to cheat insurance companies. Among the acts include not taking adequate measures to protect farmlands from lower yield due to disaster, adverse selection like cultivating crops of high yield variety but risky to disaster like flood or drought, etc. In case of Bangladesh, there is another problem which should be added under the category of moral hazard as corruption by insurance officials, where an inflated amount of indemnity is shown by the inspector. It does not mean that the farmers get that amount but the inspector mostly take a portion of it and it happens through mutual understanding between farmer and inspector, or by forcing farmers to indulge in it, otherwise they might not get their regular compensation. With the condition of being anonymous, some SBC officials confirmed such happenings last time so that SBC suffered a huge loss. Otherwise, as this study team found that there should not be such a huge loss from a crop insurance scheme.

Imperfect indemnity: It means faulty indemnity payment provision adopted in the contract, for example, instead of offering indemnity as percentage of crop yield, if it is fixed by an amount so that the effect of price variation during yield is ignored. Similarly, one of the limitations of weather index is that even not all the lands in a region are affected but indemnity should be paid to all if the weather variable is below or above the target level.

High administrative cost: As mentioned already that like Micro-credit, Micro-insurance required close monitoring with a large network of employees. Also as in Bangladesh land is divided into small fragments, typical CI programme will need huge effort to monitor it.

Re-insurance assurance: As per the discussion with stakeholders in roundtable meeting, most of the private insurance companies assured that if they get enough re-insurance support they have no problem introducing crop insurance. As mentioned already that possibility of having international re-insurance support is very rare. In that case, the only hope is SBC. SBC can play important role there by providing re-insurance support to the private and other organizations to offer CI.

To minimize the losses derived from the above problems, the study team **proposed the following measures and suggestions:**

Globally, around 80% of disaster-related losses remain uninsured. There are many reasons, as discussed earlier in the report. The cost of coverage can be disproportionately high due to market inefficiencies, such as high administrative costs – up to 30% of the premium. Demand for insurance coverage by those at risk is really low, or the risk may be so high that it is uninsurable in a country like Bangladesh. The expectation of government and international aid is a big factor behind the low demand. On the other hand, pure private sector crop insurance solutions are not feasible. In view of the above, CI can be made viable along the following lines:

Introduction of Weather Index: Introduction of Weather Index can reduce adverse selection and moral hazards to great extent. Detail about it has already been discussed in Chapter 3 and a model for application in Bangladesh is proposed in the next chapter. Adverse selection is here reduced as because it is not the crop type or land type, but a specified level of weather variable is considered here for indemnity. Loss is considered same for entire region if it does not satisfy pre-fixed weather index. So the question of moral hazard is eliminated as well. It reduces huge administrative cost as well as it does not require plot to plot investigation.

Defining variation in risk and varying premium levels: Last time SBC introduced uniform premium level, which encourages adverse selection as because in that case both the highly risky and low risk farms have to pay same premium, so that the risky ones prefer to take insurance policy. Under weather index program the risk level for different unit area under one weather stations can be classified under different risk categories. Methodology for such risk quantification based on historical climatic time series is explained in the next chapter. Even the risk level in near future under climatic changes can be predicted here as well based on future prediction of climate attributes by different GCM or other predictions. Within an unit area variation in risk level is possible, like the inundation height for different land segments might be different even though they are within one unit. Problems like this can be solved by including the elevation of each segment of land in the contract, etc as explained in detail in next chapter. However, this might be complicated and may not be practiced in the initial years. Rather a farmer's risk pooling technique can be applied as explained in the next paragraph.

Less number of perils to cover and provision for multi-peril: In an weather insurance contract it is actually impossible to cover all perils if it is not related to climatic attributes. Again, including all perils in the contract make it highly vulnerable to high losses. Instead there should be provision that someone might take 2-3 perils coverage but have to pay more for it. It also reduces administrative and technical complexity.

Risk pooling among the farmers and co-operative formation: Community or co-operative formation among the farmers within a homogeneous unit area and introducing provision of risk pooling among the farmers is possible to reduce the local variation of risk level among the farmers living within a homogenous unit area defined by Weather Index Approach. It means for an unit area if flood is defined as water level above 10m MSL, the entire region will get indemnity. However let us say 10% lands were actually not flooded. Similarly, if the water level is below 10 m MSL, no one will get compensation. In that case when the entire land got compensation there should be provision that gfarmers themselves have a co-operative and re-collect the indemnity bills from those who are not affected at all, and later compensate it to those who were affected due to flooding in a normal year but not having indemnities because that year does not satisfy weather index level. Such a co-operative can be free of influence by the insurer, but can be introduced and formed at the beginning of the contract with the support of insurer, local govt. and the govt. co-operative authority.

When the crop production is not affected such a co-operative can accumulate certain amount of crops in kind from all the member farmers and put together as a deposit. This can be utilized later to pay premium for a season while a situation occurs that most of the farmers are affected last season by other disaster, which was not insured.

Varying weather index value other than fuzzy approach: The methodology is described in next chapter that instead of defining just one value of climatic attribute as yes or not to the index level, a varying loss of crops can be defined based on variation in that climatic attribute. For example if precipitation is below 25%, 50% or 75% below average level, the indemnity might vary as well. It might not be as simple because both the magnitude and duration of disaster is important here to define vulnerability as explained in the next chapter. The risk indices defined in next chapter can be utilized in that case.

Wider coverage: At the initial stages not many farmers might be interested to adopt CI. Again only the farmers along the risky zones like highly prone to flood, drought and cyclone will only like to take CI, which is difficult to manage as against the idea of risk pooling. To overcome the problem, government can make CI mandatory for all farmers taking Agri-loan. In that case CI policy holders will be distributed over different regions ranging from low risk to high risk areas. Micro-credit organizations can help in this case as well. If the Credit is related to crop production CI should me made mandatory. In another way, farmers can be encouraged to take CI by offering low interest for those who will take CI, etc. Varying terms or duration of contract such as 1 season, 1 year, 2 years, 3 years or even 10 years contract can be made, otherwise it will be like a gambling if it is only for one season - one season somebody bought it then got indemnity, whereas other farmers might be buying policy for several seasons but no disaster. Premium level will vary among different duration contract as well like higher premium for lower contract period and lower premium for longer contract period. In crease in number of policy holders depends on motivation and advertisement as well as performance in the initial years.

Better loss assessment method: Ocular or eye based method of loss assessment makes ample scope for inspectors to indulge in corruption. In fact, if Wather index method is introduced, such an ocular method is not required because of scientific method of defining weather index and risk indices.

Public-Private Partnerships can overcome the reasons for market failure for CI: from the insurers' point of view, these include high risk or small scale, absence of reliable risk data and volatility in the event costs; from the at-risk population, these include high prices, a misperception of the true risk, and above all, an expectation of the government aid after disaters, and exclusion of financial services. Therefore, a public-private partnership (PPP) can resolve this. The public sector sets a framework to reduce the physical risks, provides cover for high-risk segments and regulates market for other risks. The Indian Government, for example, allows private insurance companies to operate once they cover a certain percentage of poor, rural population in their business activities. These companies cross-subsidize this likely losing concern with their profits earned in other insurance markets. Thus the private sector may provide technical assistance and administrative services in covering lower-risk segments. Competition will reduce administrative costs and fraud.

National Reinsurance Scheme: The public sector company, the SBC can serve as reinsurer to the CI schemes, covered by the private companies. In this case, India can again serve as an example: the Infrastructure Regulatory and Development Authority (IRDA) established under the 1999 Act has been charged with overseeing and regulating the insurance industry and named the General Insurance Company (GIC) as the national reinsurer to which all the country's direct insurers must cede 20% of their business. This kind of provision for the private companies can be introduced in Bangladesh, where they also have to cover a certain percentage of small-holder farmers and other rural poor. Besides, the non-insurance firms like banks and hedge funds are getting involved in this area, and they can also be persuaded to contribute to this reinsurance coverage, as part of their corporate social responsibility.

International Financing: Financial support from the international community would be required to either subsidize CI schemes and/or to provide risk capital to finance their costs for reinsurance and consequently the costs of premiums. The existing *ex-post, ad-hoc* model of financing natural disaster losses in developing countries by the development partners fails to provide disaster-prone countries with sufficient incentives for mitigation and risk reduction. As donor-funding arrives in the aftermath of catastrophic events, such cyclone Sidr, and by and large is used for emergency relief and reconstruction purposes, very little of this aid is invested in long-term mitigation projects. As opposed to commercial property insurers, which frequently link the very availability of insurance coverage to the implementation of concrete risk reduction measures by the insured, donors require nothing of this sort. As a result, countries at risk see little economic or political benefit from investing in mitigation or better enforcement of construction codes or land-use policies that would restrict construction activities in harm's way. Besides, there is uncertainty in the quantum of aid, which depends often on the media exposure of the events. For example, international support for the Indian Ocean Tsunami was exceptional, with estimates of about US$7,000 per affected victim, which can be compared, for example, with the devastating floods affecting Bangladesh in 1998, where support was estimated at about $3 per affected victim (Tsunami Evaluation Coalition, 2006). Besides, less dramatic, slow-onset climate disasters cumulatively affect the developing countries in bigger ways, which remain unnoticed and neglected. So this culture of funding *ex-post* needs to be changed a little, and more money should be made available for *ex-ante* financing. Therefore, international financing can create either an International Insurance Pool (IIP), as suggested by the AOSIS, or a Climate Impact Response Fund (CIRF), as suggested by Muller, or the Climate Change Funding Mechanism (CCFM), as proposed by the Germanwatch. The funds in such instruments can be mobilized through the following means:

- The first source can be the financial contributions by Annex-B (industrial country) Parties to the UNFCCC. These contributions could be based on the criteria of capability (e.g. GDP/person) and/or the aggregated amount of emitted CO_2 (per person) since a specified point in time (say since 1990). However, from the political point of view, the latter criteria will be a sensitive issue. But the persuasion for this has to be based on the application of the accepted principle of common, but differentiated responsibilities.
- Some additional revenue-generating approaches can be explored by the developed countries that, in turn, can set incentives for their own citizens to limit GHG emissions. These may include imposing climate fees on aviation (as proposed by Muller), or a general CO_2 fee. To finance such an international fund, countries may also consider using at least a part of the income generated by auctioning emission rights within national emissions trading schemes. If the income generated by auctioning were used to set up regional or national adaptation funds, a window of these funds could be used for contributing to the proposed international pool. One main benefit from these contributions would be a reduced vulnerability of the poor in the developing countries to climate disasters, and hence the ability to avoid diverting a growing percentage of development aid for emergency and disaster relief. For example, in 1987/88, the share of disaster assistance from ODA was 1.61%, while it

increased to 8.51% in 2003. Such a reduction to vulnerability of the poor would also contribute towards reaching the MDGs.

- o Among other potential contributors to the international insurance fund are global and regional financial institutions, and bilateral donors, such as the World Bank, Inter-American and Asian Development Banks, DFID, and the German Ministry for Economic Cooperation and Development (BMZ), which have made the reduction of physical vulnerabilities in developing countries and their adaptation to climate change an integral part of their development agenda. Their financial support to such an insurance scheme could become an effective vehicle to promote hazard mitigation and risk awareness in their member countries.
- o Two recent projects by the World Bank are specially promising as a potential link with the broad programme of funding support for insurance. The Global Fund for Disaster Risk Reduction and Recovery (GFDRR) will provide technical assistance for mainstreaming disaster risk and serve as a stand-by facility to provide quick relief funding. A Global Insurance Index facility (GIIF) sponsored by, among others, the EC, is in the planning stage. This facility, as envisaged, will provide backup capital for index-based insurance covering weather and disaster risks in developing countries to assure financial protection for small risk-transfer transactions. By constructing a diversified portfolio of developing country risks, the facility would leverage risk transfer and thus jump-start the development of risk transfer markets in countries with underdeveloped insurance markets (World Bank, 2005c). It is anticipated that other donor and financial institutions will join the GIIF initiative.
- o Together with governmental sources, the international reinsurers, such as Munich Re, Swiss Re and the international NGOs, such as Red Cross/Red Crescent, Oxfam, Care, etc. can join hands in piloting the CI schemes, particularly in the LDCs like Bangladesh. Malawi or India already set precedents in micro-and index-based crop insurance. These initiatives need to be scaled up.

7.2 Weather Index based Crop Insurance: Demonstration of a Model for Bangladesh

Developing a successful weather risk management and transfer program for agriculture involves four essential steps:

- Identifying significant exposure of an agricultural grower/producer to weather;
- Quantifying the impact of adverse weather on their revenues;
- Structuring a contract that pays out when adverse weather occurs; and
- Executing the contract in optimal form to transfer the risk to the international weather market.

Each of the steps is outlined in the following four subsections:

Identifying the Risk

Identifying weather risk for an agricultural grower or producer involves three steps:

- identifying the regions at risk from weather and the weather stations that reflect that risk;

- identifying the time period during which risk is prevalent; and
- identifying the weather index providing the best proxy for the weather exposure.

This last step is the most critical in designing an index-based weather risk management strategy. Rather than measuring the actual impact on crop yields - or related fluctuations in demand, supply, or profitability - the index acts as a proxy for the loss experienced due to weather and is constructed from actual observations of weather at one or more specific weather stations.

Location and Duration

All weather contracts are based on the actual observations of weather variables at one or more specific weather stations. Transactions can be based on observations from a single station or a basket of several stations or on a weighted combination of readings from multiple stations like;

- If an individual farmer is interested in purchasing weather protection for his particular crop, the index-based weather contract must be written on the weather station nearest the farmer's land to provide the best possible coverage for the farmer client.
- A larger grower, with several production regions, may be more interested in purchasing a weather contract based on several weather stations to reflect the weather conditions in all areas covered by the business. The grower's risk management strategy can be either to purchase a weather contract on each of the identified weather stations or to purchase a single contract on a weighted average of several stations.

All contracts have a defined start and end date to limit the period over which the underlying index is calculated. This calculation period describes the effective dates of the risk protection period during which relevant weather parameters are measured at the specified weather stations. For agricultural end users, the duration of the weather contracts will be determined by the specific requirements of their business. Contract duration has the flexibility to address individual end-user business exposures; which can be weekly, monthly, seasonal, and even multi-annual.

Final settlement of the weather contracts typically occurs up to forty days after the end of the calculation period, once the collected weather data have been cross-checked and quality controlled by the relevant data-collecting body, usually the National Meteorological Service.

Underlying Indexes

A weather index can be constructed using any combination of measurable weather variables and any number of weather stations that best represent the risk of the agricultural end user. Common variables include temperature and rainfall, although transactions on snowfall, wind, sunshine hours, river flow, relative humidity, and storm/hurricane location and strength are also possible but used to be more complex.

The normal process for designing an index-based weather insurance contract for an agricultural grower, for example, involves identifying a measurable weather index strongly correlated to crop yield. After gathering the weather data, an index can be designed by

- Looking at how the weather variables have or have not influenced yield over time.
- Discussing key weather factors with experts, such as agro-meteorologists and farmers; and/or

- Referring to crop growth models using weather variables as inputs for yield estimates or phenology models illustrating how weather variations relate to pest development.

A good index must account for the susceptibility of crops to weather factors during different stages of development, the biological and physiological characteristics of the crop, and the properties of the soil. If a sufficient degree of correlation is established between the weather index and crop yield or quality, a farmer or an agricultural producer can insure his production or quality risk by purchasing a contract that pays if a specified undesirable weather event occurs or a specified desirable weather fails to occur.

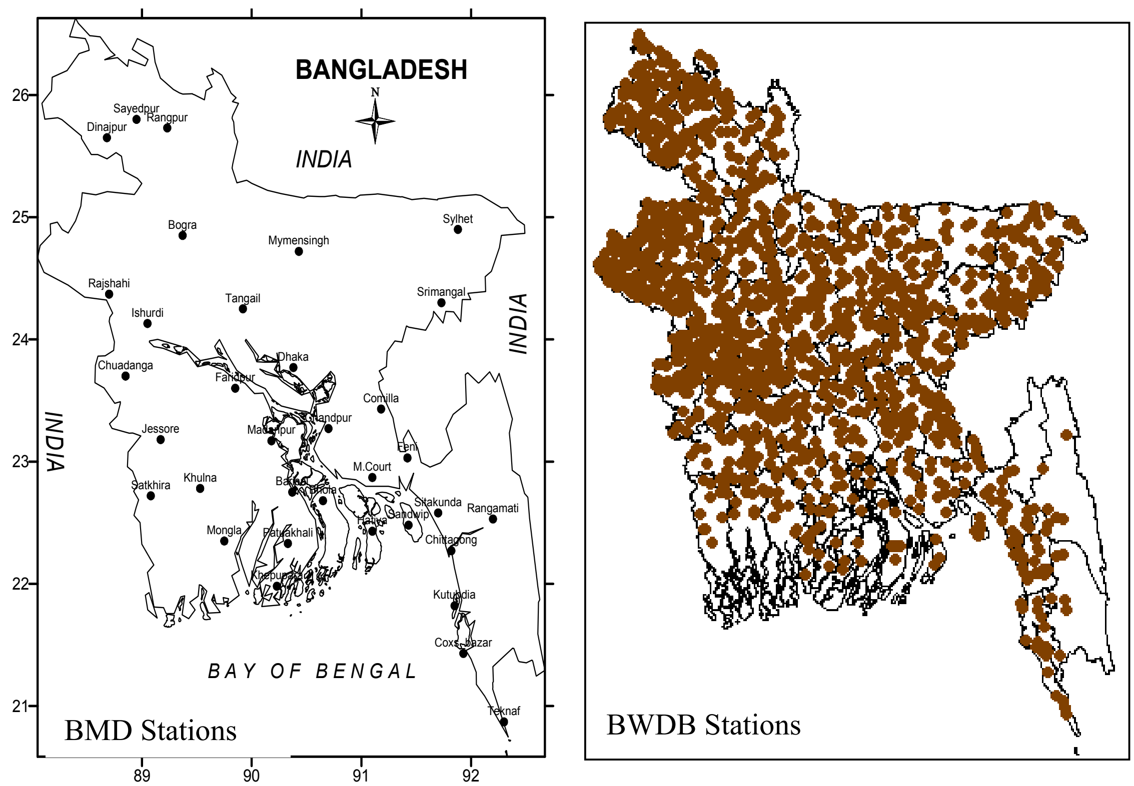


Figure 7.1 Weather Stations of BMD and Hydrological (Rainfall) stations of BWDB

The index possibilities are limitless and flexible to match the exposure of the agricultural grower or producer, as long as the underlying data are of sufficient quality collected from adequate meteorological stations. For some meteorological parameters there are standards for adequacy of stations like precipitation. According to WMO, there should at least one meteorological station for 10,000 sq. km.

Figure 7.1 on the previous page shows the location of meteorological stations along Bangladesh. There are 32 full-fledge meteorological stations with provision of measuring a number of climatic parameters. As it is seen from the figure that other than the North-Eastern part, i.e. Sylhet, Mymensingh and Brahman Baria the number of stations sound adequate for the rest of the country. Bangladesh Meteorological Department has future plan to install 12 more stations along the country. In that case it will be good enough to cover meteorological data for the entire country. Other than these, there are few more organizations which collect primary data of hydro-climatic parameters like SPARSO, BWDB, BIWTA, Agriculture Department, Department of Environment (DoE), LGED, etc.

Figure 7.2 explains the methodology to identify a region belonging to a station. Here it is assumed that the area belongs to a station having homogeneous climatic characteristics. If there are significant differences in hydro-climatic characteristics along different parts of the covering area of a station, the applicability of weather index for insurance will be erroneous. Again, the adequacy and quality of data depend on the type of index proposed for the weather insurance contract. A few examples of weather indexes for specific agricultural exposures and their applicability in Bangladesh are explained below.

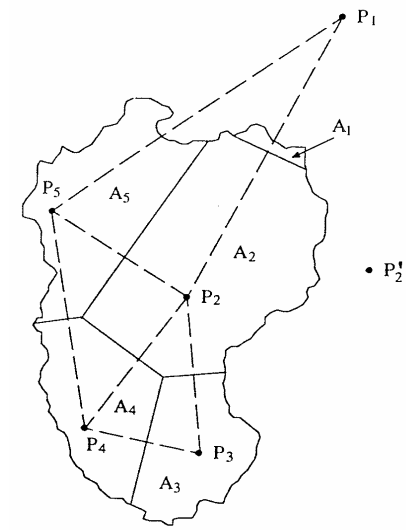


Figure 7.2: Methodology to fix station coverage.

Weather Index: Daily average Temperature

Critical temperatures causing crop damage may vary depending on the length of time that temperatures deviate from expected level as well as on the variety, health, and development stage of a plant. Likewise, for a particular crop the critical temperature required for different growing period can be fixed and deviation from it can be correlated to yield loss. The required temperature at different months can be used as ***Weather Index*** for that crop. Temperature data can be collected from the nearby weather stations. Crop damage can also be the result of specific or critical temperature events that can be detrimental to yield or quality. Freezing conditions, for instance, were reported to have caused more than US$600 million in damage to the U.S. citrus crop in a single week of December 1998. In 2005, in Bangladesh, due to a prolonged cold spell along Brahman Baria district a large area of Boro rice fields were affected, where there was no rice inside the husk of rice. During the flowering and maturation time of rice the temperature was not at required level so that no rice could be formed there. During field survey at Sunamgonj almost same incidents were heard and according to the farmers such incidents are occurring more frequently nowadays.

Weather Index: Deficit Rainfall and Drought

Meteorological drought is usually defined in terms of deviation of precipitation from normal levels and duration of a region's dry periods. Agricultural drought refers to situations in which soil moisture content no longer meets crop growing needs in an area due to insufficient rainfall. Crops, particularly rain-fed crops, often have a minimum overall threshold of cumulative rainfall necessary for successful and healthy plant development. These water requirements must be met by natural rainfall, stored soil moisture from precipitation prior to the growing season, or supplemental irrigation. Therefore, a deficit of rainfall below these levels, in the absence of irrigation, can cause plant moisture stress that affects development and reduces yields.

A simple cumulative rainfall index can be developed to suit a grower's specific insurance requirements with regard to such decreases in rainfall and yield. Looking at historical yield data, for example, can establish an empirical relationship between seasonal cumulative rainfall and yield. The distribution of rainfall during the growing season or at specific stages of a plant's development is often more important than total rainfall, however, and customized indexes must be developed to capture this risk (Stoppa and Hess 2003). Such indexes may also include other weather parameters, such as temperature and relative humidity. Other factors like availability of irrigation water can be embedded into a more complex index. Crop growth models or historical yield data can be used to infer the empirical relationship between rainfall amounts and yield/quality for specific soil and crop types.

A number of alternative rainfall contracts is possible to develop. One of them, the proportional contract simply pays in percentage terms for levels of rainfall below a well-specified strike or threshold. For example, if the median rainfall in a given area is 300 mm from November to March, one might begin payments anytime rainfall is below 250 mm. These payments would be based on the level below the strike of 250 mm. The percentage calculation would be performed as follows:

If rainfall from November to March < 250 mm, then

Payment percentage = (250 - actual rain) / 250

For example, if the rainfall is 200 mm, the payment percentage would be 50/250 or 20 percent. Those at risk (farmers, agribusinesses, farmer organizations, banks, etc.) would purchase contracts at some specific value, say 1,000 MAD. If the payment rate is 20 percent and the insured purchased 10 units of the 1,000 MAD, the actual payment would equal .20 x 10 x 1000 = 2000 MAD. The contract could also simply be sold in any MAD unit value. The principles are the same:

Indemnity = payment percentage x total MAD value or liability.

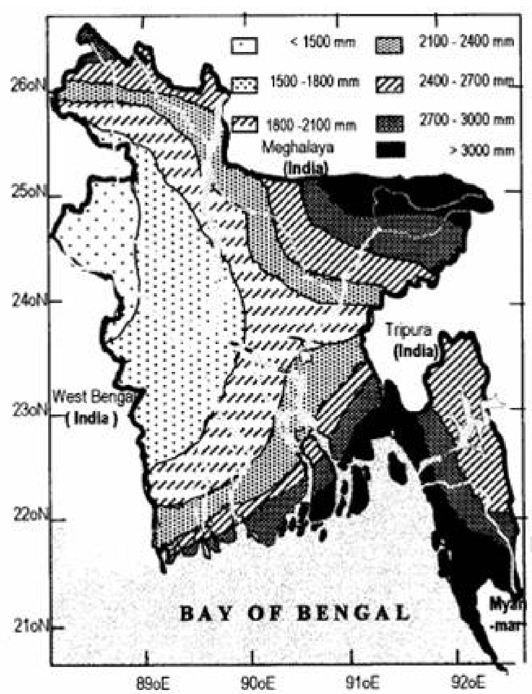


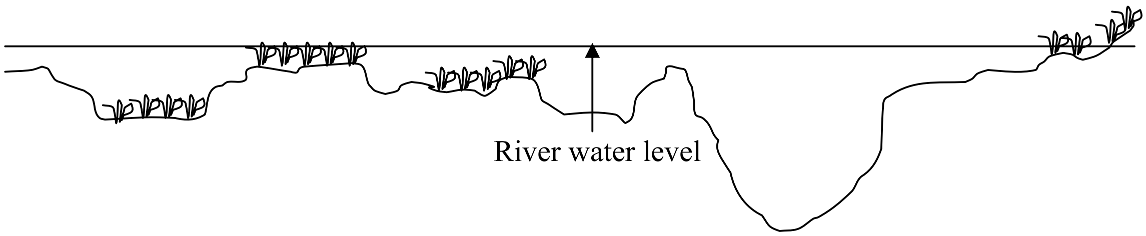
Figure 7.3 Precipitation variations along Bangladesh

Table 7.1 Crops in Bangladesh and their climatic tolerance.

B Aman	Broadcast Aman; a rice crop usually planted in March/April under dryland conditions, but in areas liable to deep flooding. Also known as deep water rice. Harvested in October to December. All varieties are highly sensitive to day length.
T Aman	Transplanted Aman; a rice crop planted usually July/August, during the monsoon in areas liable to a maximum flood depth of about 0.5 meter. Harvested in November/December. Local varieties are sensitive to day length whereas modern varieties are insensitive or only slightly sensitive.
Boro	a rice crop planted under irrigation during the dry season from December to March and harvested April to June. Local Boro varieties are more tolerant of cool temperatures and are usually planted early in areas which are subject to early flooding due to rise in river levels. Improved varieties, less tolerant of cool conditions are usually transplanted from February onwards. All varieties are insensitive to day length.
B Aus	broadcast Aus; a rice crop planted March/April under dryland conditions. Matures on premonsoon showers to be harvested in June/July, and is insensitive to day length.
T Aus	Transplanted Aus; a rice crop, transplanted March/April usually under irrigated conditions and harvested June/July. The distinction between a late panted Boro (c.v) and early transplanted Aus is academic since the same varieties may be used. Varieties are insensitive to day length.
Kharif	the wet season (typically March to October) characterized by monsoon rain and high temperatures.
Kharif 1	the first part of the kharif season (March to June). Rainfall is variable and temperatures ad high. The main crops grown are Aus, summer vegetables and pulses. Broadcast Aman and jute are planted.
Kharif 2	the second part of the kharif season (July to October) characterized by heavy rain and floods. T. Aman is the major crop grown during the season. Harvesting of jute takes place. Fruits and summer vegetables may be grown on high land.
Rabi	the dry season (typically November to February) with low or minimal rainfall, high evapotranspiration rates, low temperatures, and clear skies with bright sunshine. Crops grown are boro, wheat, potato, pulses and oilseeds.
HYV	high yielding variety; introduced varieties developed through formal breeding programmes HYVs have a higher yield potential than local varieties but require correspondingly high inputs of fertilizer and irrigation water to reach full yield potential.
Local	varieties developed and used by farmers. Sometimes referred to as local varieties improved varieties (LIVs)
NCA	net cultivable area; total area which is undertaken for cultivation

Weather Index: Flooding - without and with Embankment

Excess water that causes inundation destroys crops. In case of Bangladesh flooding is the most serious culprit for crop damage. Even though it is not much practiced elsewhere but it is still possible to include flooding effect in weather insurance contract. If the croplands are situated in the floodplain of a particular river, the recorded water level of the river at a particular gauge station can be compared with topography or land elevation and determine the inundation height of an area as shown in Figure 7.4. For simplicity of calculation, for a particular gauge station the inundation height for crop damage can be fixed so that any crop land within the coverage area of the station will get compensation if the water level is above a fixed level. For example, in Bangladesh, BWDB has already fixed the danger level for different rivers, which varies considerably for different parts of the country as shown in Figure 7.4.



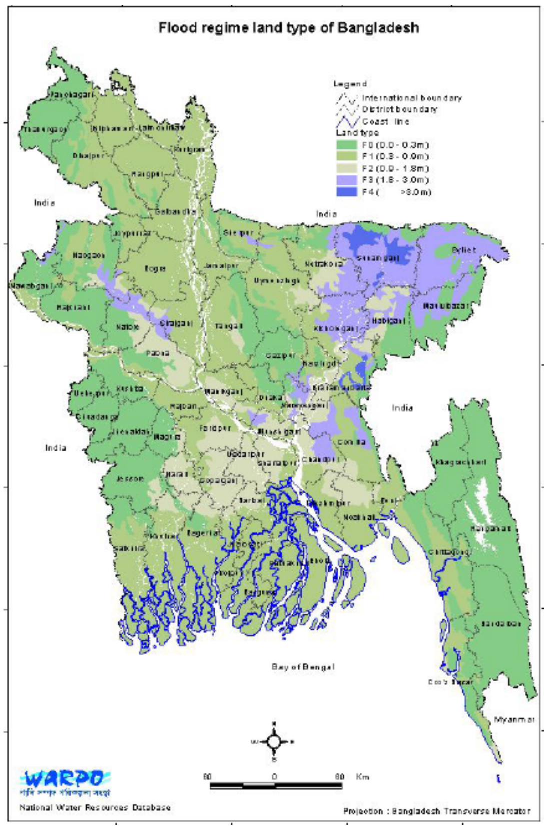
Land Type (by depth of flooding)	
F0 (highland)	0-30 cm, Intermittent flooding, land suited to HYV rice in wet season
F1 (medium highland)	30-90 cm, Seasonal flooding, land suited to local varieties of Aus and T. Aman in monsoon season
F2 (medium lowland)	90-180 cm, Seasonal flooding, land suited to B. Aman in wet season
F3 (lowland)	180-300 cm, Seasonal flooding, land on which B.Aman can be grown in wet season
F4 (very lowland)	>300 cm, Seasonal or perennial flooding does not permit growing of B. Aman in the wet season

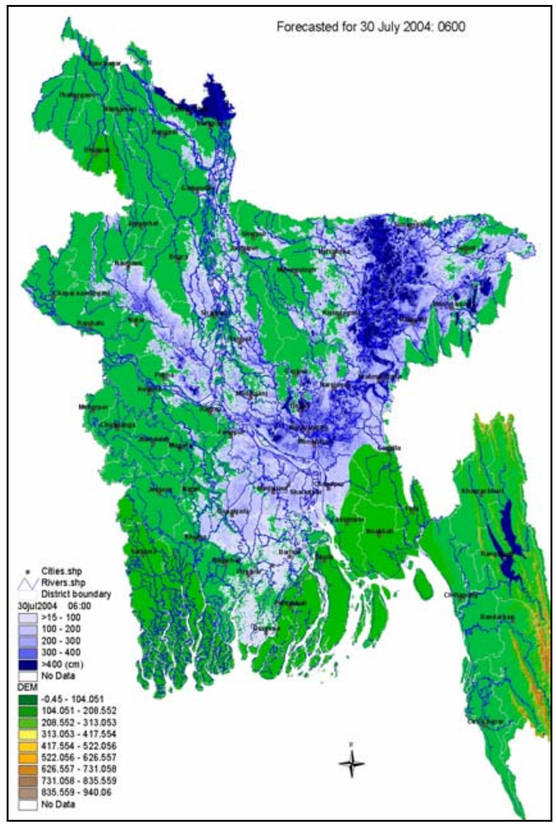
Figure 7.4: Determination of inundation height for flood

However, even within the coverage area of a station the elevation of different land segments might vary, and thus should vary the inundation height as well, as shown in Figure 7.4. For individual land segments such elevation measurement is possible and can be written in the contract, if possible. If the water level at the nearby river gauge station is above a certain level so that the inundation height for that land can harm crop, it can be considered as the flooding height index in that case.

Time of inundation is another important concern here as well. For the case of river flooding calculation of inundation height and time are much easier, but might be difficult in the region suffering from flash flood. Because of high velocity of flow such flooding can cause more damage than usual, even within a short period of time. For tidal flooding this might be even more hazardous as it brings saline water which further decrease yield. As shown in Figure 7.4, different parts of Bangladesh suffer from different types of flooding. The yield variation due to inundation height and time thus might vary among different types of flooding.

Whether the region is within or outside the embankment is another question. For an area protected by embankment, if the recorded water level is above the embankment height, full damage of crop can be assumed. However, embankment might fail even at a lower water level than embankment height. To avoid moral hazards, however, there should be provision that in no case, if water level is below the embankment height no indemnity will be paid. It is because there are possibilities that even though embankment did not fail but artificially it might be broken later to get indemnity. Such a provision will also leave a sense of belonging among farmers to protect those embankments by themselves as well along with govt. officials. Especially, for submergible embankments in the Haor area this might be the most appropriate as because those submergible embankments are mostly made and maintained by farmers. So they will have better sense of belonging as because if those embankments fail for water level below desired height, they will lose their crop and will not get any indemnity. Because of low flood risk within the embankment, there should be provision that if one declares himself within embankment, his premium will be lower. Embankment height will be collected from respective authority like BWDB, LGRD, etc. For special case if an embankment really fails, it should be confirmed from respective authority like BWDB, but the indemnity will be paid lower than contract.





Land type	Maximum depth of flooding	Seasonally flooded	Permanently flooded
Medium Highland 1 (F0)	0.3m	16%	0%
Medium Highland 2 (F1)	0.9m	44%	1%
Medium Lowland (F2)	1.8m	23%	1%
Lowland (F3)	3.0m	11%	3%
Very lowland (F4)	>3.0m	1%	1%
Total		95%	6%

Source: NWMP estimates

Figure 7.5 Land type with inundation depth along the entire country.

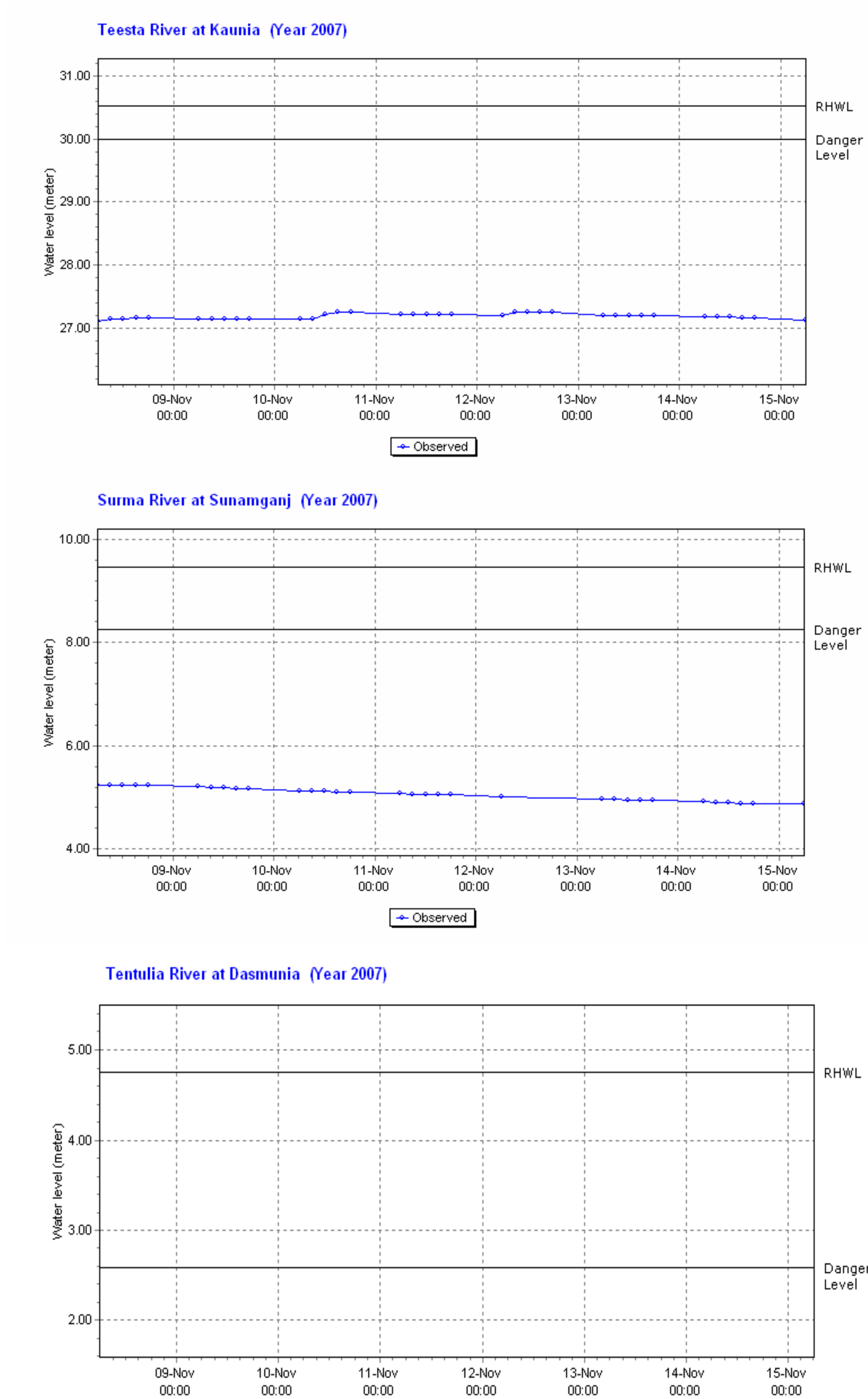


Figure 7.6 Defined danger level by BWDB for different rivers (Level varies on topographical condition)

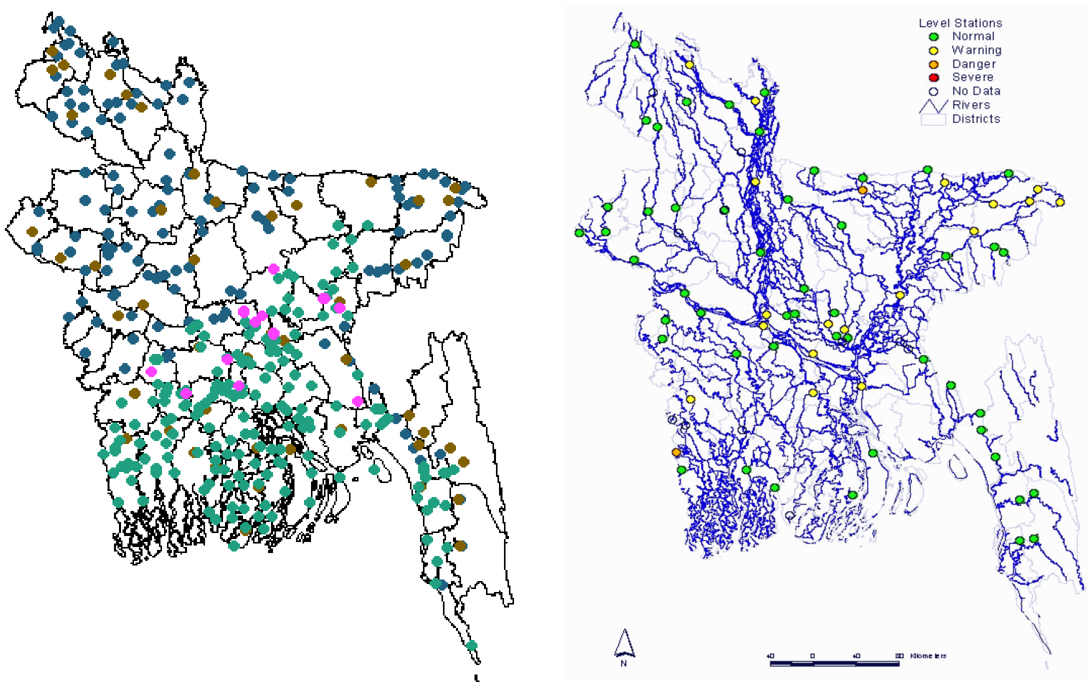


Figure 7.7 River flow and water level stations (Real time monitoring by FFWC)

Extreme Weather Event

For extreme weather event like cyclone, Tornado, Hailstorm, etc. the methodology might be almost same as that of traditional insurance scheme. However, to avoid actuarial investigation or damage assessment, which is the main source of moral hazard, it is still possible to take help from weather stations or any other technical measures like satellite picture. For cyclone the damage assessment is possible either through observing the magnitude or category or by the height of storm surges. In fact cyclone and storm surge used to affect a large area and in that case the coastal gauge stations to measure water level can collect the inundation height. However, for disaster occurring at a smaller spatial scale like tornado and hailstorm, it might not always happen that the weather station can record it, especially for the case of Bangladesh where weather stations are not densely located. In that case if possible, satellite pictures can be used. A simplified actuarial analysis can be made there as well to confirm the region affected by such event instead of assessing each and every land unit.

Combined Index

In some cases, variation in crop yield might be due to a combination of several climatic factors like temperature, water availability, groundwater level, relative humidity, etc. For example, drought possibility increases with both the increase in temperature and decrease in rainfall. Lowering of groundwater will further aggravate it. In the same case, simply rainfall deficit might not a good approximation, provided the location of the site whether close to a river or not so that irrigation facilities are abundant. Once again, the river flow in the river not necessarily always correlated with the rainfall recorded in the nearby station as because water might come from the upstream segment of the catchment. In that case the contribution of flow in the river from upstream should be added with the rainfall occurring in the vicinity.

Methodology to develop an index in that case is possible by providing a weight factor for each of the hydro-climatic variables as follows;

Index = (Rainfall deficit / Target rainfall)*(Runoff deficit /Target runoff)

Or, = 0.3*(Rainfall deficit/Target rainfall) + 0.25*(Runoff deficit /Target runoff) + 0.25 (GW level fall/Target GW level)

Quantifying the Loss

Once the index has been identified, it must be calibrated to capture the financial impact of the specified weather exposure as measured by the index. Two approaches are possible at this stage: identifying the financial exposure per unit of the defined index, and/or establishing the limit, the total financial protection, required per risk period, that is, the maximum payout necessary in a worst-case scenario. The approach chosen depends on the nature of the underlying index and weather event. If the weather exposure is event driven, for example, such as a Category 5 hurricane hitting a particular location or a cold winterkill event destroying an entire wheat crop, the latter approach is more appropriate. If the weather exposure is of a cumulative nature, such as drought the former approach should be chosen.

Unit Exposure

In designing an index, expert scientific agrometeorological assessments, either in conjunction with crop model output or with verification using historical yields, used to be employed that best proxies the weather sensitivity of the crop in question. After developing weather indexes to capture the impact of adverse weather conditions on a specific crop's yield, it is straightforward to calculate the financial impact of these events for producers. Having identified the index, the crop yield, *Y,* or volume, *V,* variability per unit of the defined index, *I,* can be defined, as follows:

$$\Delta Y = \Delta V / H = a(I)\,\Delta I$$

where, *a(I)* is some function of *I* that relates the index to the yield *Y,* and *H* is the planting area of the crop. In order to calibrate an appropriate weather contract, the variation in crop yield must now be converted into a financial equivalent that mirrors the producer's exposure. This can be done, for example, by considering a producer's production and input costs per hectare planted or by considering his expected revenue from the sale of the crop at harvest.

Producers with fixed-price delivery contracts or those using price risk management instruments to protect themselves from market fluctuations in the price of their crop at harvest time know the financial value of each kilogram or metric ton they produce and hence can quantify the financial cost of a shortfall in production. If a grain producer, for example, knows he will receive $*X* per metric ton of crop, the following relationship must hold for his change in revenue:

$$\Delta Revenue = X \times (Actual\ Yield - Expected\ Yield) \times H$$
$$= X \times \Delta V = \pm\, X \times H \times a(I) \times \Delta I$$

A good weather hedge must offset the negative Δ *Revenue* fluctuation in the event of a drop in yield from budgeted levels if a producer is to protect his earnings. In order to perfectly replicate his position, the farmer could enter into a weather contract with the following incremental payout *P* per unit index:

$$\Delta P = X \times H \times a(I) \times \Delta I$$

Therefore, his overall position would be:

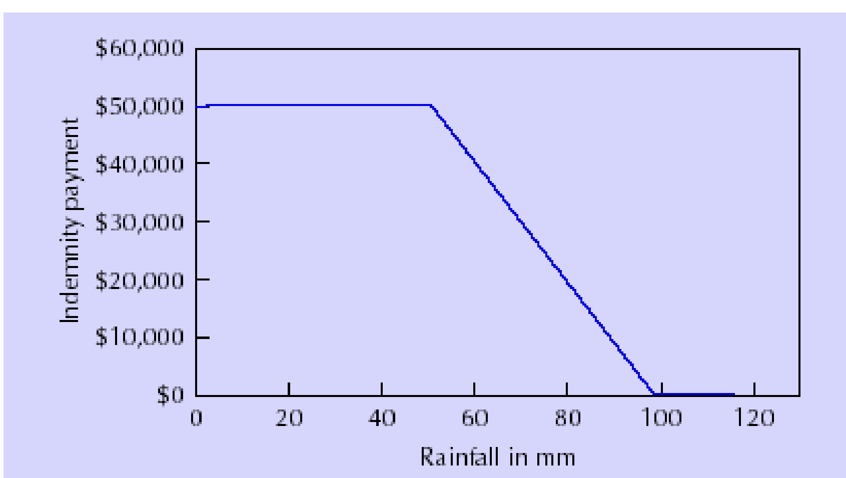
$$\Delta Revenue + AP = - X \times \Delta Y \times H + X \times H \times a(I) \times \Delta I = 0$$

Producers may have contractual obligations to deliver a predefined amount of their farmed product to a buyer at harvest time, with associated penalties if these obligations are not met. In such a situation, it would be straightforward to quantify and structure a hedging product to protect producers from these contractual costs in the event of weather related shortfalls in production.

The Limit

Most weather contracts have a limit, which corresponds to the maximum financial payout or recovery from the contract in a worst-case scenario, such as a complete crop failure. The maximum payout can be set by either considering the value-at-risk for the producer in the event of a total crop failure or by looking at historical index, production, and sales data to find the worse-case scenario historically in order to establish a limit. Alternatively, a producer may simply want to insure his production and input costs in order to recover these outlays if the crop fails. If a producer's production costs are \$*Z* per hectare farmed, \$*Z* will therefore correspond to the maximum payout, the limit of the weather contract, for each hectare the producer wishes to insure. The unit exposure *P* will therefore be as follows:

$$\begin{aligned}\Delta P &= \left(-\Delta Y / Expected\ Yield\right) \times Z \\ &= \left(a(I)\Delta I / Expected\ Yield\right) \times Z, \ for\ \Delta Y < 0\end{aligned}$$



Source: Skees 2003.

Figure 7.8: A weather contract for drought based on rainfall

Structuring the Product

Once the index has been identified and calibrated, the next step is to structure a contract that pays when the specified adverse weather occurs, thus performing a hedging or risk-smoothing function for the agricultural grower or producer. The approach for offering such a contract can be either of the following:

In general, most weather contracts are defined by a set of standard specifications including:

- The reference index, *I,* and weather station(s): complete specification of the index and data used to construct it;
- The term, *T:* the risk protection period of the contract, including the start and end date of the contract;
- A strike, *K:* also known as an attachment level, the level at which the weather protection begins;
- The payout rate, *X:* the financial compensation per unit index deviation above or below the strike at maturity, defined as the unit exposure in the previous section; and
- The limit, *M:* the maximum payout per risk protection period.

Risk Retention and Premium

It is clear that an important aspect to consider when structuring an index-based solution is the retention of risk by the party seeking protection. This means defining the index trigger level at which the weather protection begins. The strike determines the insured party's level of risk retention and is the key to pricing and success in transferring the risk. A strike very close to the mean of the index indicates a low level of risk retention by the end user and a high probability that the contract will pay out. This implicitly means a large premium, as well as the possibility of inspiring little interest in the weather market if the location or nature of the risk is outside the main liquid trading hubs or variables. A strike farther away from the mean reduces the probability of a payout and hence the premium of the contract, as the entity is retaining the more frequent, near-the-mean risk internally and transferring less to the market. The level of risk retention will depend on the risk appetite and business imperatives of the end user and the sensitivity to the premium associated with entering into a contract. By retaining more risk, all things being equal, the producer would reduce the premium of the contract.

7.2.1. A Typical Weather Insurance Contract

Insurer: Private Insurance Companies, Micro-finance organizations, Bangladesh; Krishi Bank (BKB) and Sadharan Bima Corporation (SBC).

Insured: Mandatory for farmers availing institutional credit, any other farmer or farmer groups. Again, those who have taken crop insurance policy will get advantage of having Agri-loan as well.

Subject matter insured: Paddy (IRRI/BORO, Aus, Aman, Wheat)

Perils covered: Flood, Cyclone & salinity, Hailstorm and Drought (not more than two perils for each region).

Definition of peril: A particular land insured should be declared as belonging to a weather station from where the climatic data will be collected to compare whether the peril occurred or not. When a particular climatic parameter related to crop yield observed in that weather station exceeds the limit of Weather Index as defined in the contract, it will be considered as a peril to the entire area covering the station. However, the definition of peril might still vary from land to land. For example, to estimate flooding height the water level of the nearest gauge station can be collected but it will vary from land to land depending on its altitude or elevation. In that case the altitude or elevation of each of the pieces of land should be written there.

Sum insured: 70% of the last five years' average production in the concerned field.

Premium: Premium rate will vary depending on the peril to cover and historical hydro-climatic condition of the region. For example, for Sunamgonj, premium rate will be higher for flood but lower for drought. While for Rajshahi, it will be higher for drought and lower for flood. Rate will be fixed depending on the historical climatic record of the region and its deviation from the weather index value of a particular peril. A per cent of the premium should be directly subsidized by the government. It will encourage more clients than before. Again, because of variation in premium level depending on disaster risk and lower coverage of yield (60%), premium level will be tolerable to many of the farmers with low risk so that they will be interested to buy a policy as well. This will reduce the chance of adverse selection to a great extent.

Indemnity: For a particular station, if the calculated value of Weather Index exceed the specified value, indemnity will be paid to all the farmers belong to that station. The hydro-climatic parameters require to calculate the Index should be collected from the specified weather station. If topographical data is used, for example, to calculate inundation height – it should be compared with the water level data, etc. A committee should be formed including experts in agriculture, water, meteorology, climate change and disaster that's decision will be final in that case.

Organizational structure

The organizations which have close contact with farmer groups or at least has a large network of local offices at rural areas should be preferred for the program. If SBC like it to restart, they should ensure such facilities or make contract with those types of local organizations to work for them. As it is seen from the FGD and Questionnaire survey, even though NGOs are working at grassroots level, farmers have still better confidence on Govt. organizations as because at least those organizations will exist until the end. Whereas, unless those reputed NGOs, there are always possibilities that small NGOs might bankrupt and not exist at all after collecting premium. An incident like this happened at Lalmonirhat as it was mentioned in FGD discussion. The best solution there should be involvement of both Public and private organizations where government should provide adequate guarantee to grow confidence among the farmers.

The loss assessment should be completely based on climatic records as observed to the nearest station as mentioned in the insurance contract. There should not be any sort of visual observation there, but solely on the climatic parameters observed. If in practice such estimation is found faulty like there was losses of crop due to extreme weather but it still it did not cross the Weather Index value, revision of the value of Weather Index should be made to make it more realistic. If required, the area belong to a weather station can be further subdivided into several pieces for a more realistic Weather Index.

7.2.2. Prospective Stakeholders for Cop Insurance Program

The stakeholders identified and their probable roles are described below;

National Stakeholders: The stakeholders under this category include probable insurance providers at national level like Sadharan Bima Corporation (SBC), Public and private sector banks including Bangladesh Krishi Bank (BKB), insurance companies, NGOs and Govt. micro-finance organization PKSF who were or are involved / interested in microfinance or micro-insurance related products. As it is seen from the past experience that Govt. agencies like SBC might not be a good option to offer CI so that attracting private enterprises or NGOs should be the main target here. However, SBC still can play important role in the form of a potential re-insurer. Bangladesh Krishi Bank on the other hand might be a potential stakeholder as it is already involved with the agri-credit disbursement and familiar with the farmers group and have grassroots level activities to some extent. Govt. microfinance organization PKSF is another potential entity, which can support the crop insurance process through funding, which it provides already to microfinance organizations at a very low interest rate. In that case, government should have policy to declare crop insurance as the same business entity like those of micro-finance organizations.

Agriculture, Climate Change and Disaster Experts: Expert views and continuous consultation with experts in the field of Agriculture, climate change and disaster management is highly required. Their role should be to provide feedback on the ongoing program, suggestion for improvement, update on future prediction on climate change, disaster trend and technological advances in the agriculture sector, etc. Regular meeting with the experts can be arranged to get feedback from them.

Hydro-meteorological organizations: Good quality hydro-meteorological data is a must for success of weather insurance program. Bangladesh Meteorological Department (BMD) and Bangladesh Water Development Board (BWDB) are the main contributors in that case. Representatives from these two organizations must be included in the CI program, especially while loss assessment and Weather Index are fixed. For areas with scarce weather stations, it might require to install temporary stations to measure at least a few weather parameters required for index calculation. Suggestion and expert views can be taken there from those organizations.

Regional/local Stakeholders: Divisional/district or local offices of the government organizations and the national NGOs involved or are likely to be involved in crop insurance process were identified. To run CI program smoothly it requires grassroots level monitoring and network. Last time, one of the main reasons why SBC failed in implementing CI was that they didn't have enough arrangements or manpower at local level and they had no strategy of closely monitoring the program. On the other hand, many of the NGOs offering micro-credit were highly successful because of their intensive grassroot level activities in close contact with people and intensive monitoring program.

Framers group and Representatives: Formal & informal cooperative groups/associations of farmers, local Disaster Management Committees (DMCs), and Local Government (LG) bodies involved in or are interested in crop insurance provision or management, or any other mutual risk support mechanisms were identified. Awareness among farmers and understanding of the insurance procedure are very important for a success of the program. Lack of it makes scope for moral hazards, corruption and inefficiency of the program. Representatives from farmers group is again required to understand their needs and problems.

Role of Government: Several organizations of Bangladesh Government, especially Department of Insurance, the ministry of Agriculture, Ministry of Commerce, Ministry of Finance, Ministry of Food and Disaster Management and the local government authorities might play important role there. The main role here to play by government agencies are to include it in the national policies, define criteria for CI program, regulate and monitoring the process, subsidizing CI if required and support with manpower or including CI within the existing administrative structure of local government appropriately.

Academic Institutes: Crop Insurance is still an emerging topic and there are a number of methodologies there. The applicability or suitability of the methods varies among countries and largely depends on the socio-economic, geographical and climatic characteristics of the region. Including Crop Insurance, micro-insurance is becoming a fast growing sector nowadays, which requires adequate institutional support as well. Institutes that might play important role there are Insurance Academy, Institute of Microfinance, BARC, Agri-economics Department of Agriculture Universities, BARI, which include a large number of economists and insurance experts. One of the reasons why SBC introduced CI project failed last time was that it was introduced hastily without proper training and understanding of the SBC officials about the crop insurance process.

Donors and International organizations: As it is evident from the experience worldwide that in most cases Crop Insurance project are not financially profitable, i.e. the expenditure in the form of indemnity and administrative cost is much larger than earnings from premium (Table 3.7). The international and donor organizations, such as UNDP, FAO, World Bank, GEF & any other agencies interested can provide subsidy or monetary supports to such CI project that they usually provide in other form, especially in developing countries. Under UNFCC proposal there are possibilities that CI might be an approach for developing countries to take compensation from developed countries due to climate change effects.

In fact, all the stakeholders mentioned above need to work together in an integrated manner to support CI processes. For example, the huge moral hazard in the CI process could be substantially reduced if the damage assessment authority was given to a committee composed of insurance expert, agriculture specialist, economist, climate expert, local govt. officials and farmers group together instead of just one person or only insurance company officials. A half-day **Inception Workshop** was arranged for discussion of the proposed methodology, inviting all the relevant stakeholders to collect and incorporate their views and ideas in the research methodology.

7.3 Way Forward: Proposal to Pilot Weather Index-based CI Model in Bangladesh

A pilot project can be undertaken to introduce Weather Insurance in Bangladesh at several locations. Under the project a detail layout of policy and institutional framework, methodology, and applicability can be demonstrated. The steps followed for it can be as follows;

- ☑ **Experience from neighboring country**

Before starting the Pilot program, a study team may gather experience from India, by staying there for few weeks, and meeting and discussing with relevant people on the methodology and performance of weather insurance scheme.

- ☑ **Launching a Pilot Project in the field**

  Site Selection: A pilot scale project may be started in three Thana. A preliminary survey should be made before selection of a pilot site. At the initial stage it is better to select areas where the things will be less complex like close to a weather station, a long time historical time series data for different climatic and crop yield variations are available.

  Collection of Data: Historical time series data of climatic parameters, natural disaster events, and yield variation, topographical data, etc.

  Defining Weather Index and Station: After the sites are selected, detail topographical and climatic information should be collected. Based on this, the Weather Index should be clearly defined for different disasters like flood, drought or cyclonic storm surges.

  Defining Risk Level: Analysis of historical time series of extreme climatic events compared to the defined Weather Index, calculation of several risk indices accordingly, predicting change in future risk level, especially under future climatic changes.

  Fixation of Premium and Indemnity Level: Depending on risk level as calculated, variable indemnity rates can be fixed for different topographical units and risk categories.

  Formation of Farmer's Community for each uniform Index Category: This might help to reduce the dispute regarding loss assessment, indemnity payment.

- ☑ **Provision for Government subsidy and/or involvement of International donor organizations**

- ☑ **Search for an organization to start selling the insurance contracts:** It will be better to introduce the program by a private insurance company or NGO. However, subsidy from government, re-insurance assurance from SBC and international support should be available for the project so that it is not a loss venture again. Minor adjustment is possible as per the insurer's conditions or desire. Oxfam or Care may be involved in this pilot project.

- ☑ **Monitoring the program and feedback**

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