

Community-Based Autonomous Adaptation and Vulnerability to Extreme Floods in Bangladesh: Processes, Assessment and Failure Effects

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Thesis Submitted For the Degree of Doctor of Philosophy
in
Discipline of Geographical and Environmental Studies
The University of Adelaide
August 2010

ABSTRACT

The Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report (2007), especially Chapter 17: *Assessment of Adaptation Practices, Options, Constraints and Capacity* demonstrates the importance of adaptation to climate change. The IPCC (2007) warned that the megadelta basins in South Asia, such as the Ganges Brahmaputra Meghna (GBM) will be at greatest risk due to increased flooding, and that the region's poverty would reduce its adaptation capacity. A key issue in assessing vulnerability and adaptation (V & A) in response to extreme flood events (EFEs) in the GBM river basin is the concept of autonomous adaptation.

This thesis investigates autonomous adaptation using a multi-method technique which includes two participatory rapid appraisals (PRA), a questionnaire survey of 140 participant analyses over 14 *mauzas* in the case study area, group and in-depth discussions and a literature review.

The study has four key approaches. First, it reviews the flood literature for Bangladesh from 1980 to 2009 and identifies a general description of flood hazard characteristics, history and research trends, causes of floods, and types of floods. Second, it examines farmers' crop adaptation processes in a case study area at Islampur, Bangladesh, in response to different types of EFEs (multi-peak with longer duration flood, single-peak with shorter duration flood and single-peak at the period of harvesting), and describes how farmers have been adapting to the extreme floods over time. Third, it assesses the V&A in response to three EFEs in 1998, 1995 and 1988. V&A are categorized on the basis of a weighted matrix index. The thesis uses PRA methodology and makes an

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important methodological contribution for assessing V & A. Fourth, the thesis assesses the economic consequences of failure effects of autonomous adaptation in response to EFEs. The results show that Bangladeshi farmers are highly resilient to EFEs, but the economic consequences of failure effects of autonomous crop adaptation (FEACA) on marginal farmers are large. These failure effects are defined as total crop loss against potential production, plus total agricultural cost multiplied by the number of flood events in the studied area. Total agricultural cost includes cost of seedlings, fertilizer, pesticides, land preparation, human labour, and watering. The thesis estimates that the crop related loss plus plants and houses damaged due to extreme flooding in 1998 in Bangladesh was US\$14001.26 million.

The thesis contributes to current knowledge by filling three important research gaps as follows, 1) farmers' autonomous crop adaptation processes in response to various types of EFEs; 2) methodological contribution for assessing V & A through PRA; and 3) the economic consequences of the failure effects of autonomous crop adaptations. The findings of this study can act as a guide to policy decisions for effective allocation of adaptation funds at community level in Bangladesh. The thesis concludes that urgent action is needed to improve the sustainable crop adaptation capacity at community level in the foreseeable future to cope with extreme floods under a regime of climate change.

DECLARATION

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying.

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August 2010

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ACKNOWLEDGEMENTS

This has been a long journey for me. Completion of this research work and writing has been possible only with the vital support and guidance I have received from my chief supervisor Professor Nick Harvey. The most important challenge was to find out the right way to express my views and shape the thesis. Nick's timely feedback and comments regarding my writing were of immense value and helped me to proceed in the right direction without which the study would not have been possible. I would admit that along the long journey I had moments of setback, but the inspiration and moral support from Nick kept me moving ahead.

I would also express my sincere gratitude to Emeritus Professor Martin Williams. Taking valuable time from his own research, he reviewed my writing in great detail, and provided valuable feedback within a very short timeframe, which overwhelmed me.

The discipline of Geography and Environmental Studies helped me in many ways throughout the journey. I had the opportunity to participate in the ANZSEE conference in 2007 and the IAG conference in 2006 with financial support from the discipline. I also participated in a GECHS conference with a presentation of my study findings. These conferences gave me the chance to share ideas related to my study with many learned academics and researchers. I would like to thank Christine Crothers, the cartographer of the discipline who helped me by drawing few figures.

It is not easy to conduct survey work and undertake PRA in rural and remote areas of Bangladesh, particularly in isolated *char* land areas. I was given unconditional support from the local Government administration, *Upazila* Agricultural Officer, Block Supervisors, the local *Union parishad* chairmen and members and community leaders

ACKNOWLEDGEMENTS

and last but not the least, from the vulnerable farmers themselves. I am greatly indebted to them. Four field assistants, Mr Ahmed, Mr Iqbal, Mr Shamim and Mr. Rakib stayed several weeks in the field with me and helped me during the questionnaire survey and conducting PRA sessions with sincerity and diligence. My heart-felt gratitude goes to them.

I would like to thank Dr Q. K. Ahmad, Chairman, Bangladesh *Unnayan Parishad* and President, Bangladesh Economic Association; Dr K. B. Sajjadur Rasheed, former Professor of Geography and Environment, Dhaka University; Professor Munir Morad, Head of the department, UELS, London South Bank University, UK for their constant encouragement and inspiration. Professor M. Aminul Islam former VC of the Open University, Dr S. M. H. Zaman and Dr Z. Karim both as an agricultural expert, Professor AQM Mahbub, President of Bangladesh Geographical Society and Prof Bhuiya of Jahangirnagar University, helped me with their valuable opinions in various forms, either by phone or face to face interview from time to time. Dr Jan E. Carey and Chris Nance helped me with proof reading.

I cannot thank enough my sisters and brothers Dr Asfia, Dr Zakaria, Dr Afia, Dr Yousuf and Ms Irani for the encouragement they provided throughout this journey. I remember my mother who was the source of never ending encouragement for me, although unfortunately she could not see me completing it. My daughter Farah helped me with data entry which was a very rewarding experience for me. I am also deeply indebted to my wife, Dr Raunak Konok, who was there for me all through my journey, despite her busy work schedule in Hospital. Last but not the least, my gratitude to almighty God for enabling me to complete this task.

ABREVIATIONS

ACA: Autonomous Crop Adaptation.

ADB: Asian Development Bank.

AFDB: African Development Bank.

BCCSAP: The Bangladesh Climate Change Strategy and Action Plan.

BWDB: Bangladesh Water Development Board.

BWFMS: Bangladesh Water and Flood Management Study.

CBAC: Community Based Adaptation Committee.

COP: Conference of the Parties.

DFID: The Department for International Development.

EFEs: Extreme Flood Events.

EIA: Environmental Impact Assessment.

ENSO: El Niño-Southern Oscillation.

ESCAP: United Nations Economic and Social Commission for Asia and the Pacific.

FAO: Food and Agriculture Organization.

FAP: Flood Action Plan.

FC: Fertiliser Cost.

FCDI: Flood Control and Drainage and Irrigation.

FEACA: Failure Effect of Autonomous Crop Adaptation.

FEACAs: Failure Effects of Autonomous Crop Adaptations.

FPCO: Flood Plan Coordination Organization.

GBM: Ganges, Brahmaputra and Meghna

GCMs: Global Circulation Models.

ABBREVIATIONS

GDP: Gross Domestic Product

GECHS: Global Environmental Change and Human Security

GOB: Government of Bangladesh

HYV: High Yielding Variety.

IECO: International Engineering Company.

IPCC: Inter-governmental Panel on Climate Change

IRRI: International Rice Research Institute.

IWRM: Integrated Water Resource Management

LC: Labouring Cost.

LPC: Land Preparation Cost.

MHL: Medium High Land.

MLL: Medium Low Land.

MoEF: The Ministry of Environment and Forest.

MPO: Master Plan Organization.

N: Number of Flood Strikes.

NAPA: The National Adaptation Program of Action.

NGOs: Non-Government Organizations.

NWP: National Water Plan.

OECD: Organization for Economic Co-operation and Development.

PC: Pesticides Cost.

PRA: Participatory Rapid Appraisal.

PRRA: Participatory Rapid Rural Appraisal

RAP: Rapid Assessment Procedures.

RRA: Rapid Rural Appraisal

SC: Seedling Cost.

TECL: Total Expected Crop Loss.

TERI: The Energy and Resources Institute.

Tk: *Taka*

UNDP: United Nations Development Program.

UNEP: United Nation Environment Program

UNFCCC: The United Nations Framework Convention and Climate Change

UNO: *Upazila Nirbahi Officer*

USAID: United States Agency for International Development.

USCSP: United States Country Study Program.

V & A: Vulnerability and Adaptation.

VGf: Vulnerable Group Feeding.

VLL: Very Low Land.

WARPO: Water Resource Planning Organization.

WC: Watering Cost.

GLOSSARY

Agricultural Block Supervisor: *Upazila* Agriculture Office has divided several blocks of agricultural lands. The block supervisors are responsible to collect agriculture related data from the concerned block/s and report to the agriculture office. They are responsible to discuss with the local farmers about their cropping decisions, and availability of agricultural needs.

Aman: It is a variety of rice which grows in *kharif 2* cropping season (July to November). It has local as well as high yielding variety.

Ashar, ograhoyon: These are Bengali months.

Bazar: Small commercial place.

Bigha: Land measuring unit. One *bigha* = 0.33 acre.

Bonna: It is an abnormal flooding which brings havoc and disaster.

Borsha: It is a normal annual flood event. Farmers usually adapt with this normal annual flood event, and cultivate their required crops on the agricultural lands.

Chalan bill: One of the richest wetland areas of Bangladesh.

Char land areas which are sand bars formed within a river or estuary. It is a remote and isolated area from manilands, and it has no utility services such as electricity, gas and water.

Chinaduli Union: It is located in the case study area.

Gainja, Haloi and Kater: Local variety of *aman* crop. These are short maturation crop.

Kharif 2: It is a cropping season, and extends from July to November (*Shraban* to *kartik*) and comprises most of the monsoon season.

Machang: Usually located under the roof, farmers use the *machang* as a storeroom.

Matbar: Local community leader who is usually wealthy at grass-root level.

Mauza: It is a root level land identification unit in Bangladesh. Sometimes it means a village. Several mauzas comprise a Union.

Plabon: Exceptionally severe floods. These devastate the livelihoods of people and cause havoc to the national economy.

Rabi: It is a cropping season, which is the period between November and February (*agrahaon* to *magh*).

GLOSSARY

Rikshaw: Tri-cycle, pulled by man.

shobaraj, bagha, chonda, boro digha, hash kolom, ponkhiraj, kartic jhula, roga jhula, echa kuri - all are local varieties *aman*. These are called deep water *aman*, and grow with incoming flood water.

Shotok: It is a local land measuring unit. One shotok = 0.0104 acre.

Taka: currency of Bangladesh. 1 US dollar = 70.22 *taka* (OANDA.com).

Transition between *Kharif 2* and *Rabi*: This is the period extending from the beginning of recession of flood water to the time before farmers start planting IRRI *boro*.

Union Parishad: Every *Union* has elected committee, it is called *Union Parishad*. Every *Parishad* has an elected chairman and several elected members.

Union: It is a local administrative unit in Bangladesh. Several *Unions* comprise as an *Upazila*.

Upazila (formerly it is called *Thana*): It is an administrative unit in Bangladesh.

Upazila Nirbahi Officer: *Upazila* administrative officer who represents the Governemnt of Bangladesh.

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