



**Vulnerability of microfinance institutions to  
climate risk in the Satkhira District,  
Southwest Bangladesh**

**Adrian Fenton, Anne Tallontire  
and Jouni Paavola**

March 2017

Sustainability Research Institute

Paper No. 107

Centre for Climate Change Economics and Policy

Working Paper No. 302

**SRI PAPERS**

SRI Papers (Online) ISSN 1753-1330

First published in 2017 by the Sustainability Research Institute (SRI)  
Sustainability Research Institute (SRI), School of Earth and Environment,  
The University of Leeds, Leeds, LS2 9JT, United Kingdom

Tel: +44 (0)113 3436461  
Fax: +44 (0)113 3436716

Email: SRI-papers@see.leeds.ac.uk  
Web-site: <http://www.see.leeds.ac.uk/sri>

### **About the Sustainability Research Institute**

The Sustainability Research Institute conducts internationally recognised, academically excellent and problem-oriented interdisciplinary research and teaching on environmental, social and economic aspects of sustainability. We draw on various social and natural science disciplines, including ecological economics, environmental economics, political science, policy studies, development studies, business and management, geography, sociology, science and technology studies, ecology, environmental science and soil science in our work.

**The Centre for Climate Change Economics and Policy (CCCEP)** brings together some of the world's leading researchers on climate change economics and policy, from many different disciplines. It was established in 2008 and its first phase ended on 30 September 2013. Its second phase commenced on 1 October 2013. The Centre is hosted jointly by the University of Leeds and the London School of Economics and Political Science (LSE) and is chaired by Professor Lord Stern of Brentford. It is funded by the Economic and Social Research Council (ESRC) with a mission to advance public and private action on climate change through rigorous, innovative research.

Its five inter-linked research themes are:

Theme 1: Understanding green growth and climate-compatible development

Theme 2: Advancing climate finance and investment

Theme 3: Evaluating the performance of climate policies

Theme 4: Managing climate risks and uncertainties and strengthening climate services

Theme 5: Enabling rapid transitions in mitigation and adaptation

More information about the Centre for Climate Change Economics and Policy can be found at: <http://www.cccep.ac.uk/>

### **Disclaimer**

The opinions presented are those of the author(s) and should not be regarded as the views of SRI, CCCEP or The University of Leeds.

## **TABLE OF CONTENTS**

<b>Abstract</b>	<b>4</b>
<b>About the Authors</b>	<b>5</b>
<b>1. Introduction</b>	<b>6</b>
<b>2. Literature Review</b>	<b>7</b>
<b>3. Methods and Materials</b>	<b>10</b>
<b>4. Case Study</b>	<b>11</b>
<b>5. Results</b>	<b>13</b>
<b>6. Discussion</b>	<b>16</b>
<b>7. Conclusion</b>	<b>20</b>
<b>References</b>	<b>21</b>

## **ABSTRACT**

This article explores how microfinance institutions are affected by and are responding to flooding by examining a case study in Satkhira District, Southwest Bangladesh. We develop a framework for understanding how microfinance institutions can reduce their vulnerability to climate risks and use the framework to empirically assess local-level practices, drawing from semi-structured interviews with households and local branch managers as well as household survey data. While microfinance institutions are directly vulnerable to flooding, their main exposure arises from the exposure and sensitivity of client livelihoods and their lack of adaptive capacity. Branch managers are unable to screen clients for climate risk for ethical, practical, and financial sustainability reasons. Branch managers have also limited capacity to manage aggregated risk. We argue that efforts should instead focus on reducing client vulnerability, tackling the problem at its source. While much potential exists for microfinance institutions to do so, it is not actively and explicitly being achieved. Loan product innovation could facilitate clients' adaptation to relevant climate hazards. This requires empirical understanding of autonomous household adaptation to incorporate client knowledge of adaptation needs, options, and associated barriers. Our results indicate that homestead loans, disaster management loans, and loans for alternative income-generating activities would help reduce client vulnerability. Integrating non-financial services could also contribute to addressing non-financial barriers to adaptation.

## **KEYWORDS**

Microfinance, Institutions, Bangladesh, Climate change, Adaptation

Submission date 24-11-2016;

Publication date 31-03-2017

## **About the Authors**

**Adrian Fenton** is a PhD Researcher at the Sustainability Research Institute of the School of Earth & Environment. His research examines how rural finance institutions influence the livelihoods of households in Bangladesh. In particular, his research focuses on the role played by microfinance institutions in facilitating and inhibiting climate change adaptation.

Adrian is also a Visiting Researcher at the International Centre for Climate Change and Development (ICCCAD) and an Affiliate Researcher of the Centre for Climate Change Economics and Policy (CCCEP).

In addition to his academic research, Adrian has private consultancy experience working on assignments for the United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP), and the International Institute for Environment and Development (IIED), as well as non-governmental organisations such as Oxfam and CARE international.

His research is part funded by the University Meets Microfinance initiative, the Sustainability Research Institute and the Centre for Climate Change Economics and Policy.

**Dr Anne M. Tallontire** is a senior lecturer in business, environment and sustainability in the Sustainability Research Institute at the University of Leeds. She has worked on voluntary sustainability standards for over fifteen years, exploring implications for small scale producers and workers, particularly in Africa. She wrote her PhD on fair trade and has conducted several research and consultancy projects on standards in agri-food chains, for ETI, HIVOS, Fairtrade International, Department for International Development, and Foreign Investment Advisory Service of the World Bank.

**Jouni Paavola** is Professor of Environmental Social Science and Director of the ESRC funded Centre for Climate Change Economics and Policy (CCCEP) in the School of Earth and Environment at the University of Leeds. His research examines environmental governance institutions and their environmental, economic and social justice implications, with a focus on climate change and biodiversity. He leads the CCCEP second phase research theme on enabling rapid transitions in mitigation and adaptation. He has published his research in journals such as *Science*, *Ecology and Society*, *Ecological Economics* and *Energy Policy*, and have co-edited books published by Blackwell, MIT Press and Routledge. He is member of editorial boards of *Ecological Economics* and *Environmental Policy and Governance*.

## 1. Introduction

Adaptation to climate change is an increasingly important policy issue in developing countries. We regard adaptation to climate change (henceforth adaptation) as the process through which actors adjust to changing conditions, hazards, risks, and opportunities posed by climate change (Smit & Wandel, 2006). In autonomous adaptation actors such as households and businesses independently respond to changing conditions, hazards, risks, and opportunities posed by multiple stimuli (Smit et al., 2001; UNFCCC, 2009). In planned adaptation actors such as development institutions undertake top-down measures in anticipation of climate change, often to facilitate autonomous adaptation.

Planned adaptation is based on a view that autonomous adaptation will be insufficient without external intervention. But understanding which interventions are needed can only be gained by understanding how local-level actors are adapting autonomously. Understanding how local-level organisations are responding to environmental and climate risks (henceforth climate risks) is important, as they influence the adaptation decisions of others by influencing the risks and incentives to adopt adaptation measures and by governing access to resources (Agrawal, 2008). Yet understanding of local-level institutions and their role in adaptation remains underdeveloped, with simplified assumptions often made regarding organisational responses to climate change (Agrawal, 2008; Berkhout, 2012; Berman et al., 2012). Microfinance institutions (MFIs) are examples of organisations that play an important role in the autonomous adaptation of other actors. Microfinance refers to the financial services provided to low-income and disadvantaged households, who are not served by the conventional banking sector. We use the term MFI to refer to any organisation offering these financial services, including non-governmental organisations (NGOs) and savings-based credit cooperatives (SCOs).

There is growing interest in the potential of MFIs to support autonomous household adaptation (e.g. Agrawala & Carraro, 2010). However, we know little about how these institutions themselves are responding to the impacts of climate change (Fenton et al., 2015). This article seeks to contribute to filling this gap in evidence. We explore how SCOs and NGOs are affected by and are responding to flooding in the Satkhira District, Southwest Bangladesh by drawing from semi-structured interviews with households and local branch managers as well as household survey data. We focus on Bangladesh because the country has a vibrant microfinance sector and is one of the most vulnerable countries to climate change. It is exposed to multiple climate hazards, including flooding, which regularly affects large parts of the country (MoEF, 2008). The microfinance sector has thus experienced significant losses due to major flooding events.

We find that local MFIs are vulnerable to flooding as it reduces the ability of their clients to repay loans. Branch managers are unable to screen out climate risk and have few other options than to delay repayment collections. Because they cannot screen out climatic risks, MFIs can only adapt by reducing or managing them. We find that SCOs attempt neither alternative, which should be a concern for adaptation planners and development practitioners alike. Some NGOs do attempt to reduce risks by either

providing specialised loan products, renegotiating existing loans, or disbursing additional loans, and by using liquidity and contingency funds, but they need to do more to ensure specialised loan products provide the relevant capacities to reduce sensitivity.

In what follows, we first review what is known about the climate risks MFIs face and how they can respond to them. We then outline the materials and methods used and describe the case study we examine in the article. We then examine how MFIs are affected by flooding and to what extent they have pursued options to reduce or manage climate risks. Finally, we relate our findings back to the literature to draw conclusions and policy implications.

## **2. Literature Review**

The need to adapt arises from vulnerability to climate change impacts (henceforth 'vulnerability'), which is understood differently in the risk-hazard, political ecology, and ecological resilience literatures (see Eakin & Luers, 2006; Eriksen & O'Brien, 2007). Political ecology emphasises wider structural causes of vulnerability (Eakin & Luers, 2006). While it may be suited to local-level studies, it is less suited to answering the questions posed by this research (see Eakin et al., 2009). Ecological resilience in turn experiences difficulty when exploring local phenomena over shorter terms as it focuses on socio-ecological systems and their changes over longer time spans (Eakin & Luers, 2006).

We adopt the risk-hazard approach due to its applicability for local-level analysis, its compatibility with the assessment of microfinance, and its relevance for understanding local-level responses to climate change as well as understanding how these changes impact on livelihoods and assets. Vulnerability is considered to be determined by exposure and sensitivity to climate hazards and the capacity to adapt (Eakin & Luers, 2006; Smit & Wandel, 2006). Exposure refers to the existence of assets which can be adversely affected by climate hazards, and the likelihood of the adverse effects occurring (IPCC, 2014). Sensitivity refers to the extent to which assets are adversely affected (IPCC, 2014). Adaptive capacity is the ability to undertake measures that reduce exposure and sensitivity. It is comprised of specific and general capacities (Eakin et al., 2014) and it is determined by many factors that vary across actors. For instance, national adaptive capacity is underpinned by different factors than adaptive capacity at the local-level (cf. Adger & Vincent, 2005; Brooks et al., 2005; Grothmann & Patt, 2005; Jones et al., 2010). Adaptation consists of the processes through which actors adjust to the stresses, risks, and opportunities associated with hazards (Smit & Wandel, 2006). The measures through which this is achieved are referred to as adaptation options, and the factors inhibiting their implementation are adaptation barriers (IPCC, 2014). Maladaptation occurs when measures inadvertently increase vulnerability (Barnett & O'Neill, 2010).

We make a distinction between coping and adaptation. Coping refers to immediate responses to events without changing current practices and norms, whereas adaptation changes them in order to reduce vulnerability to anticipated future events (Berman et al., 2012).

It has been argued that reducing poverty requires long term access to financial services, and thus financially sustainable MFIs (see Bhatt & Tang, 2001; Morduch, 2000; Woller et al., 1999; Woller & Woodworth, 2001). The suggestion that MFIs can play an important role in facilitating autonomous household adaptation builds upon this reasoning as it is also a long term process (see Agrawala & Carraro, 2010; Hammill et al., 2008; Heltberg et al., 2009).

However, little existing literature explores how climate hazards influence the financial sustainability of MFIs and their adaptation options. Their financial sustainability is undoubtedly affected by climate hazards. For example, major flooding in Bangladesh in 1998 resulted in a significant reduction of loan repayments which created liquidity problems and required capital injection to keep the sector functioning (Nagarajan & Brown, 2000; Twigg, 2004; World Bank, 1999).

Risks deriving from climate hazards increase the demographic, physical environment, and macroeconomic risks facing MFIs (see Pantoja, 2002). They are 'risk aggregators', depending on factors such as the number of clients served, their vulnerability, and their geographical dispersion (Pantoja, 2002). Climate hazards increase client vulnerability and thus risks associated with client demographic and socioeconomic profile. This has implications for operational risks (e.g. increased credit risk due to non-payments, resulting in lower portfolio quality), portfolio quality (e.g. portfolio at risk, write-off ratio, and risk coverage ratio), and financial management risks (e.g. increased asset and liability risk due to increased liquidity risk) (see Bruett, 2006; Dowla, 2009; Pantoja, 2002).

We propose that there are three distinct ways in which MFIs can reduce their vulnerability. These include 1) screening out vulnerable clients; 2) reducing client vulnerability; and 3) managing aggregated vulnerability at the MFI level. We discuss each approach below in more detail.

Screening out vulnerable clients is theoretically the first option to reduce MFI vulnerability, achievable by changing breadth (number of clients) or depth (degree of vulnerability of clients) of outreach (see Navajas et al., 2000). Increasing breadth of outreach is unlikely to reduce MFI vulnerability. Climate hazards pose covariate risks affecting entire localities (Miranda & Farrin, 2012). A geographically dispersed client base could in theory reduce vulnerability if climate hazards in different localities are uncorrelated (Meze-Hausken et al., 2009). However, in reality this may seldom occur. Climatic hazards such as cyclones often impact whole countries, most notably small-island states (IPCC, 2014). Climate hazards are also often insufficiently uncorrelated across localities. For example, in Bangladesh coastal flooding coincides with other hazards affecting the rest of the country (CCC, 2007).

Decreasing depth of outreach is also unlikely to reduce MFI vulnerability. Climate hazards affect both poor and non-poor groups as well as those with different livelihood profiles. For instance, rural households with non-agricultural livelihoods are affected by flooding as much as households with agricultural livelihoods in the same locality (Fenton et al., 2016). Additionally, serving wealthier clients could prove maladaptive by increasing the vulnerability of potential clients and accentuating inequities.



Furthermore, no widely applicable metric exists for vulnerability because of its context specific nature (see Barnett et al., 2008; Smit & Wandel, 2006).

Reducing client vulnerability is the second option for MFIs to reduce their vulnerability. Existing literature focuses on the ability of existing loan products to facilitate adaptation (e.g. Agrawala & Carraro, 2010), adopting the 'adaptation as development' position (see Ayers & Dodman, 2010). Loan products are presumed to foster adaptation because they can contribute to poverty reduction. But these studies apply a meso or macro lens and are not based on local empirical evidence. Consequently, it remains unknown whether existing loan products reduce vulnerability to climate hazards or not. Development of loan products requires knowledge on feasible adaptation options within a locality, the specific capabilities required for their implementation, and their associated barriers to implementation. This is likely to require extra technical support and training for MFI staff (Miamidian et al., 2005). It may be challenging to identify adaptation options that can be supported with microcredit. For instance, microenterprises can be highly vulnerable to flooding and overcoming adaptation barriers may entail costs surpassing credit limits (Fenton et al., 2017). Existing loan products can also be adapted to support vulnerability reduction. Contract conditions and behavioural clauses can be used to incentivise clients to adopt risk reduction measures (see Huybrechs et al., 2015). For instance, clients could receive lower interest rates if they cultivate flood tolerant crop varieties. However, while evidence is slowly emerging on the potential of contract conditions and clauses to reduce risks, their use is scant. Index-based insurance can help transfer risks to a third party, and also in theory incentivise risk reduction behaviour among clients (Heltberg et al., 2009; Linnerooth-Bayer & Mechler, 2006). However, despite its theoretical benefits, many pilot projects have failed to scale up creating concerns about its effectiveness in practice (Binswanger-Mkhize, 2012).

Non-financial services can also be supplied to help overcome non-financial adaptation barriers. This is a fairly common microfinance practice, the basis of which is that non-financial services should be supplied to reflect the multiple constraints inhibiting poverty reduction (Woller & Woodworth, 2001). However, it has been argued by some that MFIs should only provide financial services, not to dismiss such concerns, but due to the belief that MFIs are not best placed to provide these services (see Bhatt & Tang, 2001; Dunford, 2001; Woller & Woodworth, 2001). Many non-financial services from book-keeping advice to health and education programmes have been integrated with financial services (see Dunford, 2001; Sievers & Vandenberg, 2007). Under a graduation model they are supplied at different times as client well-being increases (see Huda & Simanowitz, 2009; Matin & Hulme, 2003; WFP-Oxfam, 2015). However, we know little about how these services can facilitate autonomous adaptation.

Managing aggregated vulnerability at the MFI level by creating and adapting internal processes and policies is the third option to reduce MFI vulnerability. This is needed in the financial services sector in general (Dlugodecki & Lafeld, 2005) and the options for MFIs are similar to those of the rest of the sector: contingency funds, altering liquidity levels, staff training and the use of guarantee funds (Bastiaenen & Van Rooij, 1997; Dlugodecki & Lafeld, 2005; Miamidian et al., 2005). Contingency funds are important as the lack of liquidity is typically the biggest financial risk after a disaster.

Donors have contributed to the initial capitalization of contingency funds (Goldberg & Palladini, 2009). These funds can reduce MFI sensitivity to climate hazards by alleviating the consequence of mass deposit withdrawals, default, and late repayments while also providing capital for additional loan provision after disasters occur. Interest in meso-index insurance is growing, which avoids some problems associated with household level index-insurance (see Barnett et al., 2008; Miranda & Farrin, 2012; Miranda & Gonzalez-Vega, 2011). However, widespread development of this product has not yet occurred (see Miranda & Farrin, 2012).

To conclude, insufficient attention has been paid to the vulnerability of MFIs and how they can address climate risk. We suggest that reducing client vulnerability and managing it within MFIs are the most promising avenues. The existing literature acknowledges this potential at the meso and macro-level but has not evidenced it at the local-level. Thus it is not well placed to understand the livelihood implications of current MFI practices, which require household level studies (Hulme, 2000). There is also little evidence on how local level representatives of MFIs are affected by and are responding to climate hazards. If this was known there would be greater understanding of the vulnerability of MFIs and their potential role in adaptation planning both as project implementers and as project beneficiaries.

### **3. Methods and Materials**

Our research was conducted in Noapara Village in the Satkhira District of Southwest Bangladesh. The site was chosen on the basis of key informant interviews which indicated it was typical of the area, exposed to flooding, served by multiple financial institutions, accessible and secure, and respondents were at a low risk of research fatigue. A single case-study was adopted to achieve an in-depth examination of the context-specific nature of vulnerability and adaptation. This required qualitative methods and a prolonged presence in the locality to gain the familiarity and trust of research participants.

Fieldwork gathered both qualitative and quantitative materials. A mixed-methods strategy enabled the triangulation of participant experiences. In March 2014, 30 participants (11% of the population) engaged in focus group discussions to explore village livelihoods and history and validate the appropriateness of the case-study. Between May and June 2014, 266 households (99% of the population) were surveyed on their livelihoods, land ownership, social support networks, assets, exposure to environmental hazards, and credit usage, with a particular focus on access to financial institutions.

We conducted field research between March and April 2015, involving semi-structured interviews with 38 household heads (14% of the population) to explore household vulnerability and microfinance access. Additionally, short interviews were conducted with market stall owners (72% of market stalls) regarding their experiences with credit. Personal observation and informal conversations complemented the data collection methods. Key informant interviews were also conducted with key national level stakeholders and NGO head office representatives where possible and relevant.

Village-level research was used to construct an overview of MFI coverage. Institutions which had distributed the most loans to households were selected for interviews. Semi-structured interviews (20) were undertaken with branch managers from NGOs (9), and SCOs (7) regarding their personal experiences and the problems faced by their branch. Interview topics ranged from external risks, performance management, factors used to screen loan applications, to internal and external climate-proofing efforts.

Focus group findings were interpreted in situ with participants. Survey data was analysed using SPSS and interpreted with reference to the literature. Semi-structured interviews were coded according to interview themes. Analytical categorisation was then undertaken using an iterative process building on the initial descriptive coding, and drawing upon literature themes to interpret the material.

#### **4. Case Study**

Noapara Village has 267 households, 74% of which have 3-5 members, and 94% of which are male-headed. The common livelihood is to cultivate high-yield varieties of rice in winter and migrate seasonally in search of agricultural wage labour during the remainder of the year. Subsistence livestock, poultry, and aquaculture are widespread livelihood activities. Less common activities include non-agricultural salaried work, international migration, and finally seasonal and permanent businesses. All common livelihood activities involve credit. For instance, most agricultural inputs are purchased on credit and debts repaid at a post-harvest festival known as Halkhata.

The village is affected by riverine flooding which also affects much of south-west Bangladesh (MoEF, 2008). Flooding results from water overflowing the banks of the Kobadak River. Top-down flood management programmes are typically considered as the main root cause of flooding (see Wesselink et al., 2015). Over time these programmes have inadvertently led to river sedimentation, reduced river outflow, elevation of rivers, and prompted subsidence in surrounding lands. The risk of flooding is significant, over the period 2004-2011 river levels exceeded the danger level every year except 2010 (BWDB, 2011).

According to the local councillor, the intensity and frequency of flooding has recently increased with major events occurring in 2008 and 2011. Flooding occurs from June to October, typically lasting 2-3 months due to poor drainage. However, major events last longer with flooding in 2011 lasting for approximately 8 months. Survey results indicate that most households have been significantly affected by flooding 3-5 times in the past decade.

Many financial institutions serve Noapara Village (effectively 1 institution per 11 households), ranging from formal banks, national and regional NGOs, and community-initiated and managed SCOs (see Table 1). NGOs were Bangladeshi microfinance NGOs such as BRAC, and not international NGOs such as Oxfam<sup>1</sup>. We consider

---

<sup>1</sup> Grameen Bank is considered a microfinance NGO such as BRAC due to similarities in how they operate. It is not easily categorised because 1) it is technically a parastatal agency operating under a special ordinance and is thus not regulated by the Microcredit Regulatory Authority. Additionally, it is owned mostly by its clients with the Government of Bangladesh being a minority shareholder. Consequently, there are grounds to categorise it as a cooperative, NGO, and a government bank.

SCOs and NGOs to be MFIs and focus our analysis on them. NGOs provide external funds, typically from the government, whereas SCOs circulate community resources. NGOs use a combination of individual and group lending and liability mechanisms. The SCOs use only individual lending and liability mechanisms. NGOs and SCOs have maximum credit limits, simplified procedures and formalised repayment structures. NGOs offer a range of current and fixed deposit savings services while SCOs only offer the opportunity to save in the initial capital accumulation phase. Their members are unable to withdraw savings without cancelling membership. NGO branches have a manager and a small team of field officers who visit microfinance groups to provide support and collect repayments. SCOs have governing committees which meet monthly, typically comprising a chairman, vice-chairman, secretary, cashier, and group members representing each village neighbourhood. Credit is also available from informal sources such as market stalls, friends, and extended family. This credit is characterised by idiosyncratic maximum credit limits and an absence of formal procedures or repayment structures. Credit from market stalls is relatively inexpensive compared to formal institutions, as peer-to-peer lending for interest is considered morally unjust under Islamic principles. Credit from friends and family is interest free for the same reason.

Survey data recorded household outstanding loans to finance providers (see Table 1). MFIs account for over half of disbursed loans (55.01%). Households prefer MFI loans because of accessibility, convenience, and trusted procedures. Informal sources account for much of the remaining disbursed loans (39.28%). Households prefer informal credit above formal credit due to its greater flexibility and low costs. Banks disbursed few loans (5.72%). Households cite lengthy and complex application procedures, an inability to obtain required documentation, the inconvenience of travelling to branches, and corruption as reasons for why they rarely attempt to access loans from these institutions.

Table 1: Breakdown of financial providers by breadth of outreach

	Traditional providers	MFIs		Informal Providers			
	Bank	NGOs	SCOs	Friends	Family	Shop	Money-lender
<b>Number of institutions</b>	7	15	9	N/A	N/A	N/A	N/A
<b>Total loans issued</b>	36	215	131	82	98	63	4
<b>% households with loans</b>	12.78%	53.00%	35.71%	30.83%	36.84%	23.60%	1.50%
<b>% of total loans</b>	5.72%	34.18%	20.83%	13.04%	15.58%	10.02%	0.64%
<b>Average loan size</b>	43,611	22,116	13,996	30,948	12,026	14,757	6,500
<b>Total credit issued</b>	1,570,000	4,755,000	1,833,500	2,537,700	1,178,500	929,660	26,000
<b>% of credit issued</b>	12.24%	37.06%	14.29%	19.78%	9.19%	7.25%	0.20%

Average loan size and total credit offered reported in local currency, Bangladesh Taka, (BDT).

## 5. Results

### How MFIs were vulnerable to flooding

MFI representatives indicated that they experience vulnerability to flooding both directly and indirectly. SCOs are directly exposed as offices are situated in flood prone areas. Flooding inundates offices causing damage to property, assets, and records. Few options exist to reduce direct sensitivity other than moving documents and assets to safer locations when required. One SCO had constructed an office on a raised plot of land to reduce sensitivity; however, it had to be demolished as its proximity to a main road violated planning laws, indicating a lack of knowledge of these issues. NGO representatives reported no damage or changes in practices due to flooding as offices are located in towns with higher land elevation. Field staff mobility is reduced by flooding but field officers can access villages using boats.

All MFIs reported being indirectly vulnerable to flooding through their clients. According to key informant and household interviews, regular flooding has been detrimental to client livelihoods (see Fenton et al., 2016, Fenton et al., 2017). Prolonged flooding causes severe erosion to traditional earthen homesteads which can then collapse. A local councillor commented that only brick and mortar homesteads and plinths survived one period of especially bad flooding. Summer cultivation of cash crops, previously an important traditional livelihood component, has been largely abandoned as it

coincides with flooding. Proceeds from this activity were used to generate income for debt repayment, asset investment, and savings accumulation. Local demand for labour has significantly reduced, previously an important regular income source. Instead, household members migrate seasonally in search of agricultural wage labour opportunities. Incomes have consequently reduced for many households. One household commented that “many people go to get a job and the daily wage decreases, I only bring back a small amount of money”. Microenterprises are also struggling due to stock damage, low demand for goods and services, and selling a higher proportion of goods on credit. Flooding has suppressed the local economy; as one branch manager explained, “If there is flood, it affects everyone more or less, if all people are affected, obviously it affects others, they cannot escape from it”.

Additionally, flooding has changed the way households use credit, with significant levels devoted to non-productive purposes contributing to household over-indebtedness (see Fenton et al., 2017). Survey data indicate that a third of current outstanding loans were obtained to smooth consumption, notably for purchasing food and medicine. Homestead reconstruction has depended on households accessing loans over time to cover reconstruction costs. One over-indebted household noted “to build this house we took loans, and to repay the loans we borrowed money from another place, and to repay the second loan we borrow money from yet another place”. Survey data showed that a fifth of current outstanding loans were obtained simply to repay existing loans, a key indicator of client over-indebtedness (see Schicks, 2014 ).

#### **How MFI representatives have responded to flooding**

All MFI representatives reported halting repayment collections during flooding. However, the non-disclosure of relevant financial data eliminates the possibility of quantitative assessment. Many NGO branch managers reported that flooding impairs the achievement of loan repayment and disbursement targets. Repeated failure to meet targets threatens job security, although most stressed that superiors understood their situation. Household interviews corroborated the inability of clients to meet repayments, which has at times resulted in community friction due to liability mechanisms. Community friction was found to be especially prevalent with respect to SCOs. Some households believed the actions of SCOs to be “un-Islamic”. Some felt uncomfortable forcefully collecting repayments from those unable to repay. One explained why he wanted to cancel his SCO membership: “I don’t want to collect money from anyone who can’t repay for my personal interest, why should I misbehave regarding this issue”.

According to MFI interviews, the screening of clients and loan applications for climate risk does not occur. The only mentioned activities that are unsupportable are salt-water shrimp production and illegal activities. Assessment of applications is largely subjective, based on personal judgement of managers, fellow group members, and the views of neighbours. Branch managers believed that clients would simply not pass such a screening process. An NGO branch manager explained: “if you consider this fact then we will not have any members”. Some branch managers also explained that it is their job to provide support to vulnerable households.

A few MFIs sought to directly reduce flooding. SCOs lobbied district government officials but without result. District officials suggested there is little to be done regarding

flooding because of a lack of resources. One NGO and SCO claimed to have made efforts to reduce flooding by organising people together to clear canals of vegetation. This does not prevent flooding but reduces its duration by increasing the flow of water away from the village. These efforts do not have a significant effect on flooding.

Interviews with SCO representatives indicated that they do not attempt to reduce client vulnerability through the creation of specialised products. They only offer generic loan products which vary in duration and size. Some branch managers of NGOs reported offering specialised loan products, which may reduce client vulnerability. However, the majority of loans issued by NGOs were generic according to household interviews. Specialised loans required clients to satisfy socioeconomic criteria, use credit for a particular purpose, or provide financial collateral. In contrast, generic NGO loans are general purpose, non-exclusive, and require no financial collateral. Specialised products are available to 'ultra-poor' households to raise cattle or start microenterprises; and to 'middle-class' households to start businesses such as chicken farms. Specialised products also include 'disaster management loans' of very low interest rates, which are designed to facilitate coping with climate hazards. However, despite the frequency of flooding these loans were uncovered in only one household interview. It also appeared to be misused. The household commented that "the loans [are distributed] among members by rotation. I got the loan this year, next year someone else will get the loan". Some branch managers highlighted that homestead construction loans were offered previously but that they have now been discontinued for reasons unknown to them.

Several NGO and SCO branch managers claimed to disseminate adaptation knowledge among clients. They do this by directly soliciting support from external institutions, disseminating information on training possibilities, and by identifying members to receive support from government programmes. Additionally, microfinance groups and group meetings are generally used by government extension officers as conduits through which they provide support as they congregate many households together at predefined times. NGO representatives say they specifically disseminate vulnerability reduction information regarding flooding, ranging from duck rearing to rebuilding homesteads. NGOs generally rely on microfinance field officers although some have specialised departments. One even had a disasters and climate change team; however, they operated in a different area than the microfinance programme. Additionally, NGOs showcase vulnerability reduction techniques with pilot model examples ranging from raised vegetable gardens to homestead construction. In our case study, many low-income households benefited from financially subsidised homestead models as part of the 'National Alliance for Risk Reduction and Response Initiative' (NARRI). SCOs generally relied upon informal information diffusion among members. A particular SCO was set-up with the explicit intention that aquaculture knowledge would disseminate across members<sup>2</sup>.

The most common way in which MFI representatives have reacted to flooding has been to halt loan repayment collection. SCOs have no procedures for this and rely on

---

<sup>2</sup> However, household interviews did not particularly indicate that this initiative was successful.

informal channels to determine whether households are unable to repay. Most NGO branch managers said that they require permission from superiors, though none highlighted difficulty in obtaining this. Although when severe events have occurred they mentioned that the order to stop collecting repayments can be actually given by the Microcredit Regulatory Authority, or the Palli Karma-Sahayak Foundation.

SCOs on occasion forgave interest repayments, according to branch managers. This response is possible because of the simple repayment schedules involving monthly interest repayments, and annual principal repayments. Thus the two debt elements are easily distinguishable. However, this practice was a last resort and used only when attempts to make clients repay had failed. Branch managers had commented that entire debts have been forgiven. However, such claims were not corroborated by household interviews. Households which have defaulted have had their membership cancelled and their savings confiscated to repay debts. Moreover, one household was forced by SCO leaders to sell land.

We did not find similar or comparable practices in NGOs who have more complex debt repayment systems that involve combined monthly repayments of interest and principal debt elements. However, defaulting on NGO loans also appears difficult. One household reported having to personally contact the Chief Executive Officer of a regional NGO to justify his need to default. Some NGOs allow households to obtain a second loan, so that if clients used the new loan productively then they would be able to repay both loans. This is done in two ways. First, existing loans are re-negotiated or a second additional loan is disbursed. SCOs do not make this possible. No evidence of risk transfer, such as insurance, was found at branch level.

## **6. Discussion**

Existing literature has not discussed the screening of MFI clients for climate risk exposure, and we are doubtful about its value for reducing MFI vulnerability. Branch managers did not or did not feel able to screen clients for both practical and ethical reasons. Screening may even increase MFI vulnerability by substantially reducing breadth of outreach, decreasing other elements of financial sustainability such as operating and personnel expenses relative to loan portfolio, and cost per borrower (see Bruett, 2006). Furthermore, restricting the client base will increase the vulnerability of potential clients, as credit is an important element of coping capacity, and a prerequisite for adaptive capacity (Berman et al., 2012; Collins et al., 2009; Fenton et al., 2017). Targeting households is also frustrated by difficulties associated with producing vulnerability metrics and because the covariate risk associated with climate hazards is pervasive across regions and thus socioeconomic groups (Barnett et al., 2008; Fenton et al., 2016; Miranda & Farrin, 2012).

Adaptive capacity is an aspect of vulnerability which varies across socioeconomic groups. MFIs could in theory start serving socioeconomically advantaged households who have greater capacity to adapt in ways that reduce sensitivity. For instance, in our case study socioeconomically advantaged households adapted from agriculture into aquaculture to reduce their vulnerability to flooding. This could cross-subsidise the risk associated with socioeconomically disadvantaged households. This resonates with the



arguments in the microfinance literature according to which serving non-poor groups allows for cross-subsidisation of services to poorer groups (see Wright & Dondo, 2001). However, higher adaptive capacity does not guarantee that adaptation will occur. Adaptation triggers are underexplored and need further study (Brown & Westaway, 2011; Grothmann & Patt, 2005). Also, wealthy households preferred bank credit because banks offer higher volumes of credit at lower cost, which limits the potential for cross-subsidisation. MFIs could of course screen socioeconomically disadvantaged households for adaptive capacity. However, most of their clients have inherently low adaptive capacity.

Thus screening has limited potential in reducing MFI vulnerability. This leaves reducing client vulnerability and managing aggregated risk at institution-level as the two remaining options for reducing MFI vulnerability. The potential for both of these will be discussed in turn.

Reducing client vulnerability tackles the problem at its source. Existing literature only partly addresses this issue from the perspective of disaster management at meso or macro-level rather than from the local-level (e.g. Pantoja, 2002), and often simply as a prelude to discussing insurance (e.g. Pierro & Desai, 2008). In our case study there were no climate-related insurance products on offer, as loans were the main product available.

The literature has only briefly discussed the benefits to MFIs of loan product innovation within the context of natural disasters and institutional sustainability (e.g. Miamidian et al., 2005). Emerging evidence indicates that 43% of MFI programmes in Bangladesh are potentially synergistic with adaptation (Agrawala & Carraro, 2010). However, because this study was not situated at the local-level we know little about the 'synergies' in practice. Local-level studies have found generic loan products ill-suited for vulnerability reduction and adaptation. Their instant repayment schedules and low credit limits often fail to overcome financial barriers associated with adaptation options (Fenton et al., 2017). They are also ill-suited for coping. Non-productive credit use contributes to client over-indebtedness, a situation where credit is obtained to repay existing debt obligations (see Schicks, 2014). Over-indebtedness increases MFI vulnerability as it erodes adaptive capacity of clients. NGOs could offer disaster management loans, which would reduce the likelihood of over-indebtedness. However, households in our case study were rarely provided these loans: they used generic loans to smooth consumption, despite frequent and severe flooding over a decade. Improving the availability of these loans would reduce both over-indebtedness and MFI vulnerability. Further research is needed on the availability of disaster management loans to establish whether this finding is case study specific or part of a wider phenomenon.

Advocates of microfinance highlight its potential for facilitating livelihood diversification (e.g. Heltberg et al., 2009). In our case-study, we identified some specialised loan products that could facilitate livelihood diversification. However, they were inappropriate for reducing client vulnerability and often incentivised investment in climate-sensitive sectors. For instance, specialised livestock loans do not necessarily reduce vulnerability to flooding. During flooding, households often sold cattle due to

lack of fodder and livestock illness, and frequently reported losses due to the low livestock prices caused by large supply and low demand. Similarly, specialised poultry loans providing clients with poultry health information and capital to build poultry sheds and purchase needed inputs do not necessarily reduce vulnerability to flooding. Despite chicken farms being relatively successful, many have made losses due to disease outbreaks during flooding which can result in excessive debt accumulation. Climate-proofing of loan products is necessary to ensure that loans do not encourage clients to invest in ways that increase their exposure or sensitivity. Paradoxically, some NGOs promote chicken farms through specialised loans, while simultaneously promoting duck instead of chicken rearing to clients to reduce their sensitivity to flooding.

Loan product innovation should be linked to autonomous household adaptation to take advantage of local knowledge (see Eriksen et al., 2011). Our case-study indicated that households were often aware of major income-generating activities into which they could adapt to reduce their vulnerability to flooding, such as aquaculture; along with the associated adaptation barriers, such as knowledge and capital. If branch managers were able to enable clients to respond to locally available opportunities by providing the relevant products and services required then vulnerability reduction should occur for both client and institution. As autonomous adaptation will be context-specific branch managers will need to adapt processes accordingly to respond to local circumstances.

Facilitating alternative and comparable income-generating activities should be a high priority for MFIs. In our case-study, an inability to adapt into aquaculture resulted in households relying upon seasonal migration to counteract the inability to cultivate cash crops. This led to a loss of income and an important source of money used by households to save, invest, and repay loans. Decreasing household income threatens the MFIs' social mission to reduce poverty and increases MFI vulnerability. MFIs have been critiqued for serving wealthier clients to improve their financial sustainability (Woller et al., 1999). Thus, client income reduction is likely to decrease MFI financial sustainability. Only those households that can access larger bank loans could adapt, leading them to consolidate land from those unable to adapt. Loan products enabling clients or even groups of clients to adopt aquaculture would have been instrumental in reducing both client and MFI vulnerability. This research area could be advanced by piloting and evaluating collective loan products to facilitate collective adaptation.

Understanding autonomous household adaptation might reduce the fungibility problem, where credit is used for purposes unrelated to those stated during the application process (see Zeller et al., 2001). Our case-study found households often diverted credit away from income generating activities to help finance homestead reconstruction and adaptation costs due to its importance to household wellbeing. This contributed to over-indebtedness as no income streams were generated (Fenton et al., 2017). Specialised homestead loans would arguably have reduced such practices, enabling households to use generic credit for income-generating activities. Homestead loans are frequently cited as important for client and MFI vulnerability reduction (e.g. Miamidian et al., 2005). However, in our case-study, relevant branch managers stated these products were terminated at institution level. We believe that the importance given to adapting homesteads by households, along with its importance for reducing

both client and MFI vulnerability, makes understanding how to up-scale homestead loans an important future research topic, especially as safe housing is a key component of the Bangladesh Climate Change Strategy and Action Plan (see MoEF, 2008).

Integrating non-financial services should theoretically contribute to client vulnerability reduction as non-financial adaptation barriers can also be addressed. The classic example would be to disseminate adaptation knowledge, argued to be a fundamental element of adaptive capacity (Williams et al., 2015). In our case-study both NGOs and SCOs were found to disburse information; however, NGOs tended to be more proactive. NGOs disburse information on various development topics with varying relevance to vulnerability reduction. For instance, the importance of hygiene for maintaining health is relevant to adaptive capacity in a general sense; whereas advising clients to build raised homestead vegetable gardens reduces sensitivity to flooding. However, it was unclear whether advice which would have the effect of reducing vulnerability was specially designed for the local context or whether the link was serendipitous as has been found in other studies (see Agrawala & Carraro, 2010).

When locally situated information was evident its value was often questionable, such as advising clients to rebuild homesteads on higher plinths and ground when higher ground is scarce and plinths are a traditional adaptation to flooding. At times the advice was simply erroneous. Prolonged flooding erodes earthen plinths unless encased with brick and mortar. Households already knew this because only homesteads constructed in this manner were left standing during severe flooding. One NGO branch manager indeed admitted that “[clients] actually have more knowledge than us”. Households also frequently prefer peer-to-peer learning over using NGO homestead adaptation models, represented in our case-study by the NARRI homestead model commonly built by NGOs throughout Bangladesh. Innovation dissemination among homesteads and the role of MFIs in it remains an under-explored area for research.

While local-level staff clearly had limited capacities regarding adaptation knowledge, it is perhaps churlish to criticise them for it. Their main job is to disburse loans and collect repayments, expecting them to be experts across multiple development and adaptation topics appears unreasonable. Consequently, a linked or parallel approach may be needed where a client receives microfinance services and adaptation knowledge from different staff from either the same or different organisations respectively (see Dunford, 2001). As hiring relevant staff with sufficient expertise may be difficult for MFIs due to associated costs, the parallel approach may be best which can also take advantage of existing government extension programmes. It remains to be seen how knowledge on autonomous household adaptation practices, MFIs, and adaptation knowledge providers can coordinate their activities together. However, approaches are emerging both within the development sector and adaptation sector demonstrating how this can be achieved (see Matin & Hulme, 2003; WFP-Oxfam, 2015).

Consequently, while much potential exists to reduce client vulnerability in order to reduce MFI vulnerability, this potential is not realised in practice. The only alternative is to manage aggregated risk at the MFI level. Existing literature has argued that

flexible internal systems are necessary to enable MFIs to respond to natural disasters (Miami et al., 2005; Shoji, 2007). In our case study, delaying collection of repayments was the most common way for branch managers to manage the impact of flooding on client livelihoods. But delaying repayment collection is a weak response to managing client vulnerability. If clients cannot repay loans the best response over longer term for ensuring institutional sustainability cannot be not to collect loan repayments. Collection of repayments was stopped simply because clients could not repay. As one NGO representative commented “the main duty of field officers when visiting flood affected villages is to find out where our clients are staying and how we can collect money from them, since they cannot earn during floods”. Only a few MFIs allow the re-negotiation of existing debt or provide additional loans. Not allowing households to obtain additional loans appears impractical. Survey data indicates that households simply seek additional loans from alternative sources when necessary. Individual MFIs cannot track this due to asymmetric information between them and their clients. Consequently, it might be more practical to allow additional loans to be disbursed so debt levels of clients can be better monitored.

The most important solutions for managing client vulnerability currently are taken centrally in MFIs. NGOs are required to create reserve and liquidity funds by clauses 20 and 34 of the MRA 2010 Act, respectively (MRA, 2011). The reserve fund clause requires at least 10% of annual profits to be deposited into a bank account to cover losses due to natural hazards, with permission from that organisations’ Council of Directors. The liquidity fund requires 15% of compulsory, voluntary, and fixed term deposits to be held as savings in a scheduled bank. This act only applies to NGOs; SCOs are not subject to nor have comparable provisions. One NGO explained that they have exceeded the regulation requirements, commenting that although liquidity problems have disappeared at the MFI level, major events still cause problems at branch level. Further research is needed on the effectiveness and implications of reserve and liquidity funds across institutions.

## **7. Conclusion**

This article explored MFI vulnerability to flooding in Bangladesh using a local-level case-study. We adopted a risk-hazard framework for understanding how MFIs can reduce their vulnerability to climate risks. We empirically assessed local-level practices in relation to this framework.

We found that MFIs cannot screen clients for climate risk for ethical, practical, and financial sustainability reasons. Much potential exists for MFIs to instead actively reduce client vulnerability. However, this potential is not currently realised. Specialised loans need climate proofing, access to disaster management loans was almost missing entirely, adaptation knowledge dissemination was inadequate, and efforts to reduce exposure to flooding were ineffective. We also find that branch managers have limited capacity to manage aggregated risk. Most simply stop collecting repayments during flooding. Many regard this as them being flexible and responsive to client needs. However, it is more likely because most clients simply cannot repay. NGOs have created centralised contingency funds in line with regulatory requirements. Further research is needed to explore how these affect MFI vulnerability. SCOs lack

comparable reserve funds, an important issue considering the proportion of household wealth held in these institutions.

In light of the inability to screen out climate risk and the lack of options for branch managers to manage aggregated risk, we argue MFIs should seek to reduce their vulnerability by reducing client vulnerability, the source of the problem. We propose loan product innovation should be central to these efforts. We argue a locally-situated and contextually relevant understanding of autonomous household adaptation is required to build upon client knowledge of adaptation needs, options, and associated barriers. We found that introducing homestead loans and upscaling supply of disaster management loans would reduce vulnerability and fungibility, arguably representing the mismatch between microfinance supply and client needs. We also argue that incorporating relevant adaptation knowledge and training will also reduce client vulnerability in order to address non-financial barriers. We propose that a parallel integrated approach is best due to the dual need for low costs and adaptation expertise. Thus MFIs need to form effective partnerships with clients and adaptation-relevant institutions such as government extension services. External support could come from Bangladesh's National Adaptation Plan; however, it is currently unknown to what extent MFIs will be involved in adaptation planning, either as recipients or as implementers. Support could also come from international climate finance institutions.

## References

- Adger, W. N., & Vincent, K. (2005). Uncertainty in adaptive capacity. *Comptes Rendus Geoscience*, 337(4), 399-410. doi: <http://dx.doi.org/10.1016/j.crte.2004.11.004>
- Agrawal, A. (2008). The Role of Local Institutions in Adaptation to Climate Change. Paper presented at the Paper prepared for the Social Dimensions of Climate Change, Social Development Department, Washington DC.
- Agrawala, S., & Carraro, M. (2010). Assessing the role of microfinance in fostering adaptation to climate change (Vol. Environmental Working Paper No. 15). Paris: OECD.
- Ayers, J., & Dodman, D. (2010). Climate change adaptation and development I: the state of the debate. *Progress in Development Studies*, 10(2), 161-168. doi: [10.1177/146499340901000205](https://doi.org/10.1177/146499340901000205)
- Barnett, B., Barrett, C., & Skees, J. (2008). Poverty traps and index-based risk transfer products. *World Development*, 36(10), 1766–1785.
- Barnett, J., Lambert, S., & Fry, I. (2008). The Hazards of Indicators: Insights from the Environmental Vulnerability Index. *Annals of the Association of American Geographers*, 98(1), 102-119. doi: [10.1080/00045600701734315](https://doi.org/10.1080/00045600701734315)
- Barnett, J., & O'Neill, S. (2010). Maladaptation. *Global Environmental Change*, 20(2), 211-213. doi: [10.1016/j.gloenvcha.2009.11.004](https://doi.org/10.1016/j.gloenvcha.2009.11.004)
- Bastiaenen, M., & Van Rooij, P. (1997). Guarantee Funds and NGOs: Promise and Pitfalls - A Review of the Key Issues International Labour Office Working Paper, No: 18. Geneva: International Labour Office.
- Berkhout, F. (2012). Adaptation to climate change by organizations. *Wiley Interdisciplinary Reviews: Climate Change*, 3(1), 91-106. doi: [10.1002/wcc.154](https://doi.org/10.1002/wcc.154)
- Berman, R., Quinn, C., & Paavola, J. (2012). The role of institutions in the transformation of coping capacity to sustainable adaptive capacity.

- Environmental Development, 2, 86-100. doi: <http://dx.doi.org/10.1016/j.envdev.2012.03.017>
- Bhatt, N., & Tang, S.-Y. (2001). Delivering Microfinance in Developing Countries: Controversies and Policy Perspectives. *Policy Studies Journal*, 29(2), 319-333. doi: 10.1111/j.1541-0072.2001.tb02095.x
- Binswanger-Mkhize, H. P. (2012). Is There Too Much Hype about Index-based Agricultural Insurance? *The Journal of Development Studies*, 48(2), 187-200. doi: 10.1080/00220388.2011.625411
- Brooks, N., Adger, W. N., & Kelly, P. M. (2005). The determinants of vulnerability and adaptive capacity at the national level and the implications for adaptation. *Global Environmental Change-Human and Policy Dimensions*, 15(2), 151-163. doi: DOI 10.1016/j.gloenvcha.2004.12.006
- Brown, K., & Westaway, E. (2011). Agency, Capacity, and Resilience to Environmental Change: Lessons from Human Development, Well-Being, and Disasters. *Annual Review of Environment and Resources*, 36, 321-342.
- Bruett, T. A. (2006). Measuring Performance of Micro-finance Institutions: A Framework for Reporting, Analysis, and Monitoring (pp. 105): SEEP Network and Alternative Credit Technologies, LLC.
- BWDB. (2011). Annual Flood Report 2011: Bangladesh Water Development Board. Government of the People's Republic of Bangladesh.
- CCC. (2007). Climate Change and Bangladesh. Dhaka, Bangladesh: Climate Change Cell, Department of Environment, Government of the People's Republic of Bangladesh, Department for International Development (UK), United Nations Development Programme.
- Collins, D., Morduch, J., Rutherford, S., & Ruthven, O. (2009). Portfolios of the poor how the world's poor live on \$2 a day
- Dlugodecki, A., & Lafeld, S. (2005). Climate change and the financial sector: An agenda for action. Association of British Insurers: London, UK.
- Dowla, A. (2009). Climate Change and Microfinance: Grameen Foundation and Oxfam USA.
- Dunford, C. (2001). Building better lives: sustainable integration of microfinance with education in child survival, reproductive health, and HIV/AIDS prevention for the poorest entrepreneurs. *Journal Microfinance*, 3(2), 1-26.
- Eakin, H., & Luers, A. L. (2006). Assessing the vulnerability of social-environmental systems *Annual Review of Environment and Resources* (Vol. 31, pp. 365-394). Palo Alto: Annual Reviews.
- Eakin, H., Tompkins, E., Nelson, D., & Anderies, J. (2009). Hidden costs and disparate uncertainties: trade-offs involved in approaches to climate policy. In W. N. Adger, Lorenzoni, Irene and O'Brien, Karen L. (Ed.), *Adapting to Climate Change: Thresholds, Values, Governance* (pp. 212-226). Cambridge, UK: Cambridge University Press.
- Eakin, H. C., Lemos, M. C., & Nelson, D. R. (2014). Differentiating capacities as a means to sustainable climate change adaptation. *Global Environmental Change*, 27(0), 1-8. doi: <http://dx.doi.org/10.1016/j.gloenvcha.2014.04.013>
- Eriksen, S., Aldunce, P., Bahinipati, C. S., Martins, R. D., Almeida, Molefe, J. I., . . . Ulsrud, K. (2011). When not every response to climate change is a good one: Identifying principles for sustainable adaptation. *Climate and Development*, 3(1), 7-20. doi: 10.3763/cdev.2010.0060

- Eriksen, S. H., & O'Brien, K. (2007). Vulnerability, poverty and the need for sustainable adaptation measures. *Climate Policy*, 7(4), 337-352. doi: 10.1080/14693062.2007.9685660
- Fenton, A., Paavola, J., & Tallontire, A. (2015). Microfinance and climate change adaptation: an overview of the current literature. *Enterprise Development and Microfinance*, 26(3), 262-273. doi: 10.3362/1755-1986.2015.023
- Fenton, A., Paavola, J., & Tallontire, A. (2016a). Autonomous adaptation to riverine flooding in Satkhira District, Bangladesh: insights for transformation (Vol. Working Paper No. 283): Centre for Climate Change Economics and Policy.
- Fenton, A., Paavola, J., & Tallontire, A. (2017). The Role of Microfinance in Household Livelihood Adaptation in Satkhira District, Southwest Bangladesh. *World Development*, 92, 192-202. doi: <http://dx.doi.org/10.1016/j.worlddev.2016.12.004>
- Goldberg, M., & Palladini, E. (2009). *Microfinance: Managing Risks and Creating Value Results of a South American Dialogue*: World Bank.
- Grothmann, T., & Patt, A. (2005). Adaptive capacity and human cognition: The process of individual adaptation to climate change. *Global Environmental Change-Human and Policy Dimensions*, 15(3), 199-213. doi: DOI 10.1016/j.gloenvcha.2005.01.002
- Hammill, A., Matthew, R., & McCarter, E. (2008). Microfinance and Climate Change Adaptation. *IDS Bulletin-Institute of Development Studies*, 39(4), 113-+.
- Heltberg, R., Siegel, P. B., & Jorgensen, S. L. (2009). Addressing human vulnerability to climate change: Toward a 'no-regrets' approach. [Article]. *Global Environmental Change-Human and Policy Dimensions*, 19(1), 89-99. doi: 10.1016/j.gloenvcha.2008.11.003
- Huda, K., & Simanowitz, A. (2009). A graduation pathway for Haiti's poorest: Lessons learnt from Fonkoze. *Enterprise Development and Microfinance*, 20(2), 86-106. doi: 10.3362/1755-1986.2009.011
- Hulme, D. (2000). Impact Assessment Methodologies for Microfinance: Theory, Experience and Better Practice. *World Development*, 28(1), 79-98. doi: 10.1016/s0305-750x(99)00119-9
- Huybrechs, F., Bastiaensen, J., & Forcella, D. (2015). Guest editorial: An introduction to the special issue on green microfinance. *Enterprise Development and Microfinance*, 26(3), 211-214. doi: 10.3362/1755-1986.2015.018
- IPCC. (2014). Annex XX: Glossary [Agard, J., E.L.F. Schipper, J. Birkmann, M. Campos, C. Dubeux, Y. Nojiri, L. Olsson, B. Osman-Elasha, M. Pelling, M.J. Prather, M.G. Rivera-Ferre, O.C. Ruppel, A. Sallenger, K.R. Smith, A.L. St Clair, K.J. Mach, M.D. Mastrandrea, and T.E. Bilir (eds.)]. In V. R. Barros, C. B. Field, D. J. Dokken, M. D. Mastrandrea, K. J. Mach, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea & L. L. White (Eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.
- Jones, L., Ludi, E., & Levine, S. (2010). Towards a characterisation of adaptive capacity: a framework for analysing adaptive capacity at the local level. ODI Background Note, Overseas Development Institute.
- Linnerooth-Bayer, J., & Mechler, R. (2006). Insurance for assisting adaptation to climate change in developing countries: a proposed strategy. *Climate Policy*, 6(6), 621-636. doi: 10.1080/14693062.2006.9685628

- Matin, I., & Hulme, D. (2003). Programs for the Poorest: Learning from the IGVGD Program in Bangladesh. *World Development*, 31(3), 647-665. doi: 10.1016/s0305-750x(02)00223-1
- Meze-Hausken, E., Patt, A., & Fritz, S. (2009). Reducing climate risk for micro-insurance providers in Africa: A case study of Ethiopia. *Global Environmental Change*, 19(1), 66-73. doi: 10.1016/j.gloenvcha.2008.09.001
- Miamidian, E., Arnold, M., Burritt, K., & Jacquand, M. (2005). Surviving disasters and supporting recovery: a guidebook for microfinance institutions. Tackling vulnerability to disasters through microfinance Disaster Risk Management Working Paper Series. No. 10. Washington DC: World Bank.
- Miranda, M. J., & Farrin, K. (2012). Index Insurance for Developing Countries. *Applied Economic Perspectives and Policy*. doi: 10.1093/aep/pps031
- Miranda, M. J., & Gonzalez-Vega, C. (2011). Systemic Risk, Index Insurance, and Optimal Management of Agricultural Loan Portfolios in Developing Countries. *American Journal of Agricultural Economics*, 93(2), 399-406. doi: 10.1093/ajae/aaq109
- MoEF. (2008). Bangladesh Climate Change Strategy and Action Plan 2008 (pp. xvi + 68 pp.). Dhaka, Bangladesh: Ministry of Environment and Forests, Government of the People's Republic of Bangladesh.
- Morduch, J. (2000). The Microfinance Schism. *World Development*, 28(4), 617-629. doi: 10.1016/s0305-750x(99)00151-5
- Microcredit Regulatory Authority Rules 2010 (2011).
- Nagarajan, G., & Brown, W. (2000). Bangladeshi Experience in Adapting Financial Services to Cope with Floods Study supported by USAID. Bethesda, MD: Microenterprise Best Practices (MBP).
- Navajas, S., Schreiner, M., Meyer, R. L., Gonzalez-vega, C., & Rodriguez-meza, J. (2000). Microcredit and the Poorest of the Poor: Theory and Evidence from Bolivia. *World Development*, 28(2), 333-346. doi: 10.1016/s0305-750x(99)00121-7
- Pantoja, E. (2002). Microfinance and Disaster Risk Management: Experiences and Lessons Learned: Prevention Consortium Draft Final Report.
- Pierro, R., & Desai, B. (2008). Climate Insurance for the Poor: Challenges for Targeting and Participation. *IDS Bulletin*, 39(4), 123-129. doi: 10.1111/j.1759-5436.2008.tb00485.x
- Schicks, J. (2014). Over-Indebtedness in Microfinance – An Empirical Analysis of Related Factors on the Borrower Level. *World Development*, 54, 301-324. doi: <http://dx.doi.org/10.1016/j.worlddev.2013.08.009>
- Shoji, M. (2007). Evaluation of Flexible Repayment System in Microfinance: A Case Study from a Natural Disaster in Bangladesh COE Discussion Paper F-series, COE-DP F-190. Tokyo, Japan: University of Tokyo.
- Sievers, M., & Vandenberg, P. (2007). Synergies through Linkages: Who Benefits from Linking Micro-Finance and Business Development Services? *World Development*, 35(8), 1341-1358. doi: 10.1016/j.worlddev.2007.04.002
- Smit, B., Pilifosova, O., Burton, I., Challenger, B., Huz, S., Klein, R., . . . Leary, N. (2001). Adaption to Climate Change in the Context of Sustainable Development and Equity Climate Change 2001 Impacts Adaptation and Vulnerability Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change (pp. 879-906). Geneva: IPCC.



- Smit, B., & Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Global Environmental Change*, 16(3), 282-292. doi: DOI 10.1016/j.gloenvcha.2006.03.008
- Twigg, J. (2004). Disaster Risk Reduction: mitigation and preparedness in development and emergency programming. HPN Good practice review, 9.
- UNFCCC. (2009). Potential Costs and Benefits of Adaptation Options: A Review of Existing Literature (Vol. FCCC/TP/2009/2). Bonn: UNFCCC Secretariat.
- Wesselink, A., Warnerb, J., Syedc, M. A., Chand, F., Trane, D. D., Huqf, H., . . . Arjen, Z. (2015). Trends in flood risk management in deltas around the world: Are we going 'soft'? *International Journal of Water Governance*, 4, 25-46.
- WFP-Oxfam. (2015). R4 Rural Resilience Initiative Annual Report 2014: World Food Programme, Oxfam America.
- Williams, C., Fenton, A., & Huq, S. (2015). Knowledge and adaptive capacity. [Commentary]. *Nature Clim. Change*, 5(2), 82-83. doi: 10.1038/nclimate2476
- Woller, G., Dunford, C., & Woodworth, W. (1999). Where to microfinance? *International Journal of Economic Development*, 1(1), 29-64.
- Woller, G. M., & Woodworth, W. (2001). Microcredit as a Grass-Roots Policy for International Development. *Policy Studies Journal*, 29(2), 267-282. doi: 10.1111/j.1541-0072.2001.tb02091.x
- World Bank. (1999). *Bangladesh: Key Challenges for the Next Millennium*. Washington, D.C: The World Bank.
- Wright, G. A. N., & Dondo, A. (2001). 'Are you poor enough?' - client selection by microfinance institutions. *Small Enterprise Development*, 12(1), 59-66. doi: 10.3362/0957-1329.2001.009
- Zeller, M., Sharma, M., Ahmed, A. U., & Rashid, S. (2001). *Group-based Financial Institutions for the Rural Poor in Bangladesh: An Institutional and Household-level Analysis*. Research Report No. 120. Washington, D.C: International Food Policy Research Institute (IFPRI).