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LOCAL-LEVEL KNOWLEDGE FLOWS IN CLIMATE CHANGE ADAPTATION: THE SIGNIFICANCE OF EXTERNAL KNOWLEDGE FOR AGRICULTURAL ACTION IN COASTAL BANGLADESH

Dissertation submitted in 2012 for the MSc in Anthropology, Environment and Development

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MSc in Anthropology, Environment and Development Dissertation

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Abstract

Knowledge flows between multiple scales are problematic due to inherent contradictions in discourse, perspectives and worldviews. In the case of climate change adaptation, global conceptions and responses take a long-term perspective. Conversely, local-level and natural resource dependent communities under pressure to adapt have differing priorities and more immediate needs. Employing a multi-sited approach in Bangladesh, exploratory research at the national-level illuminates challenges in relation to the format and content of communication. Local-level research forms the central focus of the study, uncovering explanations for observed changes in climate. With a particular focus on the knowledge sources employed to inform agricultural responses to flooding and salinity, this research highlights issues of trust, priorities and power relevant to informing and enabling adaptation options. Whilst internal sources of knowledge are more widely accessed and highly regarded, external sources of knowledge are also employed. However, experimentation with new agricultural methods to prove effectiveness must precede long-term adoption of new knowledge. In discovering differences in the resources and knowledge accessed at the micro-scale, the research reveals that adaptation efforts are ultimately motivated by individual personalities, drives and interests.

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Abbreviations/Acronyms

ARCAB	Action Research for Community Adaptation in Bangladesh
CBA	Community Based Adaptation
GGD	Gonogobeshona Dol
ICCCAD	International Centre for Climate Change and Development
NGO	Non-Governmental Organisation

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Chapter 1: Introduction: Knowledge Flows in Climate Change Adaptation

The potential consequences of climate change are receiving much attention from the global community. In recognition of the impacts of global warming and the responsibility of global powers, international experts and policy makers are increasingly focussing on adaptation efforts. Such efforts are based on an integration of knowledge between global and local scales that attempts to combine scientific, political, social and practical intellect. As a country that is highly susceptible to the effects of climate change, Bangladesh is nurturing this huge adaptation focus and, as such, has been coined the "adaptation capital of the world" (Huq 2013, quoted in IIED 2013). Within this context, challenges arise with regards to smooth knowledge flows between multi-scalar stakeholders with divergent discourses.

1.1 Background and Introduction

Bangladesh is a low lying country on the northern coast of the Bay of Bengal. It is a densely populated area characterised by a complex network of waterways, around which agricultural land is cultivated. Consequently, it is particularly exposed to climatic extremes, and is expected to be critically affected by future changes in global climate (Cannon 2002; Abedin and Shaw 2013). Flooding and drought are frequent, and the coastal belt of Bangladesh is struck by at least one cyclone a year (Ahamed 2013). Such climatic phenomena directly and indirectly affect agricultural productivity, which comprises the backbone of the economy (Sarker 2013). Whilst seasonal flooding is integral to traditional farming practices in Bangladesh, extensive flooding, or *bonna*, is increasingly regular, yet unpredictable (Adhikari and Taylor 2012). Estimates of sea level rise forecast substantial loss of fertile land, paired with significant decreases in agricultural yields due to associated salinity intrusion (Houghton 2009). For example, one estimate calculates a 15-

25% decrease in agricultural productivity by 2080 (Cline 2007). The precise consequences for Bangladesh's continuously expanding communities are largely unknown (Houghton 2009). However, local livelihoods are already irreversibly altered due to the effects of global climate change on agricultural traditions.

At the global level, climate change is gaining much attention from scientists, policy makers, and political powers. Widespread scientific consensus of rapid climate change resulting from increased carbon emissions predicts vulnerability within many natural resource dependent communities. In a bid to curb these changes, mitigation within industrial countries has been advocated. Yet, as environmental impacts are already being experienced, global discussions have shifted towards the increased and immediate need for adaptation to the effects of climate change (Grothmann and Patt 2005). This process comprises adjustment in human and natural systems in order to cope with or benefit from environmental changes (Smit *et al* 1999). It is acknowledged that local communities develop their own coping strategies, yet there is a notion that specialist support must be provided due to the pace of witnessed and predicted climatic change. As such, anthropogenic adaptation is receiving much consideration from climate change scientists (Grothmann and Patt 2005), while global climate policy aims to bring adaptation to the centre of the contemporary climate change discourse (Adger *et al* 2009).

Knowledge for supported adaptation is created through both locally informed strategies and globally driven research, including scientific climate models, adaptation technologies and political enquiry. Such external and specialist knowledge is deemed necessary to strengthen indigenous coping strategies (Smit *et al* 1999; Brooks and Adgar 2004; Raihan *et al* 2010). Though different types of adaptation, determined by their specific contexts, are expected to require different types of information (Dessai and Hulme 2004), a lack of information is expected to increase vulnerability (Schipper 2007).

However, current literature highlights disagreement as to the necessity of integrating scientific climate information in adaptation endeavours. Whilst some hold that certainty in future predictions of climatic impacts is a necessary prerequisite for effective adaptation (Füssel 2007; Gagnon-Lebrun and Agrawala 2007; Zermoglio and Devisscher 2009), others argue that appropriate action can be taken without specific effects being known (Adger *et al* 2009; Dessai *et al* 2009). Scientific knowledge that is grounded in global understandings and timescales may be in conflict with the particular worldviews and perspectives of the communities with whom it is shared (Kalaugher *et al* 2013; Krauss 2006). For example, many communities have been shown to be more concerned with their immediate livelihood strategies than projections of future climate estimates (Agar 2005; Blackburn and Clark 2007; Malone and Rayner 2001; Roncoli *et al* 2009). Moreover, local perceptions of climate change can differ from scientifically modelled trends due to the social and cultural dimensions of local-level climate observations, which contrast greatly with the abstract predictions made by climate experts (Roncoli 2006; Roncoli *et al* 2009). As such, adaptation limits may lie in the social, rather than the physical, ecological or technological domain (Adger *et al* 2009). Hence, knowledge might lubricate, rather than catalyse, action, which is more likely to be driven by individual motivations, perceptions of risk, cultural understandings and personal values. It follows that the need for the integration of scientific projections is still debatable, despite scientists stressing the importance of consulting climate modellers when designing adaptation programmes (Ayers and Forsyth 2009).

Knowledge can be understood as the transformation of information in such a way that action can be taken (Mikolajuk 2008). For information transmission to be impactful, it must be relevant, accessible and comprehensible within the specific context of its audience (Agar 2005; Zermoglio and Devisscher 2009). Contextual knowledge gaps exist (Ellis *et al*

2013), ultimately creating friction in knowledge sharing (Tsing 2005). Connecting global climate knowledge with local activities requires “strong chains” with “short links” (Brown and Fox 2001). However, a reciprocal process of knowledge sharing between multi-scalar climate change adaptation stakeholders can mitigate the friction between disparate contexts to allow beneficial action to be informed (Agar 2005; Blackburn and Clark 2007; Peacock 2010; Root and Schneider 1995).

The particular framing of climate change information at each interaction is crucial. In the media, information is often based on the causes and effects of climate change, rather than how to cope with, and adapt to, environmental variations (Grundmann *et al* 2012). In acknowledgement of this, local development organisations, governments and social institutions are being encouraged by the global climate change community to communicate appropriate knowledge at the local-level in an attempt to promote adaptation amongst vulnerable communities.

Due to a long history of development interventions resulting from a high rate of poverty, political instability and population growth, Bangladesh hosts a vast and extensive network of non-governmental organisations (NGOs) (Zohir 2004). Alongside NGOs, research institutions work with communities to develop and establish new technologies for adaptation and communication. Many of these organisations have become active participants in the global drive for climate change adaptation, taking on the role of mobilising knowledge. Furthermore, government bodies and departments are involved in both the research and instigation of adaptation activities. These national stakeholders offer a crucial link in the chain between local and global knowledge, providing a vehicle for the transmission of climate change knowledge from local to global and back again (Hasnain and Jasimuddin 2013).

The global focus on climate change adaptation manifests itself at the local-level through Community Based Adaptation (CBA) projects that are mainstreamed into the development programmes of NGOs (see Figure 1.1).

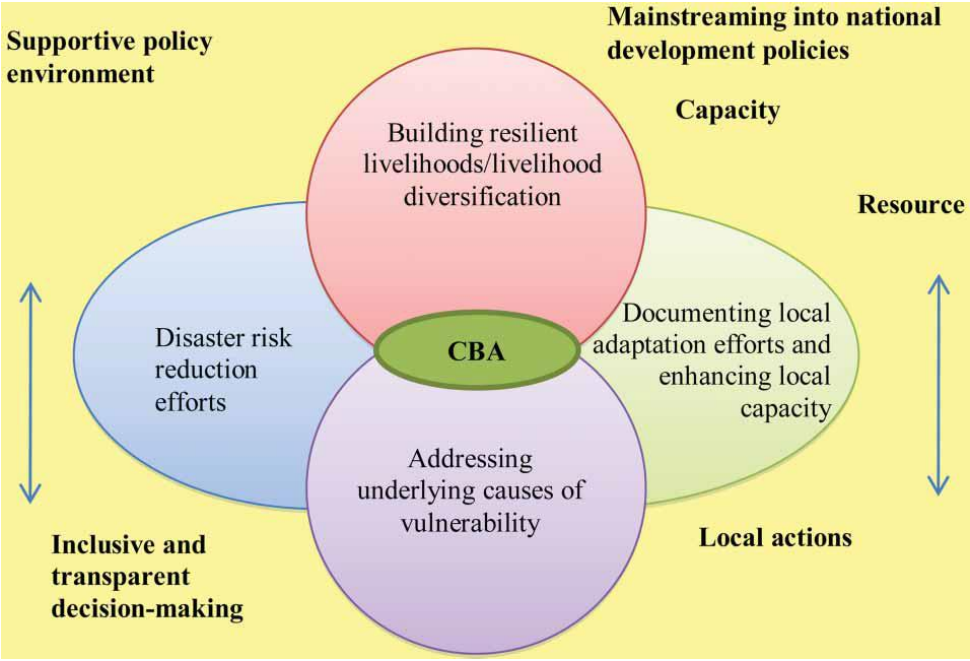

Figure 1.1: Framework for Community Based Adaptation

(Source: Adhikari and Taylor 2012)

CBA projects are designed to promote and protect sustainable livelihoods through building capacity for community-level adaptation to unpredictable and risky climates (Ayers and Forsyth 2009; Ireland and McKinnon 2013). The premise is that those who have a greater capacity to diversify their livelihood options are more able to adapt autonomously (Raihan *et al* 2010). Such adaptive capacity is believed to depend on how developed a local community is (Back and Cameron 2008; ISET 2008). In Bangladesh, development NGOs seek to facilitate CBA activities by taking an empowerment approach. Through increasing political awareness and promoting collective action, such an approach seeks to build political capacity by encouraging individuals to become part of wider decision making processes that will benefit the community (Craig 2002; Larson 2002; Rowlands 1995).

CBA audiences are targeted through vulnerability and risk analyses based on a range of factors such as geographic location, and political and financial standing in society. Livelihood diversification is encouraged amongst these audiences through provision of 'software', such as sustainable skills training, and 'hardware', such as infrastructural development. NGOs and research organisations disperse specialist scientific and technical knowledge amongst local communities, with the aim of complementing local knowledge (Adhikari and Taylor 2012). There is recognition that the means of transmitting information must be context specific (ActionAid 2012; Adhikari and Taylor 2012; Magistro and Roncoli 2001). Moreover, there is an appreciation that the impact of advice relies on local-level trust, in both the information and the informer (Brown and Fox 2001; Hasnain and Jasimuddin 2012). Critically, it is assumed that target audiences will assist community-wide inclusion by sharing the knowledge gained with the wider community.

Within this context, this study seeks to examine whether globally significant knowledge, related to climate change and adaptation, impacts local action towards agricultural responses to climatic phenomena in Bangladesh. Exploratory research at the national-level complements the central focus of research conducted at the local-level. The former examines strategies of communication and perceived barriers to knowledge flow from national to local levels. The latter was completed in Khajura, a large village in coastal Bangladesh. Here, climate change and adaptation awareness is spread via "People's Research" groups, known as Gonogobeshona Dol (GGD). With an emphasis on the environmental challenges affecting agricultural practices and a particular focus on agricultural responses to flooding and salinity, this field research reveals flow and friction in knowledge sharing at the local-level. It uncovers perceptions of observed changes in climate and highlights issues of trust, priorities and power relevant to informing and enabling adaptation options.

1.2 Research Proposal

The aims and objectives of the research are outlined below. Following this, I have highlighted the central research questions that have been answered by the research.

1.2.1 Aims and Objectives

1. To examine the dissemination of climate change adaptation knowledge at the local level.

2. To investigate agricultural responses to climatic problems in Khajura.

3. To assess whether external or specialist knowledge facilitates agricultural responses to climatic changes.

1.2.2 Research Questions

1. How is specialist climate change knowledge dispersed and accessed at the local level?

2. What environmental problems disrupt local agricultural livelihoods?

3. How are local responses to environmental problems informed?

Chapter 2: Methodology

The reciprocal communication between local and national-level stakeholders can be understood as a critical link in the chain between local and global. In this study, qualitative methods are employed to examine knowledge flow and friction at local scales. It first focuses on that knowledge which is directed by national-level aims and then moves to the local-level to examine the sources of knowledge employed for responding to agricultural problems. The methods are summarised in Figure 2.1.

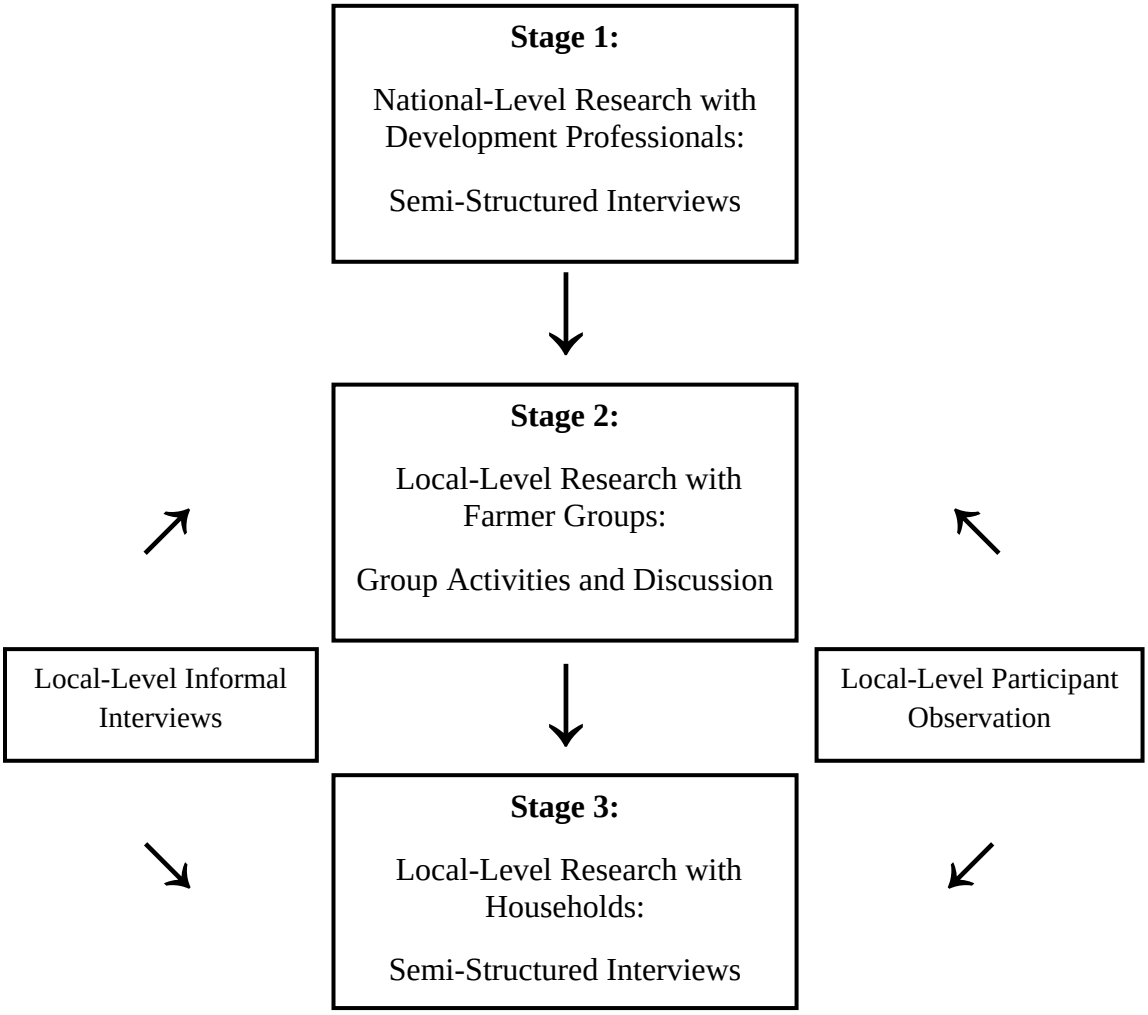

Figure 2.1: Diagram of Work Flow

2.1 Stage 1: National-Level Research with Development Professionals

Semi-structured interviews with development professionals critically examined how climate change adaptation knowledge is gained and shared, and the problems faced in relation to this (See Appendix 1). Action Research for Community Adaptation in Bangladesh (ARCAB) is a programme directed by the International Centre for Climate Change and Development (ICCCAD) that brings together national and international organisations to research and implement CBA activities in Bangladesh. The sample included representatives from the national offices of twelve different ARCAB partners that manage projects at the local-level. Hence, the results illuminate similarities across organisations.

I connected with participants by leveraging my association with ICCCAD to make initial contact. Each organisation directed me to the most appropriate member of staff for the research. It can be assumed that participants want to give the best professional representation of their organisation. My association with an institution that provides support via funding and training may have influenced responses. The information provided comes from each participant's personal experiences, dictated by specific roles and program responsibilities. Therefore, data may not reflect the experience of the entire organisation.

2.2 Stage 2: Local-Level Research with Farmer Groups

The first stage of local-level research employed group activities to examine the environmental problems that disrupt agriculture in Khajura (see Appendix 2). Activities were inspired by Participatory Rural Appraisal (PRA) techniques. They included brainstorming, ranking and discussion activities, as summarised in Table 2.1. Participants were put at ease through introductions and informal discussions at the beginning of each session. The principal results were used to inform the subsequent stage of research.

Additionally, these activities elicited rich contextual knowledge about the field site and provided an opportunity to build rapport and familiarity within the community.

Activity	**Purpose**
Brainstorming	To identify environmental causes of agricultural problems
Ranking	To explore which problems were deemed most problematic
Discussion	To examine the problems in more depth

Table 2.1: Purpose of Group Activities

Groups were organised according to scale of farming, gender and location. Initial discussions with community members suggested a clear division between large and small-scale farmers, whilst the knowledge of widespread gender divisions in Bangladesh (e.g. Wright *et al* 2012) inspired separation of male and female farmers. This created four categories, as defined in Table 2.2. A session for each category was completed for the three areas of Khajura: North, West and Central. Therefore, twelve group sessions were completed in total. The GGD group for each area was initially approached to arrange the sessions, though two were organised independently of GGD assistance. Within this, sampling was opportunistic and those groups arranged with assistance from the GGDs were not necessarily entirely GGD members. Sessions were arranged at times determined by the participants to ensure they were not rushed.

Categories per Area	
Large-Scale Female	Large-Scale Male
Small-Scale Female	Small-Scale Male

Table 2.2: Categories for Group Sessions

Some potential biases require highlighting. Firstly, activities altered according to the dynamics of each group. Whilst some groups were confident with completing tasks, others preferred assistance from the research assistant for writing down ideas. In addition, some variation in the interpretation of 'most problematic' in reference to the ranking of identified problems was apparent. Most participants ranked problems in consideration of whether an obtainable solution was available. Secondly, beyond the participants, other community members were intrigued by the activities. Whilst external interference from observers was kept to a minimum, a minor amount was unavoidable. Moreover, some answers may have been influenced by experience of similar activities arranged by external organisations, particularly as many groups were arranged via the GGDs. Finally, the timing of the research and the geographical location of participants' houses are likely to have affected responses. The group sessions conducted with residents of Central Khajura were completed in the aftermath of cyclone Mahasen, when Khajura was extensively flooded. The completion of twelve groups served to counterbalance these issues, though they should be borne in mind throughout analysis of results.

Image 2.1: Male Group Session

Image 2.2: Female Group Session

2.3 Stage 3: Local-Level Research with Farming Households

2.3.1 Central Methodology

Twenty-four semi-structured interviews were conducted with farming households in Khajura (see Appendix 3). Based on the Stage 2 results and the timing of research immediately after cyclone Mahasen, they primarily investigated agricultural responses to flooding and salinity, focusing on the sources of knowledge accessed to inform decisions. They also examined understandings of climatic observations. Informal land walks were completed with participants where possible, prompting discussions to complement interview data.

The sample population was selected on an opportunity basis, to fill a quota of twelve large-scale and twelve small-scale farming households, self-defined by participants. For each sample, households with and without GGD members were approached, reaching an overall ratio of 54% non-GGD households and 46% GGD households. The assumption was made that all members of a household would use the same agricultural techniques. Hence, any impactful knowledge gained via the GGD would affect the entire household. Interviews were conducted with either the household head or the person responsible for agricultural activities, with contributions from other available household members. There is no distinction made between male and female participants in this stage of research.

A couple of biases were apparent. Firstly, despite comprehensive explanation of our purpose, many participants assumed that we might provide aid. My presence in the aftermath of a cyclone further encouraged this assumption. Secondly, we directly approached people at their homes to arrange interviews at times suitable for them. Everyone we approached was willing to take part. However, results may be under-representative of those farming land at a distance from their home, or people who had

busier schedules. The observations discussed cannot be said to be representative of the wider population of Khajura.

Image 2.3: Land Walk with a Farmer

Image 2.4: Discussing Farming

2.3.2 Wealth Ranking

After completion of interviews, households were categorised according to wealth, in order to assess whether any differences in action were apparent. Ranking was completed by a key informant from within the community who works directly with a local NGO as a mobiliser for the GGDs. His widespread connections within the community meant that he was well placed to categorise each household. However, it should be noted this information was not triangulated: only one ranking exercise was completed with one key informant.

Participants were ranked according to low, very low, mid or high wealth group. The very low category was significantly underrepresented. Therefore they have been combined with the low wealth group to avoid presenting misleading results. As wealth was not a central research focus, participants were not targeted on this basis. Instead, ranking was completed after all of the interviews were finished. As such the wealth categories are not equally represented, and the majority of participants fit into the low wealth group.

2.3.3 Defining Scales in Agricultural Activity

In realisation of the complexity of each household's interaction with agriculture, the farming scales of the semi-structured interviews were re-categorised for analysis after completion of research. This was done to examine whether reliance on farming affected agricultural responses and utilisation of knowledge sources. The new categories include small-scale, medium-scale, and large-scale farmers. Scale allocation was based on a combination of the area of land farmed by each household, their market interaction and their reliance on alternative economic activities (see Table 2.3).

Small-scale	Households with homestead gardens, who predominantly cultivate crops for personal use and rely upon alternative activities for household income or livelihoods. Wealth ranking defined all small-scale participants as belonging to the low wealth group.
Medium-scale	Households who farm more land and sell some produce, yet still largely rely on alternative incomes or activities for the household livelihood. Wealth ranking of medium-scale participants covered categories from low to high.
Large-scale	Households who farm a large area of land or who have almost total reliance on farming, selling much of their produce. Wealth ranking corresponded to categories from low to high.

Table 2.3: Scales of Farming as Categorised for Analysis

There was much variation in the area of land farmed. In addition, farmers have different levels of interaction with market activities. Some produce crops purely for household use, whilst others sell to friends and neighbours. Large-scale farmers sell at market or arrange collections from external buyers. The corresponding wealth rankings are also indicated in Table 2.3, though they do not correspond directly with categorisations of scale.

After re-categorisation, the data set reflected a sample of six small-scale farmers, ten medium-scale farmers and eight large-scale farmers. The small and large-scale sample contained half GGD and half non-GGD households, whilst the medium scale has four GGD households and six non-GGD households. All participants are referred to as 'farmers' throughout the discussion, whether or not agriculture is their central livelihood activity. The limited sample size, in addition to the complex individual situation of each household, means that results are not representative of the wider population of Khajura.

2.4 Integrated Methods: Supporting the Central Research

Additional methods were integrated with the central research methods. They include participant observation and formal and informal interviews. The former involved observation during group meetings, participation in agricultural activities and spending time in the village and at people's homes. This heightened understanding of connections and lifestyles within the village. Additionally, a combination of formal and informal interviews was conducted with key informants from the field site and surrounding area. In essence, these interviews aimed to understand the pivotal links in the chain between external knowledge providers and community members. They explored issues surrounding agricultural actions and responses in Khajura. Further, they examined perspectives relating to the services and information provided to community members and of the source of such information. External climate change knowledge shared through NGO training was also discussed. Participants included GGD leaders and members, the local agricultural extension officer, various agricultural shop keepers and a local NGO practitioner. They were all from Khajura and the nearby town of Alipur, where market and government services are most commonly accessed by Khajura's residents. The information gained was used to triangulate the central research data, whilst also providing a rich contextual background for the study.

2.5 Translation and Interpretation: Local-Level Research Assistants

With the exception of the NGO interviews, research assistants were present to translate between Bengali and English. Throughout the group sessions, I worked with a translator from Dhaka. With a background in social and environmental science, and experience of working in the field as an interpreter, she had skills applicable to the research assignment. Before commencing I completed a briefing session and further training with her. As this assistant was unable to attend the third stage of research, I employed a new assistant from the nearby area for the remainder of the research. He had less experience and only a working knowledge of English. Therefore, I provided more thorough training for him, in addition to a comprehensive briefing on the previously completed research. This translator elicited much respect and trust from the community due to his origination from a nearby area. Nevertheless, this transition in research assistants may have affected the research, due to decreased continuity. The translation between languages means that the excerpts cited throughout this report do not represent direct quotes. Excerpts from participants are indicated in italic font.

2.6 Ethical Considerations

Full explanation and intent was explained to all participants throughout the research and consent was gained for participation in the study and for inclusion in this report. Written consent was obtained from all development practitioners who took part in the Dhaka-based research (see Appendix 4). At the local field site, I initially approached the GGDs to explain my purpose and gain verbal consent. I obtained individual verbal consent from all participants in the group, household, formal and formal interviews. I reiterated my purpose throughout the research process and whenever any confusion arose.

Chapter 3: Critical Links with Local Communities: National-Level Field Research

Exploratory research in Dhaka provided a detailed introduction to CBA, and examined communication strategies with local beneficiaries. It illuminated recognition of related challenges, which are difficult to respond to due to the time constraints of practitioners, the desires of multiple stakeholders and the complexity and variation in the local contexts within which they work. The latter is of much significance to this research.

3.1 Defining Communication Strategies

Participants indicated that face-to-face interaction was the most commonly used channel of communication with local-level communities. This is commonly in the form of meetings and training sessions with community groups. Such activity is supported through media such as visual (flip charts, posters, maps), written (documents, school books), and audio (loudspeaker, radio) aids. Due to the difficulties inherent in communicating climate change concepts, increasingly more creative methods of communication are being employed including knowledge centres, which provide a physical base for access to online and written information, drama productions, which employ youth and theatrical organisations to attract community attention, and knowledge fairs, which bridge gaps between different communities and local experts, encouraging reciprocal knowledge sharing and learning at the local-level. However, face-to-face communication remains the most common strategy, particularly amongst remote, poor and largely illiterate communities.

3.2 Overcoming Communication Barriers

Several challenges to communicating CBA knowledge at the local-level were highlighted in this phase of research. The main responses are tabulated below (Table 3.1). Each participant highlighted a combination of problems. Agreement between responses is shown in Figure 3.1.

Reported Issue	**Brief Explanation**
Language Translation	Inadequate translation of CBA information into appropriate terminology and language for target audiences
Relief Interest Only	Community-level interest in relief is more prominent than interest in acquiring new skills or information
Lack of Localised Information	Climatic information shared is not relevant to the specific location of its target audience and complexity must be balanced
Local Stakeholder Competency	Local government information is often outdated and development staff are not sharing appropriate information
Community Knowledge Sharing	Knowledge shared does not spread from the target audience to the wider community

Table 3.1: Challenges Reported in Sharing CBA Knowledge at the Local-Level

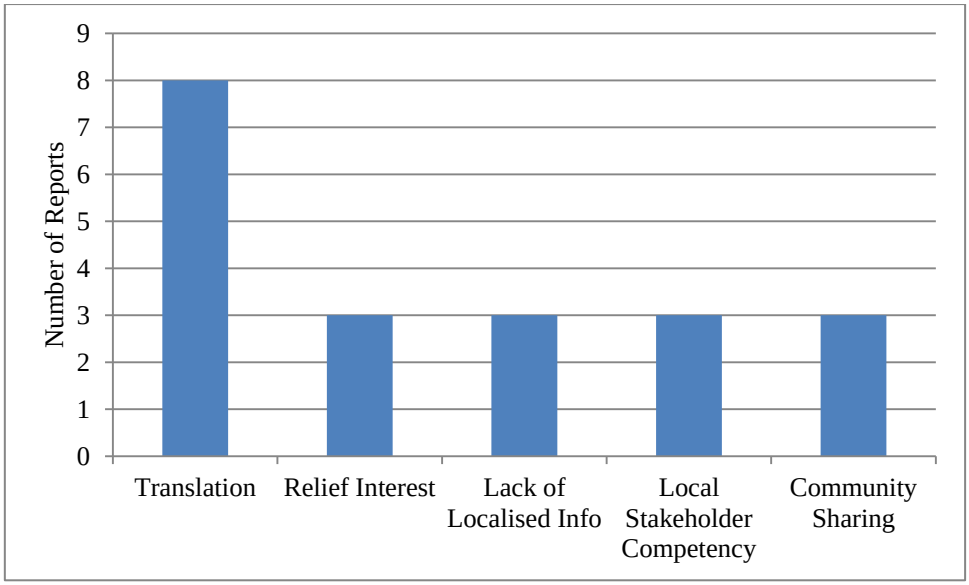

Figure 3.1: Obstacles Faced in Communicating CBA Information

The problems experienced highlight the importance of linguistic, social and political context in the communication of climate change concepts and adaptation ideas to local-level communities in Bangladesh. Translating technical climate change information into the specific language of target audiences is a particular challenge in Bangladesh where the dialects are diverse and abundant. Literacy and language barriers can alienate people who make no connection with the material used for communication (Roncoli 2006). Moreover, a local-level disinterest in knowledge was found to be problematic for creating connections. In order to gain community interest, some NGOs encourage participation in programs by providing equipment, seeds or financial support. However, this persistent dependence on aid has been found to erode the independent stability of communities (Benson *et al* 2001). In the case of Bangladesh, these results indicate that past dependence upon relief can render the supply of external knowledge void by local-level communities.

Problems were reported with regards to knowledge content. First, there is a perceived lack of precise, localised climate models and information. Whilst global knowledge is based on abstract scientific reasoning, climate knowledge at the local-level is

expected to be more valuable when specific to place and grounded within cultural understandings (Naznin 2013). Second, participants indicated that information that is too broad and simplistic is as problematic as information that is too complex or removed from community interests. It was suggested that a balance in the complexity of translated information must be maintained. Finally, in discussing the responsibilities of local-level stakeholders, it was reported that information provided by the local government is sometimes outdated and that local development practitioners could share more useful knowledge. In summary, participants conveyed that the content of knowledge shared at the local-level must be relevant, current and balanced.

Inadequate internal knowledge sharing within communities was highlighted as a critical issue. Development programmes target certain groups within communities, for example, the most vulnerable or poor, or particular ages or genders. It is expected that useful information will be shared among neighbours, friends and acquaintances experiencing similar problems. Communities are likely to share information that is genuinely deemed to be interesting, relevant and useful to their livelihoods (Agar 2005; Adhikari and Taylor 2012). Therefore, in cases where knowledge is not being employed or shared within the community, it may be that it is not deemed relevant in that particular context. It is not creating enough interest and does not have enough direct significance to become widespread.

3.3 Moving Along the Chain

Whilst the relevance of climatic knowledge relates to geographical locality, sympathy for each community's social, political and economic context is crucial for informing the format and the content of communication (Magistro and Roncoli 2001). This exploratory research indicates an appreciation of the significance of context in knowledge compatibility. However, this appreciation is being recognised through the illumination of

knowledge barriers, which represent a critical friction between national and local stakeholder communication. This friction also challenges smooth knowledge flows between local communities and local-level development practitioners, who are considered a crucial source of support for communities deemed vulnerable to climate change.

With a focus on intercultural communication, Scollon and Wong Scollen (1995: xii) point out that communicative friction is more a result of different "patterns of discourse" between various cultural groups, than of the specific presentation of information. The discourse of local communities in Bangladesh is at utter disconnect with the discourse of global and national climate change stakeholders that are advocating widespread adaptation. The following local-level research reveals the sources of knowledge that are voluntarily accessed and illuminates local perceptions of these knowledge sources. Moreover, the investigation of the impact of external information illuminates the depth of consideration of external concepts at the local-level and their relevance to the discourse of a community under pressure to adapt.

Chapter 4: Khajura: The Local-Level Field Site

Khajura is a widely dispersed village of around 700 households occupying an area of 6km², informally divided and defined as North, West and Central Khajura. It is inhabited by a Bengali Muslim community, whose livelihoods depend largely on natural resources. Residents estimate that there are around 80% fishermen to 20% farmers, though many households rely on both activities.

4.1 Geography of Khajura

Khajura is in the region of Barisal, on the coast of Bangladesh. It is a low lying area bordered by the Bay of Bengal to the south, the mouth of the Andoimanik River to the west and the Shibbazia River to the north (See Image 4.1).

Khajura's location leaves it vulnerable to significant and unpredictable climatic events alongside annual extremes (Hossain *et al* 2012). Past sudden onset events include cyclone Sidr in 2007, Aila in 2009, and most recently, Mahasen in May 2013. These events have significantly affected the residents of Khajura through loss of family members, loss of property and assets, and damage to livelihoods. Acute flooding is common during the monsoon season and there is extensive drought throughout the summer months. Furthermore, close proximity to the sea incurs widespread salinity intrusion. Both slow and fast onset events have significant implications for agricultural processes in Khajura.

Image 4.1: Location Map of Khajura (Source: Google Earth 2011)

4.2 Agriculture in Khajura

Crop farming dominates agricultural production in Khajura and practices are dictated by climate patterns. Whilst rice is a major large-scale crop, many other fruits and vegetables are grown on a smaller scale. Fruits include watermelon, mango, papaya, banana, coconut, guava and lime. Vegetables include spinach, snake gourd, cucumber, tomatoes, chilli, pulse, French beans, eggplant, okra, pumpkin and peanut. These lists are certainly not exhaustive, and new crops are frequently experimented with. Rice is generally harvested once a year, rather than three times as is common in other parts of Bangladesh

(Coelli *et al* 2002). However, farmers employ a rotational crop pattern, making use of the land year round. Produce is relied upon for personal consumption and market sales. As such, farming activity, whether on a small or large scale, is a crucial aspect of Khajuran livelihoods.

4.3 CBA Initiatives in Khajura

Due to the area's climatic vulnerability and socio-economic context, Khajura has received much attention from local, national and international NGOs. Residents recall as many as eight NGOs working in the area in recent years. In addition to climate change adaptation, NGO programmes focus on disaster risk reduction, education, public health and social protection.

As part of an NGO programme, three GGDs were established in Khajura in 2008. With a focus on CBA, these groups seek to define problems and find solutions from within the community. Members reported discussion of climate change, disaster risk reduction, salinity and agriculture, amongst other matters. Such research was initially inspired by providing globally significant knowledge about climate change and externally produced information about adaptation processes, with the ambition of achieving solutions based on the integration of local and specialist knowledge (Kabir *et al* 2011). Knowledge has been shared through face-to-face interactions including training and group activities. In addition, agricultural extension officers are relied upon to disseminate scientific and technical knowledge on agriculture (Raihan *et al* 2010). GGD members are encouraged to contact the agricultural extension officer in their search for solutions to any problems encountered. These GGDs provide the most significant portal for sharing external global climate change knowledge amongst the residents of Khajura.

Informal interviews and participant observation provided information about the members of the GGDs. These were originally established for the poorest members of the community. However, my results indicate that some members are from high wealth large-scale farming households. Each group currently has about 25-30 members. Participation from the wider community appears to be somewhat restricted, though new members can be elected in by existing members. It was explained that those voted in must be perceived to be active, confident and sensible individuals by those voting for them. Dynamics vary between groups, though voting during one committee meeting highlighted some tensions stemming from decisions made by prominent members on behalf of the GGD. Moreover, discussions with various members suggested differing perceptions of the value of the GGD itself. Whilst some see it primarily as a resource for relief and financial security, others view it as a useful resource for discussion and information, and exude a sense of pride in the success the community has achieved via the research of the GGD committee. As a portal for external climate and adaptation knowledge, these GGDs are central to the basis of this study of knowledge flows.

Chapter 5: Environmental Impacts on Agricultural Practice: Identifying Problems

Group sessions at the local-level revealed the central environmental problems affecting agricultural practices in Khajura. Aggregate examination reveals some general patterns, yet perceptions become increasingly differentiated when examination occurs at smaller scales, such as between different areas or individual households.

5.1 Determining Environmental Problems

The group exercises completed with twelve groups of farmers from Khajura reached a consensus on four fundamental environmental problems affecting agriculture. These are flood, salinity, drought and insects. They are not always considered in isolation, but are understood to be intertwined with each other and closely linked with socio-economic issues. Previous research in this area of Bangladesh has similarly found that local knowledge is gained through comprehensive integration of natural, environmental, socio-economic and cultural understandings (Raihan *et al* 2010). Additionally, the unpredictability of extreme events and the cost of responses are serious concerns for farmers. Despite this complexity, the core environmental problems remained the central focus of these exercises. Each problem is discussed further below.

5.1.1 Flood

Flooding is a common phenomenon that has shaped traditional cultivation patterns in Khajura. However, group activities indicated that increasing frequency and extent of flooding, alongside prolonged waterlogging, is posing significant problems for agriculture. Both crop damage and disrupted cultivation patterns result in decreased productivity. One farmer explained:

> *"When flood spoils our crops we must start again, so we work more and wait for longer for our crops. If crop cultivation is late because of flood then we cannot grow anything."*

Extreme river and sea flooding occur after excessive rain, cyclones and storms.

5.1.2 Salinity

Salinity is a secondary impact of flooding. Participants explained that sea water flooding increases saline intrusion in the land. This significantly decreases the production, yield and quality of crops. Salinity becomes a major issue during periods of drought, when fresh water evaporates from the land. As such, the underlying problem is sometimes defined as *"less rain"*. Farmers identify salinity through observations of *"burning"* of crops and *"white spots"* on soil and leaves. Whilst many see salinity as a major issue, an older farmer reported:

> *"Salinity is a problem here. It has always been a problem and everyone knows that so it is no big deal."*

There was not a complete consensus that salinity is increasing. In fact, some reported that it is less of a problem now than it has been in the past. Perceptions are likely to be dependent on the location of farmed land: vulnerability to saline intrusion is dictated by proximity to protective embankments or saline polluted rivers.

5.1.3 Drought

Drought is a huge problem in Khajura, reported to be intensified by the later onset of the rainy season and increasingly irregular rainfall. During periods of drought, crops become dehydrated, which hinders their growth. To secure fresh water resources, people dig canals and collect water by hand to irrigate the land. Some farmers use pump

machines, though this is a luxury not open to the majority of people in Khajura. Indeed, farmers noted the lack of such technology as the immediate problem.

5.1.4 Insects

Farmers are familiar with many insects, which weaken crops in various ways. For example, *"loda poka"* was described to be an insect that cuts the head off rice crops, and is therefore easily identifiable. Continuous insect attack is understood to be a result of increased waterlogging, salinity, and crop production in the area. One participant also explained insects to be the punishment of Allah. Traditionally, farmers used ash or prawn wastage to defend their crops against insects. However, these methods have been replaced in favour of insecticides and pesticides. These are not always adequate and so problems remain. For example, one farmer explained that such chemical treatments are not working on new insects, reporting that *"…the insects are becoming smarter than the medicine"*.

Image 5.1: A Large-Scale Farmer Applying Insecticide

5.2 Finding Patterns in Perceived Problems

Despite widespread agreement on the problems affecting agriculture, the ranking of environmental problems displays less conformity between the farmer groups (see Figure 5.1). As such, there is no agreement upon one dominant problem interfering with agricultural activity.

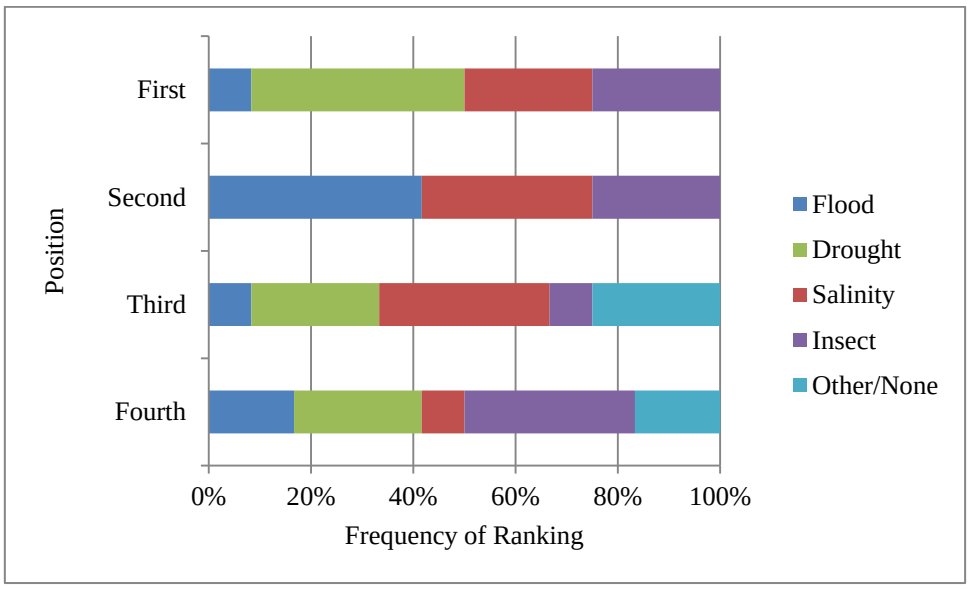

Figure 5.1: Ranking of Identified Problems

Some patterns are apparent amongst the respective areas of Khajura (see Figure 5.2). For example, flooding was more regularly cited as a problem by participants from West and Central Khajura. In North Khajura, many households are located near the river and outside the main embankment where excess water can drain easily. Land farmed in this area is therefore less likely to suffer from prolonged flooding.

Any general trends apparent between areas vary at the household-level, depending on the precise location of homesteads and farmland. Whilst all groups reported salinity as a problem in this stage of research, some farmers living within a major embankment reported that it was not their greatest concern, due to the prevalence of fresh water flooding over salt water flooding on their land. No parallels according to farming scale or gender were found within the group results and gender differences were not examined beyond this stage of research. A larger and wider reaching data set may illuminate more patterns with respect to these variables.

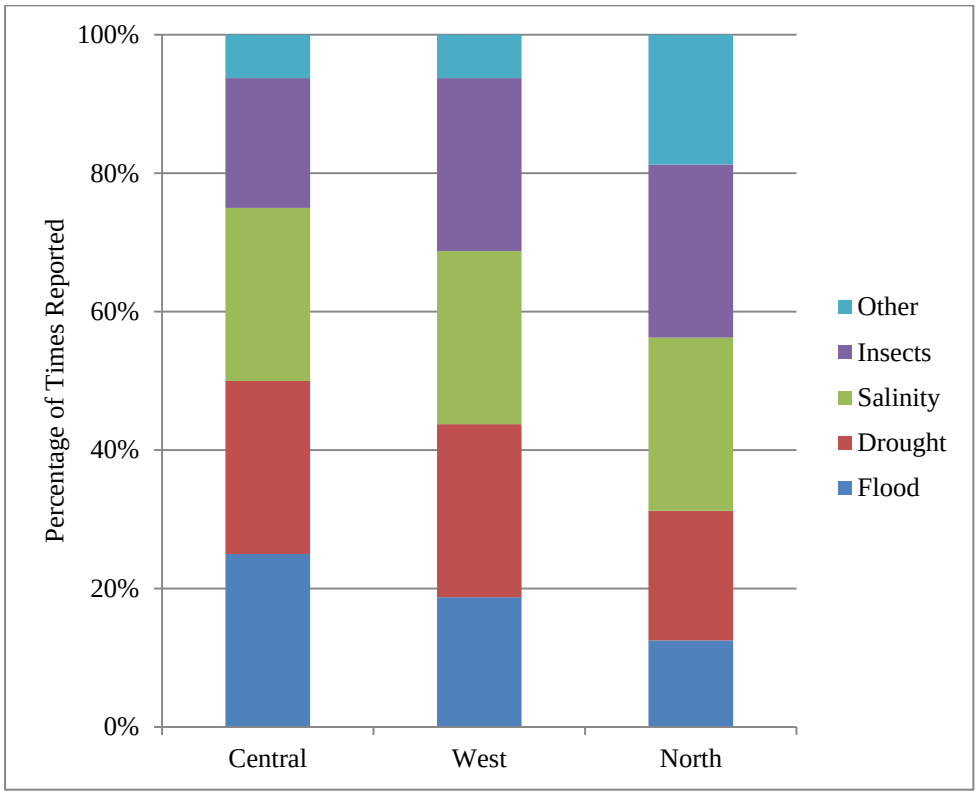

Figure 5.2: Relative Reporting of Problems within Each Area

5.3 Selecting Problems for Further Investigation

Subsequent research focussed on flooding and salinity for several reasons. Most obviously, they were widely identified in the group sessions. They are perceived as related yet contrasting problems. Additionally, they are two central concerns of NGOs that work in Khajura on CBA initiatives (Raihan *et al* 2010). Furthermore, this decision was greatly influenced by the occurrence of cyclone Mahasen during the research period. This event incurred much loss to agricultural assets and crops through storm damage and extensive flooding. It was frequently discussed within Khajura and also stimulated much conversation about previous flooding and cyclones and how residents have suffered or

coped. Therefore, a focus on flooding and salinity was appropriate and allowed exploration of issues which participants were keen to discuss.

Image 5.2: Flooding in Central Khajura

Chapter 6: Climate Change Knowledge Flows: Finding the "Reason of Reasons"

In Khajura, explanations for observed climatic changes have evolved through personal observations, cultural beliefs, word of mouth, GGD activities and, occasionally, media, such as TV and radio. The way in which people make sense of climatic changes can provide an indication of the relevance of accessible external scientific information and illuminate flow or friction in knowledge sharing.

6.1 Local Understandings of Climate Observations and Change

There was unanimous agreement amongst participants that the frequency of flooding is increasing in Khajura. Explanations for this, offered during household interviews and informal discussions, give an insight into how farmers understand climate change. Several explanations for increased flooding were described, as summarised in Table 6.1.

Infrastructural	Related to man-made or natural structures in Khajura, such as embankments, sluice gates or trees located in protective positions
Climatic	Explained through geographical observations, sometimes related to climate science
Religious	Climatic occurrences believed to be under the power of the Almighty
Local	Based on explanations heard from acquaintances by word of mouth

Table 6.1: Explanations Offered for Increased Flooding

Most participants in the household interviews gave a combination of explanations. For example, increased flooding might be understood to be caused by climatic occurrences or the power of the Almighty, but worsened by local infrastructure. In addition, there were some people who had no explanation. Figure 6.1 indicates some similarity in the

explanations given by GGD and non-GGD households. This and the various explanations are discussed in more detail below.

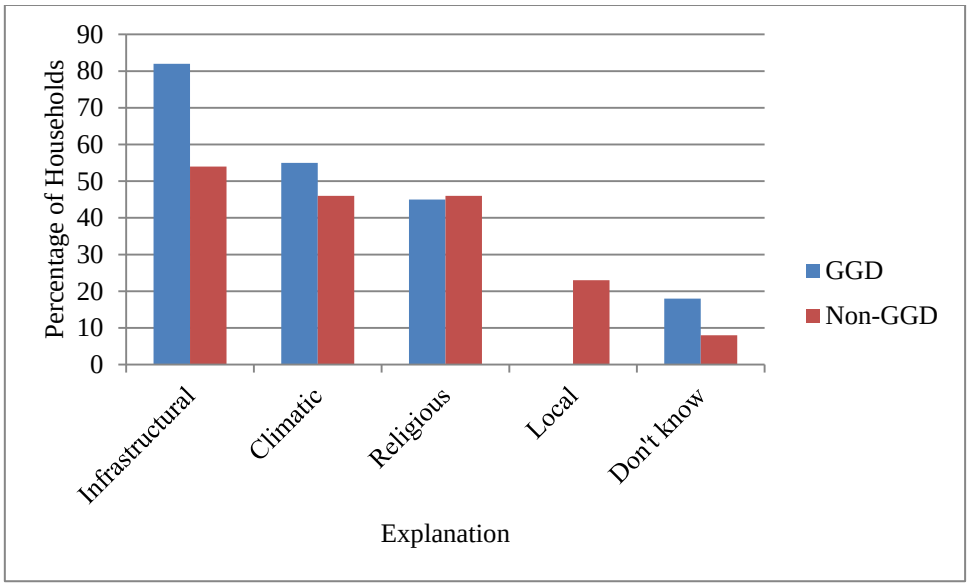

Figure 6.1: Frequency of Explanations for Increase in Flooding

6.1.1 Infrastructural Deterioration

In Khajura, increased flooding is widely recognised to be a result of damaged and mismanaged infrastructure. Sluice gates have been installed in the area to control the movement of saline water between rivers and canals. The appropriate management of these gates is critical in times of flood when they can assist in the drainage of excessive saline water. However, due to damage and management problems, sluice gates do not operate as intended. Discussions with the local agricultural officer revealed that all of the gates in the union are damaged. Yet government corruption and limited funds means that few efforts are made to repair them.

Many participants believe that without these infrastructural problems, flooding would not be an issue:

> *"If we had sluice gate control we would not have a problem, but because it is damaged, water is up, down, up, down, and therefore there are many problems."*

The fact that most people give an infrastructural explanation indicates that they believe there is a solution to the problem of flooding. The high proportion of GGD participants relaying this explanation reflects a focus on such issues in GGD activities. Moreover, it indicates that discussion of these issues is impactful upon members. However, many participants gave deeper explanations for climatic changes in tandem with these observations of infrastructural damage.

6.1.2 Climatic and Geographical Drivers

When asked why flooding is increasing only one interview participant implied an external scientific understanding of climate change. This was an elderly member of one GGD group:

> *"The air is polluted with industrial smoke, and the sun is becoming very hot. The climate is changing now so that is why it is raining."*

Further indications of global climate change understandings were gained through informal discussions with GGD members after the household interviews had been completed. One man appropriately explained that GGD sessions on climate change had taught them about the *"reason of reasons"*. Therefore, global climate change knowledge can provide an explanation for the known and observed interpretations already existent within the community. However, further discussions with GGD members indicated that such explanations had had little impact or had been forgotten.

Whilst comprehensive global explanations of climatic changes were sparse, a geographical understanding of climatic change was not unusual in Khajura. Explanations

stemmed from observations of rising sea levels, derived from personal experience and discussions amongst residents. Both GGD and non-GGD households gave such explanations:

> *"When wind from the east blows at high tide, the water level is higher than normal. The sea is nearer now so the current of the river is so fast, which increases flooding."*

Whereas the global science of climate change may be too abstract and irrelevant to spread throughout the village, tangible and visible explanations are significant in discussions of local climatic variations. In agreement with the national-level research, the locally relevant aspects of a scientific explanation may, therefore, be of interest to the wider community.

6.1.3 Religious Beliefs

Islam is widespread within Khajura and religious beliefs were often used to explain climatic changes. These beliefs also reflected notions of powerlessness amongst participants:

> *"We have nothing to do because this is God's creation."*

Though such feelings exist in Khajura, many participants giving religious explanations reported responding to flood through practical agricultural action. In agreement with this, previous adaptation studies exemplify that the belief that God is in control does not prevent farmers from engaging in purposive action (Roncoli *et al* 2002). More apparent is the depth of this religious explanation, which was offered equally by GGD and non-GGD households. There seems little impetus for individuals in Khajura to engage with external and abstract explanations for climate change when longstanding religious beliefs can explain observations.

6.1.4 Local Word of Mouth

More immediate explanations of why changes are occurring are easier for people to relate to. A locally informed explanation of climate change was provided by some participants. They explained that magnetic pillars were installed in the British period to protect the area from harmful storms and natural disasters. The recent removal of these pillars is thought to have increased the climatic vulnerability of the area:

> *"Before there were no lightning storms. Now there are no pillars, so lightning storms happen a lot and people are dying. The pillar was planted by the British. It prevents natural disasters, cyclones, and thunder and lightning. Now the pillars have all been stolen, so natural disasters and lightning storms are more frequent."*

Such accounts may be easier for people to relate to and, hence, more readily absorbed, particularly when coupled with claims that their acquaintances have witnessed the events detailed. Local familiarity with this explanation witnessed throughout the field research exemplifies that climatic knowledge can spread throughout the village. However, its underrepresentation as an explanation in the household interviews indicates that such hearsay is not always agreed upon. All of the local understandings came from non-GGD households. It may be construed that GGD activities have served to dispel such concepts, though the sample size is not large enough to be certain of this.

6.2 Discussion: The Impact of Understandings

GGD members often stated that they learnt about climate change issues in their meetings. However, NGOs are more likely to assist in situations where communities can appreciate that NGO assistance is a benefit (Datta 2007). Potential acknowledgment of this within the community may cause GGD members to exhibit an understanding of the

purpose of the NGO. Certainly, my presence as an outsider often seemed to elicit what were assumed to be the 'correct' responses. Therefore, many GGD members stated the topics that GGD activities had focussed on, though interview results suggest that the specifics of the knowledge shared within those topics had little impact on its audience. Observation of a training session indicated more concern about payments made in reimbursement for attendees' time than about the knowledge being provided. This illustrates that local-level motivation for attending NGO instigated meetings, in which external knowledge is shared, can contrast greatly to the NGO's motivation for organising meetings.

External explanations of climate change have not impacted greatly on understandings of climatic events in Khajura. The abstract nature of scientific information may not be impactful due to its inherent disconnect with local experiences (Roncoli *et al* 2009). In fact, communities that rely on natural resources tend to have their own relationship with the climate from which explanations stem (Naznin 2013). Moreover, in studies of indigenous and local knowledge, seeing and knowing are often found to be closely related (Roncoli *et al* 2009). Similarly, in Khajura, many people base their understandings on observations of the weather and climate on which they have always relied. These are unlikely to be displaced by unfamiliar explanations of an abstract and ambiguous nature.

Furthermore, in agreement with the exploratory research, there appears to be a disinterest in scientific knowledge. When a farmer was asked about why he thought flooding was increasing he explained:

> *"I am not a scientist. I do not have an idea about this. If I want to know, I have to be a scientist."*

In fact, despite knowledge that a scientific explanation exists, this farmer provided an underlying religious explanation. Indeed, Barisal region is known for remaining particularly traditional in its religious rituals and beliefs, partly thought to be due to it predominantly rural status some distance from the country's capital, Dhaka (Rozario and Samuel 2010). To many in Khajura, it appears to be religion, rather than science, that provides the *"reason of reasons"* behind climate change. As such, external explanations are of little consequence to people's actions.

If information is to be influential it must come from a trustworthy source (Hasnain and Jasimuddin 2012). The description of the 'pillars' indicates that explanations for climatic observations *do* spread throughout the village. Significantly, this explanation was learnt from familiar acquaintances, by word of mouth. In terms of climate knowledge, the range of staff employed by the array of NGOs working in Khajura mean that information is constantly being provided by new and unfamiliar people, with whom connections have not been formed. However, this examination of climate change understandings indicates that knowledge flows are enabled by locally relevant and engaging information provided by a familiar and trusted source.

There is no clear correlation between individual understandings of climate change and specific action taken for adaptation. None of the participants suggested that their agricultural choices were due to knowledge of climatic changes, whether these were observed or scientifically conceptualised. Rather, practical agricultural information has more relevance and, hence, more impact within Khajura. Sources of practical scientific knowledge will be discussed further in the next chapter.

Chapter 7: Flow and Friction in Action: Exploring Knowledge Sources and Agricultural Responses

Residents of Khajura have access to various sources of agricultural knowledge. Internal knowledge is primarily gained through observation, whilst, in agreement with the exploratory research, external knowledge is most commonly shared through face-to-face communication. Examining data from the local-level semi-structured interviews, this chapter will explore the sources of information accessed, how they are perceived, and consequently, how farmers in Khajura employ these knowledge sources to inform responses to flooding and salinity.

7.1 Sources of Agricultural Knowledge

Interviews and group sessions revealed that agricultural methods are informed through both internal and external knowledge sources. These are defined in Table 7.1.

Internal Knowledge Sources	
Source	**Knowledge Content**
Forefathers	Practical agricultural methods learned from previous generations
Personal Observation	Personal agricultural experiments, experiences and observations
Local Farmers	Observing and discussing agricultural methods with local farmers
External Knowledge Sources	
Source	**Knowledge Content**
Agricultural Training	Training arranged by external organisations
Agricultural Officer	Theoretical agricultural advice from an extension officer
Shop Keeper	Theoretical agricultural advice from agricultural shop keepers
TV/Radio Program	Practical and theoretical methods informed through the media
Books	Theoretical agricultural knowledge gained from educational books

Table 7.1: Sources of Internal and External Knowledge that Inform Agricultural Choices

There is much integration between the sources of knowledge. For example, NGOs work alongside government services to arrange training sessions, and farmers share knowledge with the local agricultural extension officer. A review of the sources of information employed in Khajura highlights the importance of trust in engaging with particular knowledge sources, and the significance of pride and experimentation in adopting agricultural advice.

7.1.1 Internal Sources of Agricultural Knowledge

i. Forefathers, Personal Observations and Individual Experimentation

The majority of local knowledge is learnt from forefathers and perceived to be common sense. Beyond this, farmers in Khajura express pride in finding their own solutions to agricultural problems. This coincides with a feeling of responsibility for one's own actions, as one participant explained:

> *"I just observe problems then try to solve them alone, because if I get success, it is my own success. If I get loss, it is my own fault."*

Moreover, visibly witnessing results is much more impactful to subsequent action than gaining theoretical knowledge. The local GGD mobiliser explained that indifference to NGO programs was reduced once related success was observed amongst neighbours. One farmer also reported experimenting with new crop types after observing unfamiliar crops in the market. When his experimentations are successful, this farmer shares advice with his friends and neighbours. This experimentation is central to the impact of information upon action.

ii. Discussions with Local Farmers

Discussions with fellow farmers following observation of their success was sometimes cited as a source of knowledge. This source is thought by some to override the need for an agricultural officer:

> *"All of us are farmers here, so I approach farmers whose crops are doing well for advice. There is no need to go to the agricultural officer."*

Informal and casual meetings occur within Khajura in which farmers discuss agricultural issues. However, one participant explained there was little point in discussing problems as all farmers are in a similar situation. He believes that if a solution is known, people will already be employing it:

> *"If everywhere is flooded, everyone suffers damage; therefore there is no one to discuss it with. We discuss smaller problems in the market. For the flooding problem we have many discussions but no solutions come out so it is very disappointing."*

In situations when no internal solutions are available, external knowledge is more likely to be employed.

7.1.2 External Sources of Agricultural Knowledge

i. NGO Initiatives and Knowledge Sharing

There is a conflict in opinions about how helpful NGO advice is. Many GGD members welcome the advice they gain and demonstrate pride in the research that the GGD provides a platform for. A major benefit of the GGD is that it offers the opportunity to discuss problematic issues. These occasions have been found to provoke thought about beneficial changes whilst also stimulating hope and action (Toomey 2011). After group

sessions some participants thanked us for providing an opportunity for the discussion of agricultural issues, exemplifying perceived benefit in sharing knowledge. However, some non-GGD members indicated disinterest and a lack of respect for the knowledge provided by NGOs. One medium-scale farmer explained:

> *"I would like advice but I don't go to NGOs or other organisations for this. I don't like NGOs and what they do. Using my own knowledge is better. Involvement with NGOs is time consuming and you must follow orders."*

Those who choose not to become involved in GGD activities may feel that the commitment they are expected to give is greater than the return they receive. A history of involvement by an NGO in one location might be beneficial for creating sustainable connections. However, if the initiatives of multiple NGOs are put under one umbrella, their reputation amongst the community might be damaged as a result of any detrimental initiatives. Therefore, a bad experience with one NGO might cause farmers to be dismissive of the knowledge any NGO provides.

Involvement in NGO initiated activities such as savings groups, crop experimentation, and fertiliser use is encouraged by provision of materials and resources from such NGOs. As such, NGOs that co-ordinate adaptation activity can be conceptualised as 'providers' (Toomey 2011: 185). Though individuals benefit from gaining resources, such provisions can make them dependent, and ultimately disempower and demotivate them from taking independent action. This was also recognised in the exploratory research, where participants reported community-level disinterest in knowledge due to an expectation of relief. Consequently, it has been suggested that adaptation based on these provisions is flawed and unsustainable (Crate 2011; Nelson and Finan 2009). There is a conflict between the need for external knowledge to be usable

without resource provision and the need for action to be encouraged through visible results, which often requires some resource availability.

ii. Agricultural Training in the Local Area

Both NGO and government training has been attended by many farmers in Khajura. Agricultural training has been occurring in the area for many years and has taught attendees about cultivation techniques, new seed varieties and the use of *"medicines"* including fertiliser, insecticides and pesticides. Many farmers highly regard training that equips them with new skills. Similarly to involvement in NGO initiatives, involvement in training has been prompted by the provision of seeds. However, interview data indicated that new seeds were only used until the trial supply was exhausted. One farmer reported that the use of some seeds advised upon was unsustainable, due to the extra labour and inputs it demanded:

> *"After training we were provided with Bridhan 41 seeds. I grew them last year and they worked very well. But you must raise your land to grow them. You also need much insecticide so it is very expensive. I do not have enough money to buy it this year so I am looking for a cheaper rice variety."*

Hence, it is important to recognise that action encouraged by training may not be enduring for those who cannot continue to buy the resources advised upon. As in the case of NGO initiatives, this suggests that knowledge may be more impactful if based upon sustainable and affordable solutions rather than the provision of resources.

iii. The Local Agricultural Officer

The agricultural extension network is a government service that aims to provide support to farmers by connecting them with trained agricultural officers (Reynar and Bruening 1996). In Khajura, it was widely reported that the knowledge from the

agricultural officer is theoretical. However, practical knowledge is more respected by some farmers:

> *"We have practical knowledge, which is better, so we don't rely on the agricultural officer much."*

Nevertheless, knowledge is sought from the agricultural officer when there are no internal solutions available. Indeed, some farmers hold him in very high regard:

> *"If I have problems with crop diseases, I go to the agricultural officer at the Union Parishad, because I know him and he is a good guy. No other people have the solution, only the agricultural officer."*

The agricultural officer gains knowledge from ongoing training and interaction with local farmers. Training is received as part of externally funded programmes and therefore knowledge provided is determined as relevant from an external perspective. However, discussions between the agricultural officer and successful farmers can mould external knowledge towards greater contextual relevance. One large-scale farmer explained that when he is successful with his farming, the agricultural officer will visit him to learn his techniques directly. While the agricultural extension officer is encouraged to visit Khajura to meet farmers and provide advice, farmers are encouraged to recognise the extension service as an accessible, useful and reliable source of information. Interaction between the two promotes exchange of internal and external knowledge, locking them into a reciprocal relationship.

iv. Local Agricultural Shop Keepers

Agricultural shops are a primary source of external knowledge for larger scale farmers who visit the market to purchase products and discuss problems. The seed companies that supply the shops provide training for shop keepers, rewarded by certificates

for them to display. In addition, shop keepers attend agricultural training sessions alongside farmers and the agricultural officer. Certificates and personal interaction may serve to build trust through heightening the reputation of shop keepers. One farmer explained:

> *"I often go to the shop keeper for advice because he has much training and knowledge about which fertiliser to use for which crop. I trust these people so that is why I go to them."*

Moreover, the completion of the Muslim pilgrimage, *Hajj*, by a shop keeper, had earned him respect amongst Muslim farmers in the area. The external advice and training sourced by these respected and trusted shop keepers is critical to the actions adopted by farmers who are attentive to shop keepers' advice.

v. Knowledge Gained from External Media

National media, such as television shows, radio programmes and books, were sporadically reported as sources of external agricultural knowledge. A few households within the village have a television through which they gain both agricultural advice and climatic explanations. However, such media was not cited by many as a pivotal source of knowledge. One large-scale farmer who reported using books had two daughters in higher education. He clearly values the benefits of such education, finding the income to continue financing their studies, despite being from a low wealth household. This personal recognition of value in certain sources of knowledge may affect how far it impacts action.

7.1.3 Discussion: The Merits of Internal and External Knowledge

These results have shown that familiarity and practical evidence serve to enhance farmers' trust in the knowledge sources they seek. Internal knowledge is regarded more highly than external knowledge due to inherent familiarity alongside feelings of personal

responsibility. There is a broad variety of external knowledge sources, each with their own ambitions and targets. Lack of cohesion between them can lead to mixed messages. Whilst external knowledge sources are employed, confidence in them often relies upon witnessed success arising from their advice.

Farmers are receptive to practical knowledge that can be tried and tested. However, as previously discussed, providing resources for experimentation in a bid to encourage the adoption of external knowledge can serve to disempower communities and promote expectations of material provisions. When farmers are unable to risk losses through their own experimentation they may favour continuation of familiar and affordable techniques. Nevertheless, farmers who are in a position to experiment will adopt new techniques when success is achieved. Farmers less able to experiment can learn from these neighbours, the latter becoming trusted internal sources of knowledge who can inform about tested techniques that are appropriate to the specific environmental context of Khajura. As such, the connections between local and external knowledge become cyclical and thereby more beneficial to the wider community.

7.3 Informing Responses to Climatic Experiences

Internal knowledge informs the agricultural choices of all the participants: none rely solely on external knowledge to inform their actions. Figure 7.1 indicates the percentage of responses reported by participants that were impacted by internal and external knowledge sources, for both flooding and salinity. Flooding is primarily responded to through internally informed actions. Conversely, most responses to salinity are informed through external sources, indicating that external knowledge can have significant impact upon agricultural action.

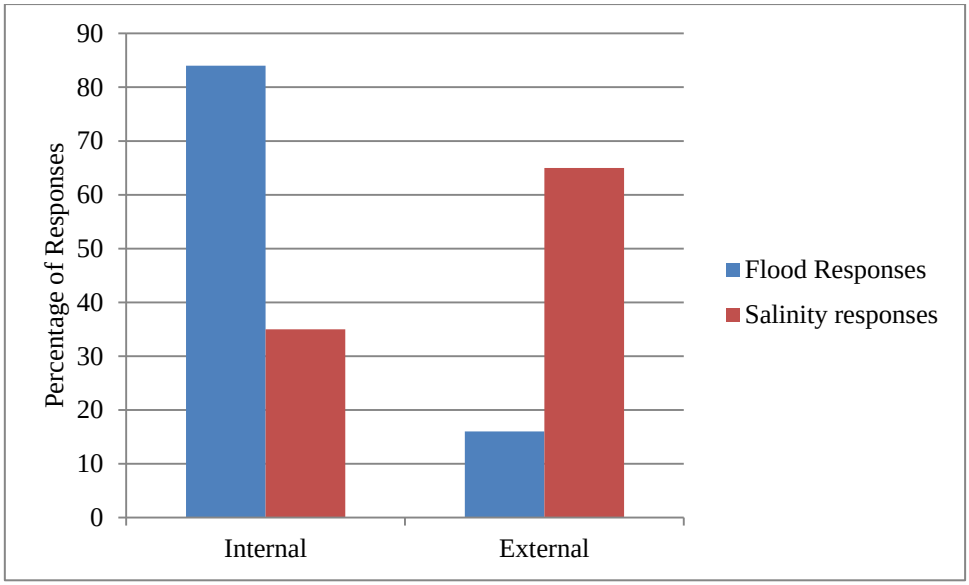

Figure 7.1: Responses Informed by Internal or External Knowledge Sources

Figure 7.2 shows the frequency with which specific sources of knowledge have impacted participants' responses to flood. The data indicates that a large majority of responses are informed through household-level knowledge sources such as forefathers or personal observation and experimentation. This suggests that flooding is a long experienced climatic phenomenon and that new knowledge is not being widely employed to respond to the increasing extent and frequency of flooding.

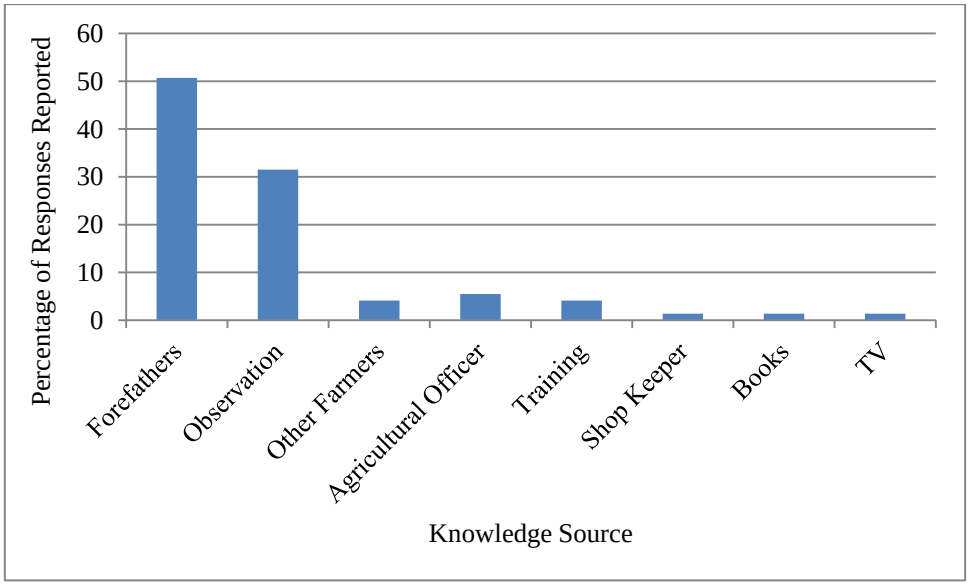

Figure 7.2: Sources of Knowledge Informing Flood Responses

The knowledge sources that impact responses to salinity are indicated in Figure 7.3. They show that external sources of knowledge have much more impact in informing responses.

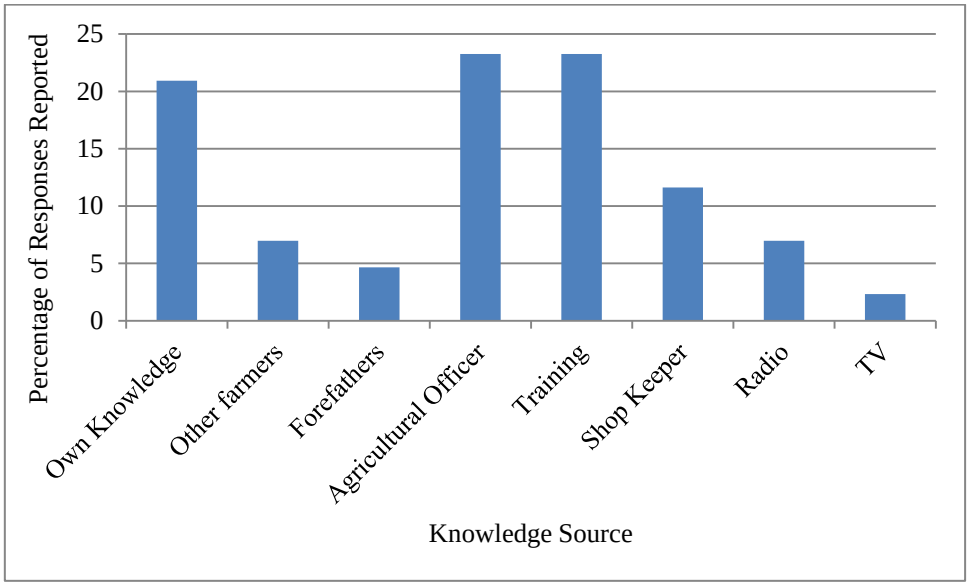

Figure 7.3: Sources of Knowledge Informing Salinity Responses

Whilst flooding is a visible problem that can be responded to with visible physical solutions, salinity is something that is within the soil and can therefore benefit from scientific knowledge. Hence, when available, specialist knowledge may be sought from external sources and advice employed in the field. The following sections will discuss the responses employed in reaction to flooding and salinity in Khajura, further examining how the responses are informed.

7.4 Agricultural Responses to Flooding

Various responses to flooding were reported. Some farmers reported one or two responses, whilst others reported a combination of up to six or seven responses. Responses can be categorised into reactive and proactive responses (see Table 7.2). Reactive responses are those actions that are taken after the event of a flood. Proactive responses are

more long-term actions that prepare for the likelihood of a flood. This latter, purposive action displays heightened consideration of climatic unpredictability. Reactive and proactive responses are discussed in more detail below.

Reactive Response	**Explanation**
Wait	Wait for the flooding to subside then salvage what is possible
Re-cultivate Crops	Save seeds or money to re-cultivate lost and damaged crops
Remove by Hand	Remove the water using a pail
Pump Machine	Remove the water using a pump machine
Dig Drain	Dig a drain to release excess water
Seek Aid	Seek aid or relief from the government or NGO
Sluice Gate Action	Approach the appropriate person to open the sluice gate
Proactive Response	**Explanation**
Cover Crops	Cover the crops to protect them from excessive rain
Raise Land	Raise the height of the land by constructing higher beds of soil
Field System	Construct a field system to manage the water volume
Crop Change	Change the crop types or varieties to more flood resilient crops
Cultivate Less Land	Cultivate a smaller area of land than in previous seasons

Table 7.2: Reactive and Proactive Responses to Flooding

7.4.1 Reactive Responses to Flooding

A collection of household-level responses are used in reaction to flooding, some of which are fairly straightforward, though perhaps not adequate for instances of severe flooding. Many farmers simply wait for the flood to drain and then re-cultivate, saving seeds as a matter of habit. One GGD member indicated use of this action due to a lack of known alternatives:

> *"We have no idea how to change our agricultural practices in response to flood. We are just waiting for the flood water to decrease."*

Two low wealth participants reported seeking aid in response to flooding. This is a reflection of the relief culture in Khajura, discussed previously. However, in neither case was aid the sole response reported. Further responses include removing water by hand and digging drains. Such traditional techniques are reiterated in GGD activities. As such, they are reported to be inspired by both internal and external knowledge sources. It is clear that these primary responses are not always possible or sufficient for instances of extreme flooding.

Image 7.1: Saving Seeds

Reactive responses have evolved alongside the introduction of new technologies and infrastructure. The agricultural officer provides information about new technologies that farmers can purchase or hire. Some medium and large-scale farmers in the mid and high wealth groups reported use of a pump machine. However, such equipment is unobtainable for less wealthy farmers. In response to this, NGOs have supplied some agricultural equipment to poorer farmers in Khajura. However, they were largely unused and eventually sold. What is clear is that farmers have knowledge of and access to these technologies, but do not always have the finances or necessity for them so continue to employ traditional methods.

In taking a more community conscious approach, medium and large-scale farmers reported requesting appropriate action from the sluice gate manager in times of flood. This reactive response is fuelled with much social and political tension. The person responsible for managing the sluice gates is a fisherman. Participants indicated that flooding can be beneficial for fishermen, who can increase their catch by fishing in the canals whilst the sluice gates remain closed. Some fishermen actually rent the canals for this purpose, further aggravating the problem by providing an economic drive to ensure the gates remain closed. Most of the small-scale participants rely on fishing for their livelihood and therefore have no incentive to request that the sluice gates are managed in favour of agricultural activity. This conflict of interests causes significant distress for larger scale farmers.

Despite knowledge of how to decrease the flood levels many of the farmers do not feel they have any power over the sluice gate situation. In fact, only six of the eighteen large and medium scale farmers reported taking any action. An indication of powerlessness came wholly from non-GGD households:

> *"We wait for the sluice gate to be opened. We are common people. We do not have enough power to take action, so we must wait for those who have power to do something."*

However, GGD activities informing farmers about their rights have encouraged a communal response. GGD members reported taking action as a group, in the knowledge that this has more impact than appealing individually. Hence, political knowledge that encourages reactive action may have some impact. At the least, the GGD brings together a group of proactive individuals who can work together to request support.

7.4.2 Proactive Responses to Flooding

Proactive responses in Khajura display planning and preparation for flooding in farming practices. They are exemplified in covering crops, constructing field systems, raising land, changing crops and cultivating less land. The farmer who reported covering crops had experimented with it after learning from a television programme. This shows willingness to try new methods, but its lack of widespread use indicates that it is inadequate for addressing the levels of flooding that Khajura experiences. Hence, such knowledge has not become widespread. Instead, field systems combining paddy boundaries, dams and ditches represent a more concrete approach. These are traditional systems that are also encouraged through GGD adaptation activities. However, while they plan for predictable flooding, they are not designed to cope with extreme flooding, when the water level is too high for easy drainage. One large-scale GGD farmer explained:

> *"I make a drain by cutting the dam, but if everything is flooded water cannot go anywhere so there is no solution."*

There appears to be little external knowledge advising upon agricultural protection against more intense climatic events. Unsurprisingly, lives and assets are a greater focus than crops:

> *"When cyclones cause huge flooding, we run away from our damaged home – what can we do with our crops and our vegetables – we need to save our own lives!"*

However, a response to the increasing levels of flooding is found in the raising of crop beds. Again, such action is often internally informed and many farmers consider it common sense; *"If you raise the land, the flood cannot reach it".* This method shows an appreciation of the increased likelihood of less manageable flooding. Yet it demands much

labour and expense and is not always enough to protect from extreme flood levels. Moreover, one farmer who was planning to raise his beds in the upcoming months explained that it was a problematic option due to the huge change in climate between seasons. During drought periods, raised land dries out much faster, dehydrating crops and increasing the severity of saline intrusion. As reflected in the group activities, farmers are caught in a conflict of extreme weather changes, experiencing sudden and slow onset climatic events, the problems of which are intensified through their unpredictability. As such, solutions are hard to find.

Interviews reflected that, with no clear solution to such unpredictability, people are forced to cultivate less land in response to the losses they incur. Previous studies in Bangladesh have found that the rural poor are often forced to sell their land, livestock and personal assets after being affected by natural disasters (Hutton and Haque 2003). Whilst cultivation of less land may exemplify adaptation through diversification for those with alternative livelihoods options, for lower wealth households who rely solely on farming it more closely reflects a strategy for survival.

7.4.3 Employing and Informing Reactive and Proactive Responses

All farmers employ a reactive response to flooding, yet some also take proactive steps. In a comparison of the various responses reported by GGD and non-GGD households, Figure 7.4 indicates that GGD households more regularly reported proactive responses and are more likely to be inspired by external knowledge sources. These observations reflect not only the increased access of GGD households to external knowledge sources, but their willingness to employ the knowledge gained.

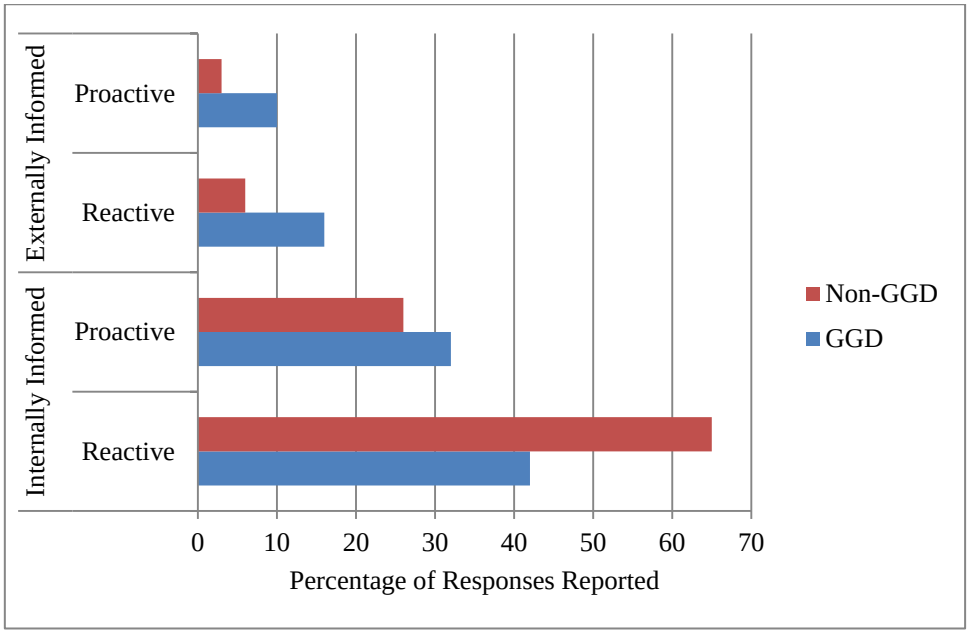

Figure 7.4: Source of Knowledge for Responses Reported by GGD Connection

In examination of specific actions, GGD households appear to be more likely to experiment with a range of responses, exemplified through their isolated reports of covering crops, removing water by hand, and cultivating less land. However, a comparison of the percentage of households taking reactive action only and the percentage taking both reactive and proactive action (Figure 7.5), indicates little difference between GGD and non-GGD households. Hence, though GGD members might trial and test a wider range of options from a broader range of knowledge sources, farmers in Khajura do not necessarily need this additional knowledge to take some form of proactive action.

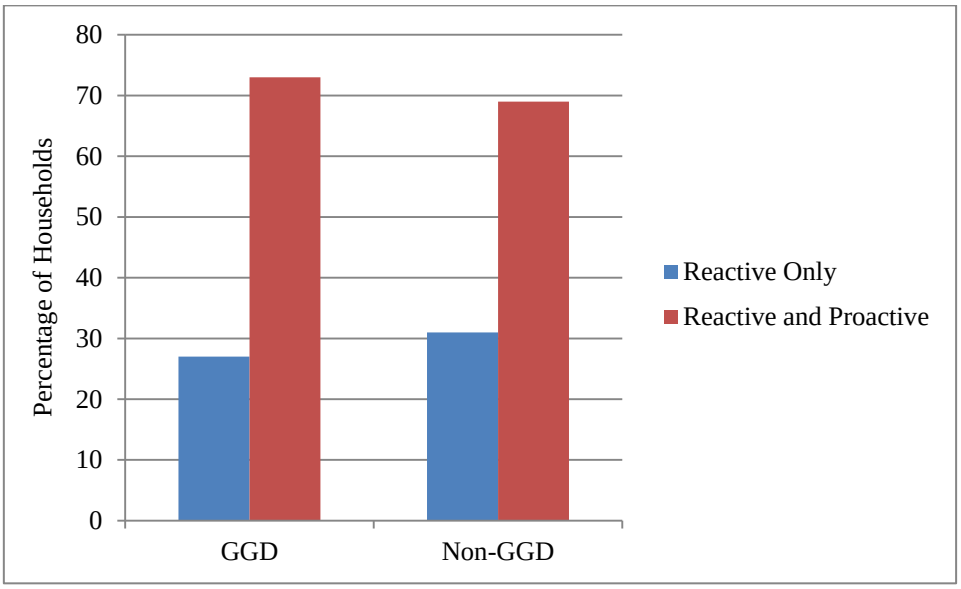

Figure 7.5: Reactive and Proactive Responses by GGD Connection

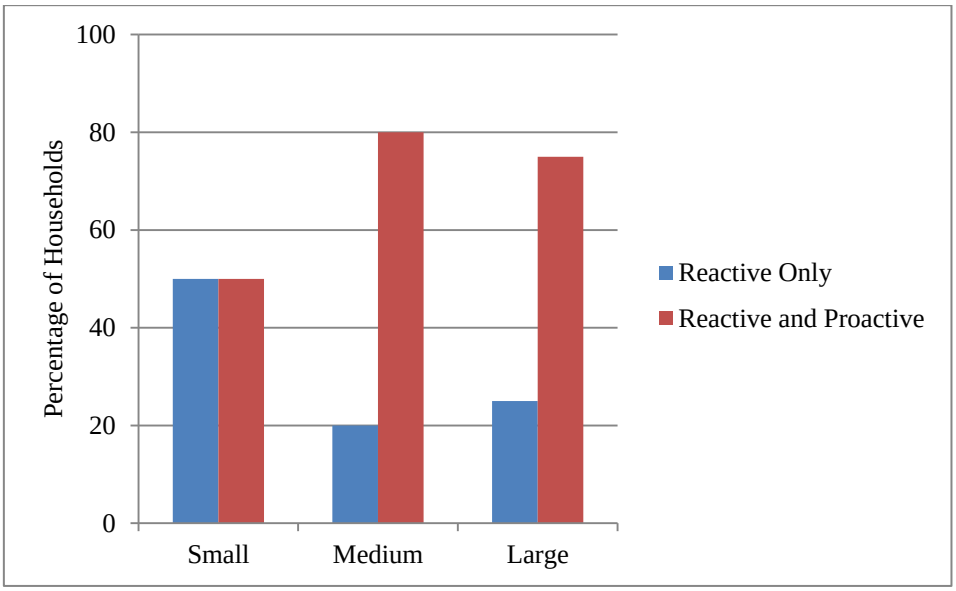

Figure 7.6: Reactive and Proactive Responses by Farming Scale

There are significant contrasts found in the type of responses employed in different scales of farming. Figure 7.6 indicates that medium and large-scale farmers are more likely to take proactive action. This could be due to their greater reliance on farming as a livelihood option. Furthermore, Figure 7.7 indicates that externally informed proactive

responses were only reported by large-scale farmers. The acquisition of proactive knowledge was from books, television and local shop keepers, suggesting that these large-scale farmers actively seek and trial alternative options due to their reliance on farming. Their personal interactions may further expose them to external information.

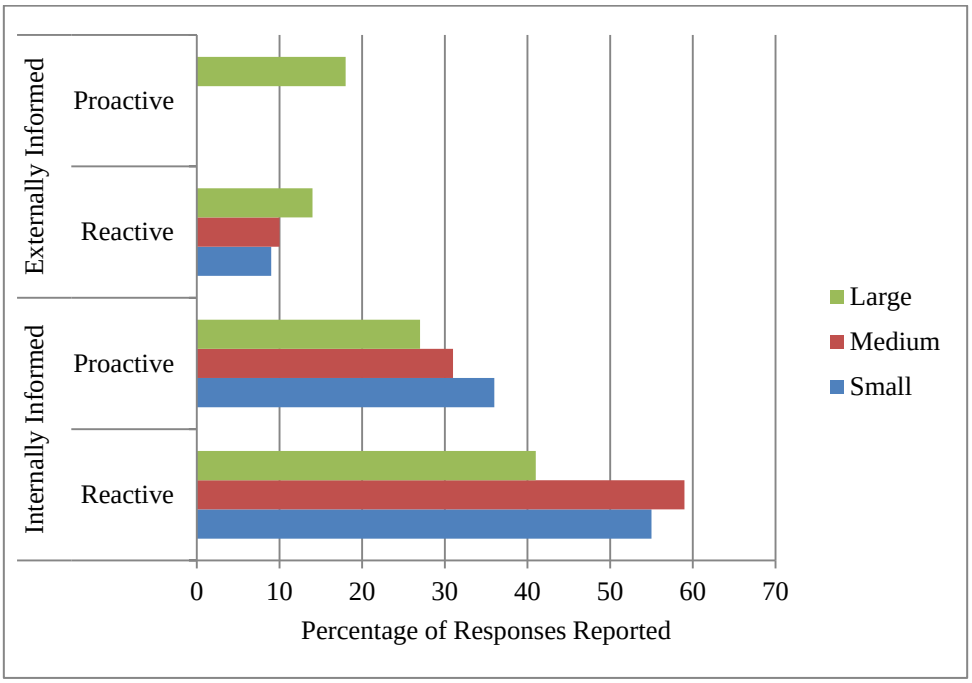

Figure 7.7: Source of Knowledge for Responses Reported by Farming Scale

In an examination of wealth categories, it appears that farmers who take only reactive action are all in the low or medium wealth groups, whilst all high wealth farmers take proactive action of some form or other (see Figure 7.8). Therefore, access to resources could determine the likelihood of proactive action.

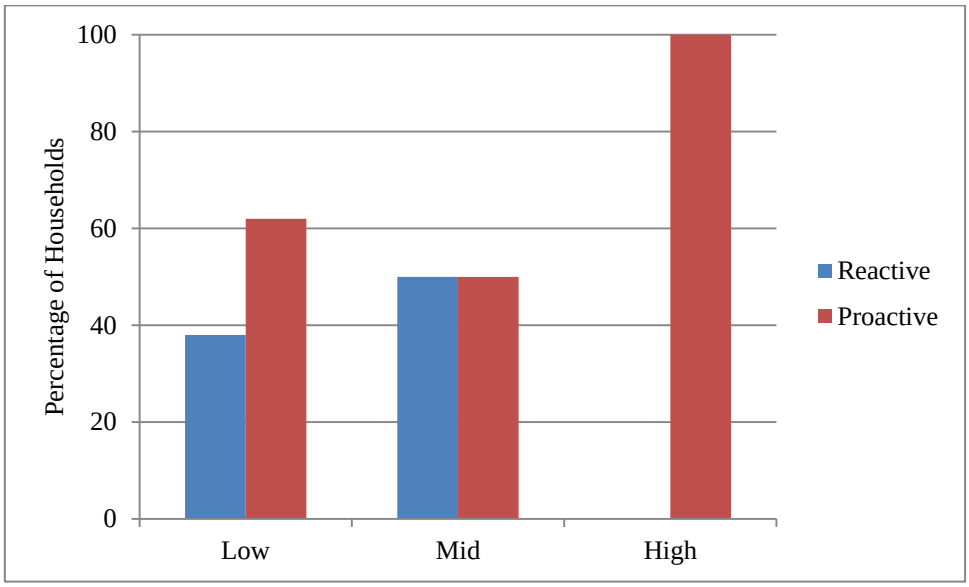

Figure 7.8: Reactive and Proactive Responses by Wealth Group

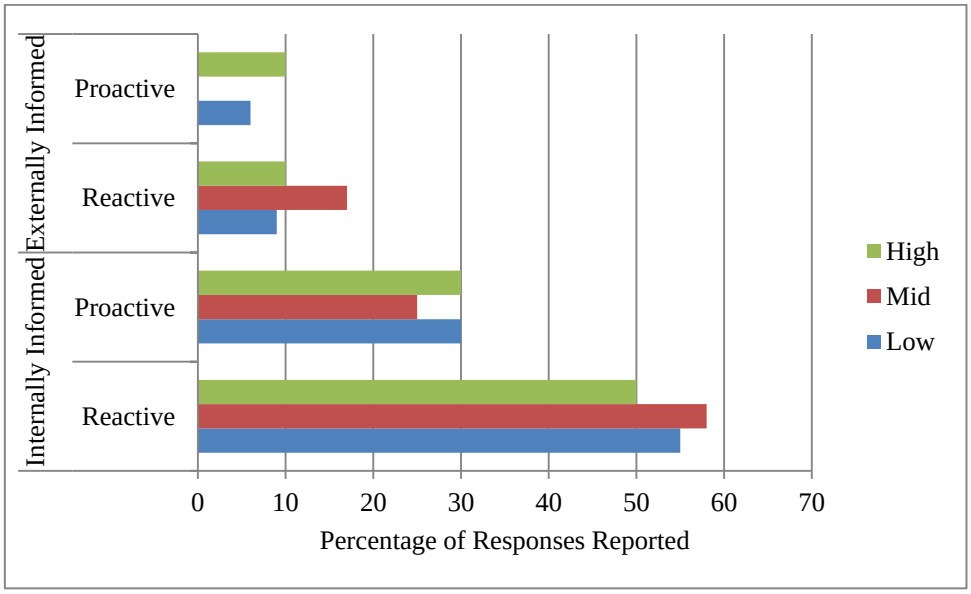

Figure 7.9: Source of Knowledge for Responses Reported by Wealth Group

There is no significant difference between the sources of knowledge employed for reactive and proactive responses by different wealth groups (see Figure 7.9), though an increased sample might allow some conclusions to be proposed.

7.5 Agricultural Responses to Salinity

Similarly to flooding, the widespread problem experienced with increases in salinity has prompted some farmers to cultivate less land. Though this was not widely reported amongst participants, one woman explained:

> *"Most people have reduced the amount of land they farm in response to increased salinity. Last year we invested much money in fertiliser, medicine and a pump machine. When we sold the rice we did not get as much money as we thought. Therefore, we have reduced the amount of land we farm this year and rely more on fishing."*

Such a reaction further indicates livelihood diversification as an approach to adaptation within Khajura. More direct responses to salinity are found in the application of fertiliser and fresh water, the use of different seeds and changes in crops.

7.5.1 The Use of Fertiliser in Response to Salinity

Use of fertiliser it is popular despite awareness of some detrimental qualities. It is beneficial in that it reduces the need to find and mobilise fresh water sources, helps market sales and reduces the uncertainty of agricultural success. However, farmers reported that the soil becomes dependent upon fertiliser, making it necessary to use increasing amounts each year. This exemplifies that short-term benefits are considered to be of more value than long-term soil sustainability. There is an acknowledgement that organic and traditional methods are better for the land. However, organic agriculture does not produce adequate yields for market activity. Indeed, some non-GGD households perceive fertiliser as the only option:

> *"Now we have to put fertiliser and insecticide on our rice crop three to four times. There is no other way to grow crops well. This is the only way, therefore it is good."*

However, one large-scale GGD farmer explained that he uses a combination of both fertilisers:

> *"Our fertiliser is better than shop fertiliser for creating stronger soil. We can use cow dung before growing the crops, but it is not useful when the crops grow up. At that time, we must use shop fertiliser to help the fruit. We always use shop fertiliser to make fruit grow quicker and stronger."*

Hence, the GGD may serve to encourage more sustainable agricultural methods. Nevertheless, the use of chemical fertiliser was reported by all participants, regardless of GGD interaction, farming scale, or wealth group (see Figures 7.10, 7.11 and 7.12).

Image 7.2:Application of 'Red' Fertiliser

Image 7.3:Uneven Application Showing Results

7.5.2 Alternatives to Fertiliser in Response to Salinity

As an alternative to fertiliser, some farmers reported the use of fresh water, new seed types and crop changes. The data set is too small for a detailed analysis. Initial indications suggest little difference between GGD and non-GGD households (see Figure 7.10), or between wealth categories (see Figure 7.11). However, comparisons between

scales of farming indicate some potential points of interest. Those who reported changing crops are both medium and large-scale farmers, whilst all those testing new seed types are large-scale farmers (see Figure 7.12). Small-scale farmers did not report using either of these methods. Instead, they more commonly reported application of fresh water. Presumably this is a more realistic option for those who farm a smaller area of land. These primary indications reflect that finding long-term solutions is more closely related to household reliance on agriculture than to climate knowledge or wealth.

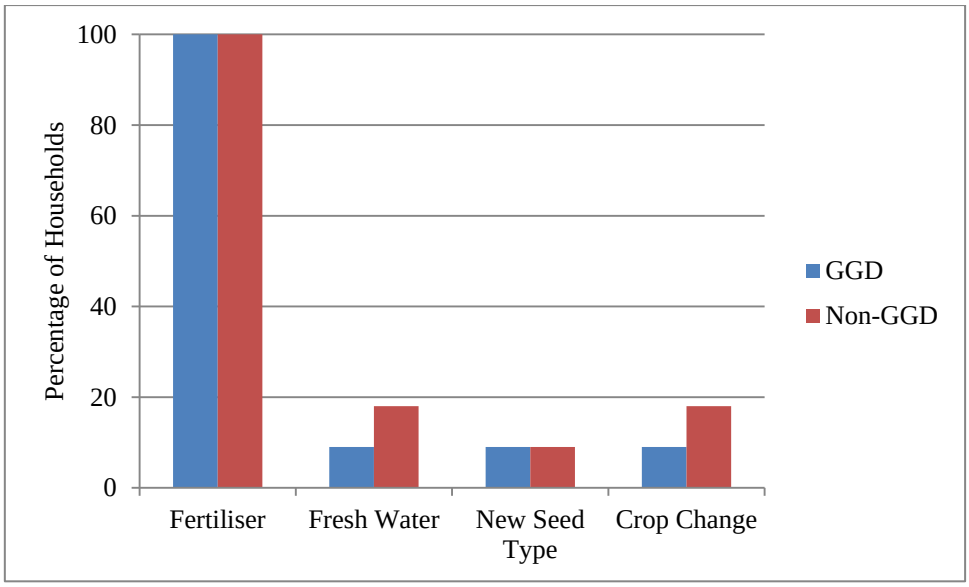

Figure 7.10: Salinity Responses Reported by GGD Connection

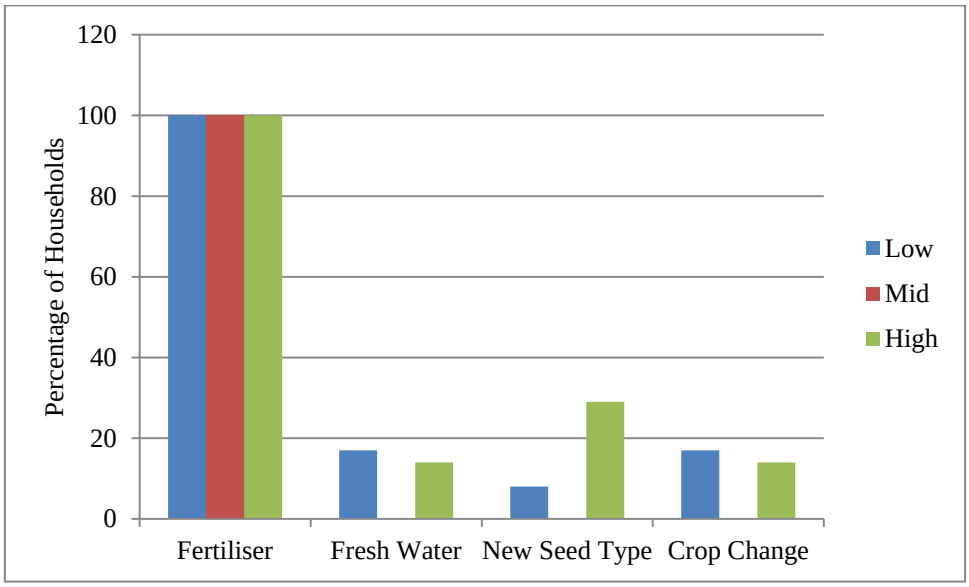

Figure 7.11: Salinity Responses Reported by Wealth Group

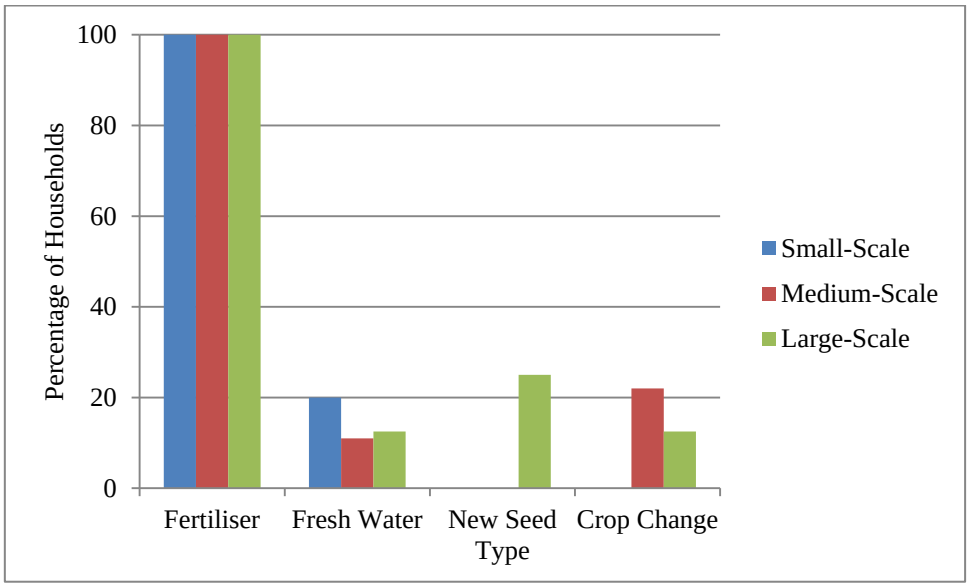

Figure 7.12: Salinity Responses Reported by Scale of Farming

7.5.3 Informing Responses to Salinity

Figure 7.13 indicates whether each specific response to salinity was informed by an internal or an external knowledge source.

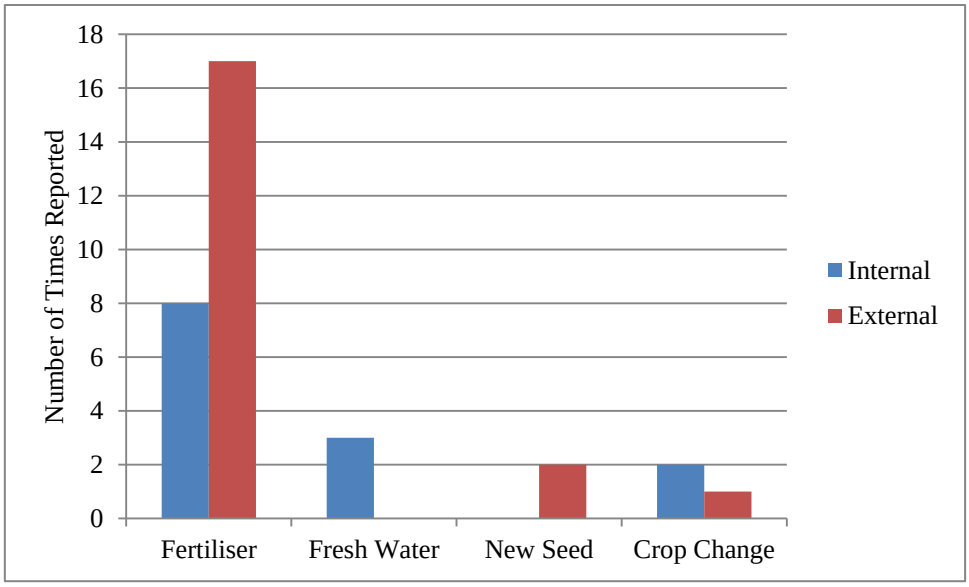

Figure 7.13: Source of Knowledge Informing Salinity Responses

There are some distinctions in the sources of knowledge employed for informing responses to salinity. Dousing the land with fresh water and changing crop patterns are

traditional responses that are internally informed. The latter was also reported to be advised by the agricultural officer, potentially highlighting reciprocity in knowledge sharing to gain contextually relevant advice. New hybrid seed types are scientifically developed. As such their experimentation was externally informed both by the agricultural officer and through GGD training. Employing fertiliser to tackle salinity is not a recent strategy. It came into use before climate change became a major issue on the development agenda. Therefore, though it is encouraged through GGD training, and advised upon by the agricultural officer or local shop keepers, some reported that they had learnt it from their own experiments or after seeing other farmers use it. This highlights that external knowledge can become widely employed if experimentation deems it to be beneficial. In becoming widespread, external knowledge is transmitted via internal knowledge sources, blurring the boundaries between internal and external knowledge.

7.6 Discussion: Responding to Climatic Impacts in Khajura

Repeated agricultural loss in tandem with notions of powerlessness has become very depressing for Khajura's residents:

"If I do hard work in the field and it is all spoiled, it causes much sorrow."

The example of the sluice gates highlights that responsibility for livelihood protection is placed in the hands of external parties such as government members and prominent individuals to some extent. Farmers desire that steps be taken by those in power, whilst simultaneously taking pride in finding their own solutions to their problems. As external political support is limited, household level responses to flooding are the most feasible option for those suffering losses.

The uncertain nature of climate change in Khajura makes it difficult to make appropriate moves towards agricultural adaptation. Adaptation through livelihood

diversification can ensure individual, household and even community-level resilience to climatic changes. Yet the specific agricultural activities that comprise the backbone of Bangladesh's economy must also be adapted in order to sustain healthy and fruitful nationwide resilience, which in turn can feed back in to adaptation support within communities. In other parts of Bangladesh, floating vegetable beds, embedded storage pots and hanging gardens are employed in response to flood (Ireland and McKinnon 2013). However, such innovative adaptation knowledge has not been shared in Khajura and there is little advice given for coping specifically with flooding.

It seems that when previously unused practical knowledge is available, it does impact action, if it is deemed trustworthy, relevant and potentially beneficial. When an outcome is ambiguous or the necessity of pre-emptive investment unclear, farmers are less likely to take action for security and, as such, incur losses when detrimental climatic events occur. Similarly, when there is more certainty in short-term benefit and success, external advice is advantageous. This is exemplified through salinity, which is a widely recognised and anticipated problem for which fertiliser is a clear and tangible solution. The benefits observed from trialling fertiliser make it worth investing in when possible. This observation has illuminated that adaptation demands experimentation. It follows that those who adapt must have access to appropriate knowledge to encourage such experimentation. In Khajura, the majority of farmers are aware of knowledge sources, and ability to access them is wide-reaching. Adaptive behaviour in agriculture is to some extent encouraged by an increased reliance on agriculture, and increased knowledge access and proactivity reflected in GGD members. However, the conditions under which certain actions are employed display no all-embracing pattern. Instead, what has become apparent is that action is dependent upon individual motivation and character. This will be discussed further in the next chapter.

Chapter 8: Personal Motivation, Drive and Obligation: Individual Action for Agricultural Adaptation

Whether knowledge is accessed and employed depends largely on individual motivations and independent drive. It becomes clear that independent personalities and proactivity determine action and, therefore, that external knowledge is not necessarily a prerequisite for adaptation. Individualistic action encouraged by various factors was exemplified within Khajura. What follows in this chapter are three profiles that detail the actions of farmers who display motivation for ensuring agricultural sustainability in the context of climatic change. This is driven by their personal experiences and circumstances and illuminated through their innovative experimentation with agricultural alternatives.

8.1 Proactive Farmer Profiles

Profile #1	
	Farming Scale: Large Wealth Group: Low GGD Member: Yes
Climate Change Understanding:	This farmer recalled GGD training that explained flooding and salinity increase through scientific climate change knowledge, providing the *"reason of reasons"*. He explained that sea level rise in tandem with infrastructural damage and mismanagement is increasing the problems of flooding and salinity.
Agricultural Action:	This farmer digs drains in response to flooding, and uses chemical and organic fertilisers for salinity. When local government members do not respond to sluice gate requests, he calls upon higher-ranking officials to encourage appropriate action. He works continuously, emphasising the need to plan ahead and test new crops to ensure a sustainable livelihood through diverse agricultural strategies.
Motivation:	The eldest son of this farmer was critically ill and money was needed for hospital treatment in Dhaka.

Profile #2

	Farming Scale: Medium Wealth Group: Mid GGD Member: No
Climate Change Understanding:	This farmer has observed that seasons are increasingly unpredictable. He gains knowledge of cyclones and weather forecasts through TV and radio, and uses this to inform his agricultural decisions.
Agricultural Action:	He has started growing banana trees in the knowledge that they are less damaged by flood. He uses natural rather than chemical fertiliser to ensure the bananas taste better.
Motivation:	Experimentation was prompted by advice from a trusted acquaintance. This farmer is in a position to experiment as he has spare land and an alternative income gained through various businesses: retail, education, fishing boats.

Profile #3

	Farming Scale: Medium Wealth Group: Mid GGD Member: Yes
Climate Change Understanding:	This farmer understands flooding to be *"God's creation"*. However, she explained that appropriate management and upkeep of the sluice gates can solve the problem.
Agricultural Action:	She approaches the local chairman to request appropriate sluice gate action. On her land, she constructs a double layer of raised crop beds i.e. a raised bed atop a raised bed. She undertakes personal experiments inspired by knowledge gained from GGD training and also trains other farmers within the village.
Motivation:	With the household head in prison, this farmer was the household's sole provider and needed to create an income to pay for her daughter's education and support her son's business.

8.2 Discussion: The Independent Element of Community Based Adaptation

The profiles exemplify individual drives for taking planned and experimental action, which are pivotal for adaptation. These motivations are driven by personal social circumstances, in terms of needs, desires and connections. In the case of Profiles 1 and 3, social commitment to caring for family members drove innovation in agricultural action. Profile 2 exemplifies that certain social connections can provide advice and encouragement for experimental action. Here, a connection made with a new but respected acquaintance influenced experimentation in a new crop type. Such proactive action is encouraged by a willingness and ability to experiment agriculturally and to access alternative knowledge, whether from internal or external sources.

Not all farmers are able to experiment due to restricted resources. It is often held that adaptive capacity depends on the availability of resources (Adhikari and Taylor 2012). Poorer people are expected to take reparative rather than preventative action in response to natural disasters (Hutton and Haque 2003). In the case of Profile 2, the farmer had unused land available and financial scope for experimentation. Though the farmer in Profile 1 is in the low wealth group, he has inherited land from previous generations. Moreover, his displayed proactivity earned him material support from external organisations seeking to encourage such behaviour within the community. This allowed his continued action.

Whilst resources and knowledge may lubricate agricultural action, results from Khajura have highlighted the importance of independent drive. This is not based solely on resource availability, but on a complex combination of proactivity in the context of significant personal or household level motivations and perceptions of necessity. Similarly, whilst GGD members have the most immediate access to external understandings and agricultural advice, their actions may be a result of their own proactivity, itself exemplified through their commitment to the GGD. At the other end of the scale, there are individuals

who feel powerless to act. These individuals can be understood to be unaware of their "objective action scope" (Grothman and Patt 1995: 202). This interpretation holds that potential physical actions are perceived to be impossible by some individuals due to inherent worldviews and contextual perspectives. Related literature suggests that motivation and perceived abilities are important to determining human action (Grothmann and Patt 2005). Moreover, personal motivations are suggested to provide adaptation incentives when risk perception is limited. Therefore, as reflected in the profiles, the specific understanding of climate change may be less important than the individual drive to move beyond perceived limitations. This drive can relate to personal interactions and obligations. Hence, actions in response to climatic changes can be understood to be on an individual rather than a community level.

This does not obviate the need for social cohesion in adaptation (Adger *et al* 2003). Instead, it considers adaptation on a smaller scale and with sympathy to individual differences based upon their personal social ties and inherent desires. Community-wide adaptation could benefit from recognising these individuals who are willing to experiment. Their achievements in successful agricultural strategies can provide example and encouragement for widespread adoption of sustainable activities. In doing so, they can translate theoretical knowledge into proven practical knowledge and integrate relevant external advice into internal knowledge systems. Subsequently these innovative individuals become a pivotal source of knowledge, mobilising smooth knowledge flows within the community and between multi-scalar stakeholders.

Chapter 9: Conclusion

Friction is apparent in local-level knowledge flows related to climate change adaptation. National-level NGO research has emphasised the importance of the social, geographic, economic and political context within which knowledge is shared. Similarly, local-level research has highlighted the necessity for information to be relevant to its specific audience in order to be put into action. The dispersal of a globally informed understanding of climate change might be of significance to some, or irrelevance to others, depending on their personal interests. Yet it does not necessarily have a direct impact on how people behave with regards to adapting their agricultural practices to withstand climatic changes. Instead, adaptation may be motivated by an individual's personal social circumstances. It can be lubricated by access to relevant practical knowledge from a trusted source, alongside the economic ability to experiment, and a measure of political support. Those with the appropriate motivation are more likely to seek solutions than those who feel powerless against continuous and recurring damage. For those exploring alternative options, knowledge should be accessible, relevant and employable.

The apparent preference for employing internal knowledge in Khajura, despite widespread access to external knowledge sources, is a result of greater trust, relevance and pride in such sources of knowledge. Community-level trust is gained from demonstrated practical knowledge, or completion of respected activities such as *Hajj*. These are experiences that residents of Khajura connect with and relate to, rather than foreign concepts from unfamiliar people with academic knowledge. As such, farmers are more likely to make changes based on visible observations from their own experiments or other farmers' experiments, rather than from intangible knowledge from an external source.

The choice of employing internal and practically visible knowledge sources points to the need for widespread socio-economic inclusion in knowledge dispersal and access.

The activities of the GGD aim for *community based* adaptation, yet in targeting the most poor and vulnerable individuals, it fails to address the whole community. This is similar amongst many NGOs currently focussing on CBA in Bangladesh. In Khajura, though the GGD groups were established for the poorest in the community, members are now voted in due to their social standing rather than their economic situation. The social perception of GGD members has implications for how the wider community receives external knowledge provided through the GGD. However, wealthier farmers have more flexibility in trialling different methods. As such, their inclusion in adaptation processes could be widely beneficial due to their ability to provide advice that is relevant to a specific environmental context. Moreover, widespread inclusion can ensure that motivated individuals are identified and incorporated into knowledge processes. It can also combine the efforts of prominent internal members of the community such as religious leaders, large-scale farmers and long-time residents and external but locally recognised individuals, such as shop keepers, agricultural officers, and NGO practitioners. Climate change adaptation knowledge may be more impactful if it reaches beyond *only* the most poor and most vulnerable to include *all* of the influential and trusted people within society.

The lack of action in reaction to long-term climate predictions in Khajura is not wholly surprising. It can be understood through the recognition of a huge contrast in priorities between global and local standpoints. In agreement with various studies of perspectives of climate change amongst vulnerable or poor communities, the short-term is more relevant than the long-term in directing livelihood activities (Agar 2005; Blackburn and Clark 2007; Malone and Rayner 2001; Roncoli *et al* 2009). This can be exemplified both in Khajura and here in the UK. Despite widespread acknowledgement of climate change in the west, there is little widespread effort being made on an individual level to commit to appropriate action. This can be understood through observations of human behaviour that highlight little action despite acknowledgement of long-term detriment

(Fehr 2002). Instead, it is the immediate and rewarding results that drive people to make change. In the context of Khajura, the scientific explanation of climate change is an abstract concept, and the comprehension of its effects in decades to come does not provide enough motivation for change. The apparent limitation in the dispersal of scientific climate change knowledge within Khajura highlights its potential insignificance to residents. Long-term activities become more relevant when those undertaking them have more reason to consider the long-term, for example if they need to save for a business, medical treatment or education, as indicated in the profiles in Chapter 8. It is the short-term, witnessed events, and successes observed in others experiencing the same event that will drive adaptation.

Given this observation that scientific knowledge may not itself impact action from within the community, it is important to ask what the place of scientific knowledge is. Internal research that finds advantageous solutions has been shown to influence action. People inform their own research through face-to-face communication with other farmers and advice from training sessions. So some knowledge to guide experimentation is crucial, but what this knowledge actually *is* should be flexible and not driven by external decisions. Hence, climatically vulnerable communities could benefit from access to knowledge that is deemed relevant internally and will therefore allow action to be guided internally. As pointed out by Ireland and McKinnon (2013: 159): “Localism entails a commitment to and valuing of the things that people do in the places where they are, without relying upon an overarching framework to introduce, validate or extend such localised ‘doings’”.

The local itself can interpret, shape and modify the global (Blackburn and Clark 2007). Local-level knowledge can inform national and international policy for adaptation support (Jones *et al* 2012; Magistro and Roncoli 2001). Here, anthropological endeavours can be beneficial in examining significant and sustainable actions towards achieving

success in climate change adaptation (Nelson *et al* 2009). However, with an increasing global focus on climate change, there is an associated risk of overlooking locally defined vulnerabilities (Mercer 2010). In studying climate change from an anthropological perspective, the understanding of local contexts is distorted by the researcher's knowledge of global phenomena (Agar 2005). Similarly, whilst this study sought to have the community define their own environmental problems, the original focus was driven by an underlying concern about global climate change.

In terms of knowledge flows, a refashioning of global knowledge at the local-level may ensure relevance in the knowledge shared. As such, complementing strategies of communication with local-level research may enable the provision of knowledge to be directed by the beneficiaries for whom it is intended and help to ensure that support provided at the local-level is comprehensive and context specific (Hutton and Haque 2003; Magistro and Roncoli 2001). As such, the provision of knowledge can be guided by the people living within the context of focus; that is to say, led from the local-scale, the micro-scale, to determine needs, and using knowledge from alternative stakeholders to fulfil those needs, where it is deemed necessary by individuals within the community. External knowledge can then become incorporated into internal practices according to its necessity and relevance in the local context.

It is clear that reciprocity is needed at all levels of the global to local climate change chain. Moving along the chain, national-level stakeholders experience problems in acquiring appropriate climate change and adaptation information to enable comprehensive exchange with local communities. Hence, it is not just the links between practitioners and communities that need to be strengthened, but the connection between practitioners and other external information portals that must be solidified. This will enable development

practitioners to maximise the value of their unique position as a vehicle between global knowledge and local action.

Finally, whilst practices are moulded to appropriately benefit communities at the local-level, vigilance must also remain at the global-level. Adaptation is a necessity that has its benefits, yet it does not bypass the need for large-scale mitigation. Climate change is and will continue to reshape the geography of the world, whilst simultaneously having a significant effect on human and natural systems. However, many governments prioritise economic growth over socially beneficial development (Ellis *et al* 2013). For international bodies, powerful nations and influential individuals, encouragement towards change, not just in vulnerable communities, but worldwide, could help to secure a viable path for the future.

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Appendices

Appendix 1: Semi-Structured Interview with Development Professionals

Organisation name:		Job Title:	
Participant name:		Location:	

How is Climate Change Knowledge Gained and Transmitted at the National Level?

Semi-structured interview

TOPIC GUIDE

I am conducting research for my Masters programme, which I am studying at University College London. My research will focus on knowledge flows in climate change adaptation.

This interview will discuss how Community Based Adaption projects are informed and how CBA knowledge is shared. It will also investigate problems experienced with regards to knowledge sharing.

This survey is an entirely confidential. Your details will not be shared with any third party.

It will take around 30 minutes.

1. **CBA projects**

i) Where does [organisation] instigate CBA projects in Bangladesh?

- Rural/urban

ii) Briefly, what are these CBA projects?

- Agricultural/fishery/structural/water etc

iii) How do you select sites in which to implement the CBA projects?

- Research
- Previous connections

Appendix 1: (continued)

Organisation name:		Job Title:	
Participant name:		Location:	

iv) Who do the CBA projects target?

- Community/household /individual
- Wealth group
- Male/female
- Age group

v) How long do the projects run for?

- Start dates
- End dates
- Proposed continuation

2. **Transmitting information**

i) How are CBA projects established at site level?

ii) Who is your first point of contact at a site?

iii) Who do you communicate with at site/local level?

- Local government/ community leaders/ individuals

iv) How is knowledge communicated?

- Channels used
- Frequency of contact
- Updating information
- Continuity of contact

iv) Who is this communication specifically targeted at?

- Community/household /individual
- Wealth group
- Male/female
- Age group

v) Who is responsible for communicating climate change based information to beneficiaries at the field sites?

- National NGO staff/local NGO staff/government/external stakeholders/community members
- Type of information

Appendix 1: (continued)

Organisation name:		Job Title:	
Participant name:		Location:	

3. **Informing CBA projects**

i) Which sources do [organisation] gain climate change information from?

- Institute/government/NGO/community/individual
- Climate change scientists/experts/internal professionals/external contacts
- International/national/regional/local level

ii) Which of these sources of information do [NGO name] use to inform CBA projects?

- Institute/government/NGO/ community/individual
- Climate change scientists/experts/internal professionals/external contacts
- International/national/regional/local level

iii) Through which channels is this information acquired?

- Channels used
- Frequency of contact

4. **Problems**

i) What problems do you have with communication of climate change information at local level?

ii) What problems do you experience in gaining necessary information to inform CBA?

ii) What problems do you experience in sharing climate change knowledge with other stakeholders?

- Why do these problems occur?
- What are the priorities at the local level?

5. **Conclusive remarks**

i) Do you have any questions for me?

Thank you and best wishes.

Appendix 2: Group Session Activities

What Environmental Problems Disrupt Local Agricultural Livelihoods?

Group Activities

ACTIVITY GUIDE

I am a student from London conducting research in Khajura for my Masters programme. I am completing my studies at University College London. My project examines culture and agriculture in Khajura. This stage of research will focus on environmental problems that farmers experience in their agricultural work.

The activities we complete today will take between 30 minutes and one hour.

This research is confidential and your details will not be shared with anyone else. However, if you give your consent, I will use the information for my university project. Before we begin, are you happy with this and do you agree to continue?

1. **Introductions and General Discussion**

i) Introductions

ii) Any questions for me

iii) Discussion of farming activities undertaken

2. **Brainstorming Problems**

i) Introduction to activity

ii) Explanation of process

- Discussion of problems in group
- Writing/drawing problems on paper

iii) Complete activity

- Prompt until no further problems are given

Appendix 2: (continued)

3. **Ranking Defined Problems**

i) Introduction to activity

ii) Explanation of process

- Discuss problems further
- Rank in terms of most problematic [start from 1 as most problematic]

iii) Complete activity

- Prompt explanations of why problems are ranked in certain order

4. **Discussion**

i) Draw attention to completed activities

ii) General Discussion

- Why are the issues problematic?
- Are they increasing/decreasing/remaining constant?
- How are they responded to?
- Changes in response

5. **Conclusive remarks**

ii) Do you have any questions for me?

Thank you and best wishes.

Appendix 3: Semi-Structured Household Interviews

How are Local Responses to Environmental Problems Informed?

Semi-structured interview

TOPIC GUIDE

I am a student from London conducting research in Khajura for my Masters programme. I am completing my studies at University College London. My project examines culture and agriculture in Khajura. I have been in Khajura for a couple of weeks talking to farmers about environmental problems that affect their agriculture. They have identified four central problems, which are flooding, salinity, drought and insects.

I am now focussing on flooding and salinity for the remainder of my research. I am looking at how farmers respond to these two problems and why such a response is used.

I am completing interviews at several households. They take about 30 to 40 minutes to complete.

This research is confidential and your details will not be shared with anyone else. However, if you give your consent, I will use the information for my university project. Before we begin, are you happy with this and do you agree to continue?

1. **Introductions and Initial Details**

i) <u>How many people live in this household?</u>

- Name of household head
- Additional family/household members
- Ages
- Occupations
- Any GGD members

ii) <u>Do you consider yourself a large-scale or a small-scale farmer?</u>

- How much land farmed
- Crops farmed
- Market activity
- Years farming
- Household occupation relied upon most

iii) <u>Do you have any further questions before we begin?</u>

Appendix 3: (continued)

2. **Flooding Affect and Responses**

i) Are your farming practices affected by flooding?

- How?
- How do you cope?

ii) Do you do anything to prepare for flood?

- What do you do?
- How long for?
- Where did you learn it?
- Further prompting according to answer

iii) Do you do anything to respond to a flood?

- What do you do?
- How long for?
- Where did you learn it?
- Further prompting according to answer

iv) Do you agree with other farmers that flooding is increasing here?

- Why do you think this is?
- Related change in agricultural techniques
- Further prompting according to answer

3. **Salinity Affect and Responses**

i) Do you suffer from salinity here?

- How?
- How do you cope?

ii) How do you respond to salinity?

- What do you do?
- How long for?
- Where did you learn it?
- Further prompting according to answer

iii) Have you changed the types of crops you grow since you started farming?

- Change
- Why?
- Result

Appendix 3: (continued)

4. **Acquiring Knowledge**

i) Who do you discuss agricultural problems with?

ii) Do you speak with the agricultural officer?

- When?
- Where?
- What do you think?

ii) Have you received agricultural training?

- When?
- Where?
- Organiser
- What do you think?

5. **Conclusive remarks**

i) Do you have any questions for me?
ii) If you have time, could you show me around your land?

Thank you and best wishes.

Appendix 4: Informed Consent Form and Participant's Agreement

Primary Researcher: Clare Stott (crstott@hotmail.com)
University Tutor: Caroline Garaway

Informed Consent Form
I am a student conducting an Anthropology MSc at University College London. I am studying knowledge flows with relation to climate change in order to ascertain how this impacts action towards climate change adaptation.

During this study, you will be asked to answer some questions as to how your organisation accesses and shares information related to climate change. This interview was designed to be approximately thirty minutes in length. However, please feel free to expand on the topic or talk about related ideas. Also, if there are any questions you feel you cannot answer or that you do not feel comfortable answering, feel free to indicate this and we will move on to the next question.

All the information will be kept confidential. Only myself, the translator and the department supervisor mentioned above will have access to this information. This interview is designed to learn first-hand information about this topic. Upon completion of this project, all data will be stored in a secure location. It will be used in a written report that will be more widely accessible, however all personal data will be anonymous.

Participant's Agreement:
I am aware that my participation in this interview is voluntary. If, for any reason, at any time, I wish to stop the interview, I may do so without having to give an explanation. I understand the intent and purpose of this research.

I am aware the data will be used for a report and a presentation. I have the right to review, comment on, and/or withdraw information prior to the report's submission and presentation. The data gathered in this study are confidential and anonymous with respect to my personal identity unless I specify/indicate otherwise. I grant permission for the use of this information for a report and presentation.

I grant permission to use one of the following *[Tick as appropriate]:*

____ My first name only ____ My full name ____ Just a pseudonym

Additional conditions for my participation in this research are noted here:

I have read the above form, and, with the understanding that I can withdraw at any time, and for whatever reason, I consent to participate in today's interview.

_____ _____ _____ _____
Participant's signature Date Interviewer's signature Date