



**Pilot Framework for Collaboration on Research on Climate Change
and the Land, Water and Food Interface in Bangladesh
Report of Phase I Scoping Study**

October 2009

**Climate Change Group
International Institute for Environment and Development**

Acronyms

ARCAB	Action Research for Community Adaptation in Bangladesh	UK-Bangladesh
BARC	Bangladesh Agricultural Research Council	Bangladesh
BARI	Bangladesh Agricultural Research Institute	Bangladesh
BAU	Bangladesh Agricultural University	Bangladesh
BCAS	Bangladesh Centre for Advanced Studies	Bangladesh
BCCSAP	Bangladesh Climate Change Strategy and Action Plan	Bangladesh
BRRI	Bangladesh Rice Research Institute	Bangladesh
BUET	Bangladesh University for Engineering and Technology	Bangladesh
CEGIS	Centre for Environmental and Geographic Information Services	Bangladesh
CEH	Centre for Ecology and Hydrology	UK
CGIAR	Consultative Group on International Agricultural Research	International
CIDA	Canadian International Development Agency	International
DAE	Department of Agricultural Extension (Ministry of Agriculture)	Bangladesh
DFID	Department for International Development	UK
ESPA	Ecosystem Services and Poverty Alleviation	UK
ESPASSA	Ecosystem Services and Poverty Alleviation in South Asia	UK
ESRC	Economic and Social Research Council	UK
FAO	Food and Agriculture Organization of the United Nations	International
GBM	Ganges, Brahmaputra and Meghna	
GECAFS	Global Environmental Change and Food Systems	UK
ICCCAD	International Centre for Climate Change and Development	Bangladesh
ICDDR,B	International Centre for Diarrhoeal Disease Research, Bangladesh	Bangladesh
IDS	Institute of Development Studies (University of Sussex)	UK
IGP	Indo-Gangetic Plains	
IIED	International Institute for Environment and Development	UK
IUCN, B	International Union for Conservation of Nature, Bangladesh	Bangladesh
LACC	Livelihood Adaptation to Climate Change	Bangladesh
LSHTM	London School of Hygiene and Tropical Medicine	UK
LWEC	Living With Environmental Change	UK
MEA	Multilateral environmental agreement	
MoEF	Ministry of Environment and Forest	Bangladesh
NAPA	National Adaptation Plan of Action	Bangladesh
NERC	Natural Environment Research Council	UK
NGO	Non-governmental organisation	
NIPSOM	National Institute of Preventive and Social Medicine	Bangladesh
OECD	Organisation for Economic Co-operation and Development	International
ORCHID	Opportunities and risks of climate change and disasters	
RCUK	Research Councils UK	UK
UKCDS	United Kingdom Collaborative on Development Sciences	UK
UNDP	United Nations Development Programme	International
WARPO	Water Resources Planning Organization	Bangladesh
WRM	Water resource management	

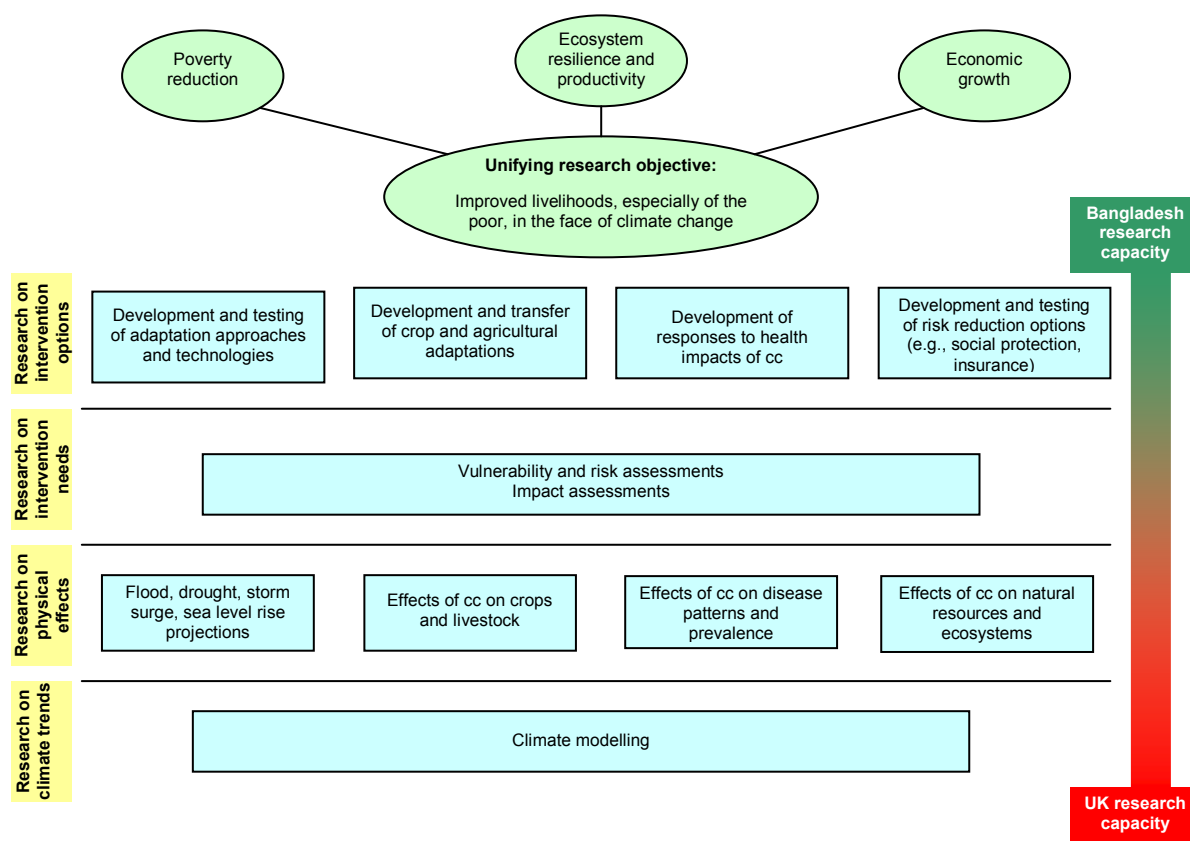
Executive Summary

This scoping study was carried out under a project commissioned by the UK Collaborative on Development Studies (UKCDS) to develop a pilot platform for collaboration between Bangladeshi, UK and other scientists on climate change adaptation research, with a focus on the land, water and food interface, including linkages to health and nutrition. The project is being implemented by the International Institute for Environment and Development (IIED) and Bangladeshi partners in three phases. Phase I aimed to identify research priorities, stakeholders, research activities and their impacts, research gaps, and barriers and opportunities for collaboration.

The study's conceptual framework assumes that the aim of development research is to inform policy and/or practice, and that the extent to which that is achieved depends on the *relevance and quality of the research*, the *effectiveness of its communication* to potential users, and *the capacity of those users* to interpret and apply it. Research related to climate change adaptation ranges from scientific and academic research to action research and policy studies.

Priority research issues

The research agenda that emerged from interviews with Bangladeshi and UK researchers is summarized below:



Existing situation in research and collaboration

Bangladeshi and UK research strengths are complementary. Bangladesh research institutions are strongest on locally-grounded research to assess impacts and develop and test interventions. UK research strengths are in assessing macro-level changes and their

likely secondary physical impacts, and on analysis of how these changes and physical impacts may affect human vulnerability and risk. The greatest opportunities for collaboration exist in areas where both sets of strengths are needed, as well as between “upstream” work on trends and effects and “downstream” research on impacts and intervention options.

In Bangladesh, NGOs and government-funded research institutes are the main research actors. The potential of Bangladeshi academic institutions to contribute more substantively to adaptation research is great, but capacity needs to be developed.

Bangladesh is not a focus of special attention by the UK climate change research community despite its status as a most vulnerable country. The number of UK scientists working on climate change in Bangladesh and the number of collaborative projects involving UK and Bangladeshi researchers are both small: 10-15 researchers including Ph.D. students and about 10 collaborative projects over the past 5 years, with total funding of less than £1 million.

Research is relevant to identified needs, but timeframes are often too short and financial resources too limited for robust results. Funding for follow-up research is often not forthcoming as a result of shifting donor or partner priorities.

The experience of collaboration has been good, but there is room for expansion. The main weakness has been the small number of Bangladesh partners involved relative to the number of researchers working in relevant fields in the country.

Communication of research results could be much better. Research results are not reaching their target audiences as effectively as they should be.

Capacity to use research results varies and is particularly weak within government agencies: Research that directly involves potential users and can therefore incorporate a capacity dimension is the most likely to achieve uptake.

Challenges and opportunities

In addition to a number of knowledge pages identified in the study, broader structural barriers include:

- The weak role of climate change science and research in policy making in Bangladesh and a parallel limited donor engagement in research.
- A lack of sensitivity by some external research partners to local context and capacities.
- A divided research community with a lack of mutual appreciation for different disciplines.
- Institutional constraints to uptake of research results, particularly in government agencies.

The scoping study confirmed the potential to develop and promote a coherent research agenda on climate change adaptation in the land, water and food interface as a framework for prioritising research by the Bangladesh government, research institutions and funding agencies. Such an agenda could strengthen collaboration between UK and Bangladeshi researchers in ways that increase the contribution of research to Bangladesh’s response to climate change. A pilot platform for collaborative research can be constructed around existing structures, emerging proposals and demonstrated interest among stakeholders. The initiative is timely and can add value to the mechanisms being developed to address climate change in Bangladesh, including the Bangladesh Climate Change Strategy and Action Plan and the Multi Donor Trust Fund for climate change.

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1. Background to the project

Recognising the opportunity offered by the rapidly evolving landscape of climate change adaptation to broaden the role of UK science in international adaptation research and practice, the Board of the UK Collaborative on Development Science (UKCDS) agreed to support a project to develop a pilot framework for collaboration on research on climate change. Bangladesh was selected as the pilot country given its strong need for adaptation research, government commitment, vibrant research community and demonstrated UK government interest and support. UKCDS members prioritised the theme of the land, water and food interface, including linkages to health and nutrition.

The project is being coordinated by the International Institute for Environment and Development (IIED) in collaboration with North-South University and Bangladesh Centre for Advanced Studies (BCAS) in Bangladesh. A Steering Group comprised of representatives of UKCDS and the project donors¹ provides oversight and an Advisory Committee of experts from the UK and Bangladesh² offer feedback on outputs and directions.

The project is being implemented in three phases. The Phase I scoping study aims to identify research priorities, stakeholders, current and recent activities and their impacts, research gaps, and opportunities for, and barriers to, collaboration. The end result of the study is a draft outline of a framework for collaborative research that will be further developed, disseminated and promoted in subsequent phases.

2. Conceptual framework

The project assumes that the aim of development research is to inform development policy and/or practice. The extent to which that aim is achieved depends on the relevance and quality of the research, the effectiveness of its communication to potential users, and the capacity of those users to interpret and apply it. Research related to climate change adaptation takes place at different points along a continuum ranging from “pure” academic research to research that results directly in policy or action. This conceptual framework, illustrated in Figure 1, implies that this pilot study needs to concern itself with:

- a. action and policy research as well as scientific research, thereby involving a wider range of research stakeholders than the academic and scientific research communities;
- b. communication and capacity -- as well as research -- requirements, barriers and opportunities, further widening the range of relevant stakeholders (see Figure 2).

¹ The Steering Group includes representatives of DFID, ESRC, NERC, the Wellcome Trust and the UKCDS Secretariat.

² Advisory Committee members are Ahsan Uddin Ahmed (Centre for Global Studies), Declan Conway (University of East Anglia/Tyndall Centre), Islam Faisal (DFID Bangladesh), David Lewis (London School of Economics), Mihir Kanti Majumder (Secretary, Ministry of Environment and Forests, Government of Bangladesh) and Atiq Rahman (BCAS).

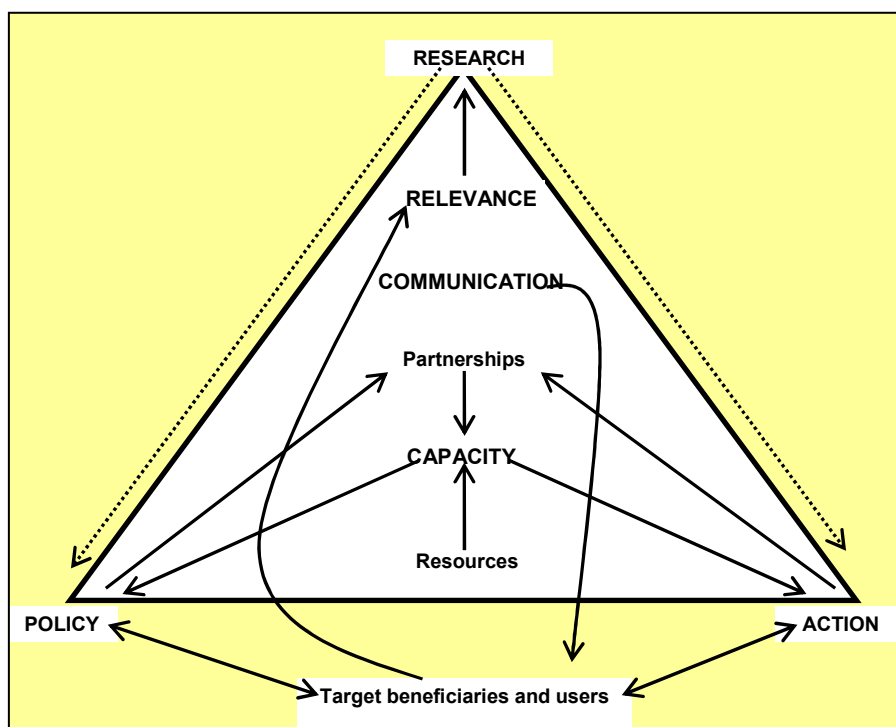


Figure 1. Scoping study conceptual framework

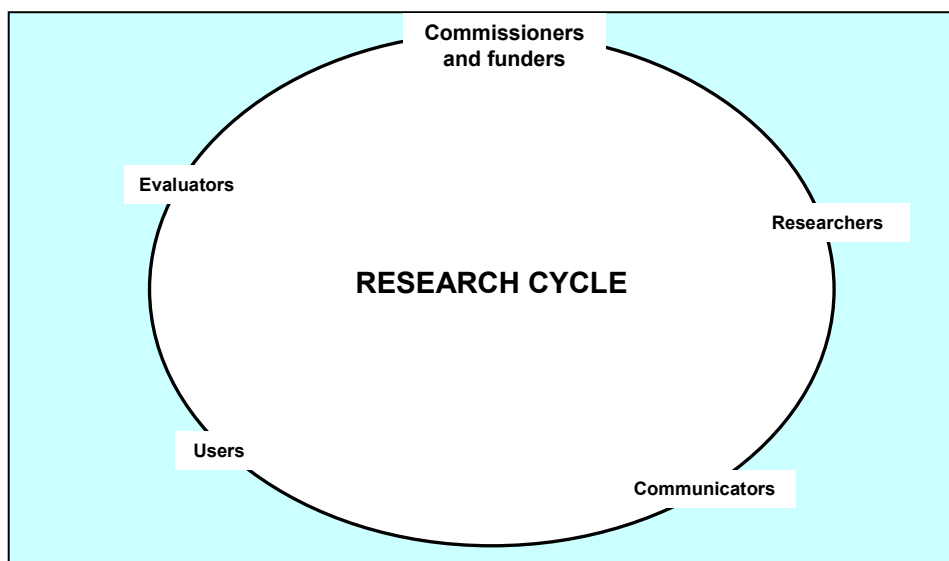


Figure 2. Stakeholder analysis framework

3. Methods

The main aim of the scoping phase was to identify where there is potential scope for adding value through improved collaboration between researchers in the UK and Bangladesh on priority climate change adaptation issues. Priority research needs (Section 4) were determined by the frequency in which they appeared in key documents and in interviews with informants, and were then organized around a single integrating framework.

Information on the existing situation (Section 5) was gathered by members of the project team in the UK and Bangladesh through desk reviews of relevant literature and web-based resources and interviews with a broad range of experts in both countries³.

The experience of collaboration (Section 6) was assessed according to three criteria: relevance of the research to priority research needs; effectiveness of its communication to potential users; and extent of uptake. The assessment is necessarily a broad one and does not attempt to individually evaluate each collaborative research activity that was identified.

Gaps, barriers and opportunities for collaboration were identified through analysis of the data, drawing on discussions with key informants. The study has given particular attention to the existing and potential roles of UKCDS members and collaborative programmes they are involved in such as the Living With Environmental Change (LWEC) and Global Change and Food Security (GECAFS) programmes.

Preliminary findings of the scoping study were presented to, and further developed by, stakeholders in both countries in a meeting of the Steering Group and Advisory Committee and a larger videoconference near the end of Phase I. Recommendations from both meetings have been incorporated into this report, and a list of participants in the videoconference is included at Appendix B.

4. Priority research issues

No broadly accepted research agenda on climate change adaptation exists for Bangladesh. The Bangladesh Climate Change Strategy and Action Plan (BCCSAP) (MoEF 2008), now undergoing revision, and the National Adaptation Plan of Action (NAPA) (MoEF 2005) offer some guidance but focus on action rather than research priorities.

To identify priority research issues, this study therefore relied mainly on the priorities identified by key informants. A national consultation organized by DFID for the development of its own current research programme that produced a general list of climate change research needs (Dalberg 2007; Dalberg 2008) also contributed to the identification of priorities, largely by validating those mentioned by informants⁴.

While most informants focused on research priorities within their own disciplines or fields of interest, a generally coherent agenda emerged, indicating a fairly high level of consensus among research stakeholders both in Bangladesh and the UK. This agenda, presented in Table 1, can be ordered around **a unifying theme of improved livelihoods, especially for the poor, in the face of climate change.**

³ See Appendix A for a list of persons interviewed.

⁴ A table listing the research priorities identified in the BCCSAP, NAPA, DFID consultation and interviews is included at Appendix C.

Table 1: Research priorities on climate change in the land, water and food interface in Bangladesh

Research objective	Research priorities			
	Land-water interface	Food and agriculture	Health and nutrition	Livelihoods
Understanding land and water trends that will affect adaptation	Ongoing modelling of future climate scenarios: sea level rise, impacts on river flows, storm surge, temperature, rainfall patterns, glacial melt Model validation and calibration			
Assessing the secondary physical impacts and risks	Flood and drought probabilities, risks and impacts Effects on biodiversity and ecosystems (at regional and local levels) Effects of land and water changes on food security Impacts on transboundary water flows			
Assessing impacts on human populations	Vulnerability, impact and risk assessments for all key areas, differentiated by social groups (e.g., gender, wealth) Macroeconomic impacts, sectoral cost-benefit analyses (health, agriculture, WRM, infrastructure) Impacts on water resource management options and strategies Impacts on development programmes and interventions Understanding links between cc, poverty and health			
Developing responses	Adaptation of infrastructure design standards	Assessing barriers to farmers' understanding of cc and uptake of new practices Development of new crop varieties and agricultural practices	Developing interventions to address vulnerabilities and impacts	Exploration of options (e.g., insurance) for decreasing vulnerability to risk from natural disasters and other cc impacts Development and testing of adaptation technologies and approaches for poor households (action research)
Testing responses		Farmer trials	Health intervention trials	

Research objective	Research priorities			
	Land-water interface	Food and agriculture	Health and nutrition	Livelihoods
Assessing impacts of responses			Impacts of adaptation interventions on health (e.g., flood defences and vector-borne diseases)	Social impacts of changes in livelihood strategies and population movements in response to cc
Communicating results				
Using results				
Developing capacity to use results				
Developing capacity to do research				

5. Existing situation in research and collaboration

A listing of the major current and recent collaborative research activities on the themes of this study is included at Appendix D, research publications identified in the study are listed in Appendix E, and a mapping of key actors around the research priorities identified above is shown in Appendix F. The current situation of research collaboration includes these characteristics:

In-country

- Climate change is currently a very high profile issue in Bangladesh, with national representatives deeply engaged in international mitigation and adaptation negotiations. Bangladesh was among the first of the Least Developed Countries to complete a National Adaptation Programme of Action and then went on to create the BCCSAP in 2008 with an aim to fully integrate climate change issues into its development agenda. The Government has recently established a dedicated climate change budget line and allocated \$45 million for the current year. To complement this initiative and to ensure donor harmonization, development partners in Bangladesh have agreed to establish a Multi Donor Trust Fund for Climate Change with a targeted initial capitalization of \$100 million. The UK and Denmark have already pledged their support and other countries have indicated interest.
- The Bangladesh adaptation research landscape includes a wide range of actors. NGOs and government-funded research institutes are prominent, with universities (with a few exceptions) playing a much smaller role in development research than is the case in the UK. The private sector is also involved in relevant research, e.g. in the development of new crop varieties, and more research is needed on their existing and potential role.
- There are a few key actors with lengthy experience in climate change adaptation research, going back ten years and more, for example BCAS and the Centre for Environmental and Geographic Information Systems (CEGIS). Many others have been entering the field in recent years as they begin to take account of climate change in their research agenda.
- Major focal areas for research have included local-level response to climate change (including several participatory action research projects led by NGOs); agricultural impacts and responses such as crop adaptations; and the health impacts of floods, droughts and disasters.
- Many projects are locally-driven, but funding is most often external. Swiss, Dutch and other bilateral agencies in addition to DFID have funded research. Intergovernmental organizations that have supported adaptation research include the FAO, UNDP and the OECD. International NGOs (some with headquarters in the UK), such as ActionAid, IUCN, Oxfam and Practical Action, are also drivers (and doers) of adaptation research.
- A handful of Bangladesh research actors capture the majority of collaborative research opportunities, largely because of their contacts, technical and human resources and ability to manage the administrative requirements of externally commissioned research. Relationships between UK and Bangladeshi researchers are therefore considerably more narrow than they are among researchers within Bangladesh.

UK collaboration

- Despite being widely cited as a “most vulnerable” country, Bangladesh is not a focus of special attention by the UK climate change adaptation research community. The number of UK scientists working in the research areas studied is quite small: around

10-15 including funded PhD students. There are many more however doing research relevant to Bangladesh in other countries. There is therefore scope for expansion of collaborative partnerships.

- The amount of UK funded collaborative research is also rather small. This study identified about 10 projects over past 5 years, with 2-3 more now getting started. It is not possible to do a comprehensive assessment of total investment, but it appears that UK funding has been less than £1 million over the past five years.
- DFID is by far the major UK funder, either directly or through others, for example, ESRC. UK research programmes have included Bangladesh in global and regional research, with the Ecosystem Services and Poverty Alleviation (ESPA) programme and GECAFS having generated country and site-level studies.

One important new initiative involving both Bangladeshi and UK-based institutions is the establishment of the International Centre for Climate Change and Development (ICCCAD), a collaborative effort of Independent University in Bangladesh, IIED, and BCAS, with initial funding from DFID. ICCCAD will offer short courses on climate change and provide opportunities for graduate study.

6. Critical review of past and current research experience

Research is relevant, but timeframes are often too short and financial resources too limited for robust results. Research on climate change adaptation in Bangladesh has been opportunistic and largely driven by the interests of individual scientists or funders, rather than programmatic or situated within a strategic framework. Research reviewed in this study has nonetheless substantially adhered to the research priorities that are identified in Section 4. Much of it has generated interesting findings, but ones that often need further investigation. However, funding for subsequent phases of work is often not forthcoming as a result of shifting donor or partner priorities. Even programmatic initiatives have often been weak on follow-up. For example, the GECAFS Indo-Gangetic Plain Science Plan (GECAFS 2008), which developed a set of researchable issues relevant to climate change and food security in 2008, has thus far not been able to support any work on that agenda. Other studies have synthesized existing knowledge or produced snapshots of a situation but not been able to extend the research in order to assess trends over time or compare findings between different sites or populations, constraints that are particularly serious when dealing with a process such as climate change.

The experience of collaboration has generally been good, but there is room for expansion. Partnerships have worked well and have made good use of the strengths and capacities of each partner. Bangladesh-based researchers are generally well aware of the capacities that are weak within their own country and where they thus need to draw on the often more specialized expertise and technologies of external partners. UK-based researchers are equally aware of their own capacity weaknesses, particularly regarding understanding of the local context and ability to manage research activities on the ground. The main weakness of collaboration to date has been the small number of Bangladesh partners involved relative to the number of researchers working in relevant fields in the country. The reason for this appears to be the tendency of external researchers to seek out partners that have experience in producing the kinds of outputs that the research donor community expects. Often those “experienced” Bangladeshi researchers then engage with others in the community, but they remain the public face of collaboration and there may be little or no interaction between the external researchers and these secondary partners.

Communication of research results could be much better. Researchers generally agree that the results of their research are not reaching their target audiences as effectively as they should be. Reasons that were cited include:

- perceived lack of interest in research by Bangladeshi policy makers and also by key donors and international agencies;

- short time frames and tight project budgets that do not allow for adequate communication and dissemination;
- incentives, particularly for UK scientists, towards reporting results in academic journal publications that are not accessible, in terms of medium or content, to potential users except other members of the international scientific community.

Capacity to use research results varies depending on the type of research and its potential users. The potential users of research on climate change adaptation range from government agencies to health care workers, local government officials, farmers and households. There is a general sense that uptake capacity is weak within government, but research that has involved government agencies directly has in some cases been able to overcome this. Farmers and households have been involved in various forms of action research that has incorporated capacity building within the process; some of these have had impressive levels of uptake. The common thread seems to be that research that directly involves potential users and can therefore incorporate a capacity dimension is the most likely to achieve uptake.

7. Challenges a collaborative research platform could address

A collaborative platform will only be useful if it is able to address the structural barriers to integration of research into development policy, planning and action. These include:

The weak role of climate change science and research in policy making in Bangladesh: One of the major priorities for a collaborative research platform must be to strengthen the linkages between science and policy. Informants repeatedly noted issues such as these:

- Policy-makers are reluctant to make use of research findings until there is a high level of confidence in them; so promising findings are not outscaled.
- The results of policy research are often blocked by bureaucrats before they reach policy-makers.
- Policy-makers are unwilling or unable to deal in long-term scenarios; so researchers need to learn how to “translate” climate impact knowledge into immediate or short-term development problems.
- The “absorptive capacity” for taking up policy research findings within government is low.

Addressing these issues in Bangladesh is timely because policy-makers are starting to become more receptive to bringing research into planning, and because the country is now creating the institutional architecture for addressing climate change, particularly through the BCCSAP with a budgetary commitment to its implementation, and through the establishment of a Multi Donor Trust Fund for climate change adaptation.

There is a need for researchers in both Bangladesh and the UK to make a shift towards a more focused objective of policy impact and greater attention to involving and communicating results to those who shape and influence policy. This will require a better understanding of the avenues through which research can influence policy and action.

Research institutions and funders also need to realign structures and incentives towards policy impact, with effective communication channels created between researchers, policy-makers and funders. Because researchers are neither trained nor given incentives to communicate with policy makers, building these linkages may require the involvement new actors, with communication training and skills. Currently, researchers are often frustrated by their inability to reach policy-makers with their findings, and there is a real need to overcome these blockages.

Too little impact on the ground: The proposed research agenda's focus on the livelihoods of the poor is in line with Bangladesh's development and adaptation priorities, and there is a need to make sure that research has an impact on the people who are or will be affected by climate change. Too often, field based research draws information from people without creating channels and mechanisms to feed back results that could improve local responses to climate change. Alliances are needed between researchers and institutions that communicate with potential adaptation research users, including schools, local government and community organizations. Such alliances could create a feedback loop that would also help researchers assess the value and relevance of their work and make it possible for research users to directly contribute to the development of research agendas and priorities.

The linkages with research, policy and action could be strengthened by involving government agencies more directly in research that is being conducted. This is often challenging, but worth making an effort towards. There is also an opportunity to increase the impact on the ground through involvement of local government and community-level NGOs in research and through greater attention to communicating research findings to local people in ways that they can use.

Limited donor commitment research that has an impact. Donors are seen to focus on "big wins" e.g. expensive infrastructure projects, and on finding quick "solutions" rather than understanding problems, communicating research results or building research capacity. The result for researchers is difficulty in accessing funding for research that can have an impact. Here also the environment may be improving: agencies such as DFID, ESRC and NERC are now requiring impact strategies, including provisions for communication and capacity-building, to be built into research proposals.

A lack of sensitivity by external research partners of local context and capacities. Although Bangladeshi researchers gave good marks to the partners they worked with in the projects examined for this study, they noted other cases in which there was a misfit between the technologies, models and approaches of external partners and the local context. They also noted that researchers are often given incentives by their institutions or donors to "push" inappropriate options.

A divided research community with a lack of mutual appreciation for different disciplines. The different institutional actors engaged in climate change research, including universities, NGOs, research institutes, government agencies and the private sector, often have effective channels of communication among themselves, but not with the others. As a result, action research is not well informed by science, and scientific research does not reach the ground. A collaborative research platform could facilitate:

- better linkages between "upstream" and "downstream" research activities, for example between research on impacts and research on interventions;
- bringing together the different but complementary strengths of different actors to add value to research activities. In order to build these synergies, issues such as disparities in languages and the ways in which different groups assess research priorities and quality will have to be overcome. There is also a need for mechanisms that make research findings widely available regardless of their source;
- integrating research going on in fields such as environmental management, health and disaster risk reduction that does not have a specific climate change focus but may nonetheless be relevant to the climate change research agenda.

Barriers to regional collaboration: Mechanisms to foster regional research collaboration are politically challenging but essential because of the unbounded nature of climate change. There are a few existing structures to build on, including a history of good collaboration in integrated water resource management (which has also successfully brought together natural and social scientists), the regional "Dhaka Declaration" on climate change, and the "Imagine a new SouthAsia" process.

Under-realized research potential in Bangladesh universities and research institutes:

Research capacity within universities has declined over the past 20 years; this is also the case to an increasing extent in government-supported research institutes and one that is undermining the country's long-term research capacity. There is substantial research potential within public and private universities and research institutions, but incentives and resources available for research are both poor. Those university professors who are engaged in relevant research are largely doing it as consultants, "outside" of their university positions. Bangladesh's new national education policy is favourable to strengthening the support structures for research within universities. Priorities that a collaborative research framework could help address include funding, technical and staff resources, and relevant academic training for young scientists.

Institutional constraints to uptake of research results, particularly in government agencies. Issues raised included staff turnover, with senior officials regularly transferred between Ministries and inadequate training for, and responsibility given to, technical staff.

Lack of mechanisms for sharing knowledge from research: Research in Bangladesh in recent years has succeeded in generating considerable knowledge on adaptation, but much of it has not been widely disseminated or exists in forms that make it unavailable to audiences that could use it. A pilot research platform could make a valuable contribution through the compilation and management of an accessible and expanding database of knowledge.

8. Addressing research gaps and opportunities through collaboration

A stylized version of the research agenda that has emerged from this study, identifying how it links to larger development priorities, is presented in Figure 3. The bar on the right of the figure identifies the complementary strengths of UK and Bangladesh research actors. Bangladesh research institutions are strongest on locally-grounded research to assess impacts and develop and test interventions. UK research strengths are greatest in assessing macro-level changes and their likely secondary physical impacts, and on analysis of how these changes and physical impacts may affect human vulnerability and risk. This suggests that the greatest opportunities for direct collaboration exist in the middle ranges of the agenda, where the both sets of strengths are needed, particularly research on physical effects and on intervention needs. Opportunities for collaboration also exist between researchers doing "upstream" work on trends and effects and those working "downstream" on impacts and intervention options.

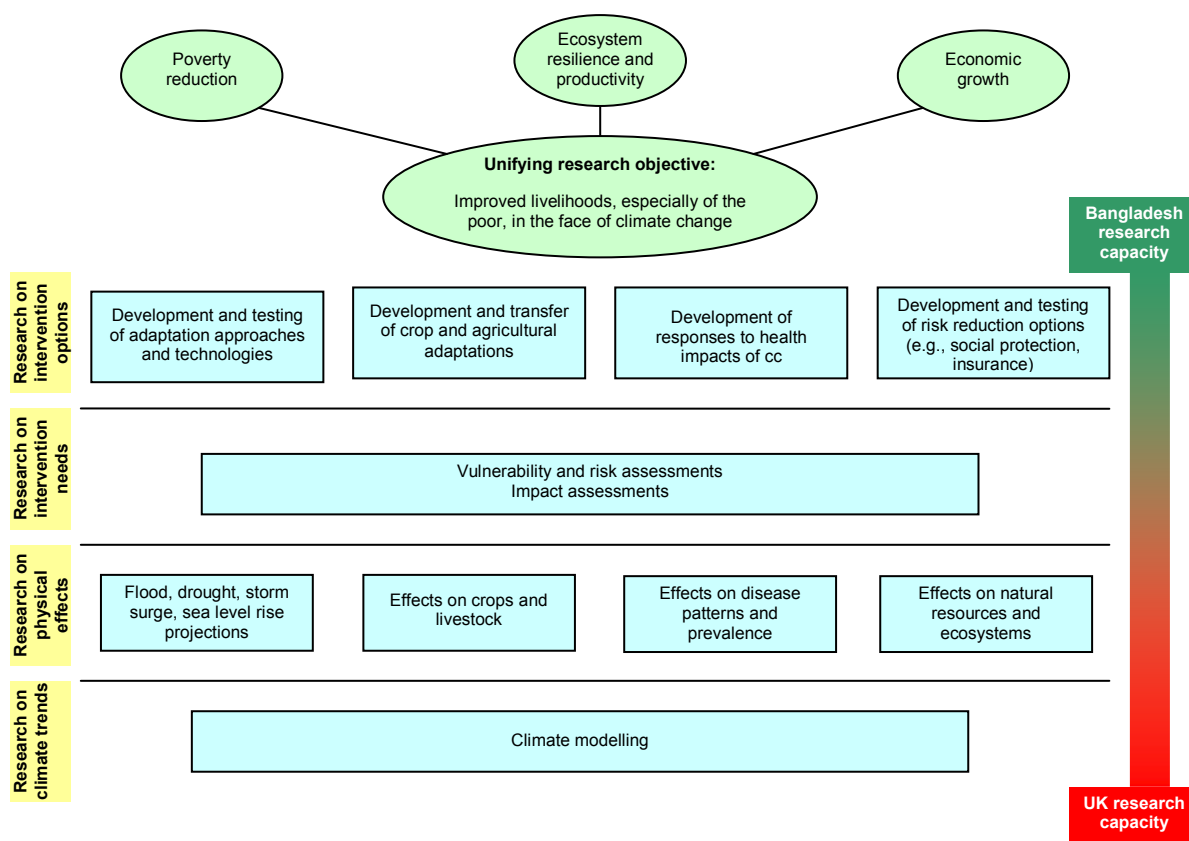


Figure 3. Proposed collaborative research agenda

Table 2 provides a preliminary list of research gaps and opportunities for addressing them within a collaborative framework. This information draws particularly on the interviews with key informants, some of whom are quoted in the “status” column.

Table 2: Research gaps and opportunities

Research objective	Status	Gaps	Opportunities
1. Understanding land and water trends that will affect adaptation	“There have been endless studies on what sea level rise will do to Bangladesh. The answer is already known.”	Global knowledge is evolving and must be updated as technology and understanding increase	
2. Assessing the secondary physical impacts and risks	“The big missing piece of the picture is linking the knowledge on primary impacts to secondary impacts that have multiple causes” “Donors want to fund research on solutions, not on understanding the underlying problems”	Collaborative transboundary research on water flow projections taking account of all influencing factors	Suggestions on the establishment of a ClimDev-Asia programme modelled after the ClimDev-Africa programme in which DFID is a major contributor
		Research to inform development of responses, e.g. effects of temperature and hydrological changes on food crops, fisheries and ecosystems	The LWEC Changing Water Cycle Programme ⁵
3. Assessing impacts on human populations	“The vulnerability side of the equation is not well explored”	Comprehensive vulnerability and risk assessment that takes account of development as well as climate trends	
		Studies disaggregating impacts by gender, social group, economic status and livelihood strategy (e.g. rural vs urban-based)	
		Long-term site-specific or cohort studies that can assess trends over time	CGIAR Challenge Programme on Climate Change, Agriculture and Food Security 2010-2020 has the Indo-Gangetic Plains (IGP) as a focus region and likely to continue using Greater Faridpur case study site established in GECAFS IGP assessment
		Community risk assessments to identify local and household level vulnerabilities	
	“Research on the technical aspects of adaptation is important, but it is also essential for research to look at the social and institutional aspects of adaptation.”	For example, research to understand the social dimension of food security	

⁵ http://www.lwec.org.uk/sites/default/files/changingwatercycle-specification_1.pdf

Research objective	Status	Gaps	Opportunities
4. Developing responses	Infrastructural options and their potential benefits and impacts have not been well studied	Adaptation needs assessments, including costings	
	“A critical issue is how to deal with risk and uncertainty; probabilities don’t tell us all.”	Risk-based approaches to assessing vulnerability	Potential to draw from learning of RCUK Global Uncertainties programme and UK Climate Impacts Programme work on risk, uncertainty and decision-making ⁶
	“We need to be guided by lessons from the past as much by forward projections.”	Application of lessons from relevant past initiatives, e.g., the Bangladesh Flood Action Plan of the 1990s, to development of current responses.	
	“Adaptation projects are not reaching the landless.”	Research on strategies and responses that address the vulnerabilities and needs of the (asset-less) ultra-poor	
	“Policy research is in its infancy” in Bangladesh and is not well received by bureaucrats.	Tools for assessing policy implications of climate change that directly engage policy-makers	UK Foresight Programme as a template for a national approach to linking climate change research to policy processes (now being replicated in other countries incl. China and US) Tools and approaches being developed through GECAFS research streams on decision support and scenarios (plausible alternative futures)
5. Testing responses			
6. Assessing impacts of responses			
7. Communicating results	“Some of what is being taught to rural communities about climate change is actually making people more confused.” “The Department of Agricultural Extension does not like to work with the poorest; they feel that is the role of NGOs.”	Methods and media to effectively communicate relevant findings to audiences at household and community levels, especially uneducated poor	

⁶ Willows, R. and R. Connell, eds. 2003. *Climate Adaptation: Risk, Uncertainty and Decision-making*. UKCIP Technical Report. Oxford: UK Climate Impacts Programme. http://www.ukcip.org.uk/images/stories/Pub_pdfs/Risk.pdf.

Research objective	Status	Gaps	Opportunities
	Information of use to researchers is often difficult to access.	Access by Bangladeshi researchers to academic journals Mechanisms for disseminating results of student research (where a lot of effort is now occurring)	Document repository being developed by the Department of Environment's Climate Change Cell
8. Using results	Policy-makers and donors "do not give priority to research or credibility to Bangladesh researchers."		
9. Developing capacity to use results	"There is acute lack of capacity within the Government to turn policy research into practice."	An understanding of the development implications of climate change by development actors (government, NGOs, media, private sector)	ICCCAD short courses and workshops
	"Water resource management planning in Bangladesh is not being informed by cc knowledge and scenarios."	Running climate models and interpreting climate data for use in assessing impacts and developing responses	Series of workshops now being conducted for researchers in China under the ESPA programme with expertise from Hadley Centre, Walker Institute, University of Leeds and CAB International in UK offers a potential model and precedent ⁷
10. Developing capacity to do research	"In Bangladesh, in terms of research capacity, there is enough you can build on." "Brain drain is a big problem."	Minimal involvement and expertise of Bangladeshi academic institutions in climate change research	British Council Inspire strategic partnerships and exploratory grants. IIED-BCAS ARCAB project that will build partnerships with regional agricultural universities
		High-quality graduate study opportunities for Bangladeshi students	Proposed ICCCAD-organised MSc course
		Structured support and guidance to graduate students doing research on cc adaptation	Learn from ICDDR,B's experience in supporting graduate student work (e.g., establishment of a "students' house")
		Ecosystem and biodiversity data collection and monitoring	
		Methods and approaches to participatory action research informed by robust climate science	
		Raising funding for research (proposal development)	BCAS workshops on proposal writing
		Documenting results for publication in scientific journals	

⁷ <http://www.espachina.org/climate/main.asp?page=About>

9. Conclusions and next steps

Summary of directions emerging from Phase I

1. There is consensus among researchers working on climate change issues in Bangladesh around research priorities in the land, water and food interface. There is the opportunity to develop and promote this research agenda as a framework for prioritising research by the Bangladesh government, research institutions and funding agencies.
2. The research agenda developed in Phase I offers opportunities to build on existing limited but constructive collaboration between UK and Bangladeshi researchers in ways that increase the contribution of research to Bangladesh's response to climate change.
3. The development of a platform for collaborative research is compatible with, and can add value to, the mechanisms being developed to address climate change in Bangladesh, including the BCCSAP and the Multi Donor Trust Fund for climate change. There is the opportunity to engage in a dialogue with key actors to increase the contribution of research to the emerging national climate change adaptation architecture.
4. The consultations carried out in Phase I stimulated positive responses from both UK and Bangladeshi researchers and research users and engaged important stakeholders such as Bangladesh Secretary of the Ministry of Environment and Forest. This response included a well-received proposal to develop a research consortium on climate change in Bangladesh. There is the opportunity to construct a coherent framework around existing structures, emerging proposals and demonstrated interest among stakeholders.

Proposed activities for Phase II

1. Conduct research to assess existing and emerging mechanisms and initiatives that could contribute to the development of a collaborative research platform.
2. Engage with relevant policy-makers and research funders to get their input into, and build interest in and support for, a structured framework for collaborative climate change research.
3. Bring researchers from Bangladesh, the UK and elsewhere who are working on related issues together through videoconferences and other means to identify needs and opportunities for collaboration.
4. Conduct exchange visits to expose leaders in the research community and in climate change research decision-making to relevant research capacities and initiatives in Bangladesh and the UK.

Proposed activities for Phase III

1. Bring stakeholders in both countries together to identify and piece together the components of a research platform.
2. Share the proposed framework with potential users, including UKCDS members, Bangladesh government officials, and key international research and development actors to get their input and build support.
3. Launch the platform at a high-level seminar in Bangladesh and disseminate the results widely in Bangladesh, the UK and internationally.

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Appendix A
List of persons interviewed

Name	Position	Organization	Email
QK Ahmad	Chair	Bangladesh Unnayan Parishad (BUP)	bup@citechco.net
Ahsan Uddin Ahmed	Advisor	Centre for Global Change	ahsan.ua@gmail.com
Raquibul Amin	Programme Coordinator	IUCN	raquib@iucnbd.org
Mozaharul Alam	Research Fellow (formerly)	BCAS	mozaharul.alam@bcas.net
Wahida Bashar	Manager & Theme Leader - Risk Reduction, Livelihood Security and Risk Reduction Sector	ActionAid	wahida.ahmed@actionaid.org
Abbas Bhuiya	Head, Poverty and Health Programme and Social and Behavioural Sciences Unit	ICDDR,B	abbas@icddr.org
Chiara Bianchizza	Graduate student	Imperial College London	chiarabianchizza08@imperial.ac.uk
Kazi Faisal Bin Seraj	Senior Research Associate (Environment Unit)	BRAC Research and Evaluation Division	faisal.k@brac.net kazi.seraj@gmail.com
Terry Cannon	Visiting Fellow, Climate Change Group	IIED	terrycannon@blueyonder.co.uk
Andrew Collins	Director, Disaster and Development Centre	Northumbria University	andrew.collins@northumbria.ac.uk
Islam Faisal	Programme Officer	DFID and FCO	i-faisal@dfid.gov.uk
Frank Farquharson	Fellow	Centre for Ecology and Hydrology	fakf@ceh.ac.uk
Remeen Firoz	Programme Officer	IUCN	remeen@iucnbd.org
Nasimul Haque	Senior Project Specialist	Comprehensive Disaster Management Programme (CDMP)	nasimul.haque@cdmp.org.bd
Abu Wali Raghieb Hassan	Sub-Component Manager, LACC Project	Dept of Agricultural Extension	hassan58_dae@yahoo.com
Ahmadul Hassan	Senior Water Resources Planner, Division Head R&D and Training	CEGIS	ahhassan@cegisbd.com
John Ingram	Executive Officer	GECAFS	john.ingram@eci.ox.ac.uk
Anisul Islam	Director	Centre for Natural Resource Studies	info@cnrs.org.bd
Saiful Islam	Associate Professor and Coordinator Climate Study Cell	BUET	saiful3@gmail.com
Babar Kabir	Director, Disaster, Environment & Climate Change Programme	BRAC	babar.k@brac.net
Swarna Kazi	Water Quality Specialist	DEFRA	swarnakazi@gmail.com
Aneire Khan	PhD student	Imperial College London	aneire.khan@ic.ac.uk
Amanat U. Khan	Director, Disaster Research, Training & Management Centre	Dhaka University	amant.ullah@gmail.com
Sari Kovats	Lecturer (and Tyndall Centre Research Fellow)	LSHTM	Sari.Kovats@lshtm.ac.uk
Sanjib Kumar Saha	National Lead Consultant, LACC Project	FAO	sanjib_saha61@yahoo.com
David Lewis	Reader in Social Policy	LSE	d.lewis@lse.ac.uk
Shamaila Mahbub	Programme Officer	British High Commission	shamaila.mahbub@fco.gov.uk
Robert Nicholls	Professor	Tyndall Centre	r.i.nicholls@soton.ac.uk

Name	Position	Organization	Email
Sam Page	Senior Scientific Officer	CABI	s.page@cabi.org
A.K.M. Sayedur Rahman	Programme Officer	FAO	sayedur.rahman@fao.org
Ataur Rahman	Senior Scientific Officer	BARI Wheat Research Center	ataur67@yahoo.com
Sajid Raihan	Manager, Risk Reduction, Livelihood Security and Risk Reduction Sector	ActionAid	sajid.raihan@actionaid.org
Jon Ryan	Political Section	British High Commission	jon.ryan@fco.gov.uk
Farida Shahnaz	Programme Manager, Reducing Vulnerability & Natural Resource Management	Practical Action	shahnaz@practicalaction.org.bd
Tom Tanner	Research Fellow	IDS	T.Tanner@ids.ac.uk
Abu M. Kamal Uddin	Programme Manager	Climate Change Cell	kamal.uddin@cdmp.org.bd
Paolo Vineis	Chair, Environmental Epidemiology	Imperial College London/Grantham Institute	p.vineis@imperial.ac.uk
Tim Wheeler	Head, Crop and Climate Group	Walker Institute	t.r.wheeler@reading.ac.uk

Appendix B

Videoconference with project stakeholders

13 October 2009

10:00-12:00 am Wellcome Trust, London

4:00-6:00 pm BRAC University, Dhaka

Participants

Name	Affiliation	Country
Jainul Abedin	International Rice Research Institute	Bangladesh
Q. K Ahmad	Bangladesh Unnayan Parishad	Bangladesh
Cristina Coirolo	Institute of Development Studies	UK
Declan Conway	International Development University of East Anglia	UK
Frank Farquharson	Centre for Ecology and Hydrology	UK
Remeen Firoz	IUCN, Bangladesh	Bangladesh
Tighe Geoghegan	IIED project team	UK
Abu Wali Ragib Hassan	Department of Agricultural Extension/Local Adaptation to Climate Change Project	Bangladesh
Saleemul Huq	International Institute for Environment and Development	UK
John Ingram	Global Environmental Change and Food Systems	UK
A. K. M. Saiful Islam	Bangladesh University of Engineering and Technology, Institute of Water and Flood Management and Climate Change Study Cell	Bangladesh
Amanat U.Khan	Dhaka University	Bangladesh
Aneire Khan	Imperial College/Grantham Institute for Climate Change	UK
Mizan R.Khan	North South University/IIED project team	Bangladesh
Sari Kovats	London School of Hygiene and Tropical Medicine	UK
Sasha Leigh	Natural Environment Research Council	UK
David Lewis	London School of Economics	UK
Charlie McLaren	UKCDS	UK
Maliha Muzammil	IIED project team	UK
Sam Page	CABI	UK
Atiq Rahman	Bangladesh Centre for Advanced Studies	Bangladesh
Sajid Raihan	Action Aid	Bangladesh
Sanjib Kumar Saha	FAO, Local Adaptation to Climate Change project	Bangladesh
Abu M. Kamal Uddin	Climate Change Cell, Department of Environment	Bangladesh
Abdul Wahab	Bangladesh Agricultural University	Bangladesh

Appendix C

Priority research issues identified in interviews, consultations and key documents

Topic	Issue	Mentioned in key document ⁸	Mentioned by interviewees
Agricultural crops	Adaptation of crops and cropping patterns to changing conditions (heat, salinity, drought)	1, 2, 3	3
Agricultural crops	Potential changes in crop pests and diseases	1	1
Agricultural land	Technologies for and costs of flooded land reclamation	1	
Climate	Development of models to project future climate scenarios, sea level rise, rivers, storm surge, temperature, rainfall patterns, glacial melt	2	5
Climate	Health risks and impacts (differentiated) of climate change		4
Climate	Local and regional impacts of higher temperatures	1	
Climate	Potential impacts of more intense and frequent monsoon winds	1	
Climate	Relation between cc and tectonic movement	1	
Development policy	Macroeconomic and sectoral impacts/CBA of cc adaptation (health, WRM, ag, infrastructure)	2	3
Development policy	Impacts of cc on development programmes	1, 2	
Development policy	Addressing risk and uncertainty in adaptation		2
Development policy	Adaptation trade-offs (e.g., food security vs environment)		1
Disasters	Resilience of agriculture to drought and floods		1
Disasters	Development of effective forecasting and early warning systems	1	1
Disasters	Exploring options for insurance to cope with enhanced climatic disasters	3	1
Diseases	Changes in disease patterns and prevalence	1, 2	1
Drought	Strategies for improved agricultural water management systems	2	
Ecosystems	Differential effects on ecosystems and biodiversity, by region	1, 2	2
Ecosystems	Effects of salinity intrusion on coastal ecosystems	1	2
Energy	Technologies for large-scale energy saving	1	
Energy	Implications of cc on HH energy options		1
Fisheries	Effects of climate change on fisheries	1, 2	2
Food security	CC impacts on food security (land and water impacts; social dimensions)		2
Forests	Changes in forest composition	1	
Forests	Human adaptation responses to forest change	1	
Grazing	Effects of cc on livestock and grazing patterns	1, 2	
Health	Relationship between cc, poverty and health	2	2
Health	Impacts of adaptation interventions on health (e.g., flood defences and vector-borne diseases)		1

⁸ 1=DFID Bangladesh consultation; 2=BCCSAP; 3=NAPA priority project

Topic	Issue	Mentioned in key document ⁸	Mentioned by interviewees
Health	Responses to health issues of cc (intervention trials)		1
Infrastructure	Adaptation of infrastructure design standards (roads, construction)	1	1
Livelihoods	Differential impacts of cc on the vulnerability of the poor incl. landless	1, 2	7
Livelihoods	Barriers to farmer understanding of cc effects <i>and uptake of new practices</i>	1	4
Livelihoods	Adaptation technologies and approaches for poor HHs		4
Livelihoods	Impacts of cc on specific livelihood strategies and resultant social impacts	1	3
Livelihoods	Strategies for adaptation to sea level rise	3	
Livelihoods	Changes in diet and food habits resulting from cc	1	
Mangroves	Effects of climate change on mangrove forest composition and resulting economic impacts	1	
Mitigation	Reducing methane emissions and increasing productivity on agricultural lands	2	
Mitigation	Suitability of tree species for carbon-locking properties in the context of afforestation	2	
Population	Changes in population distribution due to cc and resulting migration, and their social impacts	1	2
Public services	Adaptation of public services to changing climate	1	
Transboundary	CC impacts on transboundary LWI relations and agreements		3
Water	Technologies for improved use of rainwater	1	
Water	Impacts of cc on WRM options and strategies		3
Water	Effects of cc on groundwater resources		1

Appendix D
Collaborative research database⁹

Research objective	Research subject	Project or workstream	Timeframe	Lead institutional actors	Summary of findings and outputs
1. Understanding land and water trends that will affect adaptation	1a. Ongoing modelling of future climate scenarios: sea level rise, impacts on river flows, storm surge, temperature, monsoon and rainfall patterns, glacial melt	Impact of CLimate And Sea level change in part of the Indian sub-Continent (CLASIC)	2003-2007	CEGIS and CEH	Project aim was "to adapt models and methodologies to assess water resources availability and zones under water stress (lack of water resource or flooding risks) and their likely change due to global warming". The project investigated the implications of climate change on water resources and flooding in the basins of the Ganges, the Brahmaputra and the Meghna with particular reference to Bangladesh. It also examined the possible impacts of climate change upon cyclonic storm surges in the Bay of Bengal that affect the low-lying coastal region of Bangladesh. The study obtained data on future climate from four Global Climate Models (GCMs) and used two Regional Climate Models (RCMs) for the baseline period of 1979-1999. The 'Global Water AVailability Assessment (GWAVA)' model, developed by the Centre for Ecology and Hydrology, UK and the British Geological Survey, was used to simulate surface water runoff in the GBM basin. The impacts of climate change on river flow predicted from the study indicate the possibility of substantial changes in future river flows in Bangladesh. The project also aimed to build the capacity of Bangladeshi institutions to carry on the modelling programmes.

⁹ A more detailed database accompanies this report as an Excel file.

2. Assessing the secondary physical impacts and risks	2a. Flood and drought probabilities, risks and impacts	Building adaptation strategy to climate change for selected drought and flood prone areas of Bangladesh	2006 - 2007	BCAS	The project assessed changes in water cycle, changing pattern of flood and intensity of drought, reason behind such changes activities (good and bad) keeping long term impacts of these activities under present and future climate conditions, consequences of such changes on the rights of local people including their livelihood security, practices and reliance on the agriculture forests, fisheries, housing sectors and impact of the some on gender. The existing strategies and practices will be documented and assessed depending on their outcomes and positive and negative effects on the environment.
2. Assessing the secondary physical impacts and risks	2b. Effects on biodiversity and ecosystems	Ecosystem services and poverty alleviation study in South Asia (ESPASSA)	2008	ESPA	Study noted the critical role of water, land and forests in determining the well-being of the poor in the region of study including Bangladesh and identified knowledge gaps in these areas requiring further research. Those relevant to the UKCDS study include: improved prediction of features of monsoonal rainfall within climate models, "on time scales relevant to the livelihoods of the poor"; development of crop modelling to understand how climate change "will influence the agroecological zonation of individual crops with concomitant effects on yields and food security"; improved understanding of the coping strategies of the poor to climate change.
2. Assessing the secondary physical impacts and risks	2b. Effects on biodiversity and ecosystems	Marine and coastal ecosystem services for poverty alleviation	2008	ESPA	The situation analysis for this potential ESPA workstream identified poor coastal people in Bangladesh as among the most vulnerable to global ecosystem change, and recommended it as a priority site for research on the interactions between drivers and impacts of change across coastal, marine, terrestrial and global systems.
2. Assessing the secondary physical impacts and risks	2c. Effects of land and water changes on food security	Impacts of Sea Level Rise on Landuse Suitability and Adaptation Options in Southwest Region of Bangladesh		CEGIS	Under this project, land use suitability for agriculture, fisheries and the Sundarban mangrove forest was analysed for different sea level rise scenarios. The relation of land use with salinity, inundation, and sedimentation conditions was studied.

<p>2. Assessing the secondary physical impacts and risks</p>	<p>2c. Effects of land and water changes on food security</p>	<p>Global Environmental Change and Food Systems in the Indo-Gangetic Plain (GECAFS-IGP)</p>	<p>2002-2011</p>	<p>GECAFS</p>	<p>Implementation phase began 2006 in partnership with CGIAR and others. Science Plan and Implementation Strategy lays out a research agenda to be implemented through the GECAFS programme over five years (2006-2011). Emphasizes increasing knowledge on how food systems in the Indo-Gangetic react to environmental change; thus research outputs may not be directly relevant to specific cc and development issues in Bangladesh. Work includes comparative case study research in one regional of Bangladesh (Greater Faridpur; see below). Collaborative research involves national researchers “closely linked with policy makers, the private sector and civil society (NGOs)”. Includes a component on “regional scientific networking” that would draw other ongoing research into the GECAFS knowledge base. The key to making this research stream most useful would be in collaborative projects that both yield locally relevant results and contribute to GECAFS’s broader research agenda.</p>
<p>2. Assessing the secondary physical impacts and risks</p>	<p>2c. Effects of land and water changes on food security</p>	<p>Food system vulnerability and adaptation to global environmental change in Greater Faridpur Region in Bangladesh</p>	<p>2006-2009</p>	<p>GECAFS</p>	<p>Ongoing case study research under the GECAFS-ICP. Identifies ways in which food systems of the region are vulnerable to climate change, particularly too much water during monsoon and late flooding. Includes participatory identification of adaptation measures to address the issues.</p>
<p>2. Assessing the secondary physical impacts and risks</p>	<p>2g. Effects of cc on disease patterns and prevalence</p>	<p>Effects of local climate variability on transmission dynamics of cholera in Matlab, Bangladesh</p>		<p>ICDDR,B</p>	<p>Cholera is considered as a model for climate-related infectious diseases. In Bangladesh, cholera epidemics occur during summer and winter seasons, but it is not known how climate variability influences the seasonality of cholera. Therefore, the variability pattern of cholera events was studied in relation to the variation in local climate variables in Matlab, Bangladesh. Results demonstrate that in summer and winter seasons in Bangladesh, temperature and sunshine hours compensate each other for higher cholera incidence. The synergistic effect of temperature and sunshine hours provided the highest number of cholera cases.</p>

<p>3. Assessing impacts on human populations</p>	<p>3a. Vulnerability, impact and risk assessments, differentiated by social groups (e.g., gender, wealth)</p>	<p>Understanding the role of ecosystem services in the livelihoods of the poor in desakota regions under climate change:</p>	<p>2008</p>	<p>ESPA</p>	<p>Research carried out under the ESPASSA work stream. Desakota Study Team (2008) defines priorities for further research, including research on the interface between rural-urban reconfigurations ("desakota") and climate change. Proposed research approaches include: long-term, larger scale interdisciplinary case studies "that document natural-social interactions and implications for ecosystem service and poverty interlinkages"; macro analysis at regional scale "including implications of climate-land cover-vegetation feedbacks and land use changes"; action research "to develop, test, and evaluate technological, social and institutional innovations". Work included a case study from southwestern Bangladesh (Ahmed 2008a) that examined how climate changes were impacting the environment of rural areas, resulting in mass migration to the outskirts of Dhaka (the desakota phenomenon). Focuses particularly on health, nutrition, economic and social impacts of saline intrusion and water logging, both of which are expected to increase with climate change. Examines the differential impacts on women and men.</p>
<p>3. Assessing impacts on human populations</p>	<p>3a. Vulnerability, impact and risk assessments, differentiated by social groups (e.g., gender, wealth)</p>	<p>Climate change and urban poverty in Bangladesh (ClimUrb)</p>	<p>2009-</p>	<p>University of Manchester, Brooks World Poverty Institute</p>	<p>A programme of individual research projects on the theme of vulnerability and resilience of poor urban people, focusing on cc impacts on livelihoods and assets, fostering pro-poor political change related to urban policy and governance in the context of cc, and strengthening community response and resilience.</p>
<p>3. Assessing impacts on human populations</p>	<p>3b. Macroeconomic impacts, sectoral cost-benefit analyses (health, agriculture, WRM, infrastructure)</p>	<p>Economic modelling of climate change adaptation needs for physical infrastructures in Bangladesh</p>	<p>January 2009 - May 2009</p>	<p>CEGIS</p>	<p>The objective of this study was to compare the expected economic damage with cost of adaptation to sea level rise. In this regard, the expected damage to agriculture in the coast due to sea level rise was estimated. A physical adaptation model, developed by the Institute of Water Modelling (IWM), was used and an economic model was developed.</p>

<p>3. Assessing impacts on human populations</p>	<p>3d. Impacts of cc on development programmes and interventions</p>	<p>ORCHID: Piloting Climate Risk Screening in DFID Bangladesh</p>	<p>2007</p>	<p>IDS</p>	<p>The project aimed at developing a screening process DFID to identify and manage climate change impacts on development investments. It identified some research priorities to make programmes more responsive to climate issues. Recommendations on the Chars Livelihoods Programme included: action research on migration flows related to climate shocks in order to increase livelihood resilience; research on climatic impacts to livelihoods; and research on local awareness of and experience in climate risks. Recommendations on the Transport Management Reform Programme of the Roads and Highways Department included research on road design requirements in the context of climate change and identified Birmingham University as an appropriate partner.</p>
<p>3. Assessing impacts on human populations</p>	<p>3d. Impacts of cc on development programmes and interventions</p>	<p>Climate Change Adaptation Target Setting Project (CCAT)</p>		<p>IUCN</p>	<p>The project wanted to explore the acceptability of climate change targets as means to mainstream climate change adaptation measures into development planning. Main indicators included: health impacts ,agriculture and food security, goods and services of ecosystems, gender perspectives, disasters, vulnerability mapping, etc. Major activities include: setting up and activating expert group for synthesizing existing climate change adaptation knowledge, developing vulnerability mapping based on literatures and secondary information, agree on the process of developing a common format, for global use, towards setting up goals and targets, explore indicators revealing quantitative and qualitative measures of adaptive capacity, etc.</p>

3. Assessing impacts on human populations	3d. Impacts of cc on development programmes and interventions	Development and Climate Change project: Bangladesh country study		OECD	A project to provide guidance on how to mainstream responses to climate change within economic development planning and assistance policies, with natural resource management as an overarching theme. The work included three sub-studies: "Climate Change and Development in Bangladesh" by Ahsan Uddin Ahmed (Bangladesh Unnayan Parishad, Dhaka); "Analysis of GCM Scenarios and Ranking of Principal Climate Impacts and Vulnerabilities in Bangladesh" by Stratus Consulting, Boulder, USA (Joel Smith); and "Review of Development Plans, Strategies, Assistance Portfolios, and Select Projects Potentially Relevant to Climate Change in Bangladesh" by Maarten van Aalst of Utrecht University, The Netherlands.
3. Assessing impacts on human populations	3e. Understanding the links between climate change, poverty and health	Floods, drought and micronutrient deficiency	in proposal stage	Imperial College, London	Micronutrient deficiency is common in frequently flooded areas where micronutrients are washed from the soil over time. Severe micronutrient deficiency among women is common in rural areas of Bangladesh. The study will compare nutritional indices in the dry season and after monsoon floods in two areas with different likelihood of floods. The purpose is to contribute to the design of larger studies on nutritional impacts of floods and drought in Bangladesh.
3. Assessing impacts on human populations	3e. Understanding the links between climate change, poverty and health	Effects of rising salinity on public health	2007-2010	Imperial College, London (Grantham Institute for Climate Change)	Most of the land area of Bangladesh consists of deltaic plains of large river systems which suffer from natural and man-made hazards both in terms of acute climate events (floods and drought) and environmental degradation (salinization and soil degradation), which are likely to be exacerbated by climate change and sea level rise. This research aims to: 1. Measure variation in salt composition in drinking water sources in coastal villages and develop protocols for measuring urinary salt excretion and risk markers in order to design a study on hypertension risk; 2. Perform a hospital based case-control study on the association between salt water intake and the risk of developing (pre)eclampsia and hypertension among pregnant women in the same areas; 3. Develop a model that includes different sea-level rise scenarios, the corresponding salinity intrusion and the burden of disease from hypertension associated among women.

3. Assessing impacts on human populations	3e. Understanding the links between climate change, poverty and health	The meaning of health security for disaster resilience in Bangladesh	2007-2008	Northumbria University and ICDDR,B	Work on the established knowledge on the association of poverty and health that extends to health and disasters focusing on less evidence as to how good health or health security mitigates a disaster and what people do that keeps them healthy in terms of food, water, sanitation, housing and health care before, during and after disasters in order to mitigate their impact in the context of Bangladesh.
3. Assessing impacts on human populations	3e. Understanding the links between climate change, poverty and health	Floods, health and climate change strategic review	2004	Tyndall Centre for Climate Change Research	Global assessment that identified a number of health issues related to flooding in Bangladesh that have been the subject of research and that need to be addressed in the context of climate change.
4. Developing responses	4a. Adaptation of infrastructure design standards; 4e. Exploration of options for decreasing vulnerability to risk from natural disasters and other cc impacts;	Increasing the resilience of poor communities to cope with the impact of climate change	2007	Practical Action Bangladesh	By strengthening the capacity of vulnerable communities, the project aims to increase the resilience of poor people to cope with and adapt to the adverse impacts of climate change. Outputs from the project were: 1. Community based disaster preparedness plans; 2. Implementation of sustainable technologies for natural resource management, water conservation and agriculture. 3. Capacity building of support institutions, local and regional stakeholders to incorporate community based climate change mitigation strategies into development planning and natural resource management strategies; and 4. Effective changes in policy and practice at local, regional and international levels to support community based climate change adaptation measures.

<p>4. Developing responses</p>	<p>4b. Assessing barriers to farmers' understanding of cc and uptake of new practices; 4c. Development of new crop varieties and agricultural practices</p>	<p>Livelihood Adaptation to Climate Change (LACC): Improving adaptive capacity to climate variability and change for sustainable food and livelihood security in drought prone and coastal regions of Bangladesh</p>	<p>Phase 1: 2005 - 2007 (LACC I); Phase 2: 2008 - 20009 (LACC II)</p>	<p>Department of Agricultural Extension (DAE)</p>	<p>"The project promotes climate change adaptation and disaster risk reduction processes and capacities for sustainable livelihoods and food security in the rural sectors including crops, livestock, fisheries and forestry and other key factors of rural livelihoods in the drought prone and coastal regions of Bangladesh" (FAO, 2008). The project is linked to the national Comprehensive Disaster Management Programme. Phase 1 tested livelihood adaptation options with in 4 drought-prone subdistricts over 5 cropping seasons. The demonstrations assessed levels of acceptance of a range of agricultural practice adaptation. Among the relevant findings: growing drought-tolerant fruit trees and alternative cereal crops and rainwater harvesting practices using mini-ponds appeared to have high levels of acceptance; dry seedbed rice farming also appeared promising, but required technical training for farmers; water saving irrigation practices increased water efficiency, but savings to farmers were minimal; uptake of new oilseed crops was limited by pest and disease infestation; Phase II is now underway and a third phase is anticipated.</p>
<p>4. Developing responses</p>	<p>4c. Development and testing of new crop varieties and agricultural practices</p>	<p>Development and dissemination of improved wheat varieties to poor farmers to increase resilience</p>	<p>2004-ongoing</p>	<p>CABI</p>	<p>A bottom-up system of wheat seed technology transfer was piloted in north-west Bangladesh with 45 food insecure farming families in the 2004-05 wheat season, then scaled out to 545 families in the 2006-07 season. The seeds were a heat and disease tolerant variety, and participating families were trained as seed producers and traders. The project increased food security and income for participating families.</p>
<p>4. Developing responses</p>	<p>4c. Development and testing of new crop varieties and agricultural practices</p>	<p>Adaptive Crop Agriculture Including Innovative Farming Practices in the Coastal Zone of Bangladesh</p>	<p>2006 - 2007</p>	<p>CEGIS</p>	<p>The main objective of the study was to find out suitable adaptation measures that have the potential to help farmers adapt to climate change and to identify suitable varieties of crops that would be able to adapt to climate change. The CROPSUIT model developed by CEGIS was used in this study to estimate the physical suitability of land for different types of land use and crop cultivation. Different types of rice crops and non-rice crops were selected for field-testing.</p>

4. Developing responses	4e. Exploration of options for decreasing vulnerability to risk from natural disasters and other cc impacts	Social Protection Approaches for Climate Change	2008-2012	IDS	The programme explores the policy links between cc adaptation, disaster risk reduction and social protection. Research themes include institutions and policy processes, rights and exclusion, and growth and livelihoods. Work includes doctoral research in Bangladesh on climate change adaptation and structural poverty: current impact and transformative potential of social protection.
4. Developing responses	4e. Exploration of options for decreasing vulnerability to risk from natural disasters and other cc impacts	Mainstreaming livelihood-centred approaches to disaster management		Practical Action Bangladesh	The project focuses on the roles and linkages between vulnerable communities, district and national level government institutions and humanitarian agencies with regard to disaster preparedness and mitigation.
4. Developing responses	4e. Exploration of options for decreasing vulnerability to risk from natural disasters and other cc impacts	Strengthening the Resilience of the Water Sector in Khulna to Climate Change	2009-?	Alterra (Wageningen University), Netherlands and Institute of Water Modelling, Bangladesh	Study undertaken through a technical assistance project of the Asian Development Bank to study impacts of climate change scenarios on the water sector in Khulna city and to develop recommendations on potential adaptation options to address potential impacts.
4. Developing responses	4f. Development and testing of adaptation technologies and approaches for poor households (action research)	Climate change adaptation and risk reduction in Bangladesh	2008 - present	ActionAid Bangladesh	The project aims to carry out community based action research on climate change adaptation and disaster risk reduction to facilitate communities towards better adaptation for both.

<p>4. Developing responses</p>	<p>4f. Development and testing of adaptation technologies and approaches for poor households (action research)</p>	<p>Reducing vulnerability to climate change (RVCC)</p>	<p>2000-2006</p>	<p>CARE-Bangladesh</p>	<p>Three year action learning project in communities in the southwestern region. Funded by CIDA and implemented by CARE-Bangladesh and local partners. Approach was to promote and test strategies and technologies to reduce the vulnerability of the poorest to extreme weather events. These evolved over the course of the project in response to experience. Project contributed knowledge on a range of issues relevant to local adaptation, including: the uptake of salt tolerant rice varieties (in collaboration with BRR1) and other crops and drought resistant crops; approaches to livestock rearing in the context of regular flooding; reduced health impacts of flooding through sanitary latrines; development of rainwater harvesting systems and other technologies for improved access to safe drinking water; development of adaptations to housing construction to make it more resistant to storms. Project has been well documented; so knowledge is widely available.</p>
<p>4. Developing responses</p>	<p>4f. Development and testing of adaptation technologies and approaches for poor households (action research)</p>	<p>Action Research for Community Adaptation in Bangladesh</p>	<p>5 years (now in proposal stage)</p>	<p>IIED</p>	<p>A proposed long-term project involving site-level participatory action research to understand adaptation requirements and approaches in selected ecozones and rural-urban interfaces. The aim of the project is to feed results from action research into the strategies people use to address climate change as well as into policy decisions regarding adaptation.</p>

<p>4. Developing responses</p>	<p>4f. Development and testing of adaptation technologies and approaches for poor households (action research)</p>	<p>Promotion of adaptation to climate change and climate variability in Bangladesh (with a focus on the central coastal district of Bangladesh)</p>	<p>2004-2006</p>	<p>IUCN</p>	<p>The project aims to create necessary conditions to promote adaptation to climate change and climate variability in national policies, plans and also at the local community level which includes residents of Noakhali district. A detailed work plan and mode of operation was developed. Documentation of local level coping measures was completed. An advisory committee was formed which included government officials and key institutional personnel for effective coordination and contribution to the project. Major stakeholders at the national level were identified and communicated to about the project. Important local stakeholders within the project area were identified and sensitized. The project is sponsoring "Climate Change Adaptation Network" in Bangladesh. A study titled " Risk assessment and evaluation of probability of extreme hydrological events and recommendation on subsequent disaster management" has been commissioned. This will contribute to understanding the probability of extreme hydrological events and make specific predictions to combat future climatic scenarios.</p>
<p>7. Communicating results</p>		<p>Climate Change Adaptation Network</p>		<p>IUCN</p>	<p>A climate change adaptation network has been established to act as a communication and information dissemination forum. IUCN, B is to serve as the network secretariat. The network is to serve as a platform for sharing information, views and experience of researchers and practitioners who are actively engaged in dealing with climate change issues both globally and locally. The ToR has been finalized, members have been identified and included; two meetings have been held.</p>

8. Using results		Awareness and education on the impacts of climate change and variability for central coastal char communities in Bangladesh	2008-2009	IUCN	This pilot project has been taken up to enhance preparedness of coastal communities by focusing on teachers and students of the project areas. The main objective of the project is to educate the young generation of coastal communities about climate change and to create enabling environment to face the challenges of climate vulnerabilities, for appropriate adaptation and preparedness measure. Outputs from the project include: 1. Development and publication of Training of Trainers materials and guidance books for school teachers to educate students of selected schools on climate change issues. 2. Development and publication of pictorial brochures, stickers and establishment of environmental clubs within schools for for observance of landmark environmental events, debates and essay competitions for creating and motivating awareness. 3. A documentary film on the science, impact and adaptation to climate change on coastal livelihoods, existing adaptation practices and future pathways to demonstrate the project rationale will be produced. 4. Preparation and publication of a 'Student to Student' approach book as a toolkit for sustaining awareness activities through the youth of the project area.

Appendix E

Research Publications on Climate Change and the Land, Water and Food Interface in Bangladesh

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Appendix F

Mapping of stakeholders against priority research objectives

Bangladesh stakeholders

UK stakeholders

Others

Research objective	Research priorities			
	Land-water interface	Food and agriculture	Health and nutrition	Livelihoods
1. Understanding land and water trends that will affect adaptation	1a. Ongoing modelling of future climate scenarios: sea level rise, impacts on river flows, storm surge, temperature, monsoon and rainfall patterns, glacial melt Hadley Centre CEH Proudman Oceanographic Laboratory Model validation and calibration: BUET CEGIS Centre for Global Change			
2. Assessing the secondary physical impacts and risks Walker Institute for Climate System Research	2a. Flood and drought probabilities, risks and impacts Centre for Ecology and Hydrology Oxford University Centre for the Environment (Fai Fung) BCAS North-South University			
	2b. Effects on biodiversity and ecosystems (at regional and local levels) Tyndall Centre Sustainable Coasts Programme IUCN,B			

Research objective	Research priorities			
	Land-water interface	Food and agriculture	Health and nutrition	Livelihoods
	2c. Effects of land and water changes on food security BCAS CEGIS			
	2d. Impacts of cc on transboundary water flows IUCN,B	2e. Effects of cc on crops and livestock, including on pests and diseases BCAS CEGIS	2g. Effects of cc on disease patterns and prevalence Grantham Institute, Imperial College ICDDR,B	
		2f. Effects on fisheries Bangladesh Fisheries Research Institute		
	3. Assessing impacts on human populations	3a. Vulnerability, impact and risk assessments for all key areas, differentiated by social groups (e.g., gender, wealth) IDS Bangladesh Unnayan Parishad Centre for Global Change North-South University		
			ICDDR,B NIPSOM Imperial College: Grantham Institute, Institute for Global Health, MRC-HPA Centre for Health	Action Aid Bangladesh CARE Bangladesh Oxfam
3b. Macroeconomic impacts, sectoral cost-benefit analyses (health, agriculture, WRM, infrastructure) CEGIS Ministry of Environment Climate Change Cell				
3c. Impacts on water resource management options and strategies				
3d. Impacts of cc on development programmes and interventions IDS				

Research objective	Research priorities			
	Land-water interface	Food and agriculture	Health and nutrition	Livelihoods
			3e. Understanding links between cc, poverty and health Northumbria University Disaster and Development Centre ICDDR,B	3f. Understanding the differential impacts of cc on the vulnerability of the poor, esp. the landless Action Aid Bangladesh IDS 3g. Understanding the impacts on livelihood strategies and settlement patterns
4. Developing responses	4a. Adaptation of infrastructure design standards	4b. Assessing barriers to farmers' understanding of cc and uptake of new practices	4d. Developing health-related responses to floods and other disasters Northumbria University Disaster and Development Centre LSHTM ICDDR,B	4e. Exploration of options for decreasing vulnerability to risk from natural disasters and other cc impacts IDS
		4c. Development of new crop varieties and agricultural practices BARI BAU BRRI Private seed companies CIMMYT		4f. Development and testing of adaptation technologies and approaches for poor households (action research) DAE-FAO LACC Project IIED-BCAS ARCAB Project Action Aid Bangladesh Care Bangladesh IUCN,B Practical Action Bangladesh
5. Testing responses		5a. Farmer trials CABI BARI BRRI DAE IUCN,B	5b. Health intervention trials	

Research objective	Research priorities			
	Land-water interface	Food and agriculture	Health and nutrition	Livelihoods
6. Assessing impacts of responses			6a. Impacts of adaptation interventions on health (e.g., flood defences and vector-borne diseases)	6b. Social impacts of changes in livelihood strategies and population movements in response to cc
7. Communicating results	<p>Government outreach agencies, e.g., DAE (idea of "climate farmer field schools")</p> <p>Media (TV, Radio, print & electronic)</p> <p>Ministry of Environment Climate Change Cell</p> <p>NGOs</p>			
8. Using results	Government technical agencies and departments, e.g., WARPO, DAE			
9. Developing capacity to use results	International agencies, e.g. UNDP, FAO			
10. Developing capacity to do research:	<p>UK universities (academic and research fellowships, exchange visits)</p> <p>Donor agencies</p>			