Comprehensive Disaster Management Programme, CDMP

Improved Adaptive Capacity to Climate Change for Sustainable Livelihoods in the Agriculture Sector

Summary Report
Project Phase I

Community Based Adaptation in Action

December 2007

Submitted by:

Food and Agriculture Organization of the United Nations

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1. PROJECT BACKGROUND

Bangladesh is particularly prone to natural disasters due its geo-physical position and socio economic context. The territory expands through the delta, where the rivers Ganges, Brahmaputra, Meghna and their tributaries meet and drain into the Bay of Bengal. This wet environment has created arable land, conducive for agriculture. Its economy is highly agricultural, with 63% of its labor force in the agriculture sector. Agriculture is the single most important and the largest sector of Bangladesh's economy, accounting for about 35% of the GDP.

Bangladesh, in particular its northwestern region, is drought-prone. Droughts are associated either with the late arrival or with an early withdrawal of monsoon rains. This phenomenon adversely affects rice crops, which account for more than 80% of the total cultivated land of the country, and also causes regular damage to jute, the country's main cash crop.

Droughts in March-April prevent land preparation and ploughing activities from being conducted on time, delaying the broadcasting of *Aman* and the planting of *Aus* and jute. When droughts occur in May and June, they destroy broadcast *Aman*, *Aus* and jute. Inadequate rains in July and August delay transplantation of *Aman*, while droughts in September and October reduce yields of both broadcast and transplanted *Aman* and delay the sowing of pulses and potatoes.

Boro, wheat and other crops grown in the dry season are also affected by drought. Major droughts occurred in 1966, 1969, 1973, 1978, 1979, 1981, 1982, 1989, 1992, 1994, 1995, 1998 and 2000, causing substantial reduction in food production. The consecutive droughts of 1978 and 1979 directly affected 42% of cultivated land and reduced rice production by an estimated 2 million tons.[1] The losses due to drought in 1982 were more than double the losses caused by floods in the same year. The 1997 drought caused a reduction of around 1 million tons of food-grain, of which about 0.6 million tons is transplanted *Aman.*

Because farmers are exposed to recurring droughts, they need to adapt their farming systems from year to year to the differing conditions caused by droughts. For most, however, agricultural adjustment is a costly option, as investment is needed in re-sowing, crop replacement, intercropping or irrigation. Most resort to disposal/mortgaging of assets, borrowing and eventually, to migration. This was particularly evident in 1994 and 1995, where 72% of households in a study community, sold and/or mortgaged their lands in order to cope with recurrent droughts, leading farmers into an inevitable debt trap[2].

Increasing climate uncertainties are an additional threat in drought prone environments and also one of the major factors for risk averseness. It forces farmers to depend on low input and low risk technologies. Non-adoption of new technologies to derive maximum gains during favorable seasons delays recovery after disasters. There is a risk even that investments made for poverty reduction are lost within the high-risk areas due to regular hazard impacts. Increasing climate risks, thus, further undermine development efforts of Bangladesh and aggravate poverty.

Impacts of climate change on food production and food security are global concerns, but they represent a particular threat for Bangladesh. Agriculture is already under pressure mainly due to an increase in demand for food, as well as to depletion of land and water resources. The prospects of global climate change make this problem a priority for Bangladesh.

[1] Brammer, 1987. Drought in Bangladesh: Lessons for Planners and Administrators; Ericksen et al, 1993. Socio-economic Implications of Climate Change for Bangladesh.
[2] Paul, 1995. Farmers' and Public Responses to the 1994-95 Drought in Bangladesh: A Case Study

Higher temperatures and water stress due to heat would result in a decline in vegetation and agricultural production. By 2050, according to forecast scenarios, dry season rainfall may decrease by 37%, thus increasing the risk of droughts significantly[3]. Though monsoon rainfall is expected to increase by 28%, intermittent dry and wet spells can not be ruled out. High intense rainfall would result in increased flooding and sedimentation of floodplains, making them less productive. Encroaching salinity due to sea level rise will further degrade agricultural areas.

Several government programs since the 1970th have sought to address climate risks. The development of the irrigation system in the 70th led to increased *Boro* rice production in recent years. This, however, was at the cost of other pre-monsoon crops, including pulses and oil seeds, which led to lower nutrition levels in the population, as large areas were converted to *Boro* rice. To reverse this trend, the government promoted crop diversification thereafter to increase rice production during monsoon season and other crops during dry season. However, farmers preferred to cultivate more rice during the less risky dry season. New ways and methods are needed to better inform farmers to help them identify alternative, technically viable options for livelihood adaptation. Better access to climate information could encourage farmers to adopt new risk/opportunity management practices under changing climatic conditions.

The Comprehensive Disaster Management Programme (CDMP) recognizes the risks associated with climate variability and change and the current lack of capacity in assessing and managing long-term climate risks in Bangladesh. Component 4b of the CDMP seeks to establish an integrated approach to managing climate risks at national and local levels. Under this Component, efforts were undertaken in partnership with the Food and Agriculture Organization of the United Nations (FAO) to implement activities designed to promote livelihood adaptation and reduce vulnerability to climate change, particularly amongst women and poor communities who have the lowest capacity to adapt.

The **objectives** of the project are:

1) Develop a methodology to better understand:
   - how results of climate change impact assessments, based on General Circulation Models (GCMs) and different climate change scenarios can be translated into location specific agricultural impact outlooks and livelihood adaptation practices,
   - how such options can be tested and implemented in a participatory way with farmers,
   - how to feed back results to researchers and policy makers in agriculture and the climate change "community of practice", in order to facilitate replication of success cases and avoid mal-adaptations.
2) Initiate and facilitate the field testing with farmers of:
   - livelihood adaptation strategies to better respond to disaster and climate risks,
   - improved long-lead climate forecasting, and responses to future climate change projections in agriculture

The **outputs** and deliverables of this effort include:

- an in-depth local situation assessment;
- identification of suitable project entry point activities
- a participatory project implementation strategy, suitable for replication elsewhere
- required institutional mechanisms set- in place and/or strengthened ;
- technical capacity building and training;

[3] Ministry of Environment and Forest, 2002. Initial Communication under the United Nations Framework Convention on Climate Change.

- a set of viable adaptation options fitting into location specific agro-ecological and social settings of vulnerable groups;
- lessons learned from the community based adaptation processes

2. PROJECT ENTRY POINTS

2.1 Promoting adaptation to current climate variability and extreme events

Effective climate risk management at the local level requires spatially and temporally differentiated climate information on different time scales. The uncertainties associated with climate change impacts at the local level proved to be a major constraint in transforming global climate change modeling results into locally actionable adaptation practices. Therefore, the implementation of activities was initiated from a disaster risk management perspective as entry point with the aim to phase-in climate change issues and modeling results as soon as available. Utilization of past extreme climate event analogues and potentially available long-lead seasonal forecasts for managing climate risks were the starting point to develop methodologies to better understand how climate change impacts can be translated into agricultural response options and livelihood adaptation practices. The Subcomponent of CDMP was therefore based on the principle that adaptation to short-term climate variability and extreme events serves as a basis for reducing vulnerability to longer-term climate change.

2.2 Launching local interactions on the basis of traditional knowledge and existing local adaptation practices to climate risk

The availability of usable science-based climate prediction information needs to be tailored to match farmers' understanding and needs by suitably introducing it through discussions about its relevance and potential impacts on traditional practices and incorporating existing knowledge. Farming communities have considerable accumulated experiences to live with climate risks over time and have developed a range of adaptation strategies. In order to connect climate change modeling results with local realities, the understanding of farmers' traditional knowledge on climate risk management, local adaptation practices and their potential relevance to future climate impacts is an essential baseline. It is equally important is to establish better science-society integrators which help to orient climate modeling research to meet farmers' needs and provide feedback to the climate science community on the application value of their research.

2.3 Building institutional and technical capacity

A sound institutional mechanism capable to establish a link between the scientific *climate change modeling research community* and farmers is essential to induce the use of *climate change modeling results in a farmers needs-oriented way*. The DAE in Bangladesh, with its partner research institutions like BARI and BRRI, is a farmer service-oriented institution with a long history of linking farmers with frontier technologies and innovative farm practices. Therefore it provided a good entry point for taking a lead role in connecting climate change modeling research, with communities and farmers needs. On the other hand however, considerable structural innovations within the organization as well as skills building and attitudinal changes were required to capacitate DAE (Department of Agriculture Extension), and its national research partner institutions, for performing in close collaboration and coordination new tasks needed to (i) translate climate change modeling results into medium and long term agriculture impacts and (ii) transform these into concrete adaptation options relevant to farmers' current thinking and needs; while applying a 'language' and communication strategy which farmers can understand easily.

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2.4 Addressing longer term issues of climate change through awareness raising

A fundamental assumption underlying the project work at field level was that most farmers work on the basis of day-to-day thinking rather than in view of long-term pro-active risk management. In that respect, there was a need to slowly encourage longer-term thinking and start working on issues that matter today, and then adding a longer term perspective. Therefore, the implementation process was initiated from a community level risk perception and disaster risk management perspective, and phased-in climate change issues and modeling results thereafter.

2.5 Initiating field testing of adaptation options with 'no regret' technologies

No reliable, downscaled data on potential future impacts of climate change are available yet. The best the project could do was using the PRECIS model for NW Bangladesh. Nevertheless, the project could not pretend to know how climate change impacts will be felt in the drought prone areas in NW BGD. Until better and more reliable data will be available about location-specific impacts of climate change, the project has chosen to experiment on small scale only, by focusing on 'no regret options' initially – options which are already known from as being environmentally and economically successful elsewhere, but which are not yet widely known in NW BGD. This strategy had a dual purpose: to establish field demonstrations to positively raise awareness on the one hand, but also to establish a pool of drought mitigating technologies known to farmers and DAE in NW BGD (with regard to advantages, benefits and costs) to be implemented immediately or in the future. No broad based replication strategy of adaptation options was promoted by the project in its early stage.

2.6 Introducing the concept of probabilistic climate forecasting

The institutional system's capacity and the role of active intermediation within agriculture sector agencies, like the DAE, are hitherto familiar "only" with deterministic weather forecasts of 24-72 hours. This weather forecast information is used to react and respond to hazards just before or after their occurrence. Recent progress in long-lead climate forecasting makes it possible to better inform farmers on the probability of variations on the average seasonal rainfall, offering scope for risk/opportunity management in agriculture. Long-lead climate forecasts help to make strategic decisions well in advance, reducing the impact of dry and wet spells and associated secondary impacts. However, institutional rethinking is required in two ways: (i) to shift to proactive thinking and practices for addressing climate risks before their occurrence rather than continuing with the reactive mode of managing disasters (i) to get used the concept of probabilistic climate forecasting as compared to deterministic weather forecasting.

The long-lead climate forecast information, as well as climate analogue information - as and when available - are presented in probabilistic terms, as are climate change modeling results. The communication of probabilistic climate information days and months in advance, relevant to farmers' needs, calls for evolving innovative translation and communication methodologies and processes, as well as appropriate institutional mechanisms.

3. DESIGN OF PROJECT IMPLEMENTATION STRATEGY

Designing and implementing livelihood adaptation to climate change in drought prone areas is consolidated within the policy of the Government of Bangladesh. The Comprehensive Disaster Management Programme (CDMP) recognizes the risks associated with climate variability and change. This Programme advocates establishment of an integrated approach to manage climate risks at the national and local levels and implement activities to promote adaptation and reduce livelihood vulnerability, particularly among women and poor communities who have the lowest capacity to adapt. After understanding the national policies related to climate change adaptation, the following working approach and processes were designed to guide the overall project implementation (Fig. 1).

(i) Assessment of current vulnerability – the following questions were addressed:

- Where does this society stand with respect to vulnerability to climate risks?
- What factors determine this society's current vulnerability?
- How successful are the efforts to adapt to current climate risks?

The working approaches developed by the project to assess vulnerability were:

- assessing natural, socio-economic conditions,
- assessing current climate risks,
- assessing local perceptions about climate risks and impacts,
- documentation of livelihood profiles in pilot sites,
- assessing institutional frameworks.

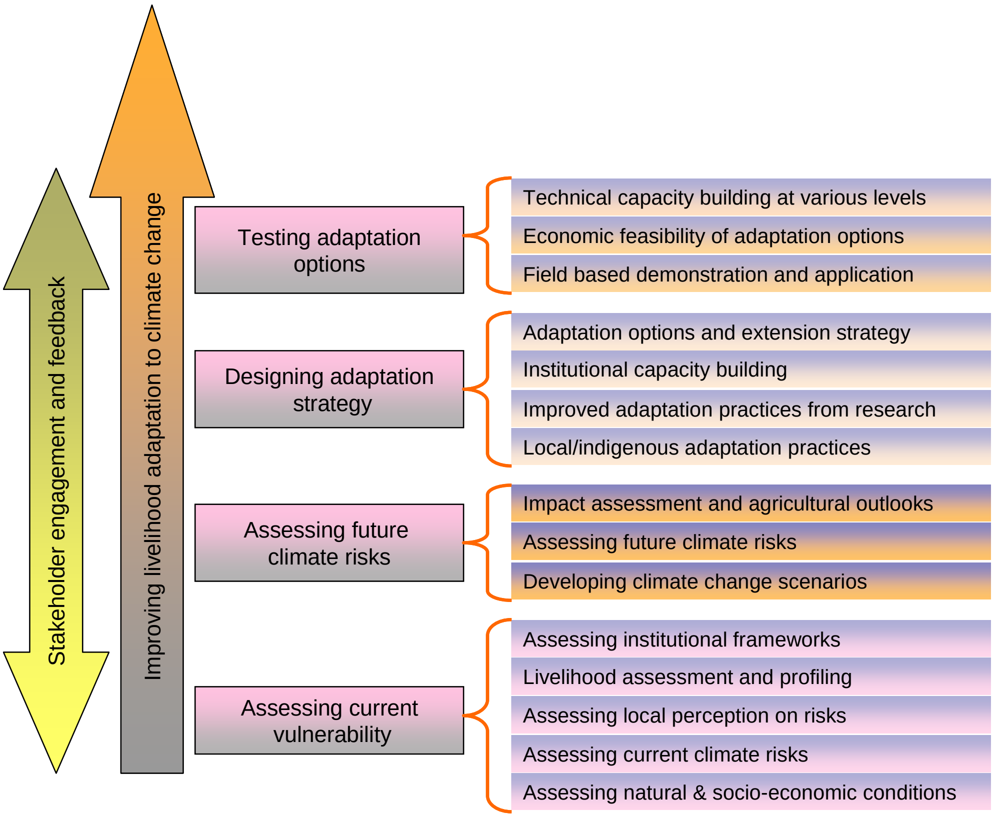


Fig.1. Operationalization strategy, project components and processes for livelihood adaptation to climate variability and change in drought prone areas of Bangladesh.

(ii) Assessment of future climate risks – focused on future climate change scenarios, vulnerability and environmental trends as a basis for considering future climate risks. The major activities to address the future risks were:

- development of climate change scenarios for the pilot region,
- assessment of future climate risks,
- climate impact outlooks on agriculture.

(iii) Design of an adaptation strategy – responds to current vulnerability and future climate risks. It involved the identification and selection of viable adaptation options and measures, and the formulation of these options into farmer-friendly adaptation menus. The key components were:

- local/indigenous adaptation practices,
- improved adaptation practices,
- institutional capacity building,
- development of adaptation options and efficient extension strategy.

An adaptation options menu was developed to identify viable options for managing climate (in this case drought-related). It synthesized adaptation practices that could catalyze long-term adaptation processes. A set of prioritized adaptation options were validated against a set of key criteria, depending on the cropping season; seasonal adaptation option menus were consolidated before each cropping season.

(iv) Testing of adaptation options: This component was undertaken with the goal of adaptation options identified through stakeholder consultations. The major steps in this phase were:

- field-based demonstrations and application of adaptation options,
- undertaking economic feasibility studies,
- technical capacity building at different levels (national to local).

4. INSTITUTIONAL MECHANISMS FOR ADAPTATION IN ACTION

4.1 Project management

The pilot project was implemented by the DAE, with the institutional mechanisms indicated in the diagram below (Fig.2). The DAE, under the chairmanship of its Director General (DAE-DG) provided technical implementation support to the project. The National Sub-component Manager was appointed to oversee the implementation. The sub-component manager was responsible for execution of the project and reported to DoE, the DAE-DG through the Director of Field Services, DAE. The Deputy Director - Monitoring (Field Services, DAE) provided secretariat support to project implementation. A core group comprising of key staff was formed in DAE at the national level which provided, after training obtained from the project, day to day technical support for the project implementation. At the field level, the project was implemented through the existing DAE manpower. *Upazilla a*nd *block* level extension workers (SAAOs) of the project pilot areas were another key target group of the project's institutional and technical capacity building process.

4.2 Subcomponent Advisory Committee

A Subcomponent Advisory Committee (SAC) under the chairmanship of the DoE Climate Change National Component Manager was constituted to provide a critical link between activities under this subcomponent and other complementary activities under component 4b of the CDMP. The representatives from the Ministry of Food and Disaster Management/ Disaster Relief and Rehabilitation (MoFDM/ DRR), DAE, CDMP and UNDP were drawn to ensure coordination of subcomponent activities with other components of the CDMP.

4.3 Technical Implementation Working Groups and implementation modalities

Technical Implementation Working Groups (TIWGs) were established for implementation of activities under the subcomponent both at the National and Upazila levels, capable of interpreting, translating and communicating climate change modeling and research results for field application. The capacity building activities were taken up through training to ensure that TIWGs are capable of translating climate change modeling and research results into locally acceptable and achievable adaptation practices, and pilot testing of livelihood adaptation options at the pilot sites with farmers.

The National Technical Implementation Working Group (N'TIWG) was formed by involving key participants from DAE, BARI, BARI, DoE, climate cell, DRR, SPARASO, BMD and BMDA. It acted as a link between the scientific community generating climate change information and the Upazila technical working groups, obtaining climate information and translating these into agriculture sector impacts. Crucially, the NTIWG transformed these impacts into locally relevant and acceptable adaptation options, in constant dialogue with the Upazila Technical Implementation Working Group (U'TIWG). The N'TIWG also transformed project methodologies and procedures and adaptation options into an ongoing agriculture sector adaptation process. This group also took the lead in coordinating meetings as technical clearing house for the selection of adaptation options to be applied and demonstrated through the extension service on seasonal basis at farmer's fields. The clearing house meetings also involved representatives from DAE, the Upazilla Technical working group as well as from national research institutes such as BARI and BRRI and BMDA (see Fig 2).

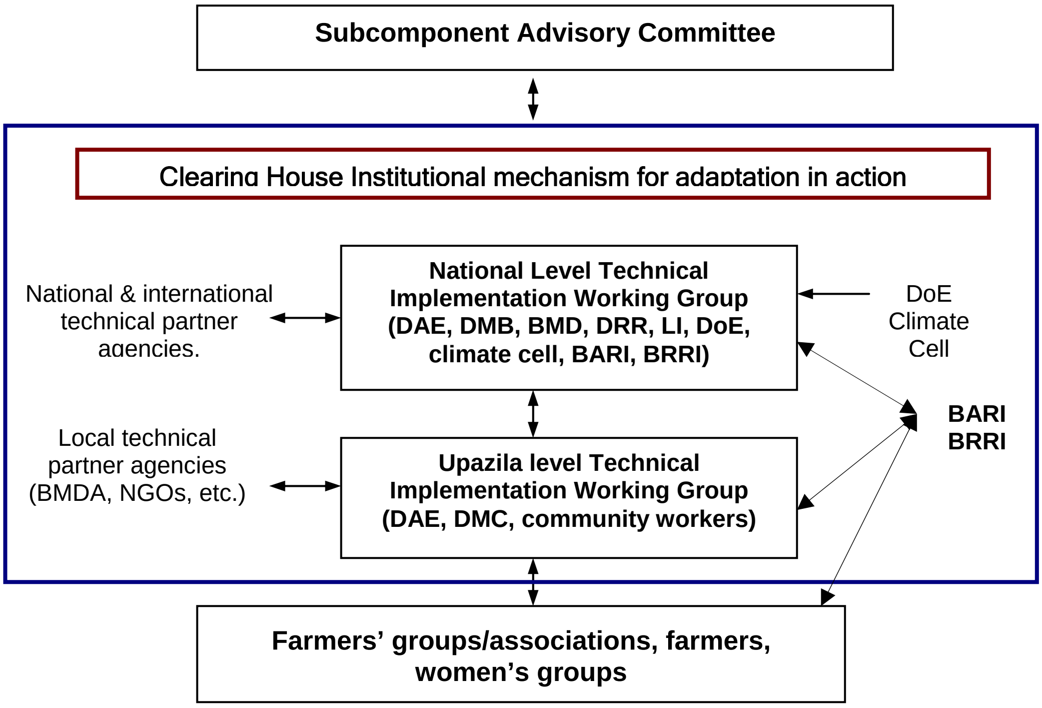


Fig.2. Institutional mechanisms for adaptation in action

The U'TIWGs are chaired by DAE and comprise representation from sectoral agencies of disaster management, agriculture, water resources management, and from selected grassroots groups such as local farmers associations. Non-governmental organizations were invited to collaborate with these groups. In addition, local Field Monitoring Officers (FMOs) were hired to facilitate working group activities in all selected upazillas. The inclusion of district level authorities in the U'TIWG ensured their active participation during the implementation process. The U'TIWG training to build technical capacity emphasized vulnerability assessment skills, and in interpreting, translating and communicating downscaled climate information on methodologies for transforming adaptation options into locally relevant and usable formats. They acted as a crucial link between local communities and the N'TIWG to facilitate the exchange of external and internal knowledge streams relevant for project implementation.

4.4 Establishment of end-to-end institutional system for forecast application

An end-to-end institutional system (Fig.3) was established to facilitate climate information flow from the national level to district and local community levels and back by involving Bangladesh Meteorological Department (BMD) and Department of Agricultural Extension (DAE).

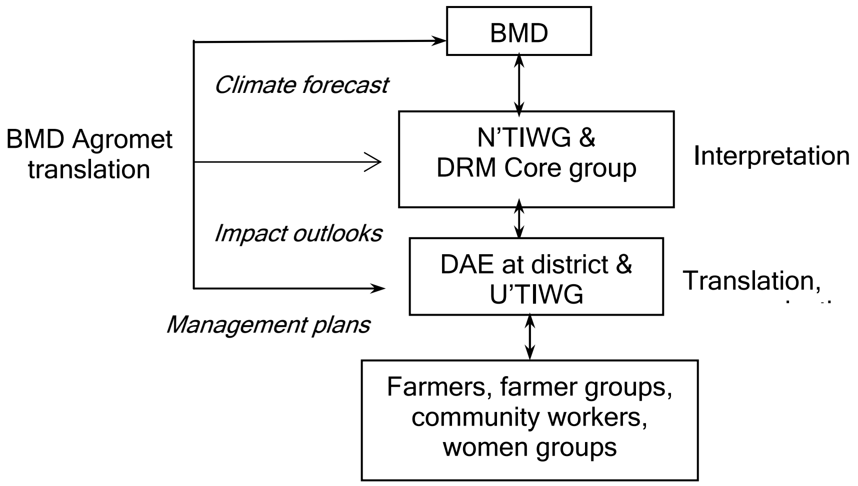


Fig. 3. End-to-end institutional system to facilitate climate information flow with feedback mechanism from national to local/community levels.

The National level Technical Implementation Working group and the core group established at DAE headquarters in Dhaka are the focal points for receiving climate information and climate change scenarios directly from the Bangladesh Meteorological Department (BMD) and the Department of Environment (DoE). The Climate Cell of DoE provides climate change scenarios by involving a network of national institutions. The National Level Technical Implementation Working Group (N'TIWG) and core group members are responsible for interpretation of climate information and to develop impact outlooks.

District level DAE staff and the Upazilla Technical Implementation Working Groups (U'TIWG) are responsible for the translation and communication of impact outlooks to the farmer groups and community workers, and the Upazilla level project implementation network under the Ministry of Food and Disaster Management (MoFDM). The Upazilla level Technical Implementation Working Group (U'TIWG) members were trained to develop location specific alternative management plans responsive to climate forecasts in general and impact outlooks in particular. The system is already in place and will be made functional during the second phase of the project.

The sub-component implementation working group members and the DAE-DRM core group members at Dhaka were introduced to various climate information providers at different scales ranging from global, regional to national. The forecast products developed at international forecasting centers were introduced to the sub-component implementation working groups and national disaster risk management core group members. Strategic linkages were established between the regional/national initiatives carried out through Climate Forecast Applications in Bangladesh (CFAB). All the products and scientific background of the forecasting systems were introduced to the sub-component implementation working group members during the training workshops. Efforts were also made to introduce the climate change scenarios developed by a network of national institutions coordinated by Climate Cell unit of Department of Environment (DoE), which has close linkages with CDMP.

4.5 Management Information System

A Management Information System (MIS) will be devised in the second phase of the LACC project to ensure a constant flow of information among various stakeholders. Throughout the process cycle, an information flow system, with feedback mechanisms was established to exchange experiences and monitor project implementation. It was proposed to have Information dissemination materials and annual feedback workshops to inform CDMP, the research community, civil society and policy makers about lessons learnt, adoption of livelihood adaptation options, and to promote discussions of local requirements for climate change information.

5. CAPACITY BUILDING

5.1 Training need assessments

Training need assessment sessions were organized with N'TIWG and DAE core group members in Dhaka, and another with about 50 Department of Agricultural Extension (DAE) Staff at Rajshahi in August 2005. In addition to the Director of the Rajshahi division, the Deputy Directors of Chapai Nowobganj and Naogaon districts participated in the sessions. The divisional level training needs assessment was combined with a brief training on weather observations and instrument maintenance.

The findings from the training needs underlined the importance for capacity building in the following areas: (a) Drought, drought types, drought impacts; (b) Climate variability and change; (c) Climate and climate change impacts in agriculture; (d) Climate forecast applications; (e) Existing and improved localized forecast products; (f) Preparation of impact outlooks and management plans; (g) Climate change and viable adaptation practices. The training needs assessment outcomes were quantified through participative discussions, brain storming sessions and group exercises.

5.2 Training strategy

The training programme strategy was embedded into the processes of the DAE's regular capacity building and extension works. The training approach was designed to be flexible so base information can be tailored to participants' needs. This flexible training strategy was recommended over a step-by-step prescribed approach. The overall format consists of sections on:

- setting goals and learning objectives,
- defining and highlighting key words and terminology,
- presenting principles and background information on individual topics, and

The approach also contains training activities with learning units (LUs) and exercises based on that module's content. The exercises exposed the participants to new concepts and skills, current risk management practices and future adaptation practices. The training materials include supplementary handouts as well as guidance for preparing:

- interactive lectures
- review sessions
- individual exercises
- group exercises and presentations

The training processes at various levels were initiated as a Training of Trainers (ToT) approach and started with a series of formal training events at all levels. The capacity building activities included formal training workshops, on-the-job training, and regular back stopping missions. The local community level (union level) training workshops were organized after ensuring community mobilization processes.

5.3 National level training workshops

5.3.1 Climate risks and climate forecast applications

A two days national level training workshop on “climate risks and climate forecast applications in drought prone areas of Bangladesh” was organized for the National level Technical Implementation Working Group Members (N’TIWG) at DAE at Head Quarters, Dhaka on 14-15 August, 2005. Sixteen N’TIWG members as well as representatives from the Department of Environment (DoE) and FAO attended the training workshop. The training curriculum included the following topics:

- Climate risk analysis tools and methods in pilot drought prone regions
- Climate and weather forecast products available with Bangladesh Meteorological Department
- Interpretation, translation and communication of probabilistic and uncertain climate information products available at national, regional and international forecasting organizations
- Inter-relationship of forecast products and locally available climate data
- Disaster calendars and local cropping systems in drought prone areas
- Preparation of agricultural sector impacts in response to forecasts

The training schedule was designed based on the brief and well targeted training need assessment with the National level Technical Implementation Working Group (N’TIWG) members. The training program included presentations, discussions and exercises. Resources persons were also drawn from Department of Agricultural Extension (DAE) and also Bangladesh Meteorological Department (BMD) to discuss about existing cropping systems and forecast products, respectively.

5.3.2 Options for livelihood adaptation to climate change in drought prone areas

The overall aim of the training workshop on “Livelihood Adaptation to Climate Change in Drought Prone Areas” was to improve the adaptive capacity to climate change for sustainable livelihoods in the agricultural sector through targeted capacity building for DAE, NTIWG and other stakeholders. The training cum validation workshop was organized at FAO conference room, FAO, Dhaka on 22-23 February, 2006. The objectives of the training workshop were to:

1. introduce the project activities to the participants and getting feedback.
2. discuss the climate change impacts in agriculture sector and to translate climate change model outputs into agricultural impacts
3. demonstrate climate risk analysis for pilot locations and to introduce probabilistic climate forecast information products.
4. introduce the livelihood adaptation practices and to evaluate them based on their relevance, economic feasibility and environmental friendliness.

Within the overall framework of project implementation, FAO partners had conducted before the workshop a climate change impact assessment and adaptation study which enabled documentation of viable local and improved adaptation practices to enhance the adaptive capacity of rural households against future climate change impacts. The adaptation options were evaluated at the workshop for their relevance, economic feasibility and environmental friendliness by the experts, representatives of research organizations and National Level Technical Implementation Group (N'TIWG) members through this training workshop.

During the training workshop it was emphasized that the proposed adaptation options are based on the detailed interaction held with local people in 12 pilot villages of drought prone districts (Chappai Nowobganj and Noagoan) and relevant project partners and local research organizations. The adaptation options served the basis for demand driven field demonstrations in the drought prone pilot villages of the project. Thirty two participants attended the training workshop representing following organization:

- Department of Agricultural Extension (DAE)
- Department of Livestock
- Department of Fisheries
- Department of Relief
- Department of Environment (DoE)
- Bangladesh Space Research and Remote Sensing Organisation (SPARSO)
- Bangladesh Meteorological Department (BMD)
- North South University
- Food and Agriculture Organisation (FAO)
- Comprehensive Disaster Management Program (CDMP)
- United Nations Development Program (UNDP)
- Bangladesh Agricultural Research Institute (BARI)
- Bangladesh Rice Research Institute (BRRI)

Major recommendations and suggestions made during the training workshop are listed in the workshop proceedings (Summary of the national level training workshop on *"Livelihood Adaptation to Climate Change in Drought Prone Areas of Bangladesh)*.

5.4 District and Upazilla level technical training workshops

One day training cum feedback workshop were organized jointly by ADPC and CEGIS with the Upazilla level Technical Implementation Working Groups (UTIWG) members at Chapai Nawabgonj and in Noagoan in mid 2005.The participants included Upazilla level technical implementation working group members, district level Agricultural Officers, Disaster Management Committee (DMC) members and farmer representatives. The purpose of the training workshops were to introduce the impacts of climate variability and future climate change in drought prone areas of Bangladesh and the pilot locations in particular. The workshop included presentations, discussions and small group exercises. A particular interest to the workshop in Naoagoan was to discuss the necessity of judicious water resource management under changing climate conditions.

Four follow-up workshops at Upazilla level were conducted in all the pilot upazillas (Gomestapur, Natchole, Porsha and Sapahar) on 6-7 December, 2005. The Upazilla level technical implementation working group members attended the workshop. The participants were introduced to drought adaptation practices documented from local farmers, Government organizations and research institutions. The participants gave their feedback about the suitability of adaptation practices for their pilot villages. Based on the discussions, adaptation options were screened and presented later at the National level validation workshop on 22-23 February, 2006.

A one day training follow up program was carried out with 52 Department of Agricultural Extension Officers of the Rajshahi division. The training was organized based on the interest from the Deputy Directors and Agricultural Officers of DAE. The training curriculum included the following titles:

- site selection for meteorological observatory

- Instrumentation and maintenance
- Observation of each weather elements
- Time of observation
- Recording and data base maintenance

5.5 Introductory seminars with Research Institutions

Bangladesh Agricultural Research Institute (BARI): Scientists at Bangladesh Agricultural Research Institute (BARI) at Rajshahi were informed about the project activities, approaches and methods of livelihood adaptation to climate change. Research works carried out *targeting the drought prone areas of Barind tract documented in the reports were introduced.* The viable adaptation options were carefully selected in consultation with the scientists of BARI. The following technologies were found most suitable for Barind tracts for demonstration in *kharif II* and *rabi* seasons.

- alternate rice based cropping systems incorporating pulses, oilseeds and vegetable
- technologies and varieties suitable for Chickpea cultivation during winter after harvest of *T. Aman* rice
- homestead gardening as a risk management strategy

Bangladesh Rice Research Institute (BRRI): Scientists of Bangladesh Rice Research Institute (BRRI) sub-station at Rajshahi were contacted and briefed about the project activities. The introductory seminar outlined the relevance of technologies developed in BRRI for livelihood adaptation to climate change. Based on the discussion, the local researchers come up with a list of viable technologies to manage future climate risks in drought prone areas. The following technologies were jointly selected by the project team and BRRI scientists:

- Short duration high temperature tolerant rice varieties for kharif II
- Intercropping rice in Mulberry for *kharif II*
- Direct sown wet seeded rice for *rabi (boro)*
- System of Rice Intensification (SRI) for *boro*

The institute has evaluated SRI technique in the farmers' field and found it suitable for *boro* season. However, it was advised to introduce the technology to the farmers as an adaptation option only after additional analysis. The project introduction seminars were organized on 8 December 2005. Subsequently the research institutes designed implemented technical training sessions on their own with farmers and extension workers in the context of introducing and monitoring the implementation of selected good adaptation practices at farmer's field level.

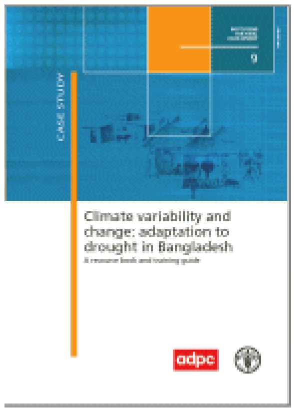
5.6 Newly Developed Training Materials

Training modules incorporating all relevant training needs of the National level Technical Implementation Working Groups (NTIWG) and Upazilla level Technical Implementation Working Groups (UTIWG) were developed:

- Module 1: Understanding climate variability and change
- Module 2: Drought and its impacts
- Module 3: Impacts of climate variability and change in drought prone areas
- Module 4: Climate risk assessment at community level in the agriculture sector
- Module 5: Agricultural adaptation options to climate variability and climate change
- Module 6: Climate forecast application to improve adaptive capacity

The training curriculum was evaluated during the structured training sessions with both national and upazilla level technical working groups in Bangladesh.

The resource book, *Climate variability and change: adaptation to drought in Bangladesh*, has been tested and prepared as a reference and guide for further training and capacity building of agricultural extension workers and development professionals to deal with climate change impacts and adaptation, using the example of drought-prone areas of Bangladesh. It also presents suggestions for a three-day training course that would be readily adaptable for any areas of Bangladesh affected by climate-related risks. The information presented on climate change adaptation would enable participants to prepare, demonstrate and implement location-specific adaptation practices and, thus, to improve the adaptive capacity of rural livelihoods to climate change in agriculture and allied sectors (http://www.fao.org/nr/clim/abst/clim_070901_en.htm).



The training modules developed under the FAO-TCP project "Strengthening Support to Disaster Preparedness in Agriculture Sector" in Bangladesh were also used. (http://www.fao.org/sd/dim_pe4/pe4_060201_en.htm)

6. INITIATION AND IMPLEMENTATION OF FIELD WORK

6.1 Baseline studies in the pilot site

The basic situation analysis was conducted by CEGIS and included the following major areas of study:

- Natural resource endowment including land, soils water and climatic parameters in the pilot areas
- Socio-economic situation in the pilot areas (including asset position and social networks),
- Main Livelihood strategies in the area and of vulnerable groups
- Presence and role of formal and informal institutions and their services for rural development in general and climate risk management in particular (if any)

- Livelihood profiling of vulnerable groups
- Local household level coping strategies of livelihood groups, and coping ranges of livelihood groups to climate impacts
- Socio-economic system response and feedbacks to droughts,
- Local perception about the droughts and impacts, including of past droughts
- Adaptation practices followed in the recent period under changed cropping patterns, and socio-economic characteristics,
- Local adaptation practices in the drought prone areas and societal acceptability to new ideas for adaptation practices

Findings in the study highlighted the good agricultural potential in the region, showing however also that in recent years, over exploitation of water resources has led to rapid fall in the ground water table (Fig. 4 source; CEGIS)). The decadal average ground water depth from surface showed a steep decline during the past 25 years from 1981. The decline was steep during summer coinciding with boro season. Local adaptations to current climate variability are practiced to some extent among farmers in the study area and were categorized as: a) traditional, locally managed responses (e.g. pond and *dighi* excavation, retention of rainwater in *khari* and canals, shedding, tillage, breaking top soil), b) state supported responses (e.g. deep tube well facilitated irrigation), c) alternative innovative responses (e.g. adoption of mango farming, orchard developing, alternative livestock and poultry/birds rearing).

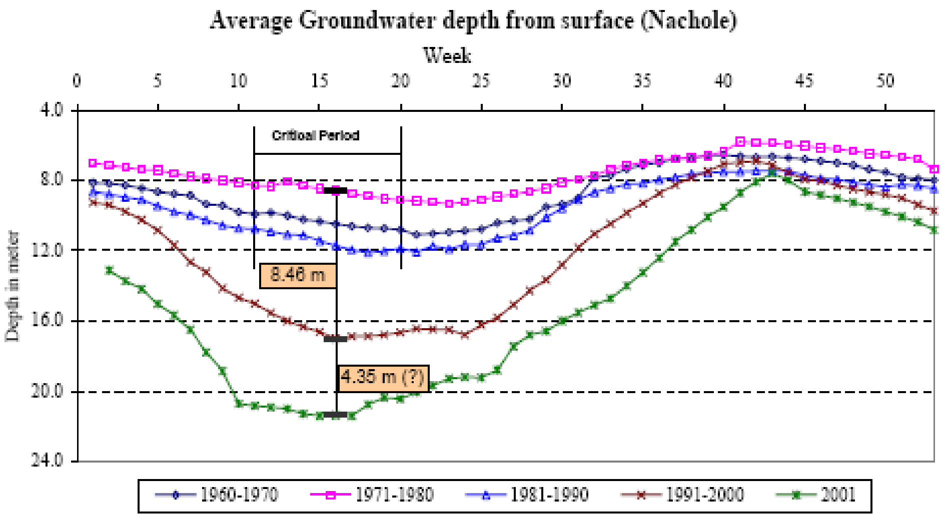


Fig.4. Average ground water depth from the surface

Several institutions including government agencies, NGOs, social, informal and private institutions as well as farmers/water user groups are operating in the area. The different agent's roles, capacities and know-how for dealing with climatic risks differ largely. With its formal mandates to provide deep tube well irrigation the Barind Multipurpose Development Agency (BMDA) is playing a lead role but pays little attention to areas where ground water is not accessible. Local-level disaster management committees officially existed, but their capacity was limited and thus local capacity building activities were carried out.

The main rural livelihood groups in the project are: wage laborers (41%); small and marginal farmers (32.4%); petty traders/ businessmen (7%); large farmers (6.9%); fishers (0.4 %) and others. Wage laborer face unemployment and crises of failed migration, petty traders lack regular customers. Large businessmen and large farmers were found to be less vulnerable due to better access to financial, social and physical assets. The relative proportion of the livelihood activities of the farmers differed between non-irrigated and irrigated areas (Fig. 5). In general cropping was a major livelihood activity among farmers irrespective of their category.

The full study is available under
(http://www.fao.org/sd/dim_pe4/pe4_060701_en.htm

BOX 1. Vulnerable groups profiling and livelihood system assessment

The study was carried out in the pilot upazilas of two districts - Chapai Nawabganj and Naogaon – of the northern Bangladesh. Geophysically the area is highly vulnerable to drought, and excessive evapo-transpiration has been an added phenomenon.

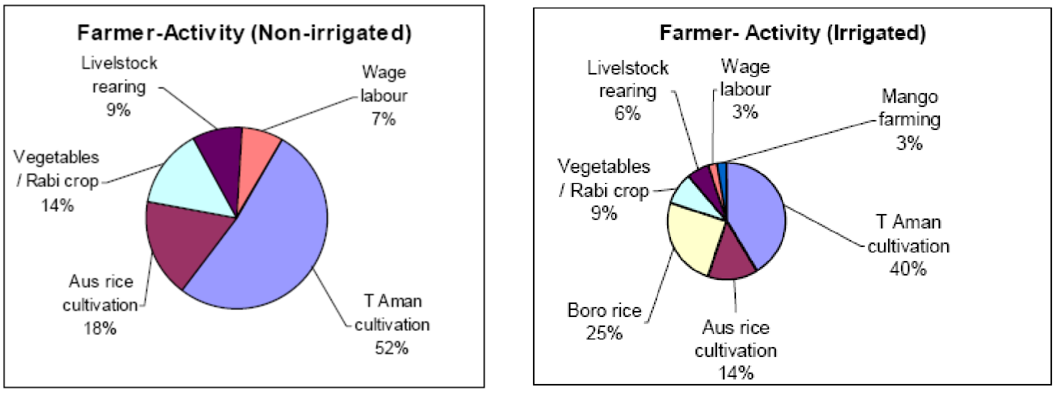


Fig. 4. Proportion of livelihood activities among the farmers in non-irrigated and irrigated areas in the drought prone areas.

The study found that both, the climatic conditions and the anthropogenic factors are contributing towards the vulnerability of livelihoods. Climatic factors are unfavorable and natural hazards strike regularly, but limited local capacities and capabilities and the (non)-access to various forms of livelihood assets represent major threats.. The most important vulnerable groups are small and marginal farmers as well as wage labourers. The state-oriented adaptive responses help in reducing vulnerabilities, but it is the local settings and physio-graphic situation that do not allow for recovery from climatic hazards. The state supported supplementary irrigation facilities to reduce the impact of drought to some extent. The study has identified some local practices and perceptions towards risk management in the pilot areas.

Additionally, it was also observed that the lack of awareness and the lack of knowledge for alternative adaptive responses led to vulnerability. It was found that several adaptive practices or coping measures are regularly considered by the farmers, but the relative success to overcome drought was limited. In this situation, the adaptive capacities of the people were improved through identification of effective adaptation measures.

After consulting with the local people and professionals it was decided for the purpose of project interventions that the farmer category would not be broken down into various sub-groups since in the study area all the farmers are vulnerable to the climatic and non-climatic risks. The fishers in the area were not included as a separate target group since the number of fishing households is very limited in the project area. However, fishing was a complementary activity to cropping within other livelihood groups.

A second in-depth baseline study to assess of current vulnerability, local perceptions of risks, future vulnerability and climate change impacts was conducted by ADPC, which highlighted among other factors the following findings.

Current risks and local perceptions: Understanding current risks and local community perception are the crucial pre-requisite for integrating climate change adaptation with DRM. Local people in the study area perceive current climate as being different to the past. The seasonal cycle has changed, droughts have become more frequent, pest and disease incidences increased, average temperature has increased in the summer while winter has shortened. Local people in the study area also perceive that their boro, aus (rice), winter vegetable and fruit (mangoes) production are affected by increased rainfall variations, temperature and drought. The observed data also showed higher variability in rainfall pattern and increased temperature trends over the last 5 decades (Fig.6 & 7; Data source: BMD, 2007).

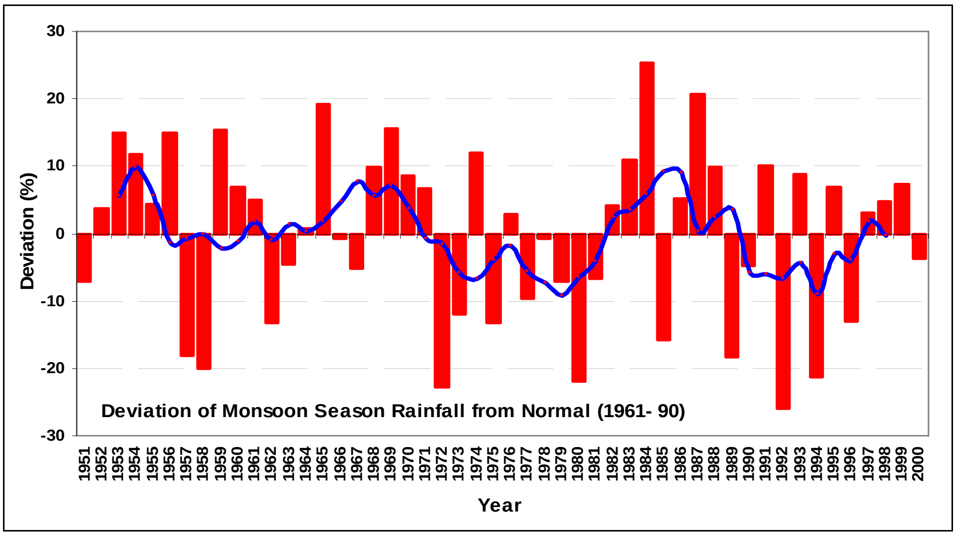


Fig.6. Deviation of monsoon season rainfall from normal (1961 – 90)

Future risks and vulnerabilities: Global Circulation Model (GCM) projections for Bangladesh indicate an average temperature increase of 1.3º C and 2.6º C by 2030 and 2070, respectively. Though monsoon precipitation is likely to increase by 27% until 2070,

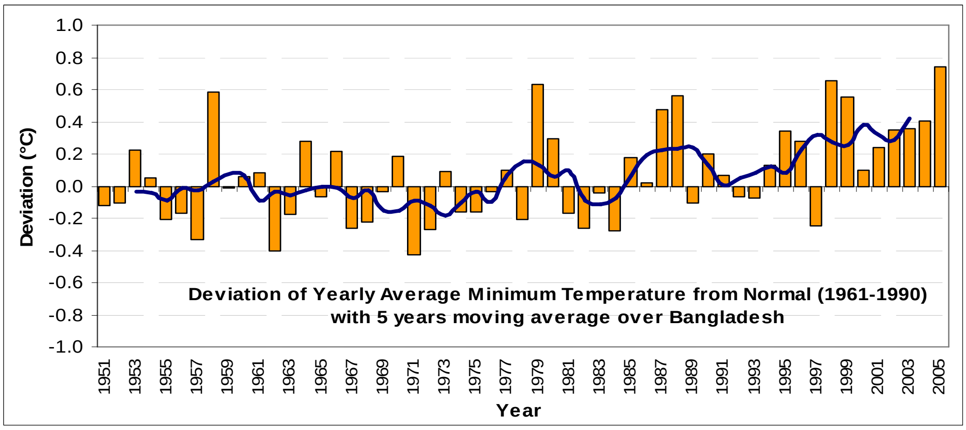


Fig. 7. Deviation of yearly average minimum temperature from normal (1961 - 1990)

precipitation distribution patterns over the plant growing period, higher temperature and higher rates of evapotranspiration would create further water stress conditions and declines in vegetation and agricultural production in the drought prone areas. A continued trend towards more frequent and intensive natural hazards is expected as result of increasing climate variability and climate change. Water deficits of around 400-500 mm may occur during the dry months of the year. Groundwater depletion is increasing since the early eighties, corresponding with large scale exploitation for irrigation. The study confirmed the assumption that the livelihood groups with more livelihood assets and institutional support are less vulnerable to climate risks. Limited access to deep tube well water in the non-irrigated areas and the occurrence of several anthropogenic factors (e.g. electricity failure, high price of agricultural input) are the main forms of perceived vulnerability of farmers.

The two studies conducted by CEGIS and ADPC indicated both that the climatic conditions and anthropogenic factors mutually reinforce the chronic vulnerability of livelihoods in rural areas. Successful local level adaptation to climate variability and change required multiple pathways of well-planned and interrelated short-term and long-term measures including:

◊ physical adaptive measures (e.g. link canals, irrigation, storage facilities for retaining water; drainage);
◊ adjustment of existing agricultural practices (e.g. adjustment of cropping pattern, selection of adapted varieties of crops; better storage of seeds and fodder; floating seed beds; switch to alternative crops (e.g. adoption of mango as cash crop),
◊ socio-economic adjustments (livelihood diversification, migration, market facilitation);
◊ strengthening of community resilience including local institutions and self help capacities;
◊ strengthening formal institutional structures and environment;
◊ policy formulation to catalyze enhancement of adaptive livelihood opportunities;
◊ awareness creation and advocacy on climate change and adaptation issues;
◊ better research, on-farm links to test new/improved crops (e.g. drought tolerant and low irrigation varieties/crops selection), and other conducive and adaptive technologies.

Adaptation to reduce the vulnerability of agriculture and allied sectors to the impacts of climate change requires coordinated actions, proper planning, financial resources and community involvement.

6.2 Social mobilization and Community empowerment

Local communities adopt coping and survival strategies to prepare for and/or respond to risk situations in any case and long before any outside assistance may come or not. Having experienced damage and loss, they are interested in protecting themselves from climate risks through community based disaster preparedness and mitigation. However, community empowerment towards the use of technologies and viable adaptation practices for better managing climate change risks are essential components for further improvements of livelihood adaptation and enhanced community resilience. The project encouraged local communities to establish their own learning and action platforms to better understand and diagnose social issues that play a catalytic role for mainstreaming and up-scaling of climate risk management and potential adaptation options.

The entry point for discussion with communities was the consensus that a broader range of adaptation options offers value added to the existing coping strategies at the community level. The process of social mobilization appeared as essential and effective to motivate farmers and farmer's groups to collaborate in a more organized way, catalyzing interest and awareness about climate variability and change and their impact on agriculture, as well as to mobilize self initiative to find out and implement adaptation options locally. The process encourages community groups to develop relations with other stakeholders in order to gain technological assistance, administrative backup and other need based supports.