CHAPTER 1

INTRODUCTION

Devastating and recurrent droughts caused by varying rainfall patterns occur frequently in many parts of Bangladesh, causing substantial damage and loss to agriculture and allied sectors. Drought impact, associated with late or early monsoon rains or even complete failure of monsoon, spreads over a large geographical area – much larger than areas affected by other natural hazards. Bangladesh experienced major droughts in 1973, 1978-79, 1981-82, 1989, 1992 and 1994-95.

The foodgrain production lost in the 1978-79 drought was probably 50 to 100 percent more than was lost in the great flood of 1974, showing that drought can be as devastating as a major flood or cyclone (Paul, 1998). Foodgrain off-take through the ration and relief systems averaged 227 000 tonnes per month in June to November 1979, compared to 169 000 tonnes per month from June to November 1974. Rice, jute and other crops were greatly affected although jute suffered the most because of lack of water for retting. Livestock also suffered, with many farmers having to sell their cattle at distress prices because they lacked fodder or needed cash to buy food which had increased in price because of scarcity. The widespread human distress resulting from reduced crops, reduced employment and incomes, and increased food prices was considerable. The droughts of 1994-95 in the northwestern districts of Bangladesh led to a 3.5 million tonnes shortfall of rice and wheat production.

Drought can affect the rice crop in three different seasons, which accounts for more than 80 percent of the total cultivated area in the country. Droughts in March and April prevent timely land preparation and ploughing, delaying planting of crops during monsoon season. Inadequate rains in July and August delay transplantation of *aman* in highland areas, while droughts in September and October reduce yields of both broadcast and transplanted *aman* and delay sowing of pulses and potatoes. *Boro*, wheat and other crops grown in the dry season (summer) are also periodically affected by drought.

Increased climate variability means additional threats to drought-prone environments and is considered a major crop production risk factor. It forces farmers to depend on low-input and low-risk technologies, leaving them unable to adopt new technologies that would allow them to derive maximum gains during favorable seasons and less able to recover quickly after disasters. Increasing climate risks undermine development and poverty reduction efforts in drought-prone areas. Future climate variability and change will aggravate these problems even more in drought-prone environments.

The impact of climate variability and change on agricultural production is a global concern. However, the impact is particularly important in Bangladesh where agriculture is the largest sector of economy, accounting for some 35 percent of GDP and 63 percent of the labour force. Agriculture in Bangladesh is already under pressure from increasing demands for food and the parallel problems of depletion of agricultural land and water resources from overuse and contamination. Climate variability and projected global climate change makes the issue particularly urgent.

Adaptation to climate change is one of the approaches considered likely to reduce the impacts of long-term changes in climate variables. Adaptation is a process by which strategies to moderate and cope with the consequences of climate change, including climate variability, can be enhanced, developed and implemented (UNDP, 2004). Obviously, many countries already are adapting to current climatic events at national, provincial, state, district and local levels in short-, medium- and long-term time frames.

However, in the past, many structural, physical and institutional adaptation mechanisms, implemented through conventional top-down approaches, lacked community participation and livelihood focus. Appropriate adaptation strategies also require balancing the need to reduce climate change impact with any constraints in national policy-making processes.

In order to increase resilience at all levels and reduce damage and losses from natural disasters, in 2003, the Government of Bangladesh approved the Comprehensive Disaster Management Programme (CDMP) as a key strategy to advance government and agency risk reduction efforts in the country. The CDMP follows a strategic institutional and programming approach to address risks associated with climate variability and change.

CDMP is designed to optimize the reduction of long-term risk and to strengthen the operational capacities for responding to, and recovering from, emergencies and disasters. Efforts to reduce vulnerability to long-term climate change have included livelihood adaptation strategies in the agricultural and allied sectors, particularly for women and poor communities with the lowest capacities to adapt.

Within the broader framework of climate change adaptation, this report looks at past drought impacts, local perceptions of droughts, anticipated climate change and its related impacts, and viable adaptation options for drought-prone areas of Bangladesh. This includes assessment of current vulnerability, coping strategies and future climate-related risks and adaptation strategies.

Considering this framework for action, the Food and Agricultural Organization (FAO) of United Nations is assisting the Government of Bangladesh and other key stakeholders in designing and promoting livelihood adaptation strategies in the agricultural sector that may help reduce vulnerability to climate change, particularly among women and poor communities. ADPC has conducted a climate change impact assessment and adaptation study that also demonstrates viable adaptation practices to improve the adaptive capacity of the rural livelihoods. The outputs and deliverables of this effort include:

- survey of climate impacts and local perceptions of climate hazards including assessment and analysis of capacities and coping strategies;
- increased understanding of the effect of drought on agriculture and allied sectors;
- analysis of climate analogues and climate change model outputs;
- documentation of viable adaptation practices and options for livelihood adaptation; and
- development of extension materials and awareness-raising methods.

This report is based on detailed interaction with all project partners and stakeholders at all levels and an extensive literature review. It is meant to serve as a basis for understanding drought impacts and to demonstrate viable adaptation options in the drought-prone areas of Northwest Bangladesh.

CHAPTER 2

DESCRIPTION OF STUDY AREA

A study on assessment of climate change impacts and livelihood adaptation in drought-prone areas was conducted in two pilot districts of Northwest Bangladesh. This chapter presents a brief description of the pilot *zillas* and *upazillas* (districts and sub districts).

The pilot locations, situated in Northwest Bangladesh, include the drought-prone districts of Chapai Nawabganj (Fig.1) and Naogaon (Fig. 2). The western part of Bangladesh borders West Bengal, India.

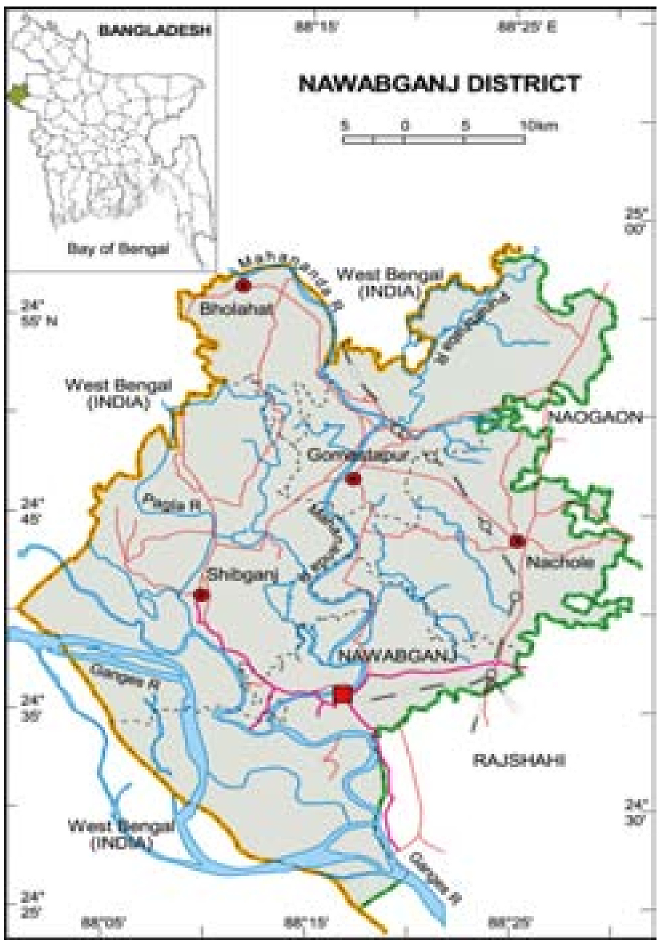

Fig.1. Location map of Chapai Nawabganj district in Northwest Bangladesh

2.1 Chapai Nawabganj District

Chapai Nawabganj district (Fig.1) has an area of 1 744.3 km^2 and a population of 1.42 million (50.1 percent male and 49.9 percent female). Located in the Barind Tract, its main rivers are the Ganges, Mahannda, Pagla, Moraganga and Punarbhaba. Average literacy rate is 35.9 percent and the main occupations are farming, commerce, service, agricultural labour, wage labour and construction. Among the farmers, 35 percent are landless, 34 percent marginal, 27 percent medium and 4 percent are big. Main crops of the district are paddy, jute, sugarcane, wheat, betel leaf, oil seed and pulses. Main fruits are mango, jackfruit, litchi, blackberry and palm. The manufacturing industries include a silk mill, textile mill and cold storage operation. Cottage industries include silk, weaving, copper, bell-metal and brass works; decorated *shika* (hanging rope shelves); pottery; hand fans; bamboo and cane works (BBS, 2005a).

2.1.1 Gomastapur Upazilla

Gomestapur Upazilla of Chapai Nawabganj district has an area of 318.1 km^2 and population of 240 123 (50.6 percent male, 49.4 percent female). Noted rivers are Mahananda and Punarbhaba. Main occupations are farming, fishing, agricultural labour, wage labour, weaving, commerce, service and others. Main crops are paddy, potato, wheat, tomato, corn, onion and garlic. Main fruits are mango and jackfruit with the nation's largest mango market located at Rohanpur. Fisheries, dairies and poultry units are also present. There are bakeries and an ice factory as well as cottage industries for weaving, bamboo working, goldsmithing, blacksmithing, pottery, woodworking, manual oil grinding and welding. NGOs operating in the area include CARITAS, PROSHIKA, BRAC and the Grameen Bank. The three villages selected for the project implementation include Baradapur and Malpur (non-irrigated) and Prosadpur (irrigated).

2.1.2 Nachole Upazilla

Nachole Upazilla in Chapai Nawabganj district has an area of 283.7 km^2 and a population of 132 308. Its main rivers are Mahananda, Lakshmikol, Aisha, Itail and Hazardighi. Main occupations are farming, agricultural labour, wage labour, commerce, service and others. Main crops are paddy, wheat, pulses and vegetables. Main fruits are mango, jackfruit, litchi, blackberry and palm. Fisheries, dairies and poultry units are present as are cottage industries for pottery and bamboo work. NGOs operating in the area include BRAC, PROSHIKA, CARITAS and Bangladesh Islamic Youth Society. The three villages selected for the project implementation include Azoir, Basbaria (non-irrigated) and Shiala (irrigated).

2.2 Naogaon District

Naogaon district (Fig.2) has an area of 3 435.67 km^2 and a population of 2.39 million (50.7 percent male and 49.3 percent female). Its main rivers are Atrai, Punarbhaba, little Jamuna, Nagar, Chiri and Tulsi Ganga. Guta, Mansur and Dighali *beels* are notable. Main occupations include agriculture, fishing, agricultural labour, wage labour, commerce, service and others. Main crops are paddy, potato, watermelon, oil seeds and pulses. Fruit production is dominated by mango, jackfruit, banana and litchi. Manufacturing activities include a rice and husking mill, ice factory, flour mill, oil mill, sawmill and welding. The cottage industries are goldsmith, pottery, bamboo and mat work and tailoring (BBS, 2005b).

2.2.1 Porsha Upazilla

Porsha Upazilla in Naogaon district has an area of 252.8 km^2 with a population of 121 809 (50.2 percent male, 49.8 percent female). Rivers are the Shiba which creates the eastern boundary and the Punarbhava. Main occupations include farming, agricultural labour, wage labour, commerce, service and others. Main crops are paddy, wheat and mustard. Main fruits are mango, jackfruit, litchi and watermelon. Manufacturing includes a rice mill and flour mill and cottage industries include bamboo work, goldsmithing, blacksmithing, pottery, woodworking, welding and sewing. Important NGOs are CARITAS, BRAC, CARE, PROSHIKA and Barendra Prakalpa. The three villages selected for project implementation are Saharandha and Chhaor (non-irrigated) and Shavapur (irrigated).

Fig.2. Location of map of Naogaon district in northwestern Bangladesh

2.2.2 Sapahar Upazilla

Sapahar Upazilla of Naogaon district has an area of 244.5 km^2 and population of 143 853. Its main river is Punarbhaba and the main occupations are farming, agricultural labour, wage labour, commerce, service and others. Main crops are paddy, wheat and mustard. Main fruits are mango, jackfruit, banana and papaya. Manufacturing includes a flour mill and rice mill, and cottage industries are bamboo work, goldsmithing, pottery, woodwork, and welding. The NGOs operating locally are BRAC, ASA, PROSHIKA, Ujjban, CARITAS and Varendra Prokalpa. The three villages selected for project implementation include Basuldanga and Bahapur (non-irrigated) and Chachahar (irrigated).

CHAPTER 3

CONCEPTUAL FRAMEWORK AND METHODOLOGY

3.1 Definition of key concepts

This section defines the concepts and terms used in climate change impact assessments and adaptation menus for drought risk management. Definitions for some terms, such as vulnerability and risk, vary among disciplines and contexts. In these cases, broad definitions are provided along with alternative definitions where applicable (IPCC, 2001; UNDP, 2004)**.**

Adaptation: A process by which strategies to moderate, cope with, and take advantage of the consequences of climate events are enhanced, developed and implemented.

Adaptation baseline: Current climate adaptations that are already in place.

Adaptive capacity: The ability of a system to adjust its characteristics or behaviour in order to expand its coping range under existing climate variability or future climatic conditions. There is a difference between "adaptive potential", which is a theoretical upper limit of responses based on expertise and anticipated developments within the planning horizon of the assessment, and "adaptive capacity," which is existing information, technology and resources of the system under consideration.

Climate change: Any change in climate over time, whether due to natural variability or human activity.

Climate change vulnerability: The degree to which a system is susceptible to, or unable to cope with, the adverse effects of climate change, including climate variability and extremes.

Climate variability: Variations in the mean state and other statistics (such as standard deviations) of the climate on all temporal and spatial scales. Variability includes more than individual weather events and may result from natural internal processes within the climate system (internal variability) or to variations in natural or anthropogenic external forces (external variability).

Coping range: The range of climates where the outcomes are beneficial or negative but tolerable. Beyond the coping range, the damages or losses are no longer tolerable and a society is said to be vulnerable.

Risk: The result of the interaction of physically defined hazards with the properties of the exposed systems, i.e. sensitivity or vulnerability. Risk can also be from the combination of an event, its likelihood and its consequences. Risk equals the probability of climate hazard multiplied by a given system's vulnerability.

Scenario: A plausible and often simplified description of how the future may develop based on a coherent and internally consistent set of assumptions about driving forces and key relationships. Scenarios may be derived from projections, but are often based on additional information from other sources, sometimes combined with a narrative storyline.

Socio-economic vulnerability: An aggregate measure of human welfare that integrates environmental, social, economic and political exposure to a range of harmful perturbations.

Stakeholders: Those who have interest in a particular decision, either as individuals or as representatives of a group. This includes people who influence a decision as well as those affected by it.

Vulnerability: The degree to which a unit is susceptible to harm due to exposure to a perturbation or stress, and the ability of the exposure unit to cope, recover or fundamentally adapt. It can also be considered the underlying exposure to damaging shocks, perturbations or stresses, rather than the probability or projected incidence of those shocks themselves.

3.2 Conceptual framework

3.2.1 Adaptive Capacity for climate variability and change in drought-prone areas

Future climate variability and change may increase the frequency of drought and thus reduce the coping range and adaptive capacity of the vulnerable population in drought-prone areas of Bangladesh. Figure 3, a hypothetical example, illustrates how a coping range is breached under climate change if the ability to cope is held constant. If that range is represented in terms of rainfall, the upper wet (Y1) baseline or reference threshold is exceeded less frequently, while exceeding of the lower threshold (or dry conditions) increases over time (Selvaraju, 2003). Vulnerability will increase to extreme levels for the dry threshold over time. Rainfall during the baseline climate that is experienced now is more or less stable with the mean (Y). With changing climate, however, rainfall tends to reduce gradually and frequency of drought (below Y2) increases.

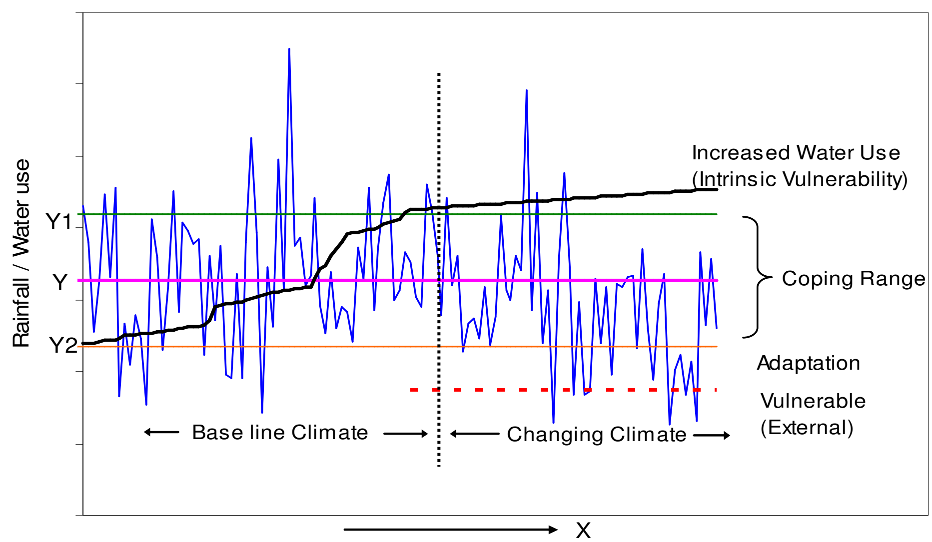

Fig. 3. A hypothetical diagram focusing on social pressure and bio-physical system performance describing the relationship among climate change, coping range, vulnerability and adaptation in drought-prone areas.

Applying this to Bangladesh, the fact that cropping intensity is also increasing in the drought-prone Barind Tract indicates there may be increased water requirements in the future. There are two factors contributing to increased vulnerability: i) higher frequency of droughts and dry spells that may affect the agriculture sector negatively, and ii) higher water requirements in the agricultural system as a whole due to increased cropping intensity. That means low rainfall and increased evapotranspiration may further aggravate the current situation in a region that is already drought prone.

The rainfall amount often exceeds the lower (dry) threshold and thus breaches the existing coping range. Once the coping range is breached, a vulnerable population has difficulty adjusting to that low level of rainfall. However, it is possible to expand the coping range through introducing novel and stable adaptation practices that could improve the adaptive capacity of the rural livelihoods in drought-prone areas. Adaptation practices can reduce vulnerability of the exposed bio-physical systems in general – the rural population in particular – with a consequent reduction in vulnerability. The nature of adaptation required depends on the planning horizon under assessment and the likelihood of exceeding given criteria over that planning horizon.

The coping range can also be used to explore how climate and coping ability may interact over time. For example, an agricultural assessment that projects growth in technology, yield and income would broaden the coping range and also could determine whether these changes would be adequate to cope with projected climate changes.

3.2.2 Climate variability and change and livelihoods

Based on the theoretical insights discussed above, a model was developed to implement adaptation to climate variability and change with an overall aim to improve the adaptive capacity of the rural livelihoods in agriculture sector (Fig.4).

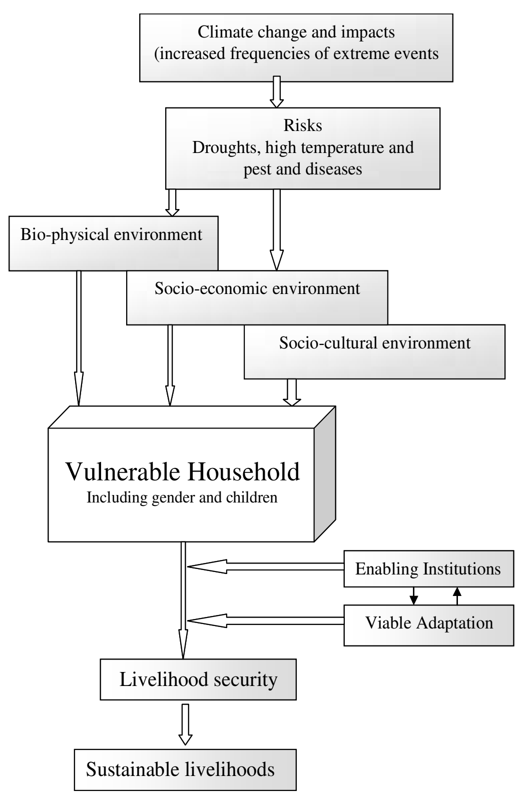

Fig.4. Conceptual framework for improving livelihood security and sustainable livelihoods through adaptation to climate change

Figure 4 shows how different environmental factors together with risk factors influence household livelihood strategies and decision-making processes over time, taking the role of gender and other vulnerable populations into account. At the center of the model are the households, where strategies are developed and decisions taken to develop and maintain livelihoods by means of the livelihood portfolio. Looking at the model from a systems perspective, climate change could influence the bio-physical (agriculture), socio-cultural and socio-economic environments of households, impacting resources and assets, including social capital. The resource management strategies and decision-making potential of the local population is also affected. The fact that coping range drops significantly under climate change is one of the reasons that improving adaptive capacity to maintain or improve livelihood security is one of the core aims of this effort.

3.2.3 Components of climate change adaptation

Designing and implementing livelihood adaptation to climate change in drought-prone areas is well within the policy of the Government of Bangladesh. The Comprehensive Disaster Management Programme (CDMP) recognizes the risks associated with climate variability and change. It seeks to establish 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 that have the lowest capacity to adapt. In terms of the national policies related to climate change adaptation, the following strategy elements, to be read from the bottom upwards but not implemented in a rigid time sequence, can be used to form an overall strategy implementation plan (Fig.5)

(i) Assessing current vulnerability – involves responding to several questions, such as: Where does this society stand today 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 major steps to address these questions are:

- assess natural, socio-economic conditions,
- assess current climate risks,
- assess local perceptions about climate risks and impacts,
- document livelihood profiles in the pilot sites,
- assess institutional frameworks.

(ii) Assessing future climate risks – focuses on developing scenarios of future climate, vulnerability and environmental trends as a basis for considering future climate risks. The major processes involved are:

- Climate impact assessment & outlooks on agriculture
- Local agro-meteorological data collection and monitoring
- Downscaling climate change scenarios

(iii) Testing adaptation options - involves the identification and selection of viable adaptation options and the further formulation of these options into farmer-friendly adaptation menus; thereafter the testing and evaluating, with the goal of improving the adaptation options identified through stakeholder consultations. The major steps of this component are:

- Institutional and technical capacity building
- Developing adaptation options & extension strategy
- Validation and selection of adaptation options
- Community mobilization and local awareness raising

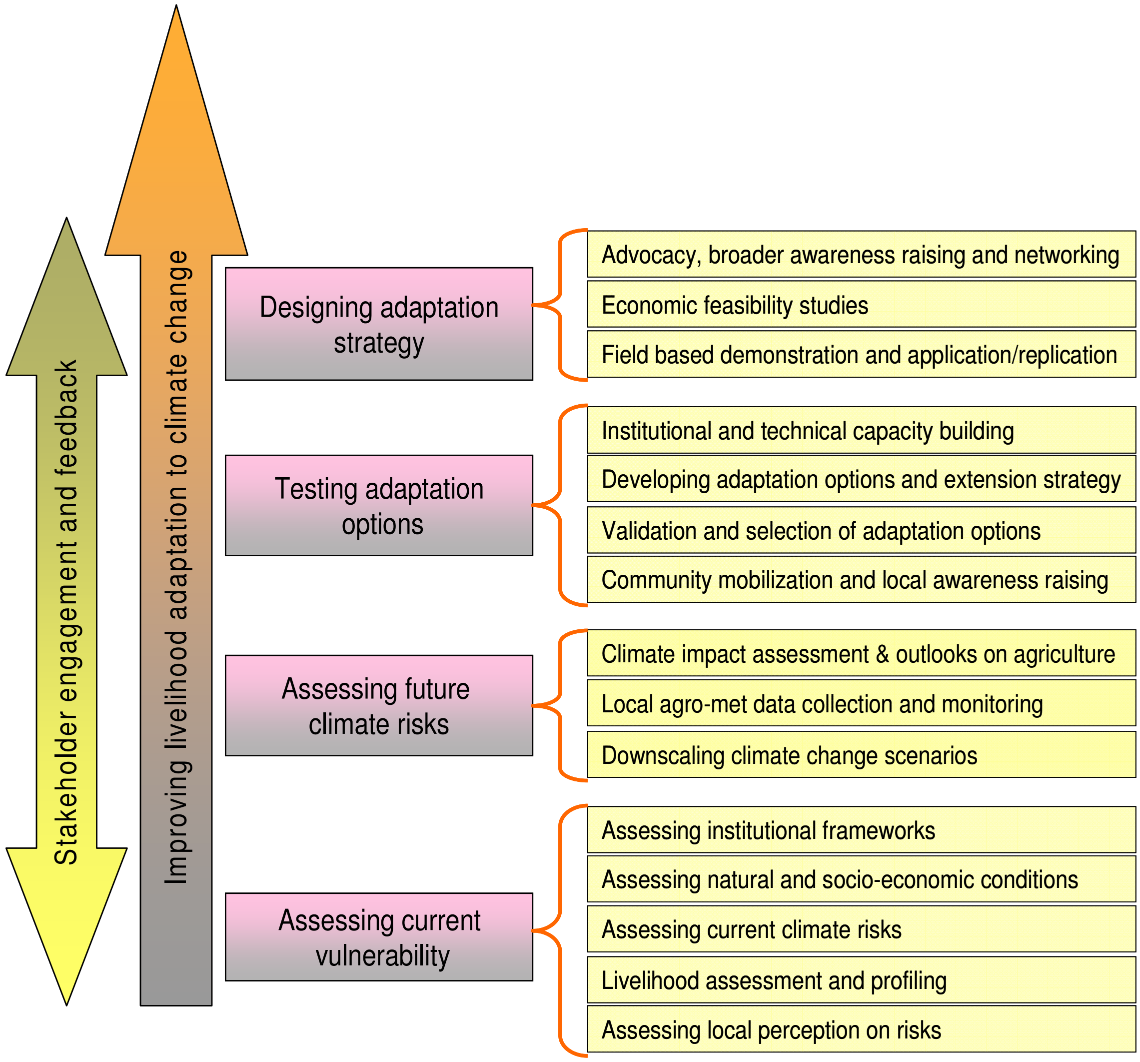

Fig.5. Operationalizing strategy and processes for livelihood adaptation to climate variability and change in drought-prone areas of Bangladesh.

(iv) Design adaptation strategy – prepares for broader dissemination and replication of successful field testing of adaptation options to current vulnerability and future climate risks. The key steps followed under this section are:

- Advocacy, broader awareness raising and networking
- Economic feasibility studies
- Field-based demonstration & application/replication

3.3. Development of an adaptation options menu

An adaptation options menu can identify viable options for managing climate risks (in this case drought-related). It synthesizes adaptation practices that could catalyze long-term adaptation processes. The four major steps for developing the tool, presented in Figure 6, are:

i) identify locally available and new research based on improved adaptation options,
ii) analyse above adaptation options based on their constraints and opportunities,
iii) validate and prioritize adaptation options against a set of key criteria, and
iv) consolidate the most suitable options into an adaptation options menu.

These steps fall well within the overall adaptation policy framework proposed for the country as a whole. Determining the viable adaptation options actually creates a menu of adaptation options with recommendations for the development planning process and its potential integration into the existing institutional agenda. The adaptation option menu provides input and catalysts for field-level demonstrations of viable adaptation options with the potential to improve the adaptive capacity of rural livelihoods to climate change.

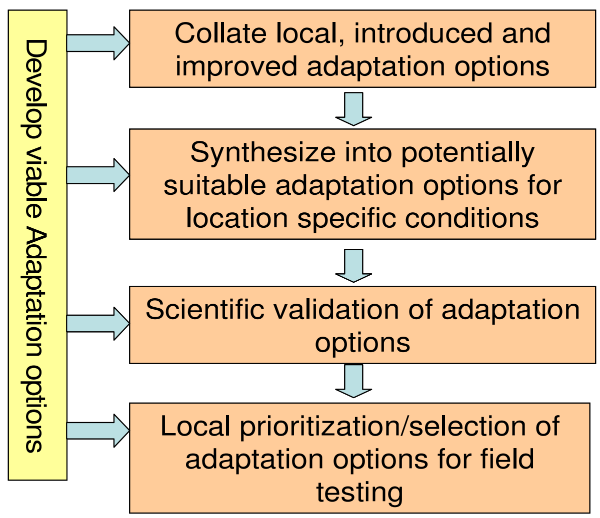

Fig.6. Sequential tasks in designing viable adaptation options for drought-prone areas

The strategy for adapting to climate variability and change impacts and awareness raising has been categorized as:

- recognition of local knowledge and existing adaptation strategies,
- establishment of an institutional framework through which local adaptation strategies can be reviewed, verified and integrated into the mainstream of resource management,
- documentation of all coping and adaptation strategies to provide a basis for the future,
- creation of mass awareness of climate variability at grassroots level, through government and non-governmental intervention and provision of essential support such as information, technology, technical know-how, alternative sources of income and employment, credit facilities, health facilities and markets information, and
- dissemination of all awareness messages in local language.

3.4 Methodology

3.4.1 General approaches

A three-stage methodology was used for assessing climate variability and change in the agriculture sector with special emphasis on livelihoods at the selected pilot study locations. The stages include the following:

1. Document local perceptions of impacts. This stage employed participatory methodology to collect perceptive information from various village-level stakeholders.
2. Analyse past climate data to understand the risks in relation to rainfall variation and dry and wet spells. At this stage, analogues of extremes and magnitudes matched with secondary data collected from other sources (including DAE) provided understanding of the magnitude of past impacts.
3. Employ a climate modeling approach to understand the future climate change scenario for the pilot study locations. This stage looked at the climatic parameters most relevant to the agriculture sector such as rainfall and temperature. Downscaling procedures were followed to develop climate change model outputs and scenarios. This allowed estimates of potential climate impacts to be based on both the model scenarios and local understanding.

Documentation of local agricultural adaptation practices, defined through participatory approaches, was integrated into documentation of local perceptions from similar areas in the region (as identified in Stage 1) and then evaluated in collaboration with other relevant national institutions identified by the project. The national institutions were encouraged to organize field demonstrations that would show the potential effectiveness of the adaptation practices.

Guidance and collaboration were provided to the national research and extension institutions to develop technically viable agricultural practice menus based on local conditions such as climatic and non-climatic risks. Guidance was also given to transform potentially viable adaptation options into farmer-friendly extension tools and messages for dissemination through small workshops, leaflets and other mass media.

The approach has been institutionalized by maintaining the collaboration and involvement of various international, national and local institutions through constant input to the Sub-Component Manager (SCM) attached to the DAE. Strong linkages with cooperating partners such as the Department of Environment (DoE) and the United Nations Development Programme (UNDP) have been maintained throughout the project. Regular exchange of ideas took place with the Climate Change Cell at DoE and other related CDMP components.

3.4.2 Methods and tools

The approaches outlined above required a well established methodology to assess the impact of past and current climate hazards[1] in the agriculture sector. The most convenient method used for documenting information from the farmers was focus group discussions[2] in 12

[1] Climate hazard is a potentially damaging physical event or phenomenon (hydrometeorological) that may cause loss of life or injury, property damage, social and economic disruption or environmental degradation.
[2] Focus group discussion is a powerful tool to explore a focused issue through well facilitated discussions – a topic is introduced and participants are asked to discuss the issue.

selected villages. A time-line analysis[3] and trend analysis[4] were also followed when necessary to understand the past impacts of climate variability.

The methodology aims at a holistic analysis of the causes and impacts of climate variability and the local perceptions[5] of climate-related hazards. The local adaptation practices the community followed to minimize the impact of drought were documented through participatory rural appraisal methods. Also, seasonal diagramming[6] was used to identify which and when crops are exposed to climate-related hazards.

A desktop analysis looked for possible trends and patterns in the long-term climate data collected from the Bangladesh Meteorological Department (BMD). Climate-related risks in agriculture are associated with the length of the growing period, dry and wet spells at various stages of crop growth (initial, development and reproductive). Simple tools explaining water balance[7] for major crops were used to assess the risks, and climate model[8] outputs derived from General Circulation Models (GCMs) were used to identify possible climate change scenarios. The climate change scenarios were developed from consultation with national research institutions and national focal points such as the CDMP Climate Change Cell and other CDMP components within Bangladesh.

The drought-prone pilot locations were ultimately identified based on a field trip to Chapai Nawobgonj and Naogaon districts in northwestern Bangladesh. The pilot study areas were chosen because they were:

- primarily drought prone[9] (moderate to severe) and
- subsistence small-scale agriculture is a major livelihood activity.

Two upazillas were selected in each of the identified districts – Gomestapur and Natchole in Chapai Nowobganj, Porsha and Sapahar in Naogaon (refer chapter 2) – and then three villages were identified in each of the four selected upazillas. This pilot location selection was based on the first-hand information of the local DAE staff. Of three villages chosen in each upazilla, one was irrigated and two were non-irrigated (rainfed). The irrigation for these villages comes from deep tubewells installed by the Barind Multi-purpose Development Authority (BMDA).

The adaptation practices followed locally and introduced by national development, research and extension organizations were collected from the respective organizations and evaluated at different levels (Fig.7).

[3] Time line analysis provides a historical perspective of the major events that have occurred in the village and their impact upon the lives of the community.
[4] Trend analysis is a profile of the changes that a community is able to recognize in its midst.
[5] Local perceptions indicate the local understanding of farmers about a particular climate hazard with respect to their exposed infrastructure and properties.
[6] Seasonality diagramming shows farmers' seasonal concerns, including crop cycles and seasonal weather issues.
[7] Water balance represents the water input and output relationships from a medium (usually soil) on a specified time period.
[8] Climate model indicates physical representation of atmospheric system components used to describe the behaviour or state of the atmosphere at a specific time.
[9] The term "drought prone" is often used loosely and ambiguously. In Bangladesh it is sometimes used to refer to the driest parts of the country – the "dry zone" – where the mean annual rainfall and short length of rainy season impose restrictions on agricultural production which are not experienced in wetter parts of the country. It is also used to refer to areas that have soils with low capacity to store moisture and, therefore, dry quickly during the period when rainfall is below average and stay dry for a long period during the dry season.

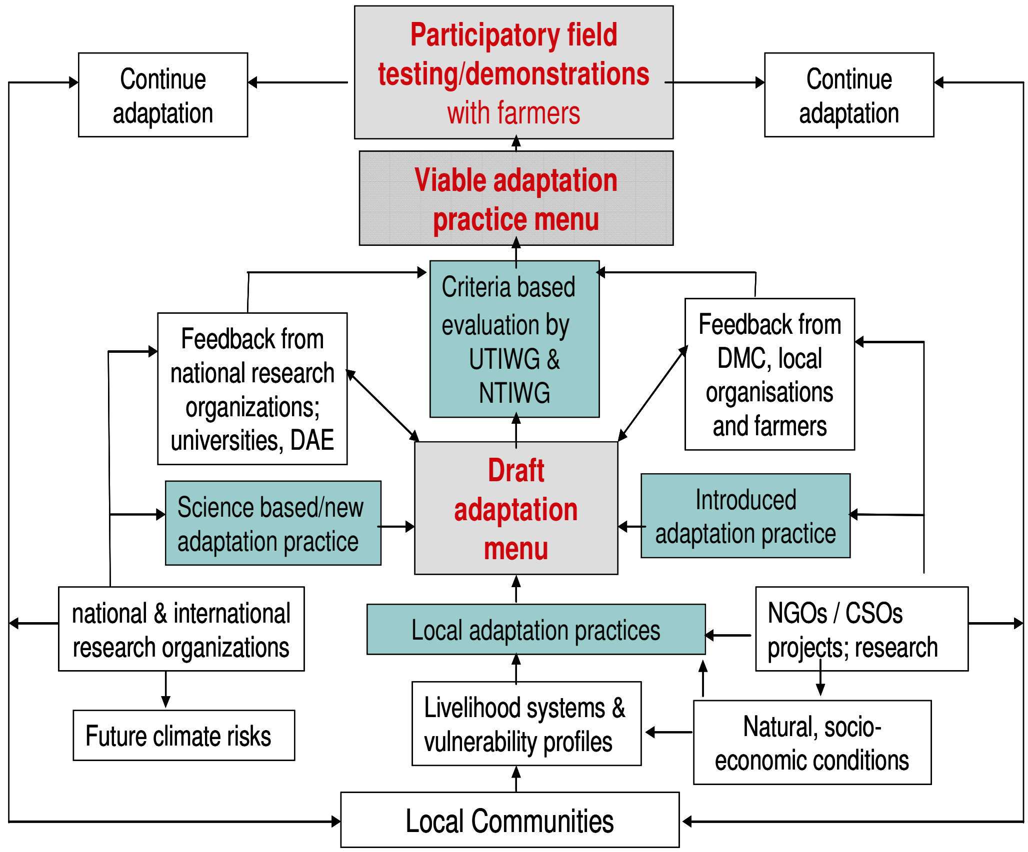

Fig 7. Overall framework and institutional structure describing activities and process of selection, evaluation and prioritization of adaptation practices for drought-prone areas in Bangladesh

3.4.3 Selection of viable adaptation practice

Viable adaptation options were selected through a sequence of evaluation processes at different levels starting from upazilla-level DMC members, Upazilla-level Technical Implementation Groups (UTIWG) and National-level Technical Implementation Working Groups (NTIWG). Consultative meetings and brief feedback workshops were also organized with the local research institutions Bangladesh Agricultural Research Institute (BARI) and Bangladesh Rice Research Institute (BRRI) and developmental organizations.

Selecting viable adaptation options requires criteria that include the type of problem and future expectations. Initially, environmental friendliness and cost effectiveness were the only two criteria considered for documenting a draft menu of adaptation practice. However, in view of the diversity of climate change adaptation options, more than one method is required to review all of the choices. Thus, they were prioritized according to:

- environmental friendliness and qualitative cost-benefit analysis;
- evaluation of adaptation options for their technical suitability;
- multi-criteria analysis;
- expert judgment.

The adaptation options were evaluated with the UTIWG and NTIWG for their technical suitability in drought-prone areas. The outcome of the stakeholder evaluation was integrated into the multi-criteria analysis. The criteria used were:

- drought mitigation – potential to reduce drought impact in terms of resources and economics,
- climate change scenarios – suitability under high temperature, frequent dry spells, high evaporation, etc.,
- environmental friendliness – less impact on the environment in terms of deteriorating quality of resources and its secondary impacts,
- economic viability – cost effectiveness and cost–benefit ratio,
- increased productivity – capacity to improve the overall productivity per unit area,
- sustainability – long-term effectiveness and capability of continuance after the project,
- social acceptability – preference of the community in all sections,
- gender integration – capacity to give larger role to women due to the particular adaptation practice,
- household income – capacity to increase household income on a continuous basis,
- employment opportunity – year-round employment opportunity for family members,
- relevance to vulnerable community – effect on small farmers, wage labourers and small businessman,
- applicability to multiple sectors – use for sectors such as agriculture, livestock, fisheries, forestry and water resource management,
- seasonal relevance – use of the adaptation practice during drought-prone *kharif* II season,
- immediate need – matching the adaptation practice to local community needs,
- institutional support – government policy and local institutions take up a particular adaptation practice,
- expert acceptance – feedback from the evaluation workshop organized at upazilla and national level.

Once potential adaptation measures were identified, they were used in discussions with key stakeholders from each sector to determine their relative feasibility based on their:

- effectiveness in reducing key risks,
- potential in technical terms as well as costs, social acceptance and manageability,
- current state of implementation and requirements of improvements, i.e. how they are being practiced in the country with or without consideration of climate change.

3.5 Details of activities

In relation to the above approaches and methodologies, the overall work programme followed the:

- inception of project and identification of pilot sites,
- assessment of climate impacts and local perception,
- analysis of climate change model outputs and scenario development,
- documentation of local and introduced adaptation practices,
- development of extension tools and awareness-raising strategies,
- provision of technical advice and coordination support.

3.5.1 Project inception and identification of pilot sites

The project inception was based on discussions of the project outline and proposed activities with FAO-SDAR, FAO-BGD, National Sub-Component Manager (SCM) and other project partners including local NGOs identified for the livelihood profiling study. The initial implementation phase was completed in May 2005, and a detailed work plan with the project partners was completed in early June 2005.

3.5.2 Assessing bio-physical and socio-economic conditions

Small focus groups with open discussions led by a skilled moderator explored issues of concern in the community – local problems, climate impacts, needs perceptions, socio-economic conditions, social capital, activity calendars, adaptation practices and institutional interventions – to elicit the group's reaction on these vital issues. Focus group meetings were conducted in all 12 pilot villages and were usually followed by a brief field by both the project team and the focus group participants.

3.5.3 Assessment of climate impacts and local perception

The past and present impacts of climate were assessed with hazard risk assessment tools[10] and problem analysis.[11] Secondary data, collected from various national organizations, were used to analyze the past impacts. The output was used to develop a hazard risk calendar for the pilot study locations with special emphasis on the agriculture sector. The assessment also included the coping strategies used by local people against climate-related hazards. The deliverable was a climate change impact analysis and perception document.

3.5.4 Analyzing climate change model outputs and scenario development

The work plan involved these major activities:

- review and develop climate change scenarios using GCMs for pilot study areas,
- analyze climate data on the frequency of past extreme events that might be expected in future (linking with climate change model outputs).

The development of climate change scenarios using GCM outputs was part of the desktop study. The DoE Climate Change Cell was contacted to create a liaison to share results of climate change model outputs. The historical climate data pertaining to rainfall and maximum and minimum temperature were collected from the Bangladesh Meteorological Department (BMD) and analyzed. The historical data sets for the pilot study area were analyzed to assess the past and current impacts on agriculture in general and livelihood in particular. Climate change scenarios were developed based on the desktop analysis of past climate analogues and future climate change as well as the local perceptions of climate impacts. These scenarios looked at the possible future state of the climate in the pilot study locations.

3.5.5 Documentation of local and introduced adaptation practices

Descriptions of the adaptation practices employed locally to minimize the impact of climate hazards were collected from farmers and local community. Adaptation practices introduced by national development, research and extension organizations were collected from the

[10]Hazard risk assessment tools include participatory rural appraisal methods described under section 3.4.2.
[11] Problem analysis provides an understanding of the climate related problems faced by the community.

respective organizations and these practices were evaluated with the farmers. The procedure involved the following activities:

- collection of local adaptation practices from farmers, using PRA,
- coordination with the national institutions to document introduced adaptation practices,
- documentation of drought adaptation practices used in neighboring regions.

3.5.6 Extension tool development and awareness-raising strategies

The impacts of climate hazards were translated into a menu of good practices in order to test their feasibility at pilot study locations. This required:

- understanding the impact of anticipated climate change on the agriculture sector of the pilot study locations through analysis of trends and awareness of local perceptions,
- developing a technically viable agricultural practice menu in collaboration with national research institutions,
- monitoring pilot testing by farmers in cooperation with agricultural extension staff,
- translating adaptation options into farmer-friendly extension tools, and
- raising awareness through demonstrating identified livelihood adaptation practices with farmers in the pilot sites.

The extension tools will include written and explanatory pamphlets, brochures and pictures of good practices. The printed materials will contain good practice menus with cost benefit analysis.