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Assessing Vulnerability and  
Adaptive Capacity to Climate Risks:  
Methods for Investigation at Local and National Levels

Anne T. Kuriakose  
Livia Bizikova  
Carina A. Bachofen

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Anne T. Kuriakose<sup>1</sup>

Livia Bizikova<sup>2</sup>

Carina A. Bachofen<sup>3</sup>

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<sup>1</sup> Social Development Department, The World Bank

<sup>2</sup> International Institute for Sustainable Development (IISD)

<sup>3</sup> Social Development Department, The World Bank

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Social Development  
The World Bank  
1818 H Street, NW  
Washington, DC 20433

Fax: 202-522-3247

E-mail: [socialdevelopment@worldbank.org](mailto:socialdevelopment@worldbank.org)



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## Abstract

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Effective planning for climate change adaptation programming in developing countries requires a fine-grained assessment of local vulnerabilities, practices and adaptation options and preferences. While global models can project climate impacts and estimate costs of expected investments, developing country decision-makers also require national assessments that take a bottom-up, pro-poor perspective, integrate across sectors, and reflect local stakeholders' experiences and values, in order to determine appropriate climate responses. This paper outlines the methodological approach of the Social Component of the World Bank's Economics of Adaptation to Climate Change study. The Social Component features both village-level investigations of vulnerability and adaptive capacity, and innovative Participatory Scenario Development approaches that lead diverse groups at local and national levels through structured discussions using GIS-based "visualization" tools to examine tradeoffs and preferences among adaptation activities and implementation mechanisms. This dynamic, multi-sectoral approach allows for real-time analysis, institutional learning and capacity development. The paper presents the research and learning approach of the study and offers emerging findings on policy and institutional questions surrounding adaptation arenas in Bangladesh, Bolivia, Ethiopia, Ghana and Mozambique.

# 1. Introduction<sup>4</sup>

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Climate change impacts and the expected increase in magnitude and frequency of both slow and rapid-onset events such as floods, droughts, cyclones, and desertification processes place developing country populations at increased risk and can undermine efforts to reduce poverty. Reducing the vulnerability of poor and disadvantaged groups and regions requires an understanding of the intersecting inequalities faced by women, livelihood groups, ethnic minorities, and children and the elderly in order to identify jointly with these groups appropriate adaptation measures and pathways for regions that improve asset bases and promote resilience.

Such analysis is required urgently as developing country governments continue international dialogue under the Copenhagen climate negotiations and begin to draw up additional plans for financing under new and existing climate mechanisms. Donor and agency support to national adaptation programs of action (NAPAs) and other strategy efforts to date has resulted in a wide range of plans for adaptation support. However even these remain under-specified in their identification of options that are locally-specific or micro-/meso- in scale (see also Agrawal and Perrin 2009). Further, adaptation options identified to date typically lie within the remit of environment and food security ministries, and are less often mainstreamed to annual plans in agriculture, water, social welfare or rural development ministries. Mainstreaming of climate change adaptation is slowly improving, though, in some countries, with Ministries of Finance in particular beginning to play a coordinating role in climate change mitigation and adaptation planning and investment as part of overall national development strategies. The current study aims to support such cross-sectoral analysis and country planning processes in climate change adaptation.

Climate change and development interact in an iterative fashion. Climate change vulnerability and impacts influence prospects for development, and in turn, development choices and decisions influence a country or region's future capacity to adapt (Bizikova et al 2007). Achieving development priorities and improving quality of life remain key goals, with adaptation to climate change a conditioning factor to be considered in the overall mix. It is the combination of development choices, adaptation actions and local capacities that allows for effective climate action in-country. The purpose of this paper is to report on an ongoing World Bank study on the Economics of Adaptation to Climate Change (EACC), and in particular on the Social Component of the EACC study. The methodology of the Social Component draws upon a range of analytical frameworks, including the sustainable livelihoods framework, assets and capabilities frameworks, institutional risk pooling approaches, social risk management framework, and environmental entitlements analysis. This methodological approach is intended to bridge the gap between community needs and priorities at the micro level and policy processes at the macro level, with an emphasis on the fact that higher-level policy development and planning must be informed by lessons learned and insights gained at the local level. By identifying and assessing the most urgent adaptation needs of the most vulnerable, as well as their local coping and adaptive strategies, the proposed inter-

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<sup>4</sup> This paper was prepared for the 7<sup>th</sup> Annual Open Meeting of the International Human Dimensions Programme (IHDP) on Global Environmental Change, Bonn, Germany, April 27-30, 2009. It reports on study design for the Social Component of the World Bank Economics of Adaptation to Climate Change (EACC) study. The authors gratefully acknowledge the support of the overall EACC study team lead, Sergio Margulis, and that of the study lead for the Social Component, Robin Mearns, as well as inputs from team members Nicolas Perrin, Nilufar Ahmad, Arun Agrawal, Urvashi Narain, Kiran Pandey, Anthony Patt, Zulfiqar Ali, Berhanu Adenew, Ruth Llanos, and Tony Dogbe.

sectoral, bottom-up approach aims to provide recommendations for setting priorities for action while helping to develop a robust, integrated model approach to increasing resilience to climate risks at national and local levels. The paper reviews new tools used in the Social Component of the study (including that of Participatory Scenario Development) that aim to amplify local voices in the national adaptation planning process and improve downward accountability in this arena.

The EACC study aims to assist decision-makers in developing countries to integrate adaptation measures into their development plans and budgets. To achieve this objective, the EACC study draws on micro-level analysis to inform calculations of global costs of adaptation in all developing countries, thus complementing the top-down aggregated perspective of the cost of adaptation for economies. The social and policy analysis, and participatory approaches that characterize the Social Component, were selected with a view towards identifying: i. vulnerabilities and adaptive capacity in terms of household, local, and area resources; ii. stakeholders' preferred adaptation options and pathways; iii. preliminary implications for adaptation planning at national and sub-national levels.

The paper is outlined as follows. After a brief introduction to the EACC, the rationale for and design of the Social Component (comprising field investigations and Participatory Scenario Development workshops) is presented. A theoretical basis for scenario development work in the area of climate change adaptation is provided, along with specification of the PSD process and tools. The paper elaborates initial findings and country response from the five national studies in Bangladesh, Bolivia, Ethiopia, Ghana and Mozambique and indicates emerging lessons for bottom-up adaptation planning and policy, focusing on questions of scale, coordination and equity at the sub-national level.

## 2. Economics of Adaptation to Climate Change

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The World Bank's Environment Department is currently undertaking a study on the Economics of Adaptation to Climate Change (EACC), funded by the governments of the Netherlands, UK, and Switzerland.<sup>5</sup> The objectives of the EACC are twofold: i. to help decision-makers in developing countries better understand and assess the risks posed by climate change and design improved strategies for climate change adaptation; ii. to develop a global estimate of adaptation costs to inform the international community's efforts (including UNFCCC and the Bali Action Plan) in determining required levels of adaptation financing in support of the Copenhagen process. The EACC is applying multiple methodological routes to determining the costs of adaptation, calculating estimates based on globally-derived sources, as well as a 'bottom-up' country track of studies that places sectoral investigations into context, validates costs and social preferences at national level, and ultimately helps prioritize, sequence, and integrating robust adaptation strategies into national development plans and budgets, through an ongoing dialogue process. The study's approach builds on earlier studies such as the Stern Report and others by World Bank, UNDF and Oxfam but represents novel thinking in its definition and costing of adaptation, wherein adaptation costs (defined as the minimum cost of restoring sector-level standards to existing pre-climate change levels) are measured against a projected development baseline, and further estimated with reference to expected welfare and distributional impacts of climate change. This is expected to result in estimates that are more robust in their detailing of temporal elements, included expected growth paths over time, though it does not attempt to address the question of the "adaptation deficit" held by developing countries whose baseline is located at a low level of industrialization and infrastructure development. Like all climate adaptation studies, EACC must make assumptions and address uncertainty of climate projections, and identify potentially high future damages and the required cost-benefit analyses needed to evaluate competing demands for ongoing investments in social and economic development. "No regrets" investments that represent both sound development policy and good climate response are expected to be particularly prized in this context of uncertainty and also given the political economy pressures within countries.

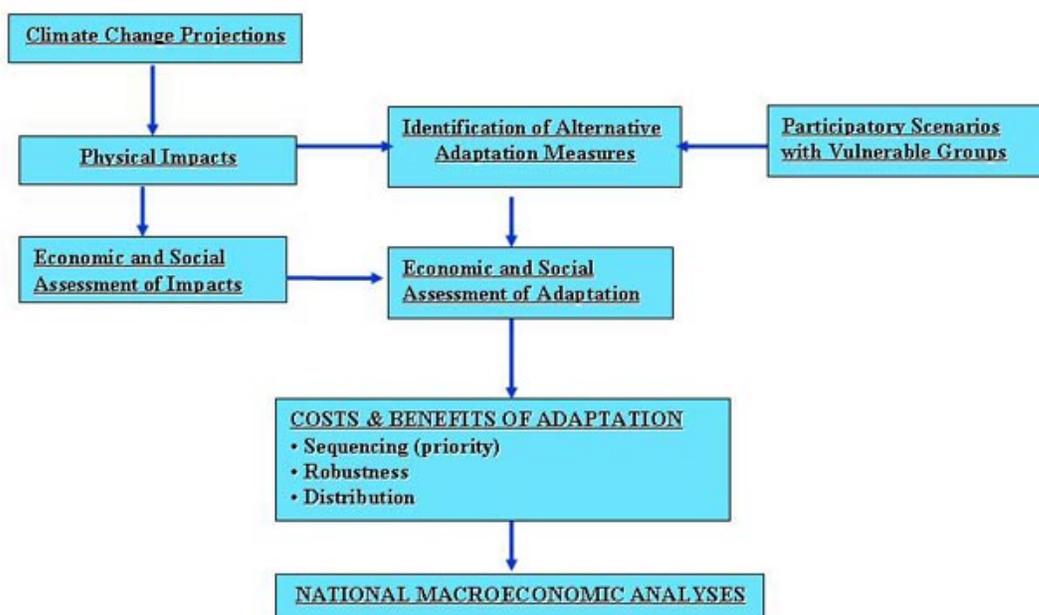
The EACC features development of global climate projections, GDP and population projections as well as sectoral investigations on a global, and in some cases national, scale in order to cost adaptation in the areas of infrastructure, agriculture, water as well as extreme events, coastal, fisheries, forestry, health, and Social. The seven country cases of the EACC comprise: Bangladesh, Bolivia, Ethiopia, Ghana, Mozambique, Samoa, and Vietnam (with the Social Component being undertaken in all but the last two countries).<sup>6</sup>

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<sup>5</sup> See <http://www.worldbank.org/environment/eacc> for further elaboration of the EACC methodology.

<sup>6</sup> Case study countries were selected with a view to: i. representing diverse agro-ecological and farming systems around the world; ii. individual countries' physical vulnerability to climate change impacts; and iii. existing interest and activities by country governments in climate change adaptation policy and planning. At the time of publication, a sixth country, Vietnam, was under consideration for inclusion under the Social Component.

Figure 1 Schematic Methodology (Economics of Adaptation to Climate Change study)



Source: EACC website, Op cit

## 2.1 RATIONALE FOR SOCIAL COMPONENT IN STUDY

Social analysis forms a key element of the EACC study due to its potential to contribute an integrative and multi-sectoral perspective to the analysis at both global and country levels. The social component of the study helps demonstrate the inter-linkages between sectors and the sometimes unforeseen consequences of investments in one sector on users in another.<sup>7</sup> Second, the social lens works at the interstices of such common conceptual frames as the formal and informal sectors; traded and use-value assets (including common property resources); and local, state and national scales, wherein one or more of such categories may routinely be less “visible” to planners and policymakers. Past experience has shown that technology choice (e.g., scale of infrastructure) and location; planning assumptions and parameters (e.g., benefit-sharing in multipurpose infrastructure; inter-sectoral water allocation in integrated water resources management); legal and institutional regimes (e.g., de jure and de facto tenure systems; formal versus traditional community institutions, pricing policies), and design of delivery mechanisms (e.g., community-based, private-sector led, public extension) all have varied impacts on the scope and room for maneuver in both problem identification and planned responses to development and adaptation challenges, and crucially that they condition the degree of pro-poor impact of such measures.

<sup>7</sup> For example investments in irrigation schemes contribute not only to agricultural productivity and demand for labor, but can also have both positive and negative effects on health (where ‘irrigation’ water is used also for domestic purposes and the increased total quantities of water improve hygiene outcomes, and yet can have negative impacts in the form of increasing vector-borne diseases such as malaria).

A third contribution offered by the social lens is the opportunity for enhanced specification of institutional and policy reform challenges by illuminating the political economy of adaptation planning and implementation (e.g., allocation among areas and sectors; the role of demand-side governance and formal consultative processes). Social analysis thus directly supports the first objective of the study which is to enhance the capacity of developing country policymakers to respond to climate change adaptation issues at various levels. Social and institutional analysis, particularly through structured scenario development interactions, further helps highlight such distributional questions in adaptation planning as rural-urban bias, spatial inequalities between leading and lagging regions. Social policy inputs to adaptation planning offer recent lessons in the areas of participatory budgeting and fiscal decentralization, as well as debates on design and targeting of social protection (including employment guarantee schemes, conditional cash transfers, community-based index insurance, and questions regarding e.g., minimum social guarantees versus area-based responses, including in disaster contexts).

Social analysis in the EACC study will take place at the levels of both the global study and the country cases. The Social Component aims to provide client countries with a methodology for identifying robust adaptation strategies and options at the local level; and to provide a basis for understanding how to structure adaptation interventions so as to benefit the most vulnerable households and communities within vulnerable regions. It aims specifically to generate new knowledge on: i. Existing Livelihood Strategies; ii. Local Experience with Climate Variability and Observed Impacts; iii. Past Adaptation Practices at Household/ Village/ Area level; iv. Institutional Arrangements for Private and Public Adaptation Activities; v. Preferred Adaptation Investments.

By utilizing both a meta-analytical approach, in-depth qualitative and quantitative fieldwork in the country cases (including the participatory scenario development approach), the social component of the EACC will employ tested conceptual frameworks of sustainable livelihoods, farming systems, local institutional development, and poverty and social impact analysis to: i. map out the range of socio-geographic vulnerability zones around the world (combining agro-ecological and social perspectives), ii. identify a range of livelihood profiles and adaptation practices, and iii. bring to the fore policy, planning and programming options and tools for future use in planning adaptation in applied settings.

The Social Component thus helps maintain:

- *A focus on the local level.* Because most adaptation is ultimately local, an understanding of local costs and benefits is necessary to help inform macro-level efforts to increase local adaptive capacity by channeling investments where they are most needed.
- *A focus on vulnerable and disadvantaged socioeconomic groups.* Poor, natural resource-dependent rural communities and households as well as urban populations affected by extreme weather events will bear a disproportionate burden from the adverse impacts of climate change. The most vulnerable groups are likely to be those overwhelmingly dependent on a single or a narrow range of climate-sensitive livelihood sources rather than those who are able to pool risk across several livelihood sources, including some that are significantly less climate-sensitive. Assessing the local-level costs and benefits of adaptation responses is essential to understand how better to support the adaptive capacity of the most disadvantaged groups, including women, indigenous people, and the poorest.
- *A focus on engaging vulnerable groups in collaborative analysis of what adaptation means in particular contexts and for distinct groups of people.* Emphasis is placed on joint, participatory analysis,

learning lessons from past experience while acknowledging limits to this experience in the face of possibly unprecedented climate changes and seeking to engage those most directly concerned in discussion of what may be plausible means of adapting to these likely future trends as well as the pros and cons of alternative adaptation options.

- *A focus on building on existing adaptive responses.* Understanding the costs and benefits of existing adaptation practices can help scale up or multiply existing adaptation responses that have a high benefit-cost ratio and improve other adaptation practices where benefit-cost ratios are low. Effective adaptation pathways are likely to be those that progressively reduce the degree of dependence on climate-sensitive livelihood sources (e.g., through livelihoods diversification, especially into non-farm activities).
- *A focus on soft as well as hard adaptation options.* Even rough comparative estimates of technological and infrastructure-oriented adaptation options versus institutional and educational or skills-based adaptation options are missing from current efforts on costing adaptation.
- *A focus on ground-truthing analysis provided by the sectoral analyses.* Rapid assessment techniques will be used to elicit information on vulnerability to climate hazards as well as to take stock of corresponding adaptive strategies used by poor and vulnerable groups to confront climate change and variability. This bottom-up approach will then be used to inform technical and policy experts in their priority setting for planned adaptation interventions.
- *A focus on triangulation between different data sources.* As different types and sources of data will be used to generate details and explanations about vulnerability, climate risks, and adaptation strategies adopted by the poor, the social component allows for validation of data through the triangulation from various sources, including use of Participatory Learning and Action methods, and quantitative approaches.

### 3. Design of the Social Component

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The study draws on the concepts of sustainable livelihoods with its emphasis on different forms of capital, and the conditioning institutions and policies)<sup>8</sup>; the environmental entitlements approach that highlights actors' socially-maintained claims upon resources (see Leach et al); and area development approaches that emphasize the range of interdependencies among resource utilization (including human capital) at micro- and meso-scales for a given territorial unit.

Recent debates on poverty have recognized the limitations of narrow 'poverty line' indicators that ignore differences among households in claims on resources, as well as intra-household inequalities (Kabeer 1996: 2). Income-based poverty lines measure consumption potential rather than household asset bases (or lack thereof). Knowing whether a household is above or below the poverty line (and recent studies have shown significant to- and fro-ing from year to year for poor households) does not reveal as much for a planner as knowing the bundle of assets (including land) and endowments and social ties on which a household in a rural economy can rely. Social vulnerability thus is an aspect of poverty and human insecurity, characterized by a lack of both tangible and intangible assets.

Swift has defined net assets as 'a wide range of tangible and intangible stores of value or claims to assistance which can be mobilized in crisis' (Swift in Razavi 1997: 54). This mobilization process, both for ongoing livelihood security as well as social risk management in times of crisis, underpins the concept of environmental entitlements advanced by Leach and Mearns. In this conceptualization, an actor (e.g., a woman farmer or agricultural tenant) with certain resource endowments (e.g., land, labor, or skills) may not necessarily be able to exploit these endowments to their advantage unless the requisite social "approvals" are in place. In other words, ability to use endowments depends on an individual's having more widely-recognized entitlements to those resources. These entitlements are the outcomes of continual processes of social negotiation. Entitlements have been defined as 'legitimate [whether legal or customary claims] and effective command over...commodity bundles' that enhance the actor's capabilities (i.e., what persons can do or be with given resources), as well as well-being (i.e., combination of income, health, status, economic and physical security) (Leach et al 1997).

The EACC-Social study employs the accepted notions of vulnerability, (i.e., exposure, sensitivity, and adaptive capacity (see IPCC 2007; Kelley and Adger 2000), with the note here that vulnerability for the purposes of this study is defined as not only physical vulnerability to climate hazards but also social vulnerability of the type described earlier, in terms of intersecting inequalities. Adaptive capacity, i.e., the ability to adjust to actual or expected climate impacts, is theorized to be influenced by many factors including existing infrastructure and assets, and potential for expansion/ scaling-up, say of area under irrigation, social and human capital, and prior experience in leveraging external support including the presence of formal organizations and effective local government that can mediate interventions and structure services. Such multiple forms of "capitals" as envisioned under the Sustainable Livelihoods framework, are key independent variables whether analyzed at the level of households or areas. Indeed Deressa et al have found that the adaptive capacity of farmers in Ethiopia is chiefly influenced by wealth status, technology, availability of infrastructure and supportive institutions, potential for irrigation and

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<sup>8</sup> For further discussion of sustainable livelihoods, see Tacoli 1998 and Ellis 1999.

literacy rate (2008 cited in EEA 2009). Households from higher wealth tiers exhibit resilience in that they are better positioned to effectively absorb and recover from losses induced by shocks such as disaster or illness. As might be expected from earlier studies on gender and agricultural extension, individual characteristics such as the education level, gender and age of the household head also determine access to information on climate change, and to improved technology packages (including drought-tolerant or early maturing crop varieties (ibid).

### 3.1 HYPOTHESES

The study is based on the working hypothesis that the degree of perceived climate exposure plus the level of adaptive capacity affect actors' propensity to adapt and to their eventual adaptation. It is expected that higher perceived climate risk/ exposure and higher adaptive capacity will lead to higher propensity to adapt, with the reverse also true. Adaptive capacity is defined as comprising elements of: i. Household and area resources (i.e., household and area asset base, in terms of natural, physical, human, social and financial capital, and incl. for example household dependence on natural resource-based livelihoods, and existing area infrastructure investments) and ii. the prevailing Policy and institutional framework (including e.g., land tenure framework, degree of decentralization, safety net provision, innovation and extension systems etc). Climate exposure (i.e., sensitivity of zones identified) is defined as (actual and) perceived changes in rainfall, temperature, sea level rise and ensuing hazards of drought, flood, storm surge. Finally adaptation propensity includes measures of household/ area budget selection and prioritization of adaptation measures, and execution of adaptation strategies whether through autonomous (i.e., private and/or collective) or planned (i.e., public-sector) adaptation.

While some endogeneity may appear to be present in the relationship stated above, the emphasis on 'propensity to adapt' also aims to get at household-level decision-making factors in livelihoods diversification, migration decisions and the like. In the case of migration for example, this helps shed light on "push" and "pull" factors that may push the most vulnerable households into survival-based 'adaptation' (coping) of extreme forms such as permanent migration once household assets are depleted, where better-off households (due to typically greater household reserves, denser social networks, and higher levels of human capital/ transferable skills) may be pulled into taking those same migration decisions both earlier and to more opportune locales.

More broadly, we envision that eventual adaptation programming can be viewed as supporting a social risk management approach as defined by Holzmann (and with attendant instruments of financial services, broad social protection and asset-based approaches, disaster risk reduction and protection of infrastructure, productive assets for income security), and with a continuous focus on advancing resiliency (itself structured by natural resource endowments and infrastructure baseline, area and household nonfarm diversification; health promotion; governance and institutional set-up; and the requisite economic incentives for the same).

### 3.2 RESEARCH QUESTIONS FOR THE SOCIAL COMPONENT

The Social Component features both village-level investigations of vulnerability and adaptive capacity, and innovative Participatory Scenario Development approaches at local and national levels. This

dynamic, multi-sectoral approach allows for an integrated analysis, institutional learning and capacity development. Research questions motivating the study interrogate the perceived impacts of climate change and local responses, with an emphasis on looking across scales. The questions are structured as follows:

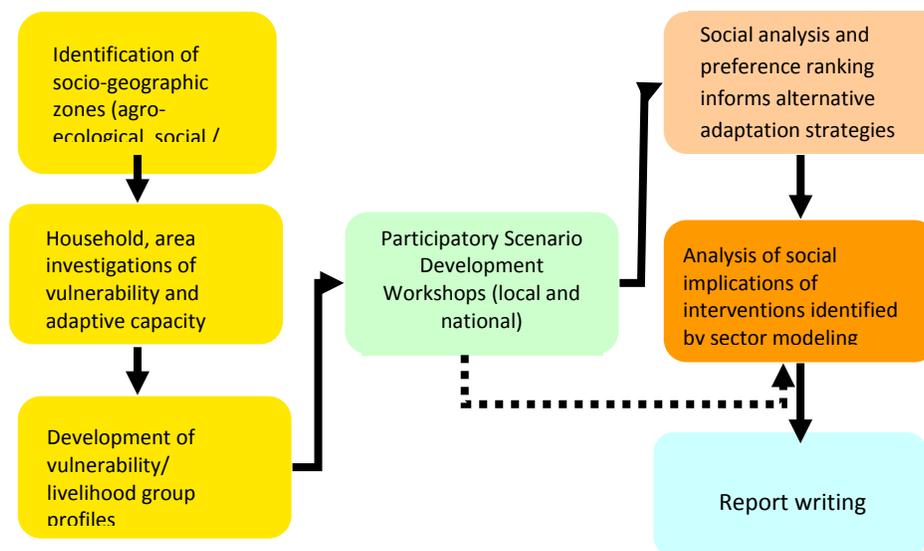
- Research Question 1: What factors make particular individuals, households, or areas more vulnerable to the negative impacts of climate change? What role do intersecting inequalities, area development deficits, and/or “distance” from the center (e.g., political, institutional, physical) play in maintaining vulnerability and reducing adaptive capacity?
- Research Question 2: What has been people’s experience of climate events to date and what adaptation measures have they taken (both autonomous and planned)?
- Research Question 3: How do different groups and local and national representatives judge various adaptation options and pathways? What criteria are used, and what key tradeoffs (sectorally, inter-temporally, socio-spatially) are identified? Do preferred design features, implementation mechanisms vary among groups?
- Research Question 4: How do identified adaptation priorities align with existing development strategies and policy emphases? Where is there congruence (e.g., ‘no regrets’ investments) and where do adaptation investments represent new focus areas? What institutional support is needed for planning and implementation going forward?

## 4. Approach to Country Studies under Social Component

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The research stages for the country studies under EACC-Social comprise: i. review of the policy and institutional environment for local adaptation, including e.g., brief review of National Adaptation Program of Action (NAPA), tenure regimes and land policy, formal and informal institutions at local level, disaster management mechanisms, policy on inter-sectoral water allocation, forestry, and health, as well as existing social protection measures in-country; ii. review of existing quantitative and qualitative data, from secondary sources and key informant interviews, on: poverty, vulnerability and climate hazards (incl. reference to agriculture, water and natural resource management). This review will lead to identification of the major socio-geographic vulnerability zones in the country (i.e., agro-ecological based, with overlay of socio-economic vulnerability/ poverty as well as climate hazards); and iii. development of a typology of livelihood profiles and of adaptation practices to characterize the main types of climate-related vulnerability and their manifestations in the livelihoods of the poor. Validation of livelihood profiles at the field level will take place through use of PLA methods, including focus group discussions, and ranking/ scoring exercises, as well as semi-structured interviews and key informant interviews with households and institutional stakeholders at the local level (see also Annex 2). We aim to develop a typology of vulnerability/livelihood profiles for sites in each socio-geographic zone, with attention such social difference as gender, age, ethnicity, disability,<sup>9</sup> and a typology and examples of adaptive responses (e.g., mobility/migration, risk pooling, storage, livelihood diversification -including non-farm development-,<sup>10</sup> and market exchange).

**Figure 2 Research Phases of Social Component**



<sup>9</sup> Investigations should also explore implications of possibly interlinked factors such as ethnicity and occupation, or ethnicity and spatial location/social settlement.

<sup>10</sup> This includes both individuals entering new and those adding additional sectors to their livelihood profile and/or changing the relative composition or emphasis on monetized and non-monetized livelihood elements within the overall “basket.”

## 4.1 PRELIMINARY RESULTS

Inception reports from Bolivia, Mozambique and Ethiopia identify a comprehensive series of socio-geographic zones for each country, by overlaying agro-ecological divisions with climate hazard and social/ poverty status. Identification of the zones is a first step towards determining how the livelihood security of vulnerable groups in country will be threatened by climate impacts.

The Bolivia team has taken the 4 physical macro-regions, i.e., the *alturas* (cold and dry) the *valles* (temperate), the *chaco* (warm and dry) and the *llanos* (warm and humid), and overlaid these with the 16 Holdridge livelihood zones that combine different data indicators of social vulnerability (e.g., food insecurity, poverty, and human development index averages) and sensitivity (including flood risk and drought indicators). Twelve municipalities have been selected as sites for investigation across this range of socio-geographic zones. Additionally, a preliminary typology of livelihood systems found in each macro-region has been developed to help specify how the projected impacts of climate change will affect these systems and shape adaptive responses. According to community testimonials, in the *alturas* (highlands) for example, warmer weather has already begun to necessitate the introduction of new seed varieties and some pastoral land been transformed to cropland.

In Mozambique, six zones have been identified: i. coastal urban areas featuring highly differential vulnerability across income groups, with large peri-urban areas vulnerable to flooding from both rivers and oceans; ii. non-urban coastal strip, which is relatively free of poverty and marked by high vulnerability to coastal flooding and storm surges from tropical cyclones and threats of erosion; iii. the lower Limpopo river basin vulnerable to floods and droughts; iv. other river basins prone to flooding; v. southern inland regions highly susceptible to severe droughts and characterized by high levels of food insecurity; and vi. central and northern inland regions also prone to droughts but perhaps the least vulnerable areas of Mozambique due to higher agriculture productivity and lower risks of flooding or cyclones. In Ethiopia, eight zones have been identified. These are: i. highland, belg cereal and livestock; ii. highland, cereal and livestock degraded soils; iii. lowland pastoral and agro-pastoral; iv. lowland, mixed farming, degraded soils; v. midland irrigable; vi. midland high agricultural potential; vii. perennial and root crops; viii. urban settings. Hazards experienced to date include drought and flood, as well as human and livestock disease outbreaks, including malaria.

## 5. Participatory Scenario Development: Rationale and Overview

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Climate change and development interact in an iterative fashion. Climate change vulnerability impacts influence prospects for development, and in turn development choices and decisions not only determine level of greenhouse gases (and resultant climate change) but also influence a country or region's future capacity to adapt (Bizikova et al 2007). The combination of development choices, adaptation actions and capacities interact simultaneously as decision-makers and citizens seek to address the issue of climate change effectively. To help communities develop effective responses to climate change, attention needs to be focused on envisioning future development priorities, investigating the role of climate change impacts in attaining these priorities, and identifying adaptation responses that are relevant in the local and regional context.

Scenarios represent an excellent opportunity to begin an exploration of different futures under changing climatic conditions. There is a growing interest in the use of scenarios, as heuristic tools that can make mental maps more explicit (Berkhout *et al* 2002), as aids to social and organizational learning (Chermack and van der Merwe 2003), as tools for scanning the future in a rigorous, creative, and policy relevant way that explicitly incorporates normative elements (Swart et al 2004), and as a means by which we may explore the effects of alternative course of action for future problems involving multiple actors, risk and uncertainty (Mayer et al 2004). In order to fully explore opportunities from scenario approaches, not only the developed scenarios are important, but also the scenario development process itself. This process can become an effective vehicle to motivate institutional learning, find commonalities across different perspectives, achieve consensus on goals, or come to a shared understanding of challenges (O'Neil et al 2008). To date, scenario approaches in climate change research have mainly been focused on impacts and mitigation actions especially at the global level<sup>11</sup> without specifically addressing views of stakeholders, and diversity of local and regional development choices.

While our focus on adaptation has evolved into a multi-disciplinary effort, there continue to be challenges in understanding the human dimensions of climate change impacts, and in integrating these with both local- and regional-scale adaptation mechanisms, and longer-term development plans. To address this complexity and the need for integration, participatory scenario approaches stand as useful tools that allow close interaction with stakeholders in a manner that aids in the understanding of effective integration of climate impact data and local priorities. Combining qualitative stakeholder and quantitative expert information (i.e., climate change projections and impacts) in participatory scenario development processes offers unique opportunities to mix good data, scientific rigor, imagination and expertise from different perspectives (Volkery et al 2008). Over the last years, a number of arguments in favor of participation in scenario development have been developed in the literature (e.g., Pahl-Wostl 2002; Welp et al 2006; Kok et al 2006; Volkery et al 2008). The consensus is that participatory scenario development approaches offer the following advantages: i. access to practical knowledge and experience, ii. understanding of problem perceptions and identification of new and challenging questions; iii. bridging of gaps between the scientific communities and governments, business, and citizens, providing a cross-check of planning assumptions; iv. improved communication between scientists and stakeholders

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<sup>11</sup> To illustrate potential societal choices and futures, and their contribution to the problem of climate change, the IPCC developed a set of emissions scenarios. The IPCC Special Report on Emission Scenarios (SRES) provided explicit linkages between development choices and level of greenhouse gases (GHGs), illustrating that development decisions could considerably alter the level of future emissions and thus climate change impacts (Nakicenovic 2000).

and facilitated collaboration and problem-solving; and v. increased salience and legitimacy of the resulting scenarios, and more ready acceptance and utility of selected adaptation pathways by end-users. In the context of adaptation to climate change, the primary function of the scenarios is to provide a framework and context within which different groups of stakeholders can better understand potential climate change impacts and consider and discuss a range of possible adaptation options, as well as what forms of public policy or investment support are needed to facilitate effective adaptation. We believe that applying participatory scenario development approaches helps in identifying locally relevant pathways of autonomous and planned adaptation in the context of development choices and decisions and in informing actors on potential trade-offs, and possible consequences of adaptation actions. During the scenario development exercise, assessments of climate change impacts help in identifying areas of high vulnerability that need to be taken into consideration when developing local pathways. However, the adaptation options selected depend not only on the impact of climate change and available technologies, but also on current and future local, regional and national priorities identified through participatory processes. In sum, planning for climate change without involving the relevant stakeholders and considering local development priorities can lead to maladaptation in the long-run.

## 6. Developing Participatory Scenarios: Design and Implementation

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Growing number of local-scale climate change impacts' studies are available, but in general, these often do not include a consideration of changing local development choices and priorities, nor the influence which such changes might have on local adaptation or adaptive capacity. In this study, participatory scenario development approaches allow us to assess the suitability of adaptation measures within local development pathways, through shared learning exercises that include both model-based and participatory approaches.

The key elements of the participatory scenario development approaches are identifying the focus of the scenarios and key local variables, challenges and priorities in the context of the current system followed by a development of local scenarios. Only internally consistent combinations, i.e. those where developments in one factor did not contradict developments in another, are considered. This process provides an opportunity to understand multi-causal linkages between variables. Defining multi-causal linkages is an important part of identifying drivers of the development goals that enable stakeholders to assess trade-off and synergies between types of adaptation, development choices and enabling policies needed to support future adaptation.

At the local level, the identified development scenarios are then carefully examined for their potential to handle climate change impacts, and to determine climate change impacts on the attainment of local development goals. Visualization techniques can be used to illuminate and to assess the feasibility of different adaptation options to climate change impacts under different local development priorities and goals. Specifically, generating visualizations of key climate change impacts (such as sea-level rise, forest character and species changes) and various combinations of response options (including, for example, an adaptive response involving building different types dikes) provides a basis to move a discussion on climate change impacts per se to one where climate-resilient development outcomes and preferred pathways for the community can be debated (Shaw et al., forthcoming; Sheppard 2005).

Integrating climate impacts and adaptation into local development by using scenario approaches and visualization provides an opportunity to express the uncertainty surrounding climate change as a degree of choice and constraint (i.e., boundary conditions) that exists with respect to local development choices (Bizikova et al., in press). In this way, stakeholders can express their views about possible responses instead of perceiving uncertainties of climate change projections as an obstacle for action. The combination of downscaled climate scenarios, locally-specific visualizations, and structured and animated scenario discussions with an emphasis on user-friendly media and simplified pathways offer a useful advance on techniques developed in other, often developed-country, settings (see for example Shaw et al forthcoming). The current methodology extends earlier approaches to include an emphasis on local development planning and joint production of scenarios with national study teams.

### **6.1 IDENTIFICATION OF ALTERNATIVE, ROBUST ADAPTATION PATHWAYS USING PARTICIPATORY METHODS TO ELICIT PLAUSIBLE SCENARIOS**

The aim of these workshops is to help local and national actors explore different climate futures and engage in structured debates around development priorities and relevant adaptation responses. The idea

is to identify the social cost-benefit of the individual activities that characterize the adaptation scenarios, bearing in mind that each adaptation pathway may have different distributional implications, even if overall costs are not very different. Figure 3 provides examples of areas of interest to be addressed by local representatives in these workshops.

Participants will include national policymakers and civil society representatives, donors, local experts, and representatives from vulnerable communities, including local government. The participatory scenario development workshops draw from down-scaled climate scenarios provided and offered as “visualizations”: facilitators aid groups in developing set of storylines and corresponding adaptation activities for expected changes in temperature, rainfall (droughts/ floods), storm surge, sea level rise. The process is intended to foster joint assessment of required interventions, distribution of benefits and also point to key political economy issues in adaptation planning and implementation. The participatory scenario development workshop design and development will have a capacity-building emphasis from the start, including participation of national teams in workshop design (facilitated by international consultants) and in training on development of visualizations and scenarios.

Workshops will help characterize various adaptation pathways possible for different livelihood groups, given their identified vulnerabilities and assets and prevailing conditions of uncertainty. The workshops will be based on scientifically robust and socially plausible data derived from the general EACC methodology (down-scaled climate scenarios over different time scales, and mapping of expected temperature, rainfall, drought, floods, storm surge, sea level rise, malaria-endemic zones, and other such general and sector-specific projections as they become available). Participants will include representatives of vulnerable livelihood groups, which will include both local experts and community members or representatives. Different assumptions on which each adaptation scenario rests will be made explicit (e.g., distribution of costs and benefits among social groups).

**Figure 3 Questions to be addressed in Scenario Development Workshops**

- What is the local vision of the future, in terms of development priorities, perceived climate change impacts, and feasible response strategies?
- Which areas/sectors are viewed as most vulnerable? What are the key drivers contributing to that vulnerability?
- What specific adaptation practices do households and communities in different socioeconomic and ecological contexts use to respond to various climate hazards?
  - Which of these adaptation responses worked, which did not, and why?
  - What are the necessary conditions for effective adaptation to occur (e.g., institutional reform; treatment of ancillary benefits, policy priorities)?
  - What policy and operational recommendations can be derived from the above?

The output of these workshops will take stock of plausible future adaptation pathways for different livelihood groups and areas and highlight the distributional implications of activities. Incorporation of

these issues ensures consideration of a local perspective that can serve as a valuable guide for planning and priority-setting processes carried out by technical and policy experts with a more system- or country-wide perspective.

## **6.2 SOCIAL ANALYSIS OF ALTERNATIVE ADAPTATION STRATEGIES**

The findings of the workshops focused on participatory scenario development, along with results from focus group discussions and community investigations for development of the livelihood and adaptation profiles, will be communicated to the sector specialists in each country case study for integration into their analyses. Through joint analysis and review of matrix ranking and scoring exercises, local consultants will be able to make recommendations on incorporating adaptation options into the sector analyses. The social analysis will interpret which social groups will benefit and which may lose from the planned adaptation strategies recommended by the sector models. It will recommend policies to address the groups at a disadvantage. For example, certain activities (i.e., the provision of social safety nets or the promotion of livelihood diversification efforts) that traditionally fall within the realm of “regular” development investments may be highlighted at this stage as necessary activities to complement the identified traditional planned adaptation strategies.

## 7. Emerging Issues and Lessons Learned to Date

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Initial work has already given rise to a number of interesting institutional and policy questions. A recurring theme is around path dependence in policymaking and the existing lenses by which poverty issues are reviewed in particular countries, based on past national experience, by policymakers and donors. For example, food aid and more recently safety nets and social risk management approaches are predominant in Ethiopia and the latter are gaining ground in Mozambique and Ghana. Bangladesh has a longstanding body of knowledge on disaster preparedness and disaster risk management of key utility to current climate adaptation discussions. Decentralization and social inclusion issues predominate in Bolivia, with the administration's focus on indigenous peoples and social accountability.<sup>12</sup> Across the study countries, spatial and area development questions have come to the fore both as past markers of political economy questions regarding sub-national investment allocations and even population resettlement (e.g., debates over investments in Ethiopian highlands versus pastoral areas), and as part of ongoing policy dialogue, as in the Northern regions of Ghana where safety net and area development investments are now planned.

The literature on safety nets reports that existing national attitudes towards equity and poverty are a key determinant of room for maneuver when broad-based social protection investments are proposed, e.g., particularly where policies with a universal coverage principle are proposed (Grosh et al 2008). Such norms and attitudes on equity also stem in part from the degree of social homogeneity within national populations, where transfers to poorer persons are less likely to be seen as 'handouts' to the Other but rather as elements of an agreed social compact among relative equals/ citizens, in those countries with homogeneous populations.

National government motivations and interest in the study have varied, in part due to previous experience and work on climate change preparations. For example, Government of Bangladesh leads a bloc of 49 less developed countries in the climate negotiations and is keen to place the EACC study in an overall context of related investigations on adaptation and its costs. Policy space for discussion of the climate change issue is also present in Bolivia where the government has declared climate change a priority area for action (with an emphasis on social vulnerability issues) and in Ghana where donors have been coordinating across sectors on climate change for some time, despite the lack of a NAPA in that country.

### 7.1 LESSONS LEARNED

Design and implementation of the study in collaboration with a range of donor, client country, and other international and national partners has given rise to a number of interesting lessons, even from the outset. Some of these are elaborated below.

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<sup>12</sup> Each level of government (i.e., national, departmental, municipal) enjoys autonomous authority within the Plurinational State of Bolivia's highly decentralized policy and institutional configuration. Recent changes to the Constitution allow for indigenous and regional autonomies to exist within the departments of state, further enhancing the scope for citizen participation when defining public investment at all levels, but especially at municipal level. The country's rich ancestral experience of local adaptation to climate variability, including in mountain environments, is also cited in support of decentralized governance.

**First, adaptation planning can be usefully coordinated with ongoing national policy reform agendas and discourse.** For example, in Ethiopia climate change adaptation issues have a natural link to the ongoing national policy debate within the drought and flood response arena on the shift from a food aid/emergencies approach to one of social risk management (that emphasizes household assets and households' ability to withstand shocks").

**Second, planning across scales (i.e. links and synergies across national, regional and local levels) matters for pro-poor adaptation programming.** For example, the reach and impact of investments in national hydro-meteorological systems, incl. local weather stations used for data collection, can be greatly enhanced through complementary investments in agricultural extension and alternative communications outreach, such as community radio, to broadcast weather and agricultural input information directly to farmers in a user-friendly format".

**Third, identifying and gaining support for soft adaptation measures is a difficult but crucial task.** Hard infrastructure is a more visible investment option and both donors and client governments have reasons to lobby for it (i. ease of design; calculable impact; ii. more funds; political wins in-country). "Soft" adaptation measures are more difficult to identify, design and gain support for, but are crucial to both structure the policy environment (e.g., pricing reforms) and to ensure effective implementation and voice of local persons (e.g., user committees; training; accountability measures).

**Fourth, political economy variables are a key element that must be understood in planning for adaptation support efforts globally.** Governance and decentralization contexts also matter, as alluded earlier. National governments frequently "cherry-pick" regions or livelihood/ ethnic groups for additional resources, using political criteria (see also Tendler 2000). Approaches such as Participatory Scenario Development can aid in making decision criteria for investments more transparent.

## 8. Conclusion

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Climate change projections and impacts experienced to date point to a physical process that will exacerbate existing socioeconomic inequalities within and between countries. Complex and uncertain climate futures require varied forms of analysis and communication at multiple scales to ensure meaningful and effective participation of diverse stakeholders. Participatory approaches to scenario development offer a means of increasing transparency and social accountability in climate adaptation planning at national level. An integrated and cross-sectoral approach to research and design intervention allow for identification of risks and benefits of adaptation options for different stakeholders. This is the approach being taken by the Economics of Adaptation to Climate Change study at the World Bank. Planning for pro-poor adaptation responses requires significant inter-sectoral coordination by governments, donors, and civil society. We have outlined an approach to social analysis of climate change adaptation practices and futures that aims to enhance transfer of knowledge and information across scales, and improve downward accountability. Action research, embedded in ongoing policy processes, offers the opportunity of fostering real-time dialogue with policymakers, and input to key development and adaptation planning initiatives over the medium- to long-term.

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## Annex 1

### SNAPSHOT OF EACC-SOCIAL STUDY IN COUNTRY CONTEXT

	<b>Bangladesh</b>	<b>Bolivia</b>	<b>Ethiopia</b>	<b>Ghana</b>	<b>Mozambique</b>
<b>NAPA prepared?</b>	Yes, plus Climate Change Strategy (2008)	No	Yes	No	Yes
<b>UNFCC Focal Point</b>	Min. of Environment	Min. of Agric.	National Meteorological Agency	Environmental Protection Agency	SETSAN (Min. of Food Security) <sup>7</sup> Min. of Environment
<b>Key Policy Concerns</b>	Disaster risk management	Decentralization; indigenous peoples	Safety nets/ social risk management	Area development; Productive safety nets	Food security
<b>Zones Identified by EACC-Social teams</b>	<ul style="list-style-type: none"> <li>- Coastal areas and islands</li> <li>- <i>Sundarbans</i> mangrove</li> <li>Riverine flood areas</li> <li>- Land erosion areas Riverine islands (chars)</li> <li>- Urban and peri-urban slums,</li> <li>- Flash flood/hilly areas</li> <li>- Drought prone areas.</li> </ul>	<ul style="list-style-type: none"> <li>- <i>Alturas</i> (cold and dry)</li> <li>- <i>Valles</i> (temperate),</li> <li>- <i>Chaco</i> (warm and dry)</li> <li>- <i>Llanos</i> (warm and humid),</li> </ul> <p>[overlaid with 16 Holdridge livelihood zones for 12 sites total]</p>	<ul style="list-style-type: none"> <li>- Highland, belg cereal and livestock</li> <li>- Highland, cereal and livestock (degraded soil)</li> <li>- Lowland pastoral-agropastoral</li> <li>- lowland mixed farming degraded soil</li> <li>- Midland irrigable</li> <li>- Midland high agricultural potential</li> <li>- Perennial production</li> <li>- Urban settings</li> </ul>	<ul style="list-style-type: none"> <li>- Upper East &amp; Upper West</li> <li>- Northern Region</li> <li>- Forest-Savanna Transition</li> <li>- High Forest</li> <li>- Coastal</li> <li>- Zongo (peri-urban settlements)</li> </ul>	<ul style="list-style-type: none"> <li>- Coastal urban areas</li> <li>- Non-urban coastal strip</li> <li>- Lower Limpopo River Basin</li> <li>- Other river basins</li> <li>- Southern inland regions</li> <li>- Central and northern inland regions</li> </ul>

<b>Main climate hazards</b>	- Floods - Sea level rise/ storm surge - Cyclones	- Droughts - Floods	- Droughts - Floods	- Droughts - Floods	- Floods - Droughts - Cyclones
<b>Existing Data</b>	Participatory Poverty Assessments; Flood response assessments (2004. 2007) and Cyclone SIDR Assessment	PNCC study	CALI study; IFPRI	Participatory Poverty Assessment (1995)	INGC study
<b>Coordination with ongoing projects/ programs</b>	CDD projects for flood and cyclone livelihood restoration	Flood management	WB Productive Safety Nets Program; Irrigation and Drainage; Pastoralist Development	PSIA; Poverty Assessment  IUCN - REDD  Civic Response community radio	Tbd
<b>NGO or university collaboration/ liaison?</b>	IUCN, BCAS, BRAC	World Vision?	Oxfam America	CARE  Univ of. Ghana	University
<b>National consultants</b>	<b>Bangladesh Institute of Development Studies (BIDS)</b>	<b>Ruth Llanos Miguel Morales</b>	<b>Ethiopian Economics Association (EEA)</b>	<b>Participatory Development Associates (PDA) Ghana</b>	<b>Anthony Patt (IIASA) Raul Varela  Isilda Nhantumbo</b>

### APPROACH TO DATA COLLECTION

Data collection strategies include:

- *Review of existing qualitative and quantitative secondary data on poverty, vulnerability, and climate hazards and validation at field level) and development of vulnerability zones and livelihood profiles.* This involves a review of household surveys, participatory poverty assessments and other existing data on poverty, climate, and agro-ecological features. This review will help to identify socio-geographic zones of country particularly vulnerable to climate change; Select two sites per zone for investigation.
- *Review of policy and institutional environment for local adaptation.* This consists of an analysis of *de jure* and *de facto* factors of the macro-level policy environment for local adaptive responses (such as land tenure and local governance, including formal and informal/ traditional governance forms). Reference will also be made to relevant national policy emphases (with regard to commercial agriculture development, land reform, urbanization, non-farm employment).
- *Validation of livelihood profiles at field level through community/civil society focus group discussions and other participatory methods* in each community to gather information regarding climate hazards, impacts, and adaptation practices. At least 3-4 focus group discussions will be organized in each community. The focus groups should be differentiated by gender, age, ethnicity, etc. Other tools to be used include wealth ranking, village history/ timelines; mapping of institutional and natural resources/ tenure, matrix ranking of adaptation options according to community-generated criteria (compiled by men's and women's focus groups), broad trend analysis (natural resource depletion, migration), seasonal calendars (rainfall, seasonality of food (in)security, health or illness, production, debt), and impact diagrams of observed climate trends and extreme events (household level shocks, community and area-level impacts).<sup>13</sup>
- *Semi-structured interviews* (15 per community site, purposively sampled from different well-being tiers during wealth ranking and female heads of households, disabled, village heads, etc.) to elicit household-level data on modules covering household composition and livelihoods, asset base, migration patterns, participation in formal organizations, governance, adaptation practices, illness, access to common property resources, and other variables related to household livelihoods and shocks.
- *Key informant/ Institutional stakeholder interviews* with officeholders in local organizations, local/provincial government offices (e.g. de-concentrated line ministries), and other decision-making bodies at local level to gather relevant information about policy and institutional mandates, functions, and capacities and civil society perceptions of the same. ]
- *PSD workshops:* To validate results of field investigations through local and national PSD workshops featuring structured discussions around adaptation options and pathways to identify:

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<sup>13</sup> Reporting of results may include construction of a matrix of "conflict and cooperation" (in terms of natural resources, tenure, product markets, labor, environmental positive externalities or re-use, etc.) comparing and contrasting the interaction of different occupational/livelihood groups in the same spatial locale.

local criteria priority ranking; local values and cultural criteria (see below) re scale and technology choice among others.

- *Feedback/integration:* Share adaptation preferences and criteria with other sector teams; Determine relationships between household and area characteristics and suitable/ effective adaptation options