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Climate Change Adaptation Assets and Group-Based Approaches

Gendered Perceptions from Bangladesh, Ethiopia, Mali, and Kenya

Noora Aberman, Snigdha Ali, Julia A. Behrman

Elizabeth Bryan, Peter Davis, Aiveen Donnelly

Violet Gathaara, Daouda Kone, Teresiah Nganga

Jane Ngugi, Barrack Okoba, Carla Roncoli

Development Strategy and Governance Division

Poverty, Health, and Nutrition Division

Environment and Production Technology Division

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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AUTHORS

Noora Aberman (n.aberman@cgiar.org) is the country program coordinator of the Malawi Strategy Support Program, of the Development Strategy and Governance Division of the International Food Policy Research Institute (IFPRI), Lilongwe.

Snigdha Ali (singdha.ali@gmail.com) is the lead coordinator in the Communications Division of BRAC, Dhaka, Bangladesh.

Julia A. Behrman (julia.behrman@gmail.com) was a senior research analyst in IFPRI's Poverty, Health and Nutrition Division when this work was written. She is currently a PhD candidate in the Department of Sociology at New York University, New York, NY.

Elizabeth Bryan (e.bryan@cgiar.org) is a senior research analyst in the Environment and Production Technology Division of IFPRI, Washington, DC.

Peter Davis (p.r.davis@sdri.org.uk) is SDRI coordinator and a research fellow at the Social Development Research Initiative, Bath, UK.

Aiveen Donnelly (aiveendonnelly@hotmail.com) was a student at Justus Liebig University, Giessen, Germany when she contributied to this work.

Violet Gathaara (vgathaara@gmail.com) is a researcher at the Kenya Agricultural and Livestock Research Organization, Nairobi.

Teresiah Nganga (treazahwnganga@yahoo.com) is a researcher at the Kenya Agricultural and Livestock Research Organization, Nairobi.

Jane Ngugi (ngugijane19@yahoo.com) is a researcher at the Kenya Agricultural and Livestock Research Organization, Nairobi.

Barrack Okoba (okoba2000@yahoo.com) is a senior principal at the Kenya Agricultural and Livestock Research Organization, Nairobi.

Daouda Koné (dkone42780@gmail.com) is a researcher at Institut d'Economie Rurale, Bamako, Mali.

Carla Roncoli (carla.roncoli@emory.edu) is a senior research scientist at Emory University, Atlanta, GA, US.

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ABSTRACT

People who rely on natural resources for their livelihoods are more vulnerable to the impacts of climate change and are often limited in their capacity to adapt to the changes. Vulnerability to climate change is exacerbated when individuals' asset base is limited or insecure. Because control over assets is highly influenced by gender—with women typically controlling fewer low-value assets than men, which are more likely to be disposed of during shocks— it is important to understand the gender dynamics of climate change adaptation and the use of assets in this process. Using a participatory rural appraisal approach, a series of qualitative studies were conducted in four countries facing negative impacts of climate change—Bangladesh, Ethiopia, Kenya and Mali—in order to determine men's and women's perceptions of climate change, adaptive approaches, and the degree to which assets and group participation play a role in adaptation strategies. Similarities were found across countries in terms of perceptions of climate change, impacts, and strategies for adaptation. Farmers and pastoralists, groups heavily dependent on natural resources, are starkly aware of and impacted by subtle climatic changes, and those with a stronger asset base were better able to adapt to changes and shocks. Social norms largely determine which physical assets women can own or control and how they gain ownership of them, often limiting women's adaptive capacity. Groups were highlighted as a key strategy for adapting to climate change for men and women, primarily as a tool to facilitate asset development through group purchase of large farm appliances (physical capital), group loans (financial capital), or capacity development (human capital). Finally, the results illuminate the degree to which women's and men's adaptive approaches are intertwined as interdependent members of a household.

Keywords: gender, climate change, adaptation, assets, group-based approaches

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1. INTRODUCTION

There is a growing body of research focusing on how agricultural households will be affected by climate change (Deressa et al. 2009; Nelson et al. 2010). People who rely on natural resources for their livelihoods are more vulnerable to the impacts of climate change and are more limited in their capacity to adapt to the changes (Smit and Pilifosova 2001). Vulnerability to climate change is exacerbated when individuals' asset base is limited or insecure, as this limits their ability to cope with shocks and to innovate when faced with new challenges (Speranza 2011). Because control over assets is highly influenced by gender, it is important to understand the gender dynamics of climate change adaptation and the use of assets in this process. Furthermore, a small but growing body of literature focuses on collective adaptation efforts of community members as a mechanism for enhancing the adaptive capacity of the whole group (Ayers and Forsyth 2009; Dodman and Mitlin 2011), and thus group participation may be a mechanism for protecting or enhancing assets, particularly for women.

In order to understand men's and women's perceptions of climate change, adaptive approaches, and the degree to which assets and group participation play a role in adaptation strategies, a series of qualitative studies were undertaken in four countries facing negative impacts of climate change—Bangladesh, Ethiopia, Kenya, and Mali—using a participatory rural appraisal (PRA) approach. The following section provides an overview of the study and methodological approach. Section 3 describes the theoretical framework that helped guide the analysis presented in this paper. Section 4 provides a summary of each country case study, which includes the general country context and the sampling approach. Section 5 provides synthesized cross-country results. Finally, Section 6 discusses the results and implications of this work.

2. STUDY OVERVIEW AND METHODOLOGY

In order to assess some of the important issues presented in the previous section, the International Food Policy Research Institute (IFPRI) and partner organizations initiated a research project entitled "Enhancing Women's Assets to Manage Risk under Climate Change." The research project aims to better understand the linkages between assets, gender, and community groups in the context of increasing climatic pressures and a strong need for vulnerable farmers to find adaptive approaches. As one component of the broader project, this synthesis of qualitative studies aims to understand gendered perceptions of the role of assets and groups in climate change adaptation.

Bangladesh, Ethiopia, Mali, and Kenya were chosen as cases studies for this project because of the challenges these countries face in terms of impacts of climate change. Africa south of the Sahara is highly vulnerable to adverse impacts from climate change, due to dependence on rainfed agriculture, persistent poverty, and poor infrastructure, particularly in rural areas (Niang et al. 2014). In Asia, Bangladesh is one of the countries most vulnerable to climate change as a result of high poverty, high dependence on agriculture, and large expected impacts from increased inland flooding, sea-level rise, and increased frequency of coastal cyclones (Yu et al. 2010).

Group interviews were undertaken in each of these countries using a PRA approach. Interview protocols to guide the interviews were developed by IFPRI and then adapted by local partners who facilitated the discussions. The gender disaggregated group interviews included modules on signs and impacts of climate change, asset control and ownership, participation in community groups, adaptive approaches, and constraints to adaptation[1].

As indicated in the name, PRA is a participatory approach intended to allow both investigators and villagers to learn from the research process. The method requires researchers to act as facilitators while local people are directly involved in the investigation of their situation (Chambers 2007). There are a variety of tools and techniques available that can be used for PRAs, depending on the context or specific objectives of the research.

For this series of country studies, points raised during group discussions were captured on flipcharts according to the category designated (for example, sign, impact, or adaptation) as they were offered by the interviewees. As such, interview participants could clearly see how their responses were categorized and change or re-classify responses as desired. Analysis was based on a combination of deductive and inductive coding, first categorizing responses according to pre-ordained topics (deductive), then coding responses thematically within each category based on the regularity of occurrence (inductive). Ranking exercises—often used in PRA as it allows participants to be a part of the analysis—were found to be challenging for some of the less educated women in the first case study country, Kenya (Roncoli et al. 2010). As such, this aspect of the PRA was discontinued in later applications.

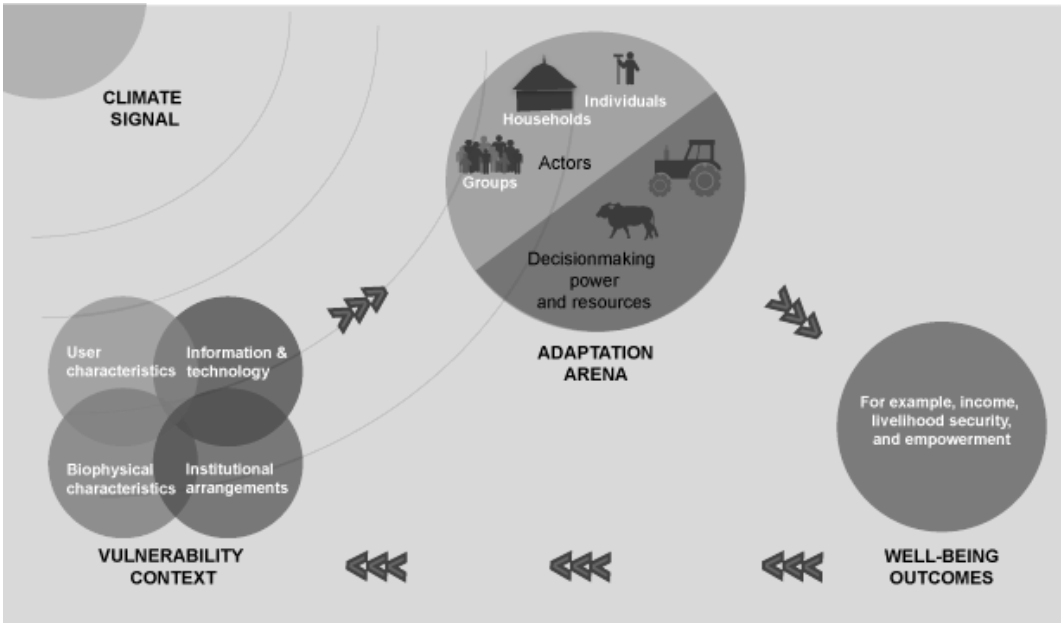
While similar approaches were used across study sites, the participatory and flexible nature of the PRA tool and differing sampling approaches applied (explained in more detail in Section 4) makes it a challenging task to compare and contrast results. However, an additional round of coding of the original PRA results was applied according to the key themes arising from the conceptual framework described in Section 3 in order to rigorously synthesize the similarities and draw together some broader lessons from the individual case studies.

[1] The Kenya study was completed before the others for a related but separate IFPRI-led project. Thus the other protocols were based on the Kenya protocol, which did not explicitly include modules on assets and groups, but the in-depth discussions did shed some light on these topics.

3. THEORETICAL FRAMEWORK

Adaptation to climate change is a complex, multidimensional, and multi-scale process (Bryant et al. 2000). While the literature on climate change adaptation is extensive, this work aims to conceptually and empirically integrate a number of other social issues and factors—such as gender, assets, and institutions—that are likely to play a role in adaptation. As such, a new framework (Figure 3.1) was developed for gender, assets and climate change adaptation by borrowing aspects from some useful existing frameworks, in order to comprehensively integrate all of these components. This framework, was described in detail by Bryan and Behrman (2013) and summarized below, was used to guide synthesis and discussion of the results presented here.

Figure 3.1 Theoretical framework for gender, assets and climate change adaptation



Source: Bryan and Behrman (2013).

Climate Signal

The first element of the framework is the climate signal. The climate signal comprises long-term changes in average climate conditions, as well as changes in climate variability—such as changes in the timing, intensity, and duration of precipitation and the frequency of extreme weather events, such as droughts and floods. The response of actors and systems depends on the characteristics of the climate stimulus, including the degree of exposure to the stress and the scale and magnitude of the event (Smithers and Smit 1997).

Vulnerability Context

The impact of climate change on the well-being of individuals, households, and communities and their ability to respond to those changes depends on the context in which climate change occurs (Adger et al. 2009). The context includes all the factors that determine an individual's, household's, group's, or community's vulnerability to climate change, including user characteristics, access to information and technology, biophysical characteristics, and institutional arrangements (Bryan and Behrman 2013).

Some actors or groups can be considered more vulnerable to climate change impacts given their livelihood activities, store of assets, social characteristics, and cognitive ability. For example, those that rely on natural resources for their livelihoods may be more sensitive to climate change impacts. Other constraining characteristics include lack of access to or control over financial resources or assets needed to adopt practices that would minimize the risks of climate change. Other users may face difficulties in pursuing particular adaptation options due to social status. Gender, in particular, is one user characteristic that may have profound impacts on individuals' access to assets and thus ability to cope with climate change. Assets may include the following categories of tangible and intangible capital: natural resource, physical, human, financial, social, and political. (Bryan and Behrman 2013; Meinzen–Dick et al. 2010))

The ability and nature of the adaptation response depends on an individual's, household's, or community's access to information about climate risks and the appropriate responses. While many communities have developed their own systems for monitoring climate conditions, this information may not be adequate to inform adaptation if the climate changes in unprecedented ways. Sociocultural changes also account for the shift away from traditional practices such as the use of bioindicators for agricultural production, even when such practices continue to provide useful information. In the absence of credit and insurance markets, climate uncertainty often results in reluctance of farmers to make investments in production technologies, such as fertilizer, which would enable them to improve their well-being over the long run (Dercon and Krishnan 2000).

Biophysical characteristics refer to the sensitivity of physical and ecological systems, which defines the natural limits to adaptation. In the climate change literature, these natural limitations are often viewed as thresholds beyond which change becomes irreversible and limits the ability to adapt (Stern 2007). That is, climate change may alter ecosystems beyond the point at which human activities can be supported (IPCC 2007). For example, water availability may decline to an extent that makes certain types of agricultural production nearly impossible. These changes in biophysical systems have profound effects on the individuals, households, or communities that access and depend on those resources.

Adaptation must also be viewed within the context of the institutional environment in which it takes place, including the ongoing development process and the broader policy environment (Smit and Wandel 2006; Jones, Ludi, and Levine 2010). For example, institutions affect the roles governing access to and control over resources and assets for adaptation and local institutions influence how climate risks and impacts are distributed across different social groups and populations (Agarwal and Perrin 2008; Jones, Ludi, and Levine 2010). Social and cultural norms, and other rules governing behavior, influence the extent to which individuals and groups within a community are able to participate in and benefit from collective action (Eriksen and Lind 2009; Patt, Dazé, and Suarez 2009).

Adaptation also depends on the *institutional capacity* of the community, referring to the degree of social capital in the community, the ability of community members to work collectively, and their ability to access resources and information from higher-level institutions such as government agencies and nongovernmental organizations. Many factors will influence the effectiveness of collective efforts to adapt to climate change. Among them are: characteristics of the community or group (for example, size, degree of homogeneity, and so on), the ways in which members of the community organize (group type), and the linkages with higher level institutions (for example, with supporting government or donor agencies) (Ostrom 1990; Rasmussen and Meinzen–Dick 1995; Tompkins and Adger 2004; Bryan and Behrman 2013).

Adaptation Arena

Adaptation can improve well-being outcomes while reducing vulnerability to future climate change by increasing the ability of actors to withstand climate change and variability, and to moderate and cope with adverse consequences (IPCC 2001). Actors at multiple scales, from the individual to the community, have different perceptions, needs, and preferences. These actors make adaptation decisions based on their access to and control over resources (such as assets, time, and habitus) and decisionmaking power (Ostrom 2005). Institutions, which often determine the rules of the game, also influence adaptation

actions. These institutions can include formal laws as well as social and cultural norms that govern behavior.

Gender norms often exclude women from participating in decisionmaking and rule setting at various levels (for example, household, group, community). Men's and women's priorities for adaptation will be shaped by the existing norms, roles, and responsibilities and how adaptation strategies build on, ameliorate, or distort these. Culturally specific gender norms define the roles that men and women play in farm and natural resource management (Meinzen-Dick et al. 2010). Furthermore, evidence indicates[2] that men and women may actually perceive climate risks differently; a fact that may further contribute to the development of gender-differentiated priorities for adaptation (Bryan and Behrman 2013).

In this framework, the adaptation arena is dynamic. The resources to which individuals, households, and communities have access to implement adaptation strategies change over time. Well-being improvements resulting from adaptation decisions taken today may reduce future vulnerability to climate change and variability and give actors more freedom to implement additional adaptation decisions in the future. On the other hand, inability to take protective measures against future climate change and extreme climate-related events may reduce well-being and increase vulnerability to future climate change, leaving actors with more limited adaptive capacity (Bryan and Behrman 2013).

In addition, the framework focuses on the differences in vulnerability and responses to climate change across genders, another critical user characteristic for the context of vulnerability. The roles of information and technology and institutional capacity—represented by farmers groups—are also considered in terms of their role in determining adaptive approaches.

This theoretical framework facilitates consideration of the implications of gender in the vulnerability context and adaptation arena. Because of the importance of women's decisionmaking power to meet their adaptive needs, the analysis also emphasizes the role of aspects of women's empowerment such as group participation and control of physical assets. Specifically, we consider the implications of gender on perceptions of climate signals and impacts, assets, adaptation approaches, and constraints to adaptation.

While also important to adaptation, this study does not focus on the implications of biophysical characteristics or broader institutional characteristics such as the policy environment.

[2] For a review of evidence, see Bryan and Behrman (2013).

4. BACKGROUND FOR COUNTRY CASE STUDIES

This paper synthesizes results from four different country contexts and sampled different agroecological zones within the countries. While many characteristics vary across countries, such as cultural norms and institutional context, each of the case study countries are seen as particularly vulnerable to climate change impacts. Furthermore, even though there was a range of regions and agroecological zones sampled within the case study countries, the communities of study are likely to be vulnerable to climate change due to their reliance on natural resources for livelihoods.

This section provides a brief description of some of the country characteristics that make each of the four country cases vulnerable to climate change, as well as an overview of the sampling and data collection in each country. Table 4.1 summarizes the characteristics of the four country cases and the group interview details.

Table 4.1 Study country characteristics

Characteristic	Bangladesh	Ethiopia	Kenya	Mali
Employment in agriculture*	• 21 percent	• 38 percent	• 32 percent	• 19 percent
Agriculture % of GDP**	• 18 percent	• 49 percent	• 30 percent	• 42 percent
Agricultural focus	• Rainfed and groundwater-irrigated rice production • Dependence on high-yielding varieties relying on groundwater irrigation • Fisheries, livestock and forestry sectors are also important	• Largely rainfed agriculture • Predominantly small-scale mixed crop and livestock production • Dependence on traditional farming techniques, overgrazing and deforestation lead to depleted soils	• Largely rainfed agriculture • Livestock production also plays a major role in food security and livelihoods. • Conflict exacerbates climate vulnerability	• Largely rainfed agriculture • Developing improved cultivars in high rainfall zones • Conflicts over natural resources common, especially between farmers and pastoralists.
Key climate change vulnerabilities	• Extreme flood frequency • Encroachment of salt water in coastal areas, depleting groundwater aquifers	• Variable/unpredictable rainfall and droughts	• Variable/unpredictable temperature and rainfall • Terrestrial surface water resources are very vulnerable to the impacts of climate change	• Declining soil productivity and population growth • Two-thirds of the country falls within the Sahara desert
Group interview details	• 30 group and 30 key-informant interviews in 15 villages across 7 agroecological zones (300 participants in total)	• 12 group interviews at 6 sites in 2 regions across agroecological zones (90 participants in total)	• 10 group interviews in 5 districts (140 participants in total)	• 10 group interviews were in 5 villages in 2 production systems (325 participants in total)

Source: Compiled by authors based on FAO (2011) and World Bank (2012).

Note: Employment in agriculture computed with FAOSTAT 2011 country data (economically active population in agriculture as share of total population). Agriculture value added as a share of gross domestic product from World Data Bank indicators for 2012.

Bangladesh

Bangladesh is a low-lying country with high population density and a large agricultural sector that is vulnerable to environmental changes. The sector employs 21 percent of the country's labor force and contributes 18 percent of country's GDP. The rural population is largely dependent on agriculture, especially rainfed and groundwater-irrigated rice production, although fisheries, livestock, and forestry sectors are also important to the economy. Encroachment of salt water in coastal areas, depleting groundwater aquifers due to widespread expansion of tubewells for agriculture and domestic use, and reduced replenishment due to declining river levels—especially in dry seasons—all jeopardize agricultural productivity and the livelihoods of the rural population (Mirza 1997; 2002; Ruane et al 2013). Dependence on high-yielding varieties of rice and other crops that rely on groundwater irrigation—especially during the dry winter months—has driven improved agricultural productivity since the 1970s. However, these improvements are vulnerable to changes in climate and water supply. Extreme weather events, such as storms, tornados, cyclones, flooding, and cold snaps, can further damage crops and undermine fragile livelihoods (Davis and Ali 2014).

For this study, 30 gender-segregated group interviews and 30 key informant interviews were carried out in May 2012 in 15 villages across 7 agroecological zones in rural Bangladesh (Davis and Ali 2014). For the group interviews, community members were who were 30 years of age and older were selected so that a trend or pattern of changes in weather in the last 15 to 20 years could be discussed. Key informants were community members who were referred to as knowledgeable by others in the village or had some level of education. Each FGD had 8–10 participants on average, yielding a total of 300 people interviewed for the study. The 15 villages were selected from a larger sample of villages in an associated quantitative survey, which re-interviewed households surveyed in an earlier study by Thomas et al. (2013). The locations of the 15 villages represented a range of different environments and a variety of climate change-related impacts.

Fieldworkers underwent two and a half day trainings and took a pretest on the interview protocol before beginning fieldwork. There were two teams of four fieldworkers, each made up of two women and two men so that female members facilitated the women's groups and key informants and male members facilitating the men's groups and key informants. Each team was sent to a different geographical location to undertake data collection. Interviews were held in the local language of Bangla.

Ethiopia

Agriculture is Ethiopia's main economic driver with 49 percent of GDP depending on agriculture, and agriculture providing employment for 38 percent of the labor force. The agriculture sector is dominated by small-scale, low-productivity farming, and is highly sensitive to climatic variations Some of the factors responsible for this are reliance on rainfed agriculture, soil degradation, and poor complementary services (Devereux 2000; Tazeze, Haji, and Assistance 2012). Variable rainfall and droughts are associated with food shortages and economic stagnation over the past few decades (Araya and Stroosnijder 2011). Even in years with average rainfall, 10 percent of households are food insecure and rely on food assistance (Conway and Schipper 2011). Largely as a response and a means of avoiding the necessity of large-scale, drought-related disaster response, the Productive Safety Net Programme (PSNS) was developed. The program aims to build household and community assets through food-for-work and cash-for-work programs to move away from emergency response. This program is the chief instrument to support the small-scale agriculture and food security in the country. (Conway and Schipper 2011)

For this study, 12 gender-segregated group interviews were held, with a total of 90 participants (42 women and 48 men) (Donnelly 2012). The site selection for the PRA was based on sites included in the Ethiopian Rural Household Survey (ERHS). Specifically, the sites were selected to represent different climatic, agroecological, ethnic-cultural and, socioeconomic conditions in order to broadly compare country specific differences. In total, six sites—situated in two regions—were visited that met the above criteria. This resulted in varied implementation and success of the land registration policy. In each PRA site, one female and one male group interview was conducted. All participants were from households

involved in sedentary farming activities and selection of individuals was done with assistance from the local farmers' organization official (*kebele* official).

Fieldworkers who conducted the interviews were affiliated with Addis Ababa University and supervised by an IFPRI consultant. They underwent a two-day training and took a pre-test of the interview protocol before traveling to the field. Interviews were undertaken in March 2012, with one fieldworker moderating and noting responses on a flip chart for interviewees to see, while the other fieldworker took detailed notes of the discussion. All interviews were conducted in Amharic and participants were offered refreshments during the process.

Kenya

Agriculture is the min driver of Kenya's economy, contributing 30 percent of the GDP and employing 32 percent of the labor force, indicating a population dependent on natural resources and thus vulnerable to climatic shocks (UNDP 2004). Eighty percent of the country's landmass is arid or semiarid, depending on rainfed agriculture, and prone to extreme weather events such as drought and floods (Herrero, Ringler, Steeg, and Thornton 2010). For these areas, livestock is often of critical importance to livelihoods and food security (Eriksen and Lind 2009; Herrero et al. 2010; UNDP 2004). Temperatures and rainfall are both predicted to increase in Kenya, putting the country at risk of more such extreme events in the future (Gosling and Dunn 2011). And terrestrial surface water resources are particularly vulnerable to the impacts of climate change (UNDP 2004). Given these realities, adaptation strategies that reduce yield variability during extreme events will likely provide the greatest benefits to farmers (Bryan et al. 2011).

The study was conducted in 5 districts, with a total of 10 gender-segregated group interviews (Roncoli et al. 2010). Sampling of districts corresponded to a related household survey that was conducted in areas where World Bank-funded climate change interventions were being implemented (excluding control areas). The districts represent a wide range of climatic, agro-ecological, and socioeconomic conditions. In each field site, individuals were recruited through the agricultural extension service or through institutions responsible for implementing the World Bank interventions. The final sample included 140 people (69 men and 71 women). Interviews were undertaken in October and November 2009.

The field team was comprised of a multidisciplinary mix of five professionals from different institutions, all proficient in participatory methods and farmer-centered research. In each site, two gender-segregated groups were formed and each was facilitated by two members of the team (female members facilitated the women's group and male members facilitating the men's group). One member facilitated the discussion, while the other wrote on the flipchart in English (so the rest of the team could follow the discussion). Other team members took notes and photographs. Interviews were held in local languages and participants were provided refreshments or small lunch allowances.

Mali

Agriculture contributes 42 percent to the GDP of Mali and employs 19 percent of the workforce, the majority of which (97 percent) is rainfed (Butt, McCarl, and Kergna 2006). Declining soil productivity and population growth pose serious challenges to agricultural productivity. Mali's arid zones—two-thirds of the country falls within the Sahara desert—populations are confronted with a harsh climate that forces them to develop different strategies from those zones with greater rainfall (Kone 2013). A history of conflict between resource user groups exacerbates vulnerabilities (Watts 2012). The challenge of meeting the food needs of a rising population is attempting to be met by developing improved cultivars in the high rainfall zones (Butt, McCarl, and Kergna. 2006). There are large productivity differentials between the traditional cultivars and the improved cultivars (Butt , McCarl, and Kergna 2006), where the existence of hydro-agricultural infrastructure creates favorable conditions for production that are indispensable for better adaptation to the impacts of climate change (Kone 2013).

For this study, 10 gender-segregated group interviews were held in 5 villages within 2 production systems: (1) the irrigated system of Alatona, with irrigated rice as the principle crop and total control of water resources and where land title is the current mode of appropriation of land, and (2) the system above the water level, with millet as the dominant crop and where the land is managed according to traditional community rules (Kone 2013). In addition to sampling according to different production systems, villages were chosen based on their accessibility and receptivity to the activity, and in order to avoid conflict areas. Individuals were recruited across five villages, and while there was an attempt to include only 6–10 people per interview, in the villages many more requested to participate, thus many interviews included upwards of 30 people. There was a total of 325 people (175 women and 150 men) interviewed in February and March of 2012 in the local language of Bamanankan. Tea was provided to the participants during the interview.

5. SYNTHESIS OF CROSS-COUNTRY RESULTS

This study focuses on communities with a high likelihood of vulnerability to climate change due to their user characteristics as farmers, fishers, and pastoralists, which are livelihoods highly dependent on natural resources. The analysis examines how three other factors of the vulnerability context—gender, information and technology, and institutional capacity (represented by participation in farmers groups)—play a role in determining adaptive approaches. Furthermore, delving into the adaptation arena, this study examines how actors' resources (assets) and decisionmaking power mediate their ability to effectively adapt, and thus their well-being outcomes.

The following section synthesizes the results across each of the four case study countries. The synthesis, guided by the theoretical framework described above, emphasizes the similarities and differences across the interview responses, and is organized according to climate signals and impacts, asset use in adaptation, adaptation approaches, and constraints to adaptation. While also important to adaptation, this study does not focus on the implications of biophysical characteristics or broader institutional characteristics such as the policy environment.

Climate Signals and Impacts

Across all four countries, the main sign of climate change reported by respondents was that of irregularity of weather, primarily rainfall. This highlights the reality that many farmers across the four countries face wherein many rely on rainfed agriculture, making the predictability of rainfall and other weather patterns a critical factor in agricultural productivity and food security. While specific characteristics of the rainfall changes varied from country to country, overall it resulted in a lack of ability to plan for the agricultural season due to variability in the onset of the rainy season or increased challenges accessing the required water resources for agriculture when in the quantity of rainfall decreased. In Kenya and Mali, early rains with subsequent dry spells also resulted in germinated seeds dying. Other signs that varied across countries were increases in temperature, noted in Bangladesh, Kenya, and Ethiopia and increased prevalence of extreme weather events in Bangladesh.

Perceived impacts of climate change tended to differ according to gender. In particular, men emphasized impacts on crops while women emphasized scarcity of resources needed for the household. Across all interviews, the majority of the impacts centered on scarcity of water. The scarcity of water for agricultural uses was frequently raised. In Bangladesh, this was primarily discussed in terms of the lowered water table making irrigation more difficult, as well as salinization of water making it unsuitable for irrigation. In Ethiopia and Kenya, discussions emphasized decreased or unpredictable rainfall. In Bangladesh, Kenya, and Ethiopia, participants also discussed the water needs of livestock. The increased scarcity of water was blamed for decreased yields and crop failures and disease and death of livestock.

Women emphasized the challenges of accessing sufficient and suitable water for household use. The problem of salinization of water was raised by women in Bangladesh as making the water unsuitable for drinking.

Some secondary impacts of climate change were also noted. In Ethiopia, participants linked the decreasing crop yields to malnutrition and famine. Whereas in Kenya and Bangladesh, heavy rains and floods were linked to water-borne diseases. In addition, in Bangladesh, Mali, and Kenya, scarce water resources were linked to increasing inter-and intra-community conflicts. In Mali, participants particularly emphasized these social impacts, including negative effects of mass migration and breakdown of the family structure and family values.

Asset Use in Adaptation

The protocols used in Ethiopia, Bangladesh, and Mali each had modules discussing asset control and use in coping with the impacts of climate change. While each country has distinct social norms related to which specific assets are owned by women and men, respectively, and how they can come into control of such assets, there are some commonalities across studies. Specifically, jewelry and small animals tend to be owned or controlled by women. In Mali, women were also described as controlling the vegetable gardens, but female control is temporary as the land owner (the husband or in death the husband's brother) can take away the land. The assets owned by women are typically described as being gifted at marriage (jewelry and, in Ethiopia, trees) or purchased by the women themselves, whereas household production of the main crops and large livestock were considered the property of the man by default. In Ethiopia, this picture is bit more nuanced, as women control some less important grains, while men control the staple grains and any marketable crops. In all cases, women's assets are seen as the most suitable for sale in the case of shocks due to climate change.

The Kenya study did not discuss asset control by gender but it did elicit information on key resources needed for adaption. There were no significant differences between men and women; all evoked the importance of capacity building, credit, seeds, and water.

Adaptation Approaches

A wide variety of adaptive approaches were cited, and many were consistent across study countries. All participants discussed the use of seed varieties that are better-suited to new climatic conditions, such as drought resistant (Kenya) and early maturing varieties for shorter rainy seasons (Kenya and Mali). Bangladesh and Ethiopia described changing planting patterns, such as planting fruit trees and traditional plants that better withstand rainfall variation. Bangladesh and Kenya also discussed the need to take up or intensify irrigation (for instance, digging deeper tubewells in Bangladesh) as well as applying soil conservation and water management practices.

All country cases also discussed attempts to diversify livelihoods through production of fruits, vegetables, dairy, or livestock for sale. Some found low-wage manual labor or food-for-work opportunities, while others admitted to resorting to theft or commercial sex (Kenya). International and urban migration was also mentioned in all country case studies.

In Bangladesh and Kenya, women said they now purchase clean water, whereas they used to be able to access suitable water from wells, rivers, and other free sources. In Ethiopia, people mentioned having to boil water for consumption now because of poor quality. In Bangladesh, people were also paying more for irrigation as usual techniques were not effective any more due to lowered groundwater levels.

Farming cooperatives and other community groups were discussed in all countries as mechanisms for accessing credit, agricultural inputs, and trainings on new agricultural practices. In Bangladesh, interviewees also noted turning to groups for help with resource management and community conflict resolution. In Ethiopia, they emphasized soil conservation and water management. In Kenya, men stressed that group participation allows people to stand up to crime and corruption without fear of repercussions, and women felt that groups ensured greater accountability and transparency in the distribution of food aid.

To cope with shocks from climate change, participants across the four countries described selling households' assets. Assets controlled by women were considered the most suitable to sell in such situations, such as small livestock and jewelry. Other longer-term ex-ante coping strategies included decreasing of food consumption, as mentioned by Kenya and Ethiopia.

Constraints to Adaptation

Barriers to adaptation included the inability to afford appropriate improved inputs, such as drought-tolerant seeds. In Kenya and Bangladesh, respondents also emphasized the need for financing to invest in income-diversifying options such as small businesses and kiosks. Furthermore, a need to improve the capacity to adapt through trainings was raised in all countries. Some specific capacity needs mentioned were:

- tools and trainings for traditional agricultural practices (Ethiopia),
- seed production (Mali),
- tree planting (Mali and Kenya),
- value-addition and marketing (Kenya), and
- income-diversification skills such as woodwork, market gardening, and production of other crops such as peanuts (Mali).

Some contextual factors were also raised as constraints. An important issue that emerged in Kenya was the lack of security, due to ethnic and political violence, drug trafficking, crime, or corruption, as a barrier to adaption as well as a consequence of climate change related stresses. Bangladesh respondents described *elite capture* as a constraint—the tendency for wealthy or well-connected households to monopolize water resources in times of drought.

6. DISCUSSION

In spite of significant cultural and agroecological differences across the four case study countries, there is a large amount of consistency of results. The results largely support current literature on adaptation, and expand on our understanding of the way in which gender, assets, and collective action play a role in adaptive approaches.

Farmers and pastoralists, heavily dependent on natural resources, are starkly aware of and impacted by subtle climatic changes. In particular, the ability to access sufficient and clean water dominates discussion of climate change. Some groups point out a diminishing ability to cope with this reality as they sell limited physical assets when faced with a shock, leaving them more vulnerable to the next one. However, those with stronger asset base—whether it be the financial assets to start a small business or the appropriate skills or training to engage in a nonfarm income earning activity—are better able to cope with the shocks and effects of climate change. This underlines the degree to which vulnerability will mediate a household or community's ability to effectively adapt to climate change.

We see that most of the agriculture-related adaptive approaches taken, and those communities wish to take, are largely based on new technologies such as drought-tolerant or early-maturing seeds or new irrigation technologies. Paradoxically, people are also depending more on *traditional* practices, such as planting older, less marketable but more drought-tolerant, crops. We also see that information on these traditional practices is less accessible. For instance, Ethiopian farmers specifically note a lack of tools and trainings on traditional technologies as a constraint to adaptation, whereas the constraints to adopting the new technologies tend to be financial. However, in spite of the emphasis by these respondents on climate-smart technologies, especially seeds, results from an earlier study in Kenya indicates that seed aid alone is not sufficient to alleviate the negative effects of climatic shocks (Sperling 2002).

Increased pressures on critical resources have changed social and cultural norms related to resources access. For instance, in Kenya, women noted that cattle herders now chase them off water points in time of drought. In Mali, participants lamented the disintegration of the traditional family structure as young people migrated away from home and adopt foreign values rather than becoming a part of the traditional village structure. Similarly, Bangladesh participants mentioned intra-and inter-community conflict over natural resources, and a tendency for elite capture in times of scarcity. These types of social conflicts could be addressed to some extent through developing the institutional capacity of the communities through group participation and trainings (Bryan and Behrman 2013). In fact, in some group interviews in Bangladesh, respondents pointed out that group participation was helping community members to work together more effectively and manage conflict within and across communities and in Kenya, people pointed to group participation as a way to stand up to crime and corruption without fear of repercussions.

Social norms govern which physical assets women own or control and how they come to get them. The assets owned by women were largely described as being gifted at marriage or purchased by women themselves, whereas household production of the main crops and large livestock were considered the property of the man. Furthermore, women's assets were typically described as the first to be sold in the case of a climatic shock. Women's control of assets is associated with empowerment and bargaining power, so decreasing a woman's stock of assets should be detrimental to well-being (Meinzen-Dick et al. 2011). The extent to which men's and women's assets are used to cope with shocks depends on the type of shock and the types of assets held by men and women in a given context (Quisumbing, Kumar, and Behrman 2011). Therefore, policy interventions designed to increase resilience to climate shocks should take into consideration the distribution of household assets between men and women and ensure that such programs do not exacerbate the gender gap in asset ownership.

Group participation was seen as an important mechanism for enabling adaptation activities and asset development by both men and women. In particular, it was seen as a mechanism for developing human capital and for group investments in expensive technologies. Particularly for women, groups offer opportunities for loans. In some groups, men pointed to women's loans as a way the family copes with

shocks. However, women may be at a disadvantage when social networks are used to disseminate information needed for climate change adaptation—women in Mali were found to be more socially isolated and less likely to receive information about mulching when it was diffused through social networks (Beaman and Dillon 2014). Additional research is needed to understand to what extent and under what conditions group participation actually protects women's and men's store of assets and their ability to adapt to climate change.

The secondary impacts of climate change on other sectors, such as education, health, and nutrition, can be seen as creating negative feedback loops. For instance, climate impacts may lead to lack of resources to invest in medical treatment, nutrition or education, while simultaneously, poor health, nutritional status, and human capital limit the extent to which people can invest energy and resources in alternative adaptive strategies.

While it is important to understand the gender-specific dynamics in terms of assets, adaptation strategies, and overall well-being outcomes, these results illuminate the degree to which women's and men's adaptive approaches are also intertwined. The concept of gender and development emphasizes the social relations and interaction between men and women (Moser 1993; Okali and Naess 2013), highlighting the degree to which individual's priorities and decisionmaking are interdependent.

REFERENCES

Adger, W. N., S. Dessai, M. Goulden, M. Hulme, I. Lorenzoni, D. R. Nelson, L. O. Naess, J. Wolf, and A. Wreford. 2009. "Are There Social Limits to Adaptation to Climate Change?" *Climatic Change* 93: 335–354.

Agrawal, A. and N. Perrin. 2008. *Climate Adaptation, Local Institutions, and Rural Livelihoods*. IFRI Working Paper W081-6. Ann Arbor, Michigan: International Forestry Resources and Institutions Program and University of Michigan.

Araya, A., and L. Stroosnijder. 2011. "Assessing Drought Risk and Irrigation Need in Northern Ethiopia." *Agricultural and Forest Meteorology* 151 (4): 425–436. doi:10.1016/j.agrformet.2010.11.014.

Ayers, J., and T. Forsyth. 2009. "Community–based Adaptation to Cimate Change: Strengthening Resilience Through Development." *Environment* 51 (4): 22–31.

Bryan, E., and J. Behrman. 2013. *Community-based Adaptation to Climate Change : A Theoretical Framework , Overview of Key Issues and Discussion of Gender Differentiated Priorities and Participation*. CAPRi Working Paper 109. Washington, DC: International Food Policy Research Institute.

Bryan, E., C. Ringler, B. Okoba, J. Koo, M. Herrero, and S. Silvestri. 2011. *Agricultural Management for Climate Change Adaptation , Greenhouse Gas Mitigation , and Agricultural Productivity Insights from Kenya*. IFPRI Discussion Paper 1098. Washignton DC: International Food Policy Research Institute.

Bryant, R. C., B. Smit, M. Brklacich, R. T. Johnston, J. Smithers, Q. Chiotti, and B. Singh. 2000. "Adaptation in Canadian Agriculture to Climatic Variability and Change." *Climatic Change* 45: 181–201.

Butt, T. A., B. A. McCarl, and A. O. Kergna. 2006. "Policies for Reducing Agricultural Sector Vulnerability to Climate Change in Mali." *Climate Policy* 5: 583–598.

Chambers, R. 2007. *From PRA to PLA and Pluralism : Practice and Theory*. IDS Working Paper No. 286. Brighton, UK: Institute of Development Studies.

Conway, D., and E. L. F. Schipper. 2011. "Adaptation to Climate Change in Africa: Challenges and Opportunities Identified from Ethiopia." *Global Environmental Change* 21 (1): 227–237. doi:10.1016/j.gloenvcha.2010.07.013.

Davis, P., and S. Ali. 2014. *Exploring Local Perceptions of Climate Change Impact and Adaptation in Rural Bangladesh*. IFPRI Discussion Paper 01322. Washington, DC: International Food Policy Research Institute.

Dercon, S., and P. Krishnan. 2000. "In Sickness and in Health: Risk Sharing Within Households in Rural Ethiopia." *Journal of Political Economy* 108 (4): 688–727.

Deressa, T. T., R. M. Hassan, C. Ringler, T. Alemu, and M. Yesuf. 2009. "Determinants of Farmers' Choice of Adaptation Methods to Climate Change in the Nile Basin of Ethiopia." *Global Environmental Change* 19 (2): 248–255. doi:10.1016/j.gloenvcha.2009.01.002.

Devereux, S. 2000. *Food Security in Ethiopia*. *DFID Discussion Paper*. Brighton, UK: Department for International Development.

Dodman, D. and D. Mitlin. 2011. "Challenges for Community-Based Adaptation: Discovering the Potential for Transformation." *Journal of International Development* 25 (5): 640–659. doi:10.1002/jid.

Donnelly, A. 2012. "Potential for Group-Based Approaches to Enhance Security of Assets for Women to Manage Risk under Climate Change: A Participatory Rural Appraisal in Rural Ethiopia." Prepared for CAPRi/CCAFS Workshop on Institutions for Inclusive Climate-Smart Agriculture, Nairobi, Kenya, 14-15 September 2012.

Eriksen, S., and J. Lind. 2009. "Adaptation as a Political Process: Adjusting to Drought and Conflict in Kenya's Drylands." *Environmental Management* 43 (5): 817–35. doi:10.1007/s00267-008-9189-0.

FAO (Food and Agriculture Organisation). 2011. "FAOSTAT 2011 Country Data." Accessed November 10, 2014. http://faostat3.fao.org/.

Gosling, S., and R. Dunn. 2011. *Climate: Observations, Projections and Impacts: Kenya*. London: Met Office.

Herrero, M., C. Ringler, J. Steeg, and P. Thornton. 2010. *Climate Variability and Climate Change and Their Impacts on Kenya's Agricultural Ssector*. Nairobi, Kenya: International Livestock Research Institute..

IPCC (Intergovernmental Panel on Climate Change) . 2001. "Climate Change 2001: Impacts, Adaptation, and Vulnerability." Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK: Cambridge University Press.

—— 2007. "Impacts, Adaptation and Vulnerability." Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Edited by C. E. H. M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, New York and Cambridge, UK: Cambridge University Press.

Jones, L., E. Ludi, and S. Levine. 2010. Towards a Characterization of Adaptive Capacity: A Framework for Analyzing Adaptive Capacity at the Local Level. Overseas Development Institute (ODI) Background Note. United Kingdom: ODI.

Kone, D. 2013. "Strengthening Women's Modes of Production in Order to Manage Risk under Climate Change: Potential for Group Approaches." Prepared for CAPRi/CCAFS Workshop on Institutions for Inclusive Climate-Smart Agriculture, Nairobi, Kenya, 14-15 September 2012.

Meinzen-Dick, R., J. Behrman, P. Menon, and A. Quisumbing. 2011. "Gender: A Key Dimension Linking Agricultural Programs to Improved Nutrition and Health." In *Reshaping Agriculture for Nutrition and Health*, edited by S. Fan and R. Andya-Lorch, 135–144. Washington DC: IFPRI.

Meinzen-Dick, R., A. Quisumbing, J. Behrman, P. Biermayr-Jenzano, V. Wilde, M. Noordeloos, and N. Beintema. 2010. *Engendering Agricultural Research*. Discussion Paper 00973. Washington, DC: International Food Policy Research Institute.

Mirza, M. M. Q. 1997. "Hydrological Changes in the Ganges System in Bangladesh in the Post-Farakka Period." *Hydrological Sciences Journal* 42 (5): 613–631.

———. 2002. "Global Warming and Changes in the Probability of Occurrence of Floods in Bangladesh and Implications." *Global Environmental Change* 12(2); 127–138.

Moser, C. 1993. *Gender Planning and Development: Theory, Practice and Training* (Online edition). London, UK: Taylor & Francis e-Library.

Nelson, G., M. Rosegrant, A. Palazzo, I. Grey, C. Ingersoll, R. Robertson, and L. You. 2010. "Food Security and Climate Change: Challenges to 2050 and Beyond." Washington DC: IFPRI. Accessed February 22, 2013 http://www.ifpri.org/publication/food-security-and-climate-change?print.

Okali, C., and L. O. Naess. 2013. *Making Sense of Gender , Climate Change and Agriculture in Sub-Saharan Africa : Creating Gender- Responsive Climate Adaptation Policy*. FAC Working Paper 057. Brighton, UK: Future Agricultures Consortium.

Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions For Collective Action*. Cambridge, UK: Cambridge University Press.

Ostrom, E. 2005. *Understanding Institutional Diversity*. Princeton, NJ, US: Princeton University Press.

Patt, A. G., A. Dazé, and P. Suarez. 2009. "Gender and Climate Change Vulnerability: What's the Problem, What's the Solution?" In *Distributional Impacts of Climate Change and Disasters: Concepts and Cases*, edited by M. Ruth and M. E. Ibarraran. Cheltenham, UK: Edward Elgar.

Rasmussen, L. N. and R. Meinzen–Dick. 1995. *Local Organizations for Natural Resource Management.* EPTD Discussion Paper 11. Washington, DC: International Food Policy Research Institute.

Roncoli, C., B. Okoba, V. Gathaara, J. Ngugi, and T. Nganga. 2010. *Adaptation to Climate Change for Smallholder Agriculture in Kenya : Community-Based Perspectives from Five Districts*. Unpublished, Washington, DC: International Food Policy Research Institute.

Ruane, A. C., D. C. Major, W. H. Yu, M. Alam, S. G. Hussain, A. S. Khan, and C. Rosenzweig. 2013. "Multi-factor Impact Analysis of Agricultural Production in Bangladesh with Climate Change."*Global Environmental Change* 23 (1): 338–350. doi:10.1016/j.gloenvcha.2012.09.001.

Smit, B., and O. Pilifosova. 2001. "Adaptation to Climate Change in the Context of Sustainable Development and Equity." In *Climate Change 2001: Impacts, Adaptation, and Vulnerability.*Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panelon Climate Change. Cambridge, UK: Cambridge University Press.

Smit, B. and J. Wandel. 2006. "Adaptation, Adaptive Capacity and Vulnerability." *Global Environmental Change* 16: 282–292.

Smithers, J. and B. Smit. 1997. "Human Adaptation to Climatic Variability And Change."*Global Environmental Change* 7 (3):129–146.

Speranza, C. I. 2011. *Promoting Gender Equality in Responses to Climate Change: the case of Kenya*. D.I.E. Discussion Paper 5/2011. Bonn, Germany: DIE (Deutsches Institut für Entwicklungspolitik -Geman Development Institue)

Sperling, L. 2002. "Emergency Seed Aid in Kenya: Some Case Study Insights on Lessons Learned During the 1990s." *Disasters* 26 (4): 326–342.

Stern, N. 2007. *The Economics of Climate Change: The Stern Review*. Cambridge, UK: Cambridge University Press.

Tazeze, A., J. Haji, and M. K. Assistance. 2012. "Climate Change Adaptation Strategies of Smallholder Farmers : The Case of Babilie District , East Harerghe Zone of Oromia Regional State of Ethiopia." *Journal of Economics and Sustainable Development* 3 (14): 1–13.

Thomas, T. S., K. Mainuddin, C. Chiang, A. Rahman, A. Haque, N. Islam, and Y. Sun. 2013. *Agriculture and Adaptation in Bangladesh: Current and Projected Impacts of Climate Change*. IFPRI Discussion Paper 01281. Washington, DC: International Food Policy Research Institute.

Tompkins, E. L. and W. N. Adger. 2004. "Does Adaptive Management of Natural Resources Enhance Resilience to Climate Change? " *Ecology and Society* 9 (2): 10.

UNDP (United Nation Development Programme). 2004. *Kenya: Adapting to Climate Change in Arid and Semi-Arid Lands (KACCAL).* UNDP and Government of Kenya.

Watts, R. 2012. *Managing Climate Change and Conflict in Mali*. Case Study 13. Brighton, UK: Institute of Development Studies.

World Bank. 2012. "World Data Bank indicators." Accessed November 10, 2014. http://data.worldbank.org/indicator/NV.AGR.TOTL.ZS.

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2033 K Street, NW
Washington, DC 20006-1002 USA
Tel.: +1-202-862-5600
Fax: +1-202-467-4439
Email: ifpri@cgiar.org