OXFAM AMERICA
RESEARCH BACKGROUNDER

Local Institutions, External Interventions, and Adaptations to Climate Variability

The case of southern Mali

Rebecca Joy Howard

OXFAM America

CONTENTS

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Author information and acknowledgments

The author is a Ph.D. researcher at the Sustainability Research Institute in the School of Earth and Environment at the University of Leeds, England.

This research was commissioned by Oxfam America, as part of a larger research project that looked at the role of local institutions in assisting communities that are dealing with climate variability, particularly drought in southern Ethiopia and southern Mali and funded by the Bill & Melinda Gates Foundation. The synthesized report is found at http://www.oxfam.org/en/policy/role-local-institutions-adaptive-processes-climate-variability-ethiopia-mali. The findings and conclusions contained within are those of the authors and do not necessarily reflect positions or policies of the Bill & Melinda Gates Foundation.

The author gratefully acknowledges the support of the people of Gouana, particularly members of the Diarra family, who hosted her. Abdoulaye Diarra and Assitan Sangare (aka Batoma) provided critical support during the data collection. Additional thanks go to Mamadou Diawara and Moussa Sissoko of Point Sud, Oxfam Great Britain, Association des Organisations Professionelles Paysannes, Todd A. Crane, Gina E. Castillo, Peter Little, Carla Roncoli, and Tigist Gizaw.

Citations of this paper

Please use the following format when citing this paper:

Howard, Rebecca Joy, “Local Institutions, External Interventions, and Adaptation to Climate Change: The case of southern Mali,” Oxfam America Research Backgrounder series (2012): http://www.oxfamamerica.org/publications/climate-change-adaptive-processes-mali.

ABBREVIATIONS AND ACRONYMS

AOPP	Association des Organisations Professionnelles Paysannes (Association of Professional Farmers Organisations)
CMDT	Compagnie Malienne de Développement des Textiles (Malian Textile Development Company)
FCFA	CFA franc- West African currency guaranteed by the French treasury
NAPA	National Adaptation Program of Action
NGOs	Non-governmental Organizations
OGB	Oxfam Great Britain
SCPC	Société Coopérative des Producteurs du Coton (Cooperative Society of Cotton Producers)
SNV	Netherlands Development Organization

EXECUTIVE SUMMARY

This research examines the role of local institutions in mediating the adaptive practices developed by individuals and collectives in the cotton-growing region of Mali. In this area, the main climate risk is erratic and inadequate rainfall, compounded by difficulties related to guaranteeing a sufficient income from cotton and cereal farming from increasingly infertile soils. The research relied primarily on qualitative methods such as participant observation, interviews, group discussions, and life histories.

The following key questions guided the fieldwork:

1. What role do local social institutions have in long-term adaptation to environmental change?
2. How have extra-local actors interacted with local social institutions in development and adaptation efforts?
3. How is the production and use of weather and climate information organized?

Drawing inspiration from Agrawal (2008, 2), local social institutional dynamics were analyzed in terms of how

a) they structure impacts and vulnerability,

b) they mediate between individual and collective responses to climate impacts and thereby shape outcomes of adaptation, and

c) they act as the means of delivery of external resources to facilitate adaptation, and thus govern access to such resources.

The research found that farmers often possess a diversity of channels for accessing the same resource, and use their own agency to select and appropriate options available to them through institutions. Local institutions also act as important media for interventions, though the way they do this depends very much on the strategy taken by extra-local actors (e.g. development agencies, private sector, etc.). Extra-local actors have pursued a number of intervention strategies vis à vis local institutions: they have supported them, worked through them and developed links between them, but they have also bypassed or challenged them. Where extra-local actors have deliberately bypassed or worked against those institutions that structure responsibilities, changes have been remarked, although these are not beneficial for everyone. One result may have been increased autonomy for women and youth, this is part of the same process where elderly experience an erosion of respect, or are unable to utilize their responsibilities, knowledge or experience.

In an exploration of access to institutions and linkages between them, the report shows that people's responses are certainly shaped by their ability to access institutions and by the influence of institutions on their status and their activities. Nevertheless, when individual agency is recognized, it is clear that institutions do not do everything by themselves. People select and

appropriate what suits them based on the range of institutional channels and options at their disposal, and while one channel may be inaccessible, others remain open. For example, certain physical organizations and structures may set barriers to entry (such as selling high quality seeds only to those who can afford to buy them, and possess the farming equipment to prove their capacity). However, networks tend to disseminate the same benefits based on a variety of currencies (exchange and gift as well as sale) and enable different strata of the population to access the same benefits eventually.

The report provides five major recommendations. Firstly, development agencies should encourage new voices in decision-making, but without imposing the form that decision-making takes. This recommendation is particularly relevant for gender-sensitive interventions. The findings show that women's responses to stressors are sometimes limited because they are not able to access certain decision-making forums. It may therefore be beneficial to encourage new voices. However, this is a delicate process which takes time, and may ultimately contribute to other voices becoming more marginalized. Women's marginalization is not an issue which is limited to adaptation.

Secondly, development agencies should broaden the criteria for selecting institutions and actors to engage with rather than insisting on channeling their support only through the most democratic and equitable organizations. Although they can contribute to a dialogue on equity, they cannot and should not expect to induce major changes to the types of local institutions that structure responsibilities, constraints and opportunities, within the time-frame of a project cycle. Employing female extension serve as a positive example and forerunner for eventual changes within the community.

Thirdly, development agencies should continue to provide support to local institutions, but this should be low-level and flexible, and local actors (both beneficiaries and local field staff) should be involved in the planning process. Beneficiaries are best placed to identify problems, make connections between different livelihood goals and design solutions which are robust in a variety of circumstances. Meanwhile, the field staff delivering the support should be accorded sufficient autonomy and resources to implement tailor-made activities developed in partnership with each of the communities they work with. Development agencies in turn should seek the input of field staff during program planning and evaluation. Most of all, efforts should be taken to encourage diversity and leave people the space to make their own choices, to adapt and appropriate new ideas and technologies, and combine them with existing strategies.

Fourthly, development agencies should work to enhance diversity of adaptation strategies, especially for women. This may mean not only providing additional channels for women to access resources (such as seeds) directly via their own forums, but also supporting women in overcoming additional barriers they may face in making use of such resources (such as the bargaining power to arrange timely plowing of their fields).

Finally, development agencies should work towards synergies between goals and actors in an aim to harmonize adaptation and development efforts. Given the complexity of livelihoods, the variety of stressors that people encounter and the multiple livelihood goals that they pursue, it is not helpful to extricate projects aimed at supporting institutions to play an effective role in

adaptation from projects focused on social and economic development, capacity-building and good governance. This is not a pipe dream: examples from this report and similar studies show that synergies between adaptation and development are already in progress. However, efforts need to be reproduced at multiple levels: between the local institutions, field staff, development agencies and policy-makers.

The recommendations in this report are applicable not only in Mali but in other contexts where development agencies are seeking to participate in a dialogue with local farmers and institutions and identify effective ways of collaborating with them.

INTRODUCTION AND PROBLEM STATEMENT

People in the semiarid and arid regions of Mali have been adapting to climate variability for as long as they have lived there, but the Great Droughts of the 1970s and 1980s that struck countries across the Sahel region were unprecedented for that century in their length and impact (Herrmann et al., 2005). These droughts posed an abnormal challenge to local adaptive strategies and also prompted considerable economic and political reforms and extensive international assistance (Batterbury and Warren 2001). Since the Great Droughts, rainfall has often been erratic and inadequate for agriculture; unpredictable and decreased rainfall constitutes the main climate risk faced by Mali (Oxfam America 2010). It is likely that there has been a 20–30 percent net decline in Sahelian rainfall in the latter part of the 20th century (Batterbury and Warren 2001), which has effectively reset the climatic and ecological baselines in the region (Nicholson, 2005, Bell and Lamb, 2006). Future climate projections are uncertain: the Fourth Assessment published by the Intergovernmental Panel on Climate Change stated that "it is unclear how rainfall in the Sahel, the Guinean Coast and southern Sahara will evolve" (Christensen et al., 2007). What is certain is that climate change will bring significant development challenges to less developed countries. The nature and extent of the weather and climate-related stressors already affecting vulnerable populations are expected to become more severe. Also, climate change is likely to create specific vulnerabilities for people who by the nature of their geographic location or livelihood strategy are particularly sensitive to climate impacts (Lemos et al., 2007).

Concerns about the impact of climate change have put adaptation high on the development agenda, but viewpoints differ in the debate. Dryland populations are very often described as extremely vulnerable, and based on this premise, one intervention pathway has involved introducing costly, top-down technocratic interventions, which have often failed. In the absence of effective insurance mechanisms, heavy investments are too risky in a situation of extreme variability (Barbier et al., 2009, Tschakert, 2007). Meanwhile, some studies underline the resilience and proven ability of dryland populations to cope with crises (Mortimore and Adams, 2001).

Local institutions are recognized as playing a critical role in shaping adaptive practices, but increasing levels of strain (brought on by environmental, socioeconomic, and political factors) may be contributing to their gradual weakening. Development agencies are enthusiastic to target and strengthen the capacities of local institutions in climate-related development projects, but such interventions may be counterproductive in the absence of a clear understanding of which institutions are relevant and how the interplay between local institutions and extra-local actors affects the outcomes of adaptation. This research therefore aims to describe the role of local institutions in mediating the adaptive practices developed by individuals and collectives in the cotton-growing region of Mali; to explore the interplay between local social dynamics and

extra-local actors; and to recommend how adaptive practices and institutions can be strengthened. The following research questions form the basis of this paper.

RESEARCH QUESTIONS AND SUBQUESTIONS

1. What role do local social institutions have in long-term adaptation to climate change?

- What are the relevant local institutions?
- How have they acted in relation to climate change, and drought in particular?
- How are they organized?
- How are they accessed, and by whom?

2. How have extra-local actors interacted with local social institutions in development and adaptation efforts?

- Who are the relevant extra-local actors?
- What are their development and climate adaptation priorities?
- What strategies and entry points have they used to pursue these priorities?
- What effect have these strategies had on local social dynamics?

Researchers and donors are recognizing that local adaptation strategies and knowledge systems warrant more attention, and several studies have identified salient local meteorological systems, early warning systems, and flexible farming strategies (Roncoli et al., 2002, Crane et al., 2011). Local institutions are recognized as playing a key role in adaptation, but they are still insufficiently understood (Agrawal 2008; Oxfam America 2010). A large-scale study on the role of local institutions in adaptation to climate change was undertaken for the World Bank (Agrawal, 2008), but it focuses primarily on formal institutions.

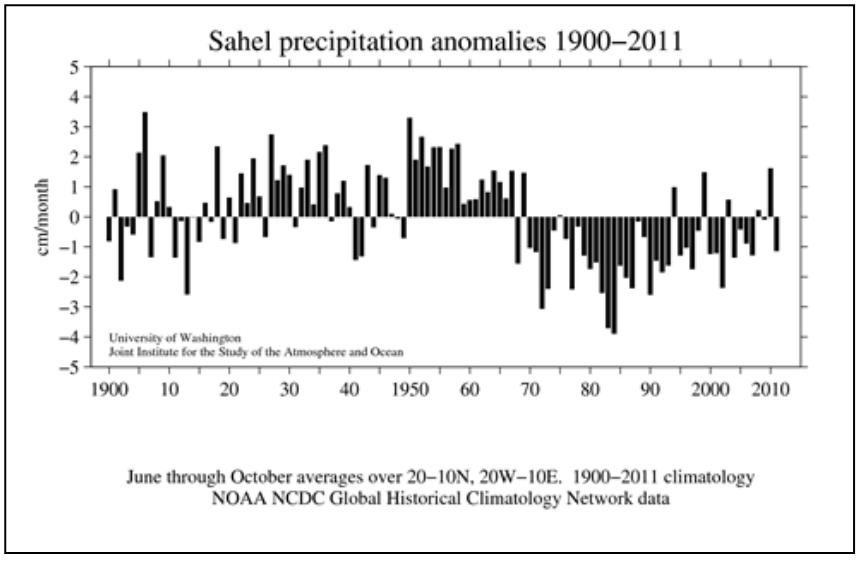
Oxfam America (2010) initiated this research project under the premise that if Oxfam is to help communities prepare for future challenges associated with climate change, it will need to focus on the practices and institutions that communities have historically relied on to help them cope with climate shocks. Strengthening local institutions is likely to be more effective than attempts to introduce new strategies designed outside the community (Oxfam America 2010). Institutions are distinguished in this research by using Agrawal's broad definition of "humanly created *formal* and *informal* mechanisms that shape social and individual expectations, interactions and behavior" (2008). The term *local* denotes any such institutions that exist, act, and are governed within the local context of the research site. The term *extra-local actor* refers to any public, private, or not-for-profit external organization that intervenes directly or indirectly in the local context.

DEVELOPMENT OF CONCEPTS: CLIMATE, ADAPTATION, AND INSTITUTIONS

CLIMATE CHANGE, CLIMATE VARIABILITY, AND EXTREME EVENTS

Climate variability and the frequency of non-normal conditions or *extreme events* are notably the most damaging faces of climate change in agriculture (Smit and Skinner 2002). However, in semiarid and arid regions such as the Sahel, drought and variability are seen as *normal* phenomena, and mean average rainfall figures become almost meaningless (Hulme, 2001). Sharp seasonal contrasts and intense fluctuations in interannual and decadal timescales warrant the region the title of the most dramatic case of climate variability yet to be measured (Hulme, 2001). Nevertheless, the events of the past 40 years are beyond "normal" variability. 1 shows that precipitation since the 1970s has been consistently lower than average almost every year. From the point of view of people who make their livelihoods as farmers and herders in the Sahel, the distinction between "normal" climate variability and anthropogenic climate change is largely academic and inconsequential. What is important is their ability to sustain their livelihoods despite the multiple stressors that they face (Crane et al., 2011).

Figure 1: Climate variability in the West African Sahel



Source: Joint Initiative for the Study of the Atmosphere and Ocean (2011).

DISTINGUISHING COPING AND ADAPTATION

Adaptation is a concept that is used in reference to both natural and human systems' responses to environmental changes (Smit and Wandel, 2006). The response may be a "process, action or an outcome … [that enables] the system to better cope with, manage or adjust" to the change (2006:282). Adaptation refers to actions related to long timescales, and it is often juxtaposed with the concept of "coping," which refers to short-term actions (Osbahr et al., 2008). In practice, the distinction between adaptation and coping is fluid: some events such as drought pockets both create short-term disturbances requiring immediate reactions (such as replanting of seeds) and contribute to longer-term livelihood stress requiring strategic planning (for example the decision to try a new variety of seed or crop the next year). Over time, coping mechanisms may become institutionalized, though in some cases, they might not contribute to longer-term renewal and innovation. Using the longer-term impacts of the Great Droughts and changing ecological baselines as a backdrop, this study focuses primarily on longer-term adaptation, because the short-term effects and immediate coping responses have already been well documented (Batterbury and Warren, 2001).

Box 1: Overview of roles played by local institutions in adaptation

1. Institutions "structure environmental risks and variability and therefore the nature of climate impacts and vulnerability" (Agrawal, 2008:27).
2. Institutions "create the incentive framework within which outcomes of individual and collective action unfold" (Agrawal, 2008:27).
3. Institutions "are the media through which external interventions reinforce or undermine existing adaptation practices" (Agrawal, 2008:27).

LOCAL SOCIAL INSTITUTIONS AS KEY ARENAS

Adaptation processes are articulated through a set of institutional and regulatory mechanisms originating from the extra-local level (Smit and Skinner 2002) and also from the local level. Agrawal notes that "the critical role of institutions is underscored in study after study of adaptive capacity and adaptation choices" (2008: 28). He identifies three distinct roles (Box 1). The way that institutions mediate climate impacts and vulnerability has been explored in several studies (Eakin, 2005, Tschakert, 2007, Barbier et al., 2009), but less research has been undertaken on local institutional dynamics, the interplay between local institutions and extra-local actors, and the effects of both on the outcomes of adaptation. Local institutional dynamics, the interplay between local and extra-local actors and the effects of both on adaptation are therefore the focus of this paper. Although Agrawal focuses his institutional analysis on formal, physical organizations, this paper uses a more encompassing analytical lens. For the purposes of this paper, institutions are categorized into three subtypes: (1) physical organizations, (2) cultural norms, rules, and structures, and (3) networked relations.

This categorization invites an exploration of informal and intangible institutions, which may be equally as important as the more formal or tangible organizations in adaptation. Cultural norms, rules, and structures shape access to and control over resources, and set the framework for allocation of tasks and responsibilities. Networked relations (see, for example, Box 2) based on values such as trust, reciprocity, and social obligations are not conducted through an organization, and may be relevant both between households in the same village and across networks that extend outside of the village. From a development perspective, the physical organizations are relatively easy to pinpoint. However, cultural norms, rules, and structures and networked relations are often more elusive because they are played out in realms that development agencies cannot easily access. Furthermore, they sometimes function contrarily to the agencies' terms of partnership (such as equity), and for these reasons they may be intentionally or unintentionally ignored or bypassed in development processes.

Box 2: Networked relations in Mozambique

In Osbahr, Twyman, et al.'s (2008) study of livelihood adaptation to climate change disturbance in Mozambique, the most significant buffer to disturbance was the ability to reciprocate through informal institutions as a social safety net. This safety net involved maintaining social connections through the traditional "gift system" with the purpose of ensuring future reciprocity. Local labor mechanisms served to repay gifts, receive food, or resolve household labor shortages. Additional labor would enable households to rebuild houses after flood damage or replant fields following drought. The minimum requirement for participating in relationships of reciprocity was having the available labor or resources in the first place. Larger households owned more goats and had greater access to lowland areas, and had more labor in comparison to smaller households.

Access and articulation

Agrawal recognizes that institutions need to be examined in order to understand their "internal processes, external relationships, and linkages with different social groups and households" (2008: 5). The linkages are fundamental to adaptation because they affect the flow of resources and influence both between institutions and from institutions to households and social groups. He conceptualizes linkages in terms of access and articulation. *Access* refers to the different degrees and types of links that households and social groups in a given location have with institutions. While some individuals or households may be heavily involved in decision making, driving the institutions and reaping the benefits, others may be excluded, intentionally or not, and may be unaffected or even hindered by institutional policies. Ability to *deal with* climate-related risks depends on the differential wealth and capacity of—and between—different households, which is linked to the ability to access different institutions (Ruijs, Bel, et al. 2011; see alsobox 2). Agrawal (2008) recognizes that in general, more-vulnerable groups are less able to access institutions that might facilitate adaptation than are richer, more powerful groups. *Articulation* refers to the degree and type of linkages between multiple institutions in a given place. Agrawal (2008) argues that we need to understand local institutional articulation and

access patterns *before* selecting which institutions can be used as intermediaries to channel resource support in any development project. The concepts of access and articulation are used to explore institutions in the findings and discussion of this report.

Box 3: Strengthening local institutions in Mozambique

In rural Mozambique, the agricultural associations created through collaboration between the state, NGOs, and the local communities have involved the reorganization of social institutions that formalize reciprocity. They have been successful in contributing to the buffering of risks, increasing gender equity, and supporting access to resources for poor people, though entrepreneurialism has been hard to establish. Nevertheless, the patterning of agricultural associations is highly political. They were built on a cultural ideology of cooperative action, which made them an ideal platform for the agricultural extension service to exploit. (Osbahr et al., 2008)

Equity, legitimacy, and effectiveness

Through this research, Oxfam aims to identify and enhance understanding of local institutions that are likely to be most effective in adaptation and conducive to being strengthened so that they can support more strongly and equitably all members of the community. However, equity and effectiveness are not always mutually compatible. In the agricultural associations in Mozambique (box 3), equity and cooperative action proved to be incompatible with entrepreneurialism. Similarly, village organizations reviewed in a study in Senegal and Burkina Faso were limited in their effectiveness, despite an elaborate set of formal rules to ensure equity in distributing or accessing benefits (Bernard et al., 2008). Adger et al. (2005) recognize that the perception of legitimacy of actions and decision-making structures is one element that should be considered when evaluating the success of adaptation. Legitimacy is contested and context specific (Adger et al., 2003), and is defined by cultural expectations and interpretations. The example in Box 3 suggests that the strengthening of local institutions may be more conducive to the endurance and legitimacy of both the institutions and the adaptation strategies that emerge through them, though the intended purpose may be to serve the political interests of governments, NGOs, or local elite. The concepts of equity, legitimacy, and effectiveness are used as criteria for exploring the adaptation practices introduced in the findings; the challenge of combining all three criteria is covered in the discussion.

METHODOLOGY AND SITE INTRODUCTION

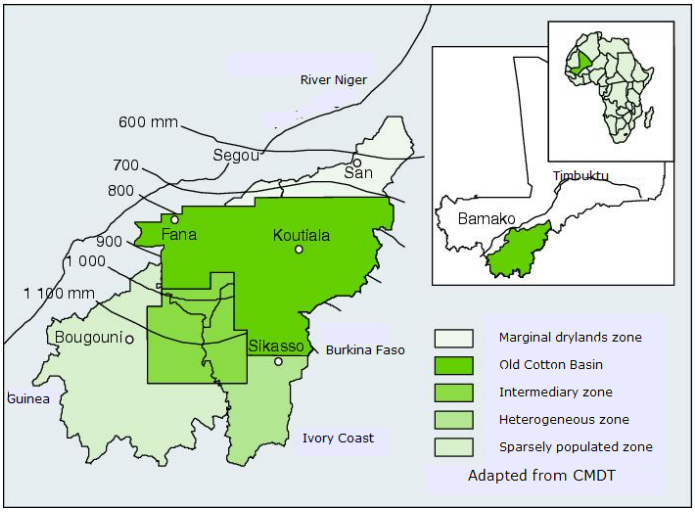
DESCRIPTION OF METHODOLOGY

Overview and choice of site

Ethnographic field research was conducted in one site in Mali over a period of 12 weeks during the 2011 growing season (June–August). Focus group discussions, participant observation, and interviews with families, elderly people, and representatives from institutions were conducted with the support of a translator. The aim was to find out how people are adapting to climate change and drought-related stressors, how their adaptive actions are mediated through institutions, and how institutions and social dynamics have been affected by interactions with extra-local actors. Primary data was prioritized, but a substantial review of secondary data was used to develop background information on local institutions and interventions in Mali.

The village of Gouana, located in the regional cotton zone of Fana, was selected in collaboration with Oxfam Great Britain (Oxfam GB) and the federation of producer organizations, known as the Association des Organisations Professionnelles Paysannes (Association of Professional Farmers Organisations) hereafter AOPP), as a research site based on scientific and feasibility criteria. Oxfam and AOPP are implementing joint programs in the cotton zone, and Fana forms part of the old cotton basin (the darkest green section on Map 1Map 1) and therefore has a history of development, relief, and economic interventions. Local communities rely on cotton growing, which is a climate-dependent activity, and are categorized as vulnerable to climate change according to the Malian National Adaptation Program of Action (NAPA).

Map 1: The Malian cotton zone (Gigou et al., 2004)



Source: Adapted from CMDT

Sampling and terminology

Fifty-eight participants took part in 11 different focus groups, which were mobilized according to age and gender categories and availability of interlocutors. For the family interviews, data on family size and producer typology[1] was used to create a sampling frame of 43 families from which a stratified sample of 12 was selected. This sample was considered to be a reasonable proportion (28 percent) of the total number of families in the sample frame. Family interviews were conducted separately with the male head of the farming unit and with one or all of the women in the family. Individual life histories were conducted with three men and three women aged between 55 and 80, and representatives of 11 institutions were interviewed.

In this study, the term *family* is used rather than *household*. *Family* refers to those persons living in the same compound, eating food prepared on the same hearth, and pooling the labor of the male members to work in the family fields, which are managed as one farming unit. This definition matches with the Bamana concept of *du* (Lacy, Cleveland, et al. 2006). In Mali, it is common to find polynuclear families composed of one family head and several households, which may be headed by the younger brothers, or the sons or even grandsons of the family head. The head of the family is the oldest male, and he continues to hold this title until his death (although if he has lost his physical and/or mental capacities to continue in this role, a younger brother will act as head). The head of the farming unit may simultaneously be the head of the family if the latter is still able to play an active role in agriculture, but in many cases, the former is a younger brother or son of the latter.

Distinctions are also made in this research between male farmers and women. The male farmers are those who work in the family field, which is considered by the state-run cotton

[1] This is a label assigned to each farming unit by the state-run Compagnie Malienne de Développement des Textiles (CMDT). The typologies (A, B, C, and D) are based on the amount of equipment owned by the farming unit, and serve to distinguish the quantities of inputs that the different sizes of farming units are eligible for.

company Compagnie Malienne de Développement des Textiles (CMDT) as the farming unit. Women are also farmers, but farming is often secondary to some of the other livelihood activities they carry out. Unlike the family fields, which are expected to be used to provide for the whole family, women's fields are considered by the family to be the women's domain, and the women are given the freedom to allocate the harvest to meet their own or other family members' needs.

Research tools and data gathered

The literature review involved analyzing a wide range of scientific papers and anthropological works written about Mali's cotton zone between the 1990s and today, and identifying local institutions, extra-local actors, and changes in local dynamics and the drivers of these changes. The review was important for gaining an understanding of the sociocultural, economic, and political context and for extending the validity of findings to a wider area than the research site alone.

Focus group discussions were conducted with the aid of a topic list. They explored local experiences of climate stressors and change, and they identified three main adaptive responses that people have developed (using more equipment, adjusting the agricultural calendar, and incorporating new varieties of seeds). Data was disaggregated according to gender and age, and key themes were identified for further exploration during individual or institutional interviews.

Interviews with families were conducted with the aid of a semistructured questionnaire that explored experiences of climate stressors (triangulating data from the focus group discussions) and allowed individuals to elaborate on the adaptive practices they draw upon (for example, how they enhance their material endowments; which knowledge they use to guide agricultural decision-making; which seed varieties they use and where they source them from; and how they respond to food shortage). Data was also collected on material capacity (equipment, laborers, land); agricultural output; other sources of income; membership in physical organizations; and links with extra-local actors. This information alluded to the institutions that mediate adaptive practices and pointed to various gender or household characteristics that lead to differential access to, or articulation between, institutions. The interviews also provided information on interactions with extra-local actors and resulting changes in local dynamics.

Life histories were conducted with the aid of a topic list (one for women and one for men). The histories were used to explore climate stressors and changes; coping and adaptation strategies; changes to the family institution (in terms of tasks and responsibilities); changes in agricultural practices (land tenure, equipment, and labor mechanisms); membership in local organizations; and links with extra-local actors over time. Institutional interviews were conducted with the aid of topic lists elaborated specifically for each institution. These interviews aimed to obtain an understanding of access to the respective institutions and the benefits each one mediates; how each one functions and interacts with other institutions and extra-local actors; and which individual or collective adaptation practices the institutions are involved in mediating. Finally, participant observation was used to yield an understanding of how climate- and non-climate-

related stressors affect people's lives; to witness interactions between individuals, groups, institutions, and extra-local partners; and to gain insight on local dynamics.

Method of data management and analysis

Data was recorded and transcribed, and partial analyses were used to develop follow-up questions while in the field. In the final week, a summary of initial findings was presented to a group of male and female village representatives. Aside from validating the findings, the main feedback was the remark that women mainly engage in agriculture because the shea trees are producing less than they used to. Although the focus of this paper is on agriculture rather than other income-generating activities, the importance of shea butter production has been acknowledged. The same presentation was also given to staff of Oxfam Great Britain (OGB) in Mali and to all the project partners at a meeting organized by Oxfam America in Ethiopia. Further research on the historical backdrop of certain local institutions and on national policies for land and natural resource management and agricultural extension was conducted in light of feedback provided during these meetings. Furthermore, Oxfam highlighted its interest in gender-related aspects, which led to the emphasis on gender in the analysis of findings.

SITE INTRODUCTION

Geographic description

Gouana is a majority Bambara village with an estimated total population is 755, of which 54 percent are under 18 years old. Gouana is located next to the road at equidistance between the towns of Fana (the regional base for the state-run cotton company CMDT) and Dioila, in Koulikoro region. Both towns have health, financial, and educational facilities and serve as an NGO base. Gouana has a maternity clinic and primary education facilities, a mosque, a temporary cotton marketplace, a CMDT warehouse, and a diesel mill. A solar pump (partly funded by CMDT) supplies water through taps on sunny days. The wells around the village tend to dry up when the water table lowers during the hot season, creating water shortages for a couple of months of the year. Gouana is not connected to the electrical grid, but the solar pump and the diesel mill provide battery-charging facilities.

The land surrounding the village is mainly used for farming and has been cleared of most trees and bushes apart from shea *(Butyrospermum parkii)*, néré (*Parkia biglobosa)*, baobab *(Adansonia digitata),* and tamarind *(Tamarindus indica)*, conserved for economic purposes. Farming is the main activity, with livestock (cattle) providing significant additional income for larger families. In the family fields, cotton *(Gossypium sp.)*, sorghum *(Sorgho bicolor)* and/or pearl millet *(Pennisetum glaucum),* African rice *(Oryza glaberrima)*, maize *(Zea mays)*, groundnuts *(Arachis hypogaea)*, and cowpeas *(Vigna unguiculata)* are grown. Women are entitled to their own plots of land, and they plant groundnuts, sorghum, and, occasionally, cowpeas. They collect shea nuts, néré pods, zaban fruits (*Landolphia senegalensis)*, and mangoes *(Mangifera indica)* from the bush. Some people manage small gardens or engage in

trading (cereals and cotton for the wealthier families, and smaller things like soap, snacks, and perfumes for women and less wealthy men). Small animals (sheep, goats, chicken, and guinea fowl) are kept by women and men, and a few families are involved in hunting, fishing, and beekeeping.

Experiences of important weather events

Table 1 catalogs some of the climate events experienced in Gouana and elsewhere in Mali in recent years. Four major risks related to drought were described by informants in Gouana:

- Shortening of the rainy season
- Decrease in rainfall quantity
- Increase in distance between rainfall events (creating drought pockets)
- More localized rain

Table 1: Recent climate events reported by residents

Year	National evidence	Local evidence
1967	High floods (Diarra et al., 2004).	Houses destroyed; village relocated.
1972–1974	Consistent drought since 1968, even before the Great Drought of 1973–1974. The drought worsened each consecutive year (Downing, 1987).	Nothing harvested from fields. People ate wild varieties of onions, cassava, and maize. Women asked for food from families who were less affected. Youth emigrated.
1982–1985	Drought had affected 60 percent of Malians by February 1985. Precipitation was close to normal during the rainy months of 1985 and 1986, but in both years, grasshoppers attacked crops in September (Downing, 1987).	Forty days without rain during the planting period. Nothing to eat and no mutual support. People ate red millet (supplied by donors) and wild fruits, leaves, and onions. Grasshoppers attacked the first harvest after the drought.
1994	Mali hit by drought (IFRC, 2007).	Those who ran out of food went to work with those who still had millet or animals in stock.
1996–1999		Three years of drought. By the third year, cereal was imported into Mali.
2002–2003	Mali hit by drought (IFRC, 2007). National food production deficit.	Rains came late but harvest was satisfactory.
2004	Locust infestation (Hebie, 2004).	Locusts passed through one farmer's field but caused no damage.

Shortening of the rainy season

Men and women in Gouana recognized that although the rainy season has always varied considerably in length, it has shortened since the Great Droughts. Records kept in Gouana only show rainfall over the past eight years, a period too short to detect longer-term changes in rainfall. Table 2 shows that the length of the rainy season in Gouana between 2004 and 2011 varied from three to six months but generally lasted four months. However, calculating the length of the season based on the first and the last rains alone is not sufficient for understanding the impact on agricultural cycles. For example, a freak rain event in early May could extend the rainy season to five or six months, but if it is followed by a drought until late May or early June, the early rain event is almost of no use for farmers. The late rains are necessary for ripening crops. Table 2 shows that there have only been three years in the past eight where significant rainfall has continued into October.

Table 2: First and last rains in Gouana between 2004 and 2011

Year	First rains	Last rains	Approximate rainy season length	
			Days*	Months
2004	June 1–10	September 21–30	112 days	3+ months
2005	May 1–10	November 1–10	183 days	6 months
2006	May 11–20	September 21–30	133 days	4 + months
2007	May 21–31	October 1–10	133 days	4+ months
2008	June 1–10	No data available		
2009	May 21–31	September 21–30	123 days	4 months
2010	May 21–31	October 1–10	133 days	4+ months
2011	May 11–20	October 11–20	153 days	5 months

Source: Gouana SCPC Rain Records.
* Calculated by taking the middle date in each 10-day measurement period.

Decrease in rainfall quantity

The reduction in rainfall that scientists have observed across the Sahel was confirmed by elderly informants who described how the change has affected the architecture of people's homes. Houses used to be built with nine supports to enable the walls to withstand heavy rains, but by the 1970s this method had been abandoned because rains were no longer heavy. Prior to the 1970s, elders remembered that during the month of August, work in the fields would be disrupted by the incessant rains. Patterns in rainfall quantity cannot be read in recent local rainfall data because the region is characterized by interdecadal cycles, but Table 3 illustrates variability in monthly rainfall quantity even for the eight years.

Table 3: Monthly rainfall quantity: Gouana, 2004-2011

Year	Rainfall quantity (mm)							Total
	M	J	J	A	S	O	N	
2004		149	205	190	168			**711**
2005	46	125	398	144	106		27	**846**
2006	76	92	169	209	188			**734**
2007	31	59	216	367	210	7		**890**
2008	No monthly data available							**711**
2009	13	98	185	197	161			**654**
2010	34	109	176	283	195	36		**833**
2011	74	163	108	228	120	34		**727**

Source: Gouana SCPC.

Drought pockets

People in Gouana perceived that drought pockets were becoming longer and more serious as the gap between rain events has increased. The way these pockets affect agriculture depends on the drought resistance of specific crops and varieties. The risk is felt particularly as people are planting, but also later on in the cycle when crops are maturing. For example, in July 2011, a six-day period without rain, one light rainfall, and then another gap of a week without rain delayed planting of food crops in family fields and women's fields, disrupted the schedule for treating the cotton crop, and wilted in the dry heat the crops already planted. By the time the heavy rainfall came on July 26, some people's planting plans had already been abandoned.

More localized rain

The elderly men noted that rain is more localized now, and this observation was corroborated by the adult men who noted considerable variations between villages in the zone. For example, farming units situated 30 kilometers from Gouana started planting much later than farming units in Gouana in 2011, contrary to previous years. According to the local CMDT extension officer, the statistics on planting collected every 10 days throughout the season show stark variations in quantities planted across the different villages. Comparisons between years suggest localized differences in rainfall because planting progress is shaped by rain events alongside material factors (such as amount of equipment, availability of labor, and size of fields).

FINDINGS

This section is divided into four subsections. First, secondary data on local institutions and extra-local actors in Mali is presented. The remaining three sections present primary data on institutions and interactions with extra-local actors in the research site of Gouana.

REVIEW OF LOCAL INSTITUTIONS IN MALI AND INTERACTIONS WITH EXTRA-LOCAL ACTORS

This section describes the types of physical organizations, norms, rules and structures, and networked relations that characterize Malian rural societies in the cotton zone, and introduces some of the mutations that these institutions have undergone in response to decentralization, the growth of cotton cash-cropping, climate change, and the proliferation of development aid. This review is important for understanding the historical backdrop of local institutions and interventions in Mali, for drawing parallels between the research site and other sites in the cotton zone, and for connecting the evolution of institutions and interventions to socioeconomic and political as well as climatic factors.

Physical organizations

Box 4: A description of a traditional form of association: The *tonw*

The *tonw* are a form of association rooted in traditional village structure, though they have undergone transformations. Most associations are composed of people of an equivalent social stature: married women organize themselves into *musow tonw*, groups of similar age, residing in the same quarter. Women group together to save and borrow money, but also to organize income-generating activities, and these activities give them a certain amount of autonomy (Jonckers, 1994). Male youth who are old enough to work, up to the age of 40–45 form the youth *ton*, which is also open to young girls before they are married (Coll, 1997).

Today, a diverse range of organizations and associations can be found at the village level. During the post-independence socialist regime, rural associations and cooperatives were imposed as part of an ideology of *coopératisme* (Coulibaly, 1998). In the 1980s, the military regime attempted to re-establish the value of traditional forms of associations (*tonw,* or *ton* in singular form, seebox 4) and passed a law defining them as a superior organizational form compared with the cotton producer organizations set up by CMDT (box 5) (Bélières et al., 2008). The decentralization process since 1991 has involved the partial transfer of responsibilities from the state to collective groups in the domains of water, health, education,

natural resource management, and economic development (Bélières, Benoit-Cattin, et al., 2008).

Many associations, economic interest groups, and local NGOs have developed since the 1970s (but especially since 1991[2]) under the initiative of local leaders or catalyzed by national and international organizations. These organizations intervene in a number of areas relevant to livelihood adaptation, with activities such as establishment of cereal banks, management of natural resources, and artisanal processing, water provision, and microfinance.

Box 5: Cotton producer organizations

The first cotton associations were initiated by CMDT in 1974–75 and were not legally recognized (Coll, 1997). Gradually, they began to accumulate functions, and by the late 1990s, many were collapsing under this weight (Bonnassieux 2002; Bélières, Benoit-Cattin, et al. 2008). Since 2003, government and NGO programs have been assisting these cotton associations to transform into legally recognized cooperative societies (sociétés coopératives des producteurs de coton; SCPCs). SCPCs are comprised of a representative from each cotton-producing farming unit in the locality, and are managed by a committee of president, secretary and treasurer. CMDT uses the SCPCs to channel inputs, information and training to farmers and the SCPC committee takes responsibility for collecting information and queries from its members and communicating it back to CMDT.

Access to agricultural inputs, advice, and loans is preconditioned by being a member of a cotton producer organization (Bonnassieux 2002; Bélières, Benoit-Cattin, et al. 2008). These organizations constitute a source of income and are considered by the CMDT and many projects as synonymous with the village at large (Coll 1997). Therefore, donor support has often been channeled through cotton producer organizations, particularly via the federation of producer organizations, AOPP (Bélières, Benoit-Cattin, et al. 2008).

Cultural norms, rules, and structures

> N'gala yé dani kè n'ga a ma kélen ya kè [God proceeded to create but not to install equality in society]. (Bambara proverb, see Béridogo 1997: 6)

Inequality is important in many ethnic groups in Mali (such as the Bambara, Minyanka, and Peuhl) as they are organized into hierarchical social structures based on gender, age, and settlement history[3] (Béridogo, 1997). The male heads of the lineage and the male heads of the family are responsible for exercising authority, controlling production, and redistributing wealth

[2] Until the end of the military regime, nongovernmental interventions were restricted by the state to those areas not covered by public development projects and extension (Bélières, Benoit-Cattin, et al. 2008).

[3] Caste is another social attribute that structures professions and responsibilities and denotes the relationship between superior and inferior castes, but the monetization of social relations that accompanied colonialism has broadened the professional and social horizons of inferior castes (Béridogo 1997).

(Jonckers 1994). The young people and the women are called to offer their services, take commands, and carry out production-related tasks. Although male youth can aspire to reach the status of elder as they move up the lineage, women are eternal “juniors.”

Generally, the oldest male in the first family to arrive in the village holds claim to the title of land chief, or *dugukolotigi*, a title inherited along patrilineal lines. The *dugukolotigi* holds a number of magico-religious functions related to the land and the invisible forces that are connected to it. As villages became established as permanent settlements and connected to a wider political administration, they also required an administrative chief, or *dugutigi*. The administrative chief is in charge of maintaining peace and arbitrating conflict, representing the village, collecting taxes, and mobilizing the population. Nowadays the *dugutigi* is also supposed to be elected by the village assembly, though often, the *dugukolotigi* has simply accumulated the tasks of the *dugutigi*. For administrative or natural resource management affairs, the chief is required to consult with his close advisers (the *dugutigisere*), with the assembly of heads of family (the *gwatigiwele*), and with the leaders of the various associations. The women and youth are not granted access to the chief’s foyer, where decisions are often made (Koné, 1997).

The idea of equity, which has been introduced through decentralization and development processes, contrasts with cultural norms, rules, and structures. Decentralization has granted women and youth opportunities to become involved in politics and to access positions of power via the municipalities (1997), and development agencies have also introduced new criteria (such as “literate” or “female”) for exercising power and holding positions of responsibility in projects and committees (Béridogo 1997).

Networked relations

Within the lineage system, solidarity principles apply only to those with the same parental lines, and family members hold an obligation to render services to the older members of the family (Jonckers, 1994). However, the family hierarchical structure is counterbalanced by the *tonw* (traditional forms of associations), founded on cooperation extending to the level of a sub-section of the village, or the village at large. Originally, the *tonw* were based on egalitarian and reciprocal relationships between members, and served to limit individualist behavior. According to Jonckers (1994), the family solidarity imposed by the lineage system has changed substantially in the face of economic market development. Market exchanges are gradually replacing reciprocity or dependency relations, and nonproductive solidarity is disappearing. Although cotton cash-cropping and the resulting large-scale economic and social changes may have slowly eroded the “peasant political ecology” of interdependence and mutual need in village affairs, customary and contractual principles of organization seem to coexist (Bingen, 1998). For example, customary principles are common in community and village-based labor, gardening, marketing, and self-help groups. The principles of reciprocity and covenant define the relationships between members and leaders in these groups, while local community-based structures of authority and accountability define expectations and obligations, often through kinship, ethnicity, and religious orientation. Meanwhile, contractual principles arise where economic interests are shaping how members assess the “costs” of their participation in a particular organization (Bingen 1998).

Strategies and entry points of extra-local actors: CMDT and AOPP

CMDT has consistently pursued the agenda of cotton farming, processing, and marketing. Specific strategies have adjusted considerably since the company's creation, in 1974, in response to changes in government policy, market opportunities, and financial pressures to restructure; however, strategies have generally involved providing agricultural inputs on credit, promoting agro-pastoralism and the use of organic fertilizer, promoting improved varieties of seeds, and creating partnerships with financial institutions to facilitate access to credit to buy traction equipment.

CMDT's entry point involved initiating cotton producer organizations (many of which have now been transformed into cooperative societies or SCPCs, seebox 5) and engaging with the heads of farming units who are members of these organizations, and the company has continued to channel its actions through these organizations. Over time, CMDT has sought to build members' capacities through literacy and technical training and to hand over responsibilities and autonomy, while maintaining a strong local presence. Producer organizations are grouped into zones, each of which is monitored by CMDT field staff. These staff members hold meetings every 10 days during the planting season as well as sporadic training sessions with representatives of the organizations in the zone. Gouana heads its zone, and therefore hosts the CMDT warehouse and the meetings and training sessions.

AOPP was created by a group of producer organizations to confront the common problems faced in agriculture. These organizations were supported by a French farmer association and the Coopération Française to create the association, which achieved legal recognition in 1995. AOPP is now represented in eight regions of Mali, seven of which have autonomous regional offices, and it incorporates more than 200 producer organizations. The actions of AOPP are guided by its five commissions (training, cereals, cotton, fruit, and livestock), whose common goal is to support farmers to autonomously combat their problems. AOPP's overall agenda is influenced by the goals of its donors, but the structure allows for producer organizations to express their needs. Recent strategies have involved introducing improved seeds, training farmers in production and use of compost, addressing land issues, and supporting capacity-development of the leaders of producer organizations.

The AOPP adviser to the Gouana cotton producers' cooperative society (the SCPC) is employed by a program partially funded by the Oxfam climate program in the cotton zone. She is one of the few female advisors in the AOPP extension team and covers 19 groups in total, visiting each one once or twice a month and working closely with two people in each village, who are supposed to monitor activities in her absence. Her activities have involved providing training on climate change; supporting the SCPC in developing a local development plan adjusted to the threats of climate change; providing training for members of the SCPC; facilitating individual and group credit applications and lobbying for the delivery of these credits; and supporting women to access land and participate in decision-making bodies. Her gender has greatly facilitated work with women, but she has encountered difficulties in accessing male spheres in some villages. Although AOPP officially works with "professional" and legally

recognized producer organizations, the Gouana adviser has moved between institutions by also engaging with informal women's groups and traditional authorities.

Summary

This section has applied the three analytical levels of institution to the context of the Mali cotton zone, and has identified two extra-local actors. The review has shown that decentralization processes and the development of the cotton sector have allowed CMDT, public and private extension services, and NGOs to be involved in shaping local institutions. Although political and economic processes continue to bear considerable influence on village-level organization, they do not simply result in the "modernization" of "traditional" organizations or the "erosion" of customary values and institutions. Instead, as Nijenhuis (2003) points out, a situation of multilayered power institutions occurs. These institutions interact and compete in a flexible and complex way, and rural societies maintain their own share of agency in shaping the changes. The review has also shown that traditional bases of social organization at the village level (gender, age, caste, and settlement history) are far from egalitarian, although there are many layers of interaction that crosscut the traditional structural divides. Some of these originate internally (for example, the *tonw*) whereas others have been introduced by development agencies (for example, the criteria of working with literate people, women, and youth). This multilayering is important to bear in mind, especially with respect to Oxfam's goal of strengthening the most equitable local institutions.

In the following sections, primary data is used to demonstrate the role of local institutions in long-term adaptation to climate change in Gouana, illustrated by two livelihood aspects. The first involves responses to changes in rainfall drawn upon by farmers in agricultural activities. The second incorporates actions taken by the members of the family unit to deal with food shortages. With both aspects, adaptive practices are introduced, and then the various ways that institutions are involved in facilitating or impeding these practices are described. This discussion is followed by a description of the effects of interventions on local dynamics. Throughout the analysis in this section, attention is drawn to the five concepts introduced earlier (access, articulation, equity, legitimacy, and effectiveness).

ADAPTING TO CHANGES IN RAINFALL

Farming systems have been adjusted to changes in rainfall through modification of farming strategies (using traction equipment and organizing resources to plant the maximum surface area in the minimum time), adoption of a range of seed varieties, and adjustments to the agricultural calendar. The sets of responses are described in the following subsections, with an eye toward the ways that they are shaped by institutional processes.

Farming strategies

In the 1990s, male farmers began to use multiple pairs of oxen, plows, and seed drills. The Great Drought forced them to accept that the rainy season had shortened and that rainfall quantity had reduced and that therefore, the only option for increasing chances of a good crop was to work faster, aided by equipment. Furthermore, reduction in soil fertility has been a trigger for farmers to cultivate bigger areas in order to get comparable yields and to use organic and inorganic fertilizer to rehabilitate infertile land. Male farmers claim that the idea of “development” has motivated them to acquire as much equipment and extend their fields as much as possible, because they are impelled by the prospect of increased production and greater wealth (the more sets of traction equipment you have, the faster you sow, the more you produce, and the more income you receive). However, they also emphasize that “development” has vastly expanded the material aspirations of the family.

The role of institutions in acquiring equipment

Despite the heavy investment cost, many male farmers in Gouana have been able to afford traction equipment by taking out loans. The cotton producer organization is thus far the only channel for accessing loans, supplied by the Banque Nationale de Développement Agricole and, more recently, by the microfinance institution Kafo Jiginew. CMDT has enabled access to credit for members of the cotton producer organization in Gouana since 1991. In the past two years, AOPP has also gotten involved in brokering access, and Oxfam has boosted the funds available to lend to farmers (box 6).

Box 6: Individual credit for men, collective credit for women

Each farming unit has an account at the microfinance institution Kafo Jiginew, through which individual account holders take out loans repayable within 12 months. Borrowers must belong to the SCPC and have a low default rate. A project funded by Oxfam and implemented through AOPP has made available additional funds; lobbying by AOPP has helped to speed up the processing of the credit applications in response to male farmers' complaints that the money was often received too late to resolve their needs at the beginning of the rainy season. Loans are used to hire or buy oxen, do small trading, repair houses, and serve as advances on crops harvested.

The AOPP adviser has also been working on improving women's access to loans. First she convinced people in Gouana that women could also join the SCPC because they are involved in the cotton harvest, and a separate Women's SCPC was established with 30 members. With the support of the AOPP adviser, this group made a joint application to borrow money from Kafo Jiginew to buy agricultural equipment, but the institutional procedures prevented them from accessing a loan because the women were requested to provide individual guarantees and to open both individual accounts and a group account. These prerequisites would have doubled costs and required each woman to go in person to the local branch in Fana. Meanwhile, the villagewide women's association has been successful in borrowing credit from another microfinance institution.

Assitan Sangare, AOPP advisor

Access and articulation: Credit

The case noted here sheds light on the issues of access and articulation. It shows that access to credit is preconditioned by membership in the SCPC. AOPP's intervention increased access for women to this institution, but additional barriers at the level of the microfinance institution mean that women are still denied access to the credit itself. The case also points to the positive impact of efforts to improve institutional articulation (links between institutions): Oxfam invested resources into an existing institutional setup using the same channel as CMDT, which farmers are already familiar with, and AOPP improved coordination between the various partners involved. The combined result was that male farmers received larger credits sooner.

The role of local institutions in organizing resources

Cultural norms define the head of the family (or his younger brother or son if he is too frail) as responsible for controlling access to equipment, allocating tasks, and coordinating labor. Under these rules, the majority of women are not required to work in the family fields, because traction equipment has reduced the need for labor, and it is heavy work. Meanwhile, the men and male youth are expected to provide their labor on the family farm—at least during the planting and weeding periods—unless they are permanently employed elsewhere or unless the head of the farming unit can manage without them. The elderly men are usually allowed to retire from agricultural activities once they reach a certain age unless their families face a labor shortage. The heads of the family prioritize the work in the family field, but will assist women by plowing their individual fields if they can spare the labor and equipment. These cultural norms have

implications on the differential labor and equipment shortfalls experienced by men and women, respectively, as the next section reveals.

The role of institutions in resolving labor/equipment shortfalls

There are a number of alternative mechanisms, accessed via networked relations (based on trust, obligation, or reciprocity), for hiring, exchanging, or procuring on credit either labor or traction equipment even if cash is not available.

Tables 3 and 4 provide a summary of the mechanisms accessible to men and women respectively, mediated by the three types of institutions under analysis: physical organizations; cultural norms, rules, and structures; and networked relations. These institutions play an important role in enhancing a farmer's capacity, especially during crucial moments when he or she is racing against the season. The way the options are drawn upon and combined varies across the spectrum of farming units as well as between the two genders, as a result of their differing goals and strategies.

Table 3: Men's mechanisms for enhancing labor and equipment

	Service	Service provider	The deal	Mediating institution
1	Seasonal hiring of oxen	Any available tender with equipment to spare	Paid for in cash or cereal at harvest	Networked relations arranged by head of farming unit with tender
2	Plowing of fields	Any available tender with equipment to spare	Exchanged for labor in plow owner's field	Reciprocal relations
3	Temporary labor for planting/ weeding (1–7 days)	Receiver of previous service	Exchanged for plowing of laborer's field	Reciprocal relations
4		Contracted laborers (usually male youth)	Cash or cereal payment paid at end of day/week	Traditional authority or head of farming unit allocates labor
5	Team labor for weeding and harvesting	Different families, organized into work groups	Mutual assistance (rotational)	Reciprocal relations
6		Women from the *musow ton*, organized into work groups	Cash payment to the group at harvest	*Musow ton*
7		The youth *ton*	Cash payment to the group at harvest	Youth *ton*
8	Seasonal labor	Male family members	Duty of male family members to provide labor	Traditional authority structures responsibilities
9		Contracted laborers	Housing and food (and a temporary plot of land if it can be spared) provided; cash and/or a proportion of the harvest given at end of season	Reciprocal relations

Box 7: Drought history and the youth *ton*

The youth *ton* has a long history in Gouana (the oldest members of the village described taking part in it), but it temporarily ceased to operate in 1999 and was reformed a decade later. The year 1999 was the third consecutive drought year, and farmers who had contracted the group were unable to settle the bill at harvest. Until 1999, rates were negotiated between the group and the contractor based on his capacity to pay. Since the group's reformulation, rates have been fixed at 10,000 FCFA per day plus food.

In the family field managed by men, the main goal is to plant as much as quickly as possible and then manage the weeds before they become too prolific. Because planting takes place during May and June when rain events are often interspersed with drought pockets, seeds that haven't germinated must often be replanted. This goal is met by allocating all the available equipment and labor to the family field until at least the cotton and sorghum fields have been weeded. Farming units that lack basic equipment choose to channel resources into hiring or borrowing equipment, while larger farming units are able to plant large surface areas with their own laborers, and then invest in hiring the youth *ton* to assist with weeding. In the sample group, 25 percent of families do not own seed drills and must plant by hand. Baba Coulibaly does not own any draft cattle, and therefore draws on service 1. This service is difficult to arrange because demand is high, and, because Coulibaly hires the cattle on credit, he has a weak bargaining position. Short-term reciprocal arrangements for exchanging plowing for laboring work (services 2 and 3) may meet the needs of both parties sooner, especially when they are only plowing and planting relatively small plots. Alternatively, a contractor who can afford to pay in cereal or food can attract individual laborers (service 4). Group labor speeds up the weeding for families with fewer laborers of their own. Team labor (service 5) is available without the need for cash.

The *tonw* (introduced in box 4) enable some farmers to meet labor shortfalls at peak times (during weeding and harvesting). Women from the *musow ton* sub-divide into teams and offer their services for the threshing of millet and sorghum and the harvesting of cotton (service 6). They are contracted by most farming units, who pay them individually in cereal for threshing, or as a group for cotton harvesting (this payment is used to boost the group's credit and savings fund). The youth *ton* offers its services once a week for the weeding of fields (service 7), and is hired only by the larger farming units in Gouana and the neighboring villages that can afford to pay. Recent changes to the youth *ton* relate to perturbations caused by drought (Box 7). Seasonal labor is provided primarily by family laborers (service 8) as mentioned, but if a farming unit can afford to supplement family labor with contracted laborers, private arrangements may be made with young men who come from other villages (service 9).

Table 4: Women's mechanisms for enhancing labor and equipment

	Service	Service provider	The deal	Mediating institution
1	Plowing of fields	Any available tender with equipment to spare	Cash payment upfront	Negotiated by husband (paid by women)
2		Plow owner	Labor supplied by husband exchanged for plowing of his wife's field	Reciprocal relations (via husband)
3		Male workforce in the family	Women entitled to this service. Timing established by head of farming unit	Traditional authority allocates labor and equipment
4	Temporary labor for planting and weeding (1–2 days)	Women in the same family or, occasionally, in different families	Mutual assistance	Reciprocal relations
5		Teams of women, organized into groups	Mutual assistance (rotational)	Reciprocal relations
6		Contracted laborers (usually male youth)	Cash (or food) payment upfront	Networked relations arranged directly or via husband/head of farming unit

Women are constrained in their agricultural activities by the cultural norms described, which define their fields as less important than the family fields. This valuing means that women's individual fields are plowed and planted much later than the family fields, unless the women pay somebody to plow their fields sooner (service 10). Djeneba Diarra was the only woman who mentioned that someone external to the family unit had plowed her field in 2011, on the basis of labor provided by her husband to the owner of the plow (service 11). As a result, she had been able to plant her field two weeks earlier than the other women in her family. Aside from Djeneba, women opted for plowing of their fields by family members (service 12) and put up with the consequences of late planting: the first women's fields in Gouana were being plowed at the beginning of July, but some women were still waiting for their fields to be plowed in late August and eventually abandoned plans to plant. Women's fields are plowed by order of seniority in the family when equipment and labor can temporarily be spared and when the climate conditions are right (preferably when the ground is moist enough). Once the field has been plowed, the proprietor can, however, draw on a range of services for speeding up planting or weeding; other women in the family are enlisted to help with the planting (service 13), which is done by hand. They are not obliged to help each other, but mutual support is a big incentive, especially because the younger women (whose fields are plowed later) will be keen to receive support in return. Late planting makes weeding more labor intensive (because weeds grow much faster during the rainiest months of July and August). Women sometimes help each other with the weeding on a rotational collective labor basis (service 14), and women who have the cash to spare may pay laborers to weed their fields (service 15).

Access: Labor and equipment mechanisms

The mechanisms summarized in tables 3 and 4 are differently accessible to men and women and to farming units of different capacity, as a result of differential resource availability.

Reciprocal relations are only accessible when there is something to offer in exchange, and larger farming units that dispose equipment, labor, cash, or spare cereal stocks have more options at their disposal. However, several of the services described by male informants can be paid for at harvest time, and this possibility effectively opens up access to those who do not have sufficient cash when the service is required. The men's status as cotton growers and managers of the family field provides assurance that they will have cash at harvest to repay debts, although those who are continually indebted and do not manage to repay gradually lose the trust of fellow farmers. Women do not have such a convincing guarantee of income at harvest, and tend to pay for services such as weeding upfront. Nevertheless, the amounts they pay are smaller, and membership in the savings and credit group helps them to raise the money.

Interventions and effects on equipment and labor mechanisms

CMDT has played a major role in creating the incentive framework for the drive to intensify production by facilitating access to credit for equipment for its cotton suppliers, by making producers more aware of their own and each other's productivity (through the record-keeping in the SCPC), and by offering entitlements to credit and inputs based on the amount of equipment that farming units own. With respect to labor mechanisms, CMDT has not generally engaged with the local institutions involved in dealing with shortfalls, but cotton farming has nevertheless had a double-sided impact. On one hand, it may have contributed to the dissolution of interfamily reciprocal labor that used to be drawn upon during harvest. For example, two life history informants both described that in the past, different families within the lineage would take turns assisting each other with the harvest of millet and sorghum in their respective fields. Nana Mariko explained that this practice eventually ceased in the 1980s in the lineage she married into because of the growing disparity in field sizes, which meant that the work in each family's field became disproportionate. All that remains of this mechanism is the rotational team weeding (service 5). On the other hand, cotton farming has facilitated collective labor supplied by women and youth. CMDT's focus is on quality, and hand harvesting (by women) is an advantage for the Malian sector. Women are considered part of the production process, which has allowed them to enter into the cotton association. Demand for labor from the youth *ton* and women's *ton* brings financial benefits for the members and sets them up in a relationship of mutual dependency with the farming units that contract their services.

The role of local institutions in land allocation and acquisition

The institutional mechanisms for acquiring land have altered considerably during the course of the past century, but increasing land scarcity (caused by increasing field size and growth in population) is the principal driver of change. The increase in agricultural equipment used by each farming unit correlates with a massive increase in demand and use of land for farming in Gouana between the 1960s and today, primarily because traction equipment enables people to cover larger areas. CMDT's strategies (to increase production, incite competition between producers, and facilitate access to credit for traction equipment) have all contributed to land scarcity, fueling the changes in institutional arrangements for land allocation. Decentralization meanwhile seems to have had little impact on institutional mechanisms for allocating land in

Gouana. Access to land is highly dependent on settlement history as well as gender, both of which serve as cornerstones of the traditional social structure. In the past, acquisition of farmland was facilitated by the village chief, but in 2008, the last available parcel was allocated and now the chief's role is merely one of witness or, at most, broker. Table 6 summarizes the changes described by the chief.

Table 5: Changes to land allocation policies—applicable to male farmers

Epoch	Colonial times	After independence (1960–1990)	Since decentralization (1992)	2011
Procedure	If you needed land, you informed the chief, you chose the land, and he authorized you to use it.	If you needed land, you were assigned a parcel by the chief.		If you ask for another parcel from the chief, you are turned down because all land has been allocated.
"Price"	Nothing given.	10 kola nuts and one cockerel.		No land to offer.
Limits and conditions	Surface area was limited by the tools used to cultivate.	The parcels were not "measured."	You must live in Gouana to cultivate land in Gouana.	You can no longer switch parcels or leave land fallow because there is not enough land. Unused land can be relinquished. You are not allowed to sell, hire, or lend your land.*

* The elders in Gouana made the decision to prohibit the lending of land (allocating to somebody for a limited time period such as two years) because they feared that this practice could create problems if the person who has received the land does not want to return it.

Box 8: The first settled family's claim to land

When the autochthonous Diarra lineage arrived in Gouana, land resources were abundant and each family just chose where to farm. In the past, the descendants of the two Diarra brothers who first settled with their families in Gouana cultivated a field all together but when this was abandoned, there were parts of the total land area left uncultivated. Now, Diarras who want to extend their farmland can use a piece of this land. The rule that unused land can be relinquished does not apply to the Diarra family—as autochthones, the land "belongs" to their lineage, so it can never be taken away.

Abdoulaye Diarra

Settlement history and access to land

The first settled lineage in Gouana (the Diarras) enjoy superior rights to land (box 8). Abdoulaye Diarra explained that although land has become scarce, many of the Diarra lineage still have reserves of unused land. Meanwhile, more recently settled farmers ("strangers"), who would formerly be allocated land by the chief (i.e., before the land ran out), still have the option of searching for a host (*jatigi*) to supply them with land. To do this, they directly approach the head of a family with spare land and make private arrangements. Together, they visit the chief and inform him of the arrangement. The chief gives his permission and then the stranger "pays" the host (10 kola nuts and a cockerel), who chooses how much to share with the chief. When land is given by the host, he will not ask for it back: in this way, the stranger inherits the parcel. The current arrangements for accessing land involve a reconfiguration of power to those who still have land to spare, but the institutional arrangements still involve a close coordination between the various parties (the chief, the host, and the stranger).

Women and access to land

Women are unable to approach the chief directly to ask for land. Instead, the primary means for obtaining access to land is through the head of the family. The head of the family allocates the women a parcel but may take it back if he needs it. If he is unable or unwilling to supply women with land, they may ask their own fathers' families, or approach a *jatigi.* It is standard practice to assign women the land that has been put out of use for the family field, because the family institution maintains the view that women's fields are secondary to the family fields. Women in Gouana recounted a variety of experiences about land tenure (Table 6).

Table 6: Women's land tenure situation

Tenure situation	Husband's family	Host
Land supplied by	24	5
Still using initial parcel of land: no threats for land to be relinquished	13	
Reallocated a different parcel of land at least once	9	
Parcel of land must be renegotiated from year to year		5
Parcel of land has been reclaimed without offering an alternative parcel		1
Parcel of land has been voluntarily relinquished	1	

The table shows that the majority of women use marital land, although women from two families have been reallocated new plots (in one case when the polynuclear family split, and in the other case when the head of the family reclaimed the parcel). One woman had voluntarily relinquished the parcel of land provided by her husband (because it was no longer productive) and sought some land from a host, but this had been reclaimed after only one season, so she had returned to her marital parcel of land. Those who are able to use the same land from year to year have a sense of tenure security, but the other side of the coin is that these women do

not usually have the freedom to move to another parcel and leave their initial parcel fallow once it becomes unproductive. The women interviewed recognized that the land they were given was usually depleted of nutrients when they were first assigned it. Tenure insecurity is understood as a factor preventing women from investing in improving their land, but actually none of the women were specifically adding any nutrients to the soil. This behavior suggests that investment in land may be more closely related to having access to the means of production: women have no control over the cattle (for organic fertilizer), cannot access inputs from CMDT, and have not been targeted by the anti-erosion programs that have taught the male farmers in the village ways to control erosion.

Box 9: AOPP's attempts to lobby for women's land

The women's association used to farm a collective field, but eventually abandoned it because the land was infertile and they always planted late. They wanted assistance from AOPP to get a better piece of land and their own plow. Assitan Sangare, the local AOPP adviser, facilitated a meeting in early June in which women and men were present to discuss the issue. In a heated debate, the men were divided: One side wanted to offer a poor-quality plot, claiming that the women could work to improve it. The other side claimed that this land was unworkable. At her next visit in mid-July, Assitan agreed with the women to go directly to the chief to explain their situation and ask for a solution. He claimed to have no available land, but agreed to call a *gwatigiwele* (the assembly of heads of families) and ask whether anybody could offer the women a plot. Neither the women nor Assitan had the right to participate in this forum. When Assitan next visited Gouana in early August, the women had still not been allocated any land, and it was already too late in the season to lobby further.

Assitan Sangare, AOPP advisor

Interventions and effects on land: Improving access and articulation

AOPP has identified sustainable access to land for women as one of the actions to be undertaken within its cotton program (AOPP, 2010). The association has been targeting organized groups of women and advocating their requests for land by accompanying them in their negotiations with relevant decision makers. Box 9 describes how this process has played out in Gouana. Access to land is a three-tiered problem for women. First, the land they are allotted is always poorer in quality because their fields are considered less important; second, they do not have access to the means of production necessary for enriching the land; and third, they cannot participate in the forums where decisions on land are made.

AOPP has attempted to intervene at all three levels: by initiating a forum where women discuss their land requirements with men, which resulted in some of the men recognizing the injustice of offering poor-quality land to women; by supporting the women in applying for credit to buy equipment (box 6); and by accompanying the women to talk to the chief. As box 9 illustrates, the

presence of the AOPP adviser as a broker has been crucial. Articulation between the various institutions involved (the women's group, the chief, the SCPC, and the *gwatigiwele*) is also crucial for women to be successful in obtaining a piece of land of appropriate quality. The AOPP adviser has succeeded in developing some of these links. Nevertheless, current institutional arrangements do not allow for either local women or the AOPP adviser (because of her gender) to participate in the *gwatigiwele*, so the adviser's attempts to improve institutional articulation are limited.

Seed practices

Male farmers use a diversity of seed varieties, which have been introduced into Gouana via multiple channels. The general trend is to adopt the varieties suited to the climate further north both in response to an observed shortening of the growing season and in anticipation of even shorter seasons in the future. However, one villager, Josef Traore, has decided to reintroduce an abandoned variety (*ɲɔba*) suited to the longer seasons that characterized the period prior to the Great Droughts in case the rainy season should get longer again in the future.

There are a variety of mechanisms for circulating seeds. For example, sorghum seeds are being commercialized by the local seed office, but 95 percent of farmers interviewed had received them as an exchange or gift and subsequently saved them from the field each year. The traditional maize variety (*dagalɛnɛ*) is circulated by gift or inheritance, but the improved varieties (*sotibaka* and *dɛnbaŋumon* and varieties supplied by CMDT) were initially sold to farmers and have been subsequently sold or exchanged between farmers.

The role of local institutions in mediating access to seeds

The cotton producer organization. Until 1999, CMDT was supplying farmers with seed varieties for a variety of crops via the cotton producer organization. The first varieties specifically billed as fast maturing were introduced after the 1984 droughts. Aside from improved varieties of cotton, CMDT also sold maize, sesame, and cowpea seeds, but only to the better-equipped producers (classified by CMDT as Type A producers). Groundnut seeds were also sold to women on credit, and repaid at harvest. In Gouana, 30 percent of male farmers interviewed were using the CMDT improved varieties of maize, which had been sold to Type A producers 10 years ago and subsequently saved and circulated. A new purportedly high-yielding variety of maize is currently available through CMDT and is being sold for 50,000–60,000 FCFA for a minimum quantity of seed to plant 1 hectare (compared with 1 hectare of cotton seed, which costs 1,007 FCFA).[4] Despite the high cost, farmers in the SCPC were considering grouping together to buy the minimum quantity and then sharing it between them or appointing one person to grow the variety and supply the seed to the rest.

The seed office. One farmer in Gouana, Solemanou Diallo, has been a member of the local seed office (Silabougouton) based in Dioila for the past six years, and he sells improved varieties of high-quality seeds to women and men from Gouana and neighboring villages. The

[4] This amount—500 FCFA—is roughly equivalent to $US1.

Dioila office is linked to regional offices and a national office, which was established by the Malian government after the Great Droughts with the purpose of conducting research and introducing new varieties of seeds to farmers in Mali. The local seed office is open to new members, but its conditions exclude most male and all female farmers: the initial subscription fee is 25,000 FCFA, renewed every year for 5,000 FCFA, and farmers must (1) own land that can be set aside for growing seeds (at a safe distance from other people's fields so as to avoid risk of cross-contamination), and (2) possess adequate production assets to ensure the seeds can be planted at the appropriate time. Seed varieties are supplied to the local offices and distributed among their members, who grow them under the proper conditions and keep written records. Government staff visit the member growers regularly, monitor growth, and supply fertilizer. Harvested seeds are tested for quality, and if they meet the required standards, the government guarantees to buy them from the growers at a fixed price, or the growers can commercialize the seeds locally (at a fixed price). If the seeds don't meet the required standards, they are sold by the local or regional seed offices to cereal traders.

The dry cereals cooperative. The dry cereals cooperative (Duiguiya), established in 2008, has sold a number of improved seed varieties on credit to its members. These seeds have been supplied to the cooperative from ICRISAT via Peace Corps volunteers who were based in Gouana. The president of the cooperative (the same individual who represents the seed office) made a request to the volunteers for specific varieties.

Seed saving. Seed saving is a common practice among male farmers and serves as an incentive for sharing, rather than buying or selling seeds. Some 92 percent of male farmers interviewed ensure that the best seeds are selected from their own or someone else's fields each harvest and set aside so that even if cereal food stocks have run out by the following planting season, they still have seed to plant. Some varieties sown in Gouana (such as *dagalɛnɛ*) have been handed down the generations for so long that no one knows their origin anymore.

The seed network. Most male farmers in Gouana continue to circulate seeds by means of exchange or gift, both with families in Gouana and with farmers outside of Gouana. The seed network is not based on kinship but on principles of solidarity: knowledge and seeds are equally accessible to newcomers. One farmer explained:

Box 10: The story of *bandoka*

Moussa had been in Mopti and returned late one rainy season to his village, Bando [70–80 kilometers from Fana]. He started planting his field much later than everyone else in the village, and the people all commented that his field would not produce anything. In fact, it produced so much that people came to ask if he would exchange the seeds he had brought from Mopti with them. Those people kept the seeds in their families, saving them after every harvest. This happened sometime after the Great Droughts of the 1980s.

Told by male farmers in Gouana during a focus group discussion.

> If you have recently arrived in the village and do not have seeds, you approach somebody from the village and he will tell you the best varieties to plant. If he has enough seeds to spare, he may give them to you. If he cannot afford to give them, perhaps he will supply them on credit ... if he does not have the capacity, or if you do not want to accept a gift, he will tell you where you can buy them. (Solemanou Diallo)

Most seeds are brought to Gouana from neighboring settlements within a radius of 15 kilometers. When male farmers travel to visit relatives, trade, or herd their cattle, they ask other farmers for seed varieties, usually those that are fast growing. However, in some cases, farmers have heard about seed varieties used further north, and brought them south in anticipation of the advancing desert. As an example, box 10 illustrates the origin of *bandoka*, a popular variety of sorghum planted in Gouana.

Table 7: Origin of sorghum seeds planted by women

	Gifted by husband	Gifted by someone else	Saved from the field	Received on credit
First year of sowing	5	1		1
Subsequent years	5		1	1

Some years, male farmers have had to replant seeds as many as four times on the same plots of land. Those farmers who dispose spare land or seeds can keep adjusting the variables until their seeds have germinated, but some farmers struggle even to get the seeds required for the first sowing. The seed network provides them with an opportunity to receive support from fellow village members, but there is, however, one limit: Shame affects those who ask for help.

> If I have sown a parcel which has not produced shoots, I may go to somebody and ask him for seeds. If these seeds do not germinate, I cannot return to him because I will be ashamed. Therefore, I will be obliged to try a different type of seed or try sowing on another parcel. (Josef Traore)

Women and seeds: Women primarily access improved seed varieties and information about seeds via their husbands. Table 7 summarizes the origins of sorghum seeds planted by women in seven families. Groundnut seeds, meanwhile, are mostly bought by women with cash or on credit. Women also replant seeds several times if they can afford to. The seedlings they plant not only suffer from drought pockets, they are also more susceptible to damage by birds because they are sown by hand and therefore are more exposed.

Interventions and effects on seed dynamics: Equity and effectiveness

Various extra-local actors have been working on introducing high-quality, improved seed varieties to stronger farming units. This model of seed introduction prevents weaker farming units from accessing benefits, but it is more likely to be effective in guaranteeing high-quality

seeds and efficient production of seeds. Quality of seed has been identified by AOPP as a problem for farmers because the seeds they save from year to year decline in performance, and the quality of seeds available on the market is not assured. Oxfam has been supporting the introduction of improved varieties of seeds in approximately 100 cooperatives across Mali, via AOPP (Oxfam, 2011), but farmers in Gouana have not yet been targeted. However, the seed office uses a similar approach, and the representative in Gouana is already successful in channeling high-quality seeds for sale to farmers in Gouana and nearby. CMDT's seed strategy involves using new cotton seeds every year and encouraging farmers to regularly buy new cereal seed stocks. Each extra-local actor has defined legitimate seed transactions in terms of commercial channels where prices are fixed at the national level.

The farmers have incorporated seeds sold to them by extra-local actors into the pre-existing diversity of seed varieties and currencies of circulation in Gouana. This diversity allows for robustness to uncertainty, another sign of effectiveness. High-yielding varieties of maize such as *sotibaka*, obtained from ICRISAT, are being grown alongside the fast-growing but lower-yielding traditional variety *dagalɛnɛ* in farmers' fields to ensure an early harvest of maize (and an end to the hungry gap for those who have already run out of their own food stocks) and a bigger crop for sale or food later on in the year. Although most farming units have shifted to using faster-growing sorghum varieties, the slower-growing variety has been reintroduced. Those farmers who cannot invest in buying improved varieties of seeds continue to rely on local seed exchange mechanisms or second- or third-generation seeds that have been bought from the various commercial programs and then grown in family fields and resold or given away to neighbors. Although this mechanism may compromise seed quality, it does ensure that improved varieties are available locally even in years when people cannot afford to buy them.

Adjustments to the agricultural calendar

In the context of extreme climate variability, farmers have developed a series of localized reference points to make sense of the season and guide their agricultural activities. However, the dramatic changes in the length of the rainy season, in the quantity and distribution of rain, and in the frequency of drought pockets in recent decades have debased some of these reference points and necessitated adjustments to the agricultural calendar. In the family fields, the main adjustment has been to do all the preparatory work in advance of the rains (clearing fields, organizing seeds, repairing equipment, and preparing oxen) so that as soon as the rains fall, fields can be plowed and sown. This adjustment is partially motivated by the fact that CMDT is more likely to award cotton with the first-grade-quality stamp if it is planted sooner, and CMDT stipulates that cotton of any grade must be planted before July 10. In the period prior to the 1970s, people would wait for the first rains to fall and for the grass to begin growing before they planted their fields, following the advice of the male elders. When CMDT arrived, it instructed people to start sowing sooner than what the old men advised (Baba Diarra). However, after the Great Droughts, CMDT realigned its advice with that of the old men and began telling farmers to start planting after May 25 to reduce the risk of drought pockets.

The diagnosis of climate-related problems in Gouana undertaken by the AOPP adviser identified a lack of understanding of the agricultural calendar as a key challenge. In fact, the

agricultural calendar cannot be “learnt” or pinned down; rather, it must be continually adjusted in response to informational cues, in combination with material factors (such as availability of equipment and labor) and actual rainfall events. The various informational cues that farmers draw upon are highlighted in the following paragraphs, and Table 8 summarizes the number and percentage of people who either mentioned these cues or claimed to have used specific ones to begin planting in 2011. The role of institutions in organizing or disseminating these cues, summarized in Table 9, is also outlined.

Table 8: Informational cues for the beginning of the planting season

Cue	Pay heed		Principal trigger	
	No.	%	No.	%
Rainfall events	6	55	8	73
Gregorian calendar	6	55	4	36
Lunar calendar	4	36	1	9
Advice from *marabout* (Islamic holy man)	2	18	2	18
Natural phenomena	3	27	0	0

Note: Data derived from male respondents (11); women repeatedly claimed that their planting actions depend on the men who plough their fields.

Observations of natural phenomena. Various natural phenomena are interpreted as signs of the onset of the rainy season. These phenomena include the appearance of the first leaves on the *wolo* tree *(Terminalia avicennioides)*, the ripening of the fruits of the *m’peku* tree *(Lannea microcarpa)*, and the appearance of a stork. Approximately 80 percent of women mentioned one or more of these signs. However, in the women’s case, although they possess the knowledge, they are not able to apply it in farming decisions because their own planting actions are dependent on the men who plow their fields. One farmer mentioned using observations of the stars to predict whether the season would be endowed with good rainfall or not. Natural phenomena are accessible to most people because they are locally contextualized. Nevertheless, the specific signs that people observe depend on their activities and on their degree of contact with the elderly, who are perceived to know the most.

Calendars. Prior to the arrival of CMDT, reference points for the agricultural season were rooted in the lunar calendar (Baba Diarra). Some elderly members of the community are still aware of the characterizations of each lunar month and the instructions about which agricultural activities should be undertaken. These guidelines have been developed by means of accumulated experiences of previous generations. Some of this knowledge is stored within vernacular names or in proverbs, which continue to shape people’s expectations, even if the environmental changes of the past four decades may have rendered some of characterizations

less accurate.[5] Lunar markers are combined somewhat ambiguously with more recent markers from the Gregorian calendar. The popular idea that rains begin on May 25 originates from a geography book that pupils read at school in the 1980s and also in the literacy magazine *kibaru* (Abdoulaye Diarra), and it has been reiterated by CMDT. Some farming units use this reference point to the degree that even if it hasn't rained, they will still start sowing on May 25 (Bassounke Coulibaly). CMDT's system is based on the Gregorian calendar months. Data on planting progress and rainfall events is synthesized into 10-day periods and collected by CMDT extension staff.

Reading of the rains. The rain gauge provided by CMDT in the 1980s serves as an important reference point for planting. Initially, the CMDT extension worker collected the rainfall measurements, but in the 1990s this task was transferred to the current secretary of the SCPC, who received training in how to measure and interpret rainfall. Other farmers can visit the rain gauge straight after rain has fallen or they can approach the SCPC secretary later. Information about the rainfall quantity spreads quickly, but knowledge about how to interpret it varies widely. The male farmers who talked about rainfall quantities as a sign of when to plant each had a different understanding of the quantity required to plant safely without the risk of the soil drying out. Responses varied from 15-plus millimeters to more than 40 millimeters.

***Marabouts* (Islamic holy men) and animist sorcerers.** *Marabouts* and animist sorcerers are consulted by most male farmers for advice about when to start planting; they may also be requested to intervene during a drought pocket. The choice of expert is based on reputation or previous positive experience with him (Abdoulaye Diarra).

Actions of other farmers. The actions of other farmers also serve as an important trigger for agricultural activities. Farmers continually observe and make comparisons between their own and other farmers' fields, and the spirit of competitiveness is heightened through CMDT's practice of collecting data every 10 days on planting progress. Another practical reason for synchronizing planting with other farmers is to avoid damage from animals. On a certain date, the chief makes an announcement that all those who own animals must tie them up so that they do not roam in people's fields. An announcement is also made at the end of the season before people may release them. Any farmer starting before animals are tied up—or harvesting after they have been released—is likely to suffer serious losses.

[5] For example, the month of August in Bambara is named after the incessant rains in August in the period prior to the Great Droughts. A Bambara proverb states that the rains always fall on the seventh, 17th, or 27th day of the seventh lunar month and that by the 27th day, fields have always been planted.

Table 9: Local institutions involved in generating weather and climate information

Physical organizations	Cultural norms, rules, and structures	Networked relations
The SCPC receives information and training from CMDT and structures competition between farmers through monitoring activities.	They shape people's activities and social interactions and therefore the phenomena they are able to learn about or observe. They acknowledge the authority of the elderly, *marabouts*, and animist sorcerers. They prescribe the dates for tying or releasing animals.	These allow observations of other farmers. These allow dissemination of information and advice between farmers within Gouana, with farmers in other villages, or between husbands and wives.

Interventions and the legitimacy and effectiveness of knowledge and information

The provision of meteorological advice and technical support in rural areas is one of the projects identified in the Malian National Adaptation Program of Action (NAPA). The aim is to enable farmers to make use of information produced by the National Meteorological Department in agricultural decision-making and to improve their production. As one of its activities, the meteorological department produces locally tailored 10-day forecasts accompanied by agricultural guidance to farmers, but the ability to generate such forecasts relies on the department receiving rainfall data from each locality. In Gouana, the data collected by the SCPC does not get passed on to the National Meteorological Department, and, as a result, no locally tailored forecasts are available. None of the farmers interviewed reported listening to scientific forecasts on the radio.

While the multiple informational cues described here can be seen as an opportunity for farmers to triangulate advice, different ideas about the legitimacy of each type of cue may create tensions within the farming unit. Again, CMDT's strategy is partly to blame: the heads of the farming units are targeted with CMDT's advice, but it is the elderly, who are excluded from the SCPC, who possess the bulk of the accumulated knowledge of previous generations. As assistant secretary of the SCPC, Abdoulaye Diarra meets with the CMDT extension worker every 10 days, attends all the training sessions, and reads the rain gauge if the secretary is away. Abdoulaye regularly consults his father, but they frequently argue about the decisions Abdoulaye makes. Meanwhile, the secretary of the SCPC, Madou Diarra, heads the farming unit and his older brother Bakary does not intervene in farming decisions because he is busy running the village shop. Madou recognizes that his late father used a variety of signs to interpret the season, but he regards the advice from CMDT as more accurate and only pays attention to rainfall measurements. Nevertheless, CMDT's advice is limited because many farmers do not understand the significance of the rainfall measurements, and reference points about what to plant when are fixed to static points in the calendar, which are liable to inaccuracy when rainfall is extremely variable. Local institutions not only provide calendar reference points about what to plant when (also liable to inaccuracy), but also systems for localized forecasting and practices for encouraging good rainfall.

INSTITUTIONALIZED MECHANISMS FOR ADAPTING TO FOOD SHORTAGES

Food insecurity is one of the faces of drought—both cereal and cotton harvests are highly affected by drought pockets and by the duration of the rainy season—but food shortages are also closely related to patterns of management of food stocks and nonagricultural income. Many of the strategies employed by people in Gouana for dealing with food shortage can be classified as coping mechanisms[6] rather than adaptation, but two strategies in particular point toward longer-term changes in social dynamics. The first strategy is the practice of procuring cereal against the promise of the cotton crop, which is gradually replacing the practice of food for work. The second strategy involves the different types of contributions offered by women to the family economy, especially during times of shortage. Both strategies are described in the next subsections. Again, the local institutions that shape these strategies and the ways that local institutions have been shaped by interventions are highlighted.

Currencies for procuring cereal

Food for work has been an important coping mechanism during the major drought periods. Families who still had cereal or animals in stock employed laborers from neighboring families to assist them in exchange for cereal or cash. Before the development of commercial cotton production, families drew on this mechanism each year to get over the hungry gap. Bazan Diarra (age 70) described that when he was a child, the millet and sorghum grown by his family was always enough to feed them until the following harvest. People came to ask for cereal in his family, and they were given it either for free, on loan, or in exchange for work. When Bouatou Mariko (age 75) was a child, the annual food shortage in his family was dealt with by digging up wild food and working in other people's fields in return for cereal. According to Bouatou, nowadays people are no longer interested in giving cereal in exchange for work in their fields. Instead, they supply cereal on credit, which is reimbursed with cotton or repaid with interest. Although traction equipment has reduced the demand for labor, there are still families who are willing to employ temporary laborers and pay them in food. Nearly one-fifth (18 percent) of families explained that they sometimes send their sons to work in other people's fields in exchange for food. One week of labor earns them 100kg of cereal, which lasts for 12–15 days.

Food for work is reportedly much less common than it was in the past, and cotton has become the major currency for procuring cereal in Gouana. Several traders in Gouana "lend" cereal to families against the promise of cotton. In this scenario, 100kg of cereal (worth between 12,000 and 15,000 FCFA at the time of procurement) is repaid at harvest with 100kg of cotton (worth 25,000 FCFA when sold to CMDT, based on 2011 prices). Forty-five percent of families interviewed draw on this mechanism to procure cereal: they are the ones who consistently endure the longest periods with an empty granary. The local cotton traders are providing a convenient service (their clients can get cereal without needing to travel to market or find the

[6] For example, gathering food from the bush; drawing on support from the extended family; selling fertilizer, poultry, animals, or other salable assets to buy cereal.

cash to buy it) and therefore take advantage of people's weak bargaining position and push the value of cotton down 50 percent below CMDT's price. These traders can predict the cereal shortages that other families in Gouana will face and therefore trade in cereals (buying them at harvest when 100kg is worth between 5,000 and 10,000 FCFA) so that they can ensure access to a proportion of cotton crop, which they then resell to CMDT. This activity allows the traders to make profit on both the cereal and the cotton. The prospect of such a profit acts as a disincentive for the practice of exchanging food for work, which, in contrast to trading, does not multiply benefits. Both food for work and cereal for cotton are dependent on the existence of wealth disparities between families.

The role of local institutions in structuring responsibilities

Within the traditional family structure, the head of the family is responsible for managing and rationing the family food stocks. However, the elderly heads are gradually experiencing a decrease in their ability to bear this responsibility: in families where the official head is elderly and is no longer involved in farming, this responsibility may in practice be taken on by a son or younger brother. In Gouana, elderly men complained that the fields do not produce enough to be able to finance all the various food and material needs of their family members. Although fields may produce more than they did in the past, both family size and level of material needs have increased (this view was reiterated by women and adult men). The elderly men also complained that whereas during their youth they would obey the commands of the traditional heads, the youth in their own families do not listen to them and choose to stay in the cities to pursue education or to look for jobs rather than coming home to work in the family fields as soon as the planting season begins.

Interventions and effects on family dynamics

CMDT's strategy of focusing its attention on the head of the farming unit rather than on the head of the family has been instrumental in this shift in authority, especially because some of the major strategies for dealing with food shortages, such as taking out credit (box 6) or procuring cereal against the promise of cotton, are accessed as a result of cotton growing. The head of the family is also traditionally responsible for controlling and distributing the family wealth, but cotton sales now provide the bulk of family income, and the payment for cotton is made to the head of the farming unit rather than to the head of the family. Meanwhile, because material demands cannot be met by revenues from the family field alone, other more junior family members are finding themselves in a position of partial autonomy. Women and youth may be better able to meet some of their own needs than can the heads of the farming unit or family, and they may choose to keep a large part of the income they earn rather than handing it to the head of the family. When the family is in difficulty, women may draw on their own assets (animals, poultry, food stocks, or access to credit from the savings circle) to assist their husbands.

Women's contributions

Women's contributions were reiterated on several occasions during interviews and discussions with men in Gouana. The activities in table 10 were documented by talking to 32 women in 8 families. The first four activities may yield direct food contributions, although women are entitled to keep at least a share of what they produce. The other three activities tend to be managed more autonomously by women, and they are not obliged to contribute any of the income to the family, although activity 5 in particular appears to serve an important buffer which women can draw upon to support the family during difficulties (see Box 11).

Although women may be taking on additional responsibilities in practice, their activities are not reflected in a shift in attitude about which members of the family have the legitimacy to provide for the family. The view held by the elders is evident in the message given by the chief to the heads of families (Box 12).

Table 10: Women's livelihood activities and contributions

	Livelihood activity	No. of women	Percentage of families	Type of contribution
1	Farming a field	31	100%	Crops are used for family nutrition or sold to fund personal or children's needs or invest in livestock.
2	Gardening	5	50%	Garden vegetables are consumed and sold.
3	Producing shea butter	32	100%	At least 50 percent of shea butter is used in cooking for the family.
4	Threshing	25	88%	Cereal received in payment is turned into couscous and eaten as a supplement between meals.
5	Livestock/poultry	23	88%	Animals are kept as a buffer and are sold/contributed when needs arise.
6	Small trade	16	63%	Income is used for personal or children's needs and paid into a savings circle.
7	Teaching	2	25%	Salary is used for personal or children's needs.

When families cope with food shortages exacerbated by drought, women's contributions may increase. Abdoulaye Diarra commented that:

> If the family is in difficulty, [women] *may* contribute food they have grown, or they *may* use their own money to buy the ingredients for the sauce, but *only as a complement* to what the family head provides. (Italics are his emphases.)

Box 11: When support from the family breaks down

Sanata Diarra, 81, was a widow in her late 30s when the droughts of the 1970s hit, but the polynuclear family that she had married into was able to withstand the shock because they had a stock of cattle. When there was enough food, it would be cooked and shared by the whole family. However, by the late 1970s, the cattle had all been sold to finance marriages and deal with the droughts, and the family began to face food shortages lasting one to three months every year. During these times, each household unit would fend for itself. Sanata would feed herself and her two children with the produce from her field and the millet from the threshing. When this food ran out, she would fetch food from the bush and ask around in the village for help. When the droughts of the 1980s hit, she was able to cope by drawing down on her own stock of goats, sheep, and a cow, bought using income from shea butter and her field.

Sanata Diarra

In fact, evidence from both women and men showed that women have often stepped in during times of difficulty or found themselves in a position where they must fend for themselves (Box 11 and Box 12). Sanata Diarra's example shows that women cannot simply rely on their husbands or the heads of their families to meet the needs of the whole family, so they attempt to generate their own income both as a way of coping with concurrent shocks, and also as a way of developing their own buffers in case of future difficulties. Some of these attempts are facilitated by institutional arrangements, whereas others are limited by institutional failures, as the following sections explain.

Institutional arrangements that provide disincentives for women's contributions

Women's attempts to farm (activity 1) are met with mixed reactions from their husbands. Although some men recognize that because they cannot provide for all the needs of their wives and children, their wives' fields serve as a way of lightening the load, the majority claim that because their wives keep all of the income from their fields, they (the men) should spend only a minimum amount of time supporting their wives in this activity. In fact, in 2010, the direct contributions made by women of their harvests to family nutrition varied from nothing at all to 100 percent. Eight women contributed more than 50 percent of what they had grown, whereas 15 women contributed less than 50 percent. Those who contributed more were generally the older women in the more food-insecure families. Supplying women with infertile land—and plowing their fields late—makes it extremely hard for women to invest in agriculture, reduces productivity, and limits women's ability to contribute. Again, these disincentives relate to the view legitimated by the seniors (adult and elderly men) that they are responsible for providing for the family, while women's income-generating activities are primarily for their own benefit.Aside from the activities mentioned in table 10, women have attempted to engage in other types of livelihood activities that have been met with resistance, in part as a result of institutional arrangements. Box 1 introduced women's attempts to get a group credit from Kafo Jiginew. In addition to an application for equipment, 130 women made a joint application for a loan to buy cereal at harvest, and resell it to families in Gouana when the prices rose later in the season. However, Kafo wanted to see the cereal before supplying the credit, and without the money, the women could not buy the cereal. Also, Kafo took so long in analyzing the file that by the time the money was available, the cereal price had risen and the activity was no longer viable. The AOPP adviser took responsibility for lobbying for the credit on behalf of the women, but Kafo insisted that a woman from the group come with her to represent the others. However, it proved very difficult to coordinate a meeting date with the three parties, and both the AOPP adviser and the women's representative made several futile trips. Women's lesser mobility compared with that of men exacerbated the institutional difficulties that a men's group might also have faced.

Box 12 describes how the activity of collecting wood for sale and charcoal burning enabled women to contribute to the family's nutritional needs during a time of crisis. However, when it continued as a livelihood option after the immediate difficulties had subsided, the activity generated a debate about legitimacy and was eventually prohibited. The intervention by the

local institutions had the effect of limiting women's capacity to support themselves. It was motivated by a concern for common natural resources, but shaped also by a social structure that denotes the heads of families as responsible for attending to the family needs, not women. This example shows that an attempt by one group of people within the community to respond to harsh conditions may be interpreted by another group as having a negative consequence for the whole community. In other words, both the legitimacy and the effectiveness of adaptation actions are contested.

The story recounted in box12 also serves as an illustration of how local institutions work together to develop and enforce rules on natural resource management. A similar story was told by both the youth *ton* and the Tree Committee.[7] Although women were labeled as the perpetrators in this case, they were not included in the debate. The message was simply transmitted to them via the heads of their families who were addressed during the *gwatigiwele*. The collaboration between the youth and the chief may have been effective in curbing deforestation by people in Gouana, but their capacity to curb unsustainable exploitation of forest resources by people from outside Gouana was limited.

Box 12: Wood for food

One rainy season, when many families had run out of grain, the women in the village held a meeting to discuss solutions. They proposed to the men that they could go cut the trees in the bush and sell the wood [to pay for cereal]. They got through the rainy season with enough to eat, but the women continued to collect firewood and burn charcoal to finance their own needs.

The chief summoned the *gwatigiwele*. He pointed out that the women had helped their families during this difficult period, but now the family heads should take responsibility for looking after their families and the women should stop cutting the trees. His words had no effect, so the family heads were summoned again. The chief reminded them of the importance of trees (1) for shea butter and (2) for preventing the encroachment of the desert. Without trees, there would be no water.

The Tree Protection Committee and the youth met together and agreed to go to the family heads and pass on the message that there should no longer be overexploitation of the trees. Recognizing that the problem still remained, they asked the chief to come up with a solution. He decided to fix an ultimatum for producing charcoal and selling wood by the side of the road. When this date came, the pile of wood still remaining was burnt, and any piles of wood found in the bush were burnt as well. During two days, the bush was under surveillance. Now, the Tree Protection Committee and the youth are responsible for surveillance of tree cutting. If they find someone guilty, they direct that person to the chief. The rule is that only fuel wood for household consumption should be collected.

Nianzon Diarra, village chief

[7] This committee of seven members was established in 1996 following instructions from the Water and Forestry Service. It is mandated by the chief to patrol the forest and report back any prohibited exploitation of forestry resources.

Institutional arrangements that provide incentives for women to contribute

The activity of shea butter production (activity 3) is endorsed by the chief (Box 12), and customary natural resource management rules that prohibit the cutting of shea trees[8] provide a further incentive for this activity. One reason for this institutional arrangement may be the guaranteed contribution of shea butter to the family economy. Whereas with most activities, the actual contribution made by each woman is subject to her own discretion (although it may be shaped by her position in the family or the difficulties that arise), contributions of shea butter appear to be stipulated: women in each of the families interviewed claimed that they contribute half of their butter to family food stocks.

Box 13: The grinding mill project

Four years ago, a group of men decided to establish a dry cereals cooperative called Duiguiya. The women's association Benkadi, which had already existed for many decades, decided to approach Duiguiya to see what they could do together. They made a joint request to the Union of Dry Cereal Cooperatives for a grinding mill in the village. The mill was donated jointly to both organizations by SNV Netherlands Development Organization and the Chamber of Agriculture, requiring of them a contribution of 10 percent of the total cost. Duiguiya oversees the functioning of the mill, takes responsibility for repairs, and has appointed a man to operate the mill. A male and a female secretary note down the revenues and report back to Duiguiya. Twelve women from Benkadi take turns in teams to manage the mill, and one woman cooks for the staff. When the donors visited to evaluate the project, men, women, and the traditional authorities were invited to a meeting, but the women's points of view were of principal interest to the donors, so the women were asked to speak in front of the men.

The villagewide *musow ton* serves as an arena for collective action. Previously, a major activity was the pounding of shea nuts. The grinding mill acquired in 2010 (Box 13) greatly facilitates this task, but the women still group together to beat the butter. The *musow ton* encompasses a series of credit and savings circles that incorporate women from the same quarter of the village. Petty trade (activity 6) is greatly enhanced by membership in the savings circle—many of the women who engage in trading explained that it is highly volatile because they struggle to accumulate capital and can lose it if a child falls ill, but the savings circle enables them to borrow enough money to start an activity, and the pressure to repay serves as a major incentive for endeavoring to produce a profit and return the money.

Access and legitimacy

This section has shown that the options available to women who seek to diversify their livelihoods and improve their adaptive capacity are shaped by perceptions of legitimacy. The *musow ton* is open to all married women, and is a legitimate forum for engaging in collective

[8] Nevertheless, this activity is limited by the deteriorating health of the shea tree population. Women connected the drop in yields of shea fruit in recent years to both the shortening of the rainy season and the practice of ploughing very close to the trees, which prevents any natural regrowth of trees from fallen nuts.

income-generating activities. Through this group, the women have been able to access resources from partners. Nevertheless, the persistent cultural norm that defines men rather than women as responsible for providing for the family limits women's attempts to generate income and leads to an underestimation of the contributions that women do in fact make.

Interventions and effects on gender dynamics: Challenging ideas about equity

Extra-local actors have targeted women in Gouana to improve their situation within the family and the community. CMDT used to have an extension program that targeted women, but it was abandoned in 2001. None of the women interviewed in Gouana acknowledged receiving any direct benefits from CMDT, even those who are members of the women's SCPC created in 2011.

Meanwhile, the approach of the local AOPP adviser has been to actively encourage men and women to work together. Before she began working with them, men and women would never join the same meeting, but she insisted on this as a way of enabling women to learn to participate in decision making. Elsewhere, she encountered resistance from the traditional authorities who told her that it would be difficult for her to hold meetings with them, because they could not allow her, as a woman, to enter the chief's foyer. Committed to her remit of working with both men and women and lobbying for equity in decision making, she agreed to hold meetings where the men sat inside the foyer and she sat outside and talked loudly enough to be heard. Eventually, the men let her into the foyer. She remarked that since she began working as an extension officer for AOPP five years ago, significant changes in interactions between women and men have occurred. This change is partly a result of combined efforts by a variety of development agencies to introduce the goal of gender equity. Solemanou Diallo, the president of the men's cooperative asserted that:

> If equity is considered, women and men should operate together. This is a change which has been introduced to us by partners such as AOPP, the organizations that come for literacy training with women, educational partners who say that boys and girls are equal, the partners who financed the grinding mill, and even through the cotton activities [because women do the harvesting]. Although the idea came from the partners, we saw that it made sense.

Notably, this change in attitude has not happened overnight, and it may not be representative of other members of the community. Even within the cooperative, it may be applied when there is an incentive to do so rather than as a general rule.

ACCESS AND ARTICULATION: PHYSICAL ORGANIZATIONS

In this section, institutional access and articulation are mapped with respect to the physical organizations relevant to adaptation in Gouana. Networked relations and cultural norms, rules, and structures cannot easily be mapped because they are complex and dynamic. Figure 2 is a visual representation of the links between (individual members of) families or social groups and

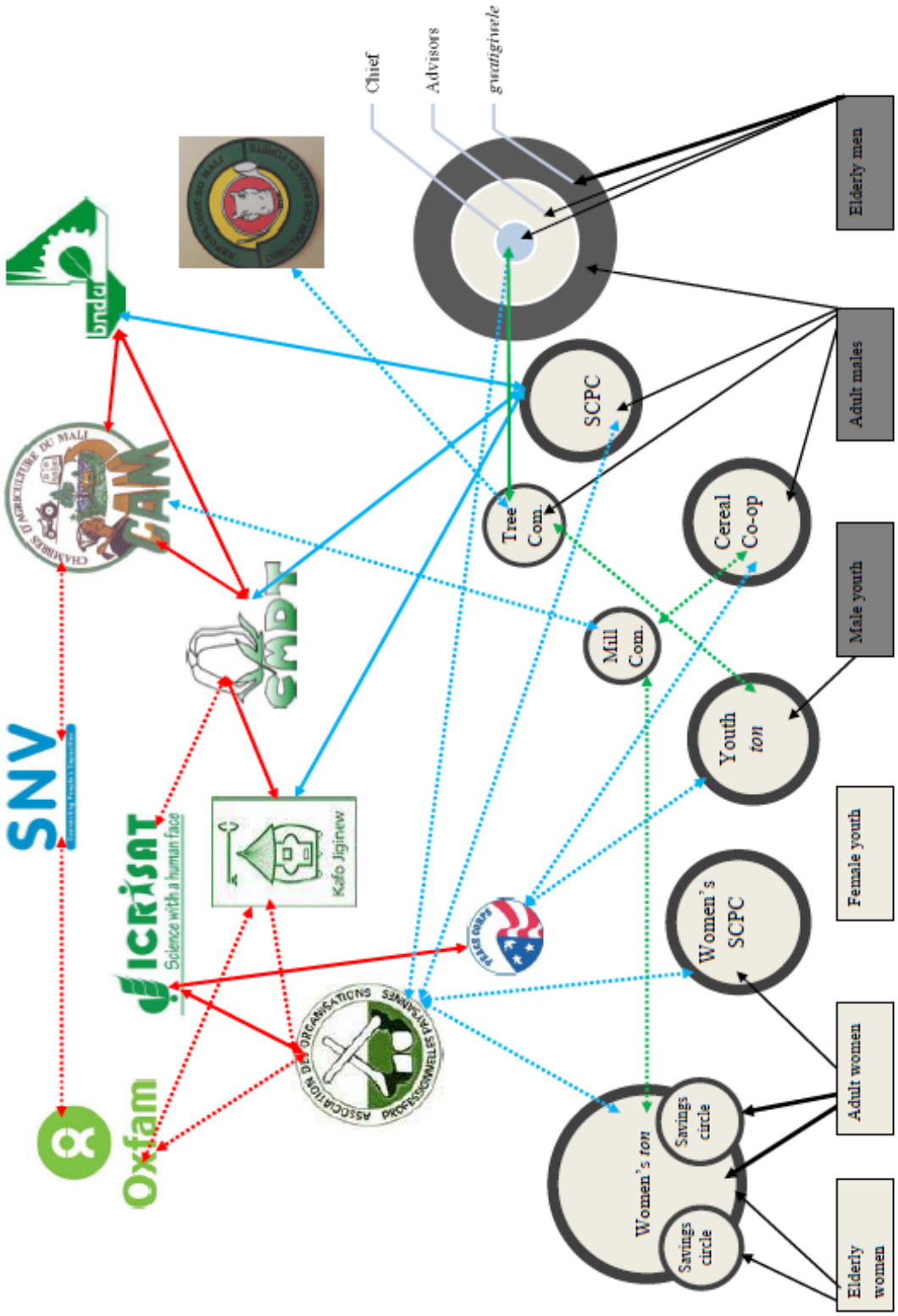
the various physical organizations, both local ones and extra-local actors, and the links between organizations. The categories established for the focus group discussions (female youth, male youth, adult women, adult men, elderly women, and elderly men) have been used as a basis for analysis.

Access

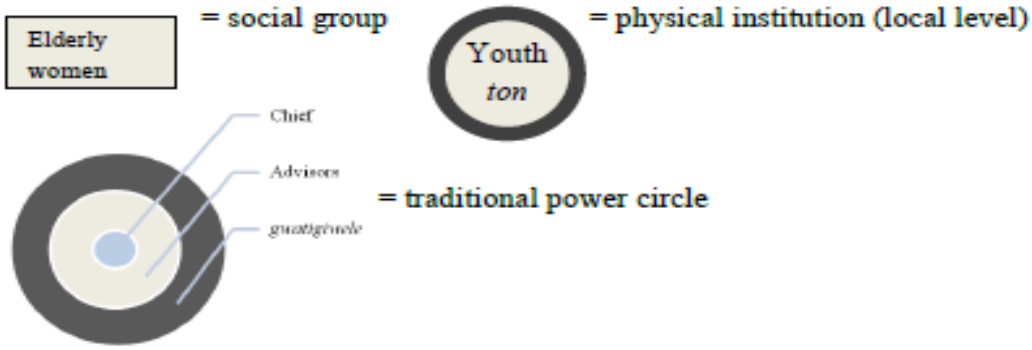
Figure 2 shows that none of the physical institutions in Gouana simultaneously support all members of the community, but most social groups belong to one or more local institutions. One member of each of the cotton-growing families belongs to the SCPC, where many important decisions about the farming unit are made and through which income, credit, and other inputs are channeled. The question of which people (the adult men or the elderly men) access the major decision-making arenas (the SCPC and the *gwatigiwele*) on behalf of their families depends on the age and activity of the head of each family. Some heads of family are in their 30s, so they can access both arenas, but most families have two separate representatives. Although married women and youth both have their own *tonw*, female youth do not access any of the physical institutions involved in mediating adaptation practices. They cannot enter the women's *ton* until they are married,[9] and these days they are no longer involved in the youth *ton.*

[9] Note that they marry at a much earlier age than men.

Figure 2: Institutional map



Key



Single-headed arrows (membership):

→ = all people in this social group participate

→ = some people in this social group participate

Double-headed arrows (partnership):

Solid lines indicate permanent institutional partnerships (more than 5 years)

Dotted lines indicate temporary institutional partnership (5 years or less)

Color of arrows

↔ = Partnerships between local institutions

↔ = Partnerships between development actors and local institutions

↔ = Partnerships between development actors

Articulation

Links with extra-local actors

The SCPC is the principal channel to connect with extra-local actors. The women's SCPC is not yet linked to CMDT, but AOPP supported the creation of this group and the local adviser is attempting to mediate a connection with CMDT. AOPP occupies an interesting social space by working with both women's and men's groups and bringing them together. This joining of the groups is done by encouraging women to join the SCPC activities and by mediating between the chief, women, and men in discussions about land for the women's field. The partnership between SNV and the Chamber of Agriculture and the women's *ton* and men's cereal cooperative has also forged a link between women and men. The only external partner that has worked directly with the youth *ton* in recent years is the Peace Corps. However, there is an interesting link between the youth and the chief via the Tree Committee (Box 12). Neither the female youth, nor the eldest women (who no longer participate in the women's *ton*), have links to extra-local actors. Flows of resources and influence from extra-local actors are mostly channeled through organizations that have been established or transformed with external support. The one exception is the intervention by AOPP to try to support the women's group in getting land (box 9) by approaching the chief. Notably, once the issue reached the *gwatigiwele* (an institution that no extra-local actor partner has attempted to reformulate), the AOPP adviser was no longer able to intervene.

Links between extra-local actors

All the physical organizations active in Gouana but based elsewhere are connected across scales to the regional and national level. In fact, these actors are all linked with each other, either directly or via additional actors not included on the map. For example, the Peace Corps volunteers who were present in Gouana until March 2012 were operating fairly independently but were nevertheless introducing seeds to Gouana from ICRISAT, an organization collaborating with AOPP and the seed bureau.[10] CMDT and AOPP collaborate closely because they both focus their attention on the SCPCs and share partners. AOPP is also involved in brokering between the SCPC and some of the organizations that CMDT has linked them with, such as Kafo Jiginew.

[10] The seed bureau has not been included on the map because it was not possible to find further information on this organization other than what was provided by the local representative.

DISCUSSION

Based on the findings presented in the previous section, the discussion that follows addresses the research questions and links them to a number of theoretical propositions and practical concerns that were introduced earlier in this paper.

THE ROLE OF LOCAL INSTITUTIONS

Relevant local institutions and responses to drought

The first research question asked what role local institutions have in long-term adaptation to drought. To provide a clearer picture of the types of institutions under analysis, this paper proposed a categorization of local institutions in Mali into three layers (physical organizations; cultural norms, rules and structures; and networked relations). The various institutions in Gouana that fall into these three categories were introduced throughout the findings, and the roles they play were described.

Broadly, institutions are involved in the following:

1. Organizing and controlling of the means of production (acquiring equipment, organizing resources, dealing with labor and equipment shortfalls, and acquiring and disseminating seeds).
2. Governing land resources.
3. Generating and disseminating weather and climate information.
4. Structuring responsibilities, constraints, and opportunities, both within the family and within the community at large.
5. Facilitating social and economic development, including systems for accessing credit to engage in income generation or to alleviate food shortages.

The way that these institutions have acted in recent decades has been shown to relate not only to a changing environment, but also to a variety of socioeconomic and political triggers. Changing farming strategies (increasing surface areas, incorporating traction equipment and fast-yielding seed varieties) are described by farmers as practices developed in response to a shortening of the rainy season, but they have also been triggered by incentives from CMDT and changing ideas about ”development” and material needs. Food shortage is a consequence of drought, but institutionalized food shortages are closely related to the (non)availability of alternative income sources and asset-management practices within the family economy, and many families face cereal shortages even following a good harvest. In box 13, women’s strategies to contribute to the family economy were driven by food shortage triggered by

drought, but their strategy fitted with a wider concern to develop an independent economic sphere—a concern that has been enhanced by gender-focused development interventions.

Organization

The ways that local institutions are structured were highlighted in the findings section. The structures of the various physical organizations relate to their historical contexts—many of them have been reformulated or are based on models devised by extra-local actors—but the individual agency of the members should still be recognized. For example, the women and men were required to work together as a prerequisite for receiving the donation for the grinding mill, but they found their own model for cooperating, a model that allows them to meet separately and govern different aspects of the project (Box 13). The men noted that in the Union of Dry Cereal Cooperatives, men and women sit together on the management committee, but in Gouana, both sexes are more comfortable managing their independent cooperatives.

Cultural norms and rules, based on the cornerstones of gender, age, and caste, are elaborated through the traditional structure of the chieftancy and the *gwatigiwele* and appropriated within each family. Customary principles are sometimes understood to change only very slowly, but despite the image of ”tradition” often imposed on African societies, people are dealing with an ongoing process of social and cultural change that exhibits powerful and conflicting dynamics (Raynaut, 2001). Decentralization processes and interventions by both CMDT and AOPP have challenged the legitimacy of certain cultural norms and rules and have infiltrated new ideas about equity. Networked relations are less clear in terms of organization: multiple options (for example, for accessing seeds or supplementary labor and equipment) are available through what Pelling and High call a “mess of criss-crossing interactions and economically and politically ambiguous social networks” (2005: 311). These networks are made sense of by the people who navigate within them, and the way that options are combined and organized relates to individual factors (such as the goal to be met, or the economic and social capital at one’s disposal). People stand at the intersection of multiple social categories (Leonard and Onyx, 2003) and use their position and the diversity of options available to identify new information, learn, and cope with change (Pelling and High 2005: 311).

Access

Agrawal has argued that while some individuals and households may be heavily involved in decision making, driving institutions, and reaping benefits, others may be excluded and may be unaffected or even hindered by institutional policies (Agrawal 2008). The concept of access (links between individuals and households and institutions) has been used throughout the findings section to describe how different strata of the community access institutions, adaptation options, and the prerequisites and benefits of interventions. Concerning access to institutions, many of the physical organizations set entry barriers preventing certain strata of the population from accessing them, but apart from elderly and unmarried women, all other strata of the population have at least one physical institution in which they participate.

Some adaptation options, prerequisites, or benefits are only accessible through one particular institution, and certain individuals, families, or social groups are effectively prevented from drawing on these options if they are unable to access that institution. For example, credit from Kafo Jiginew is currently only channeled through the SCPC, which excludes non-cotton-growing farmers. Land is now being discussed between the chief and the heads of families at the *gwatigiwele*, which excludes women and youth.

Some families and social groups encounter consistent difficulties in accessing adaptation options; some find themselves less able to benefit from opportunities to enhance their adaptive capacities because they must deal with more pressing concerns. Women face a triple barrier in accessing productive land for farming. Indebted or less-equipped farming units are entitled to access fewer agricultural inputs on credit from CMDT, and they may have to forego their own laborers in exchange for cereal or the use of another farming unit's plow. Hiring the labor of the youth *ton* or buying high-quality new seeds are options that are inaccessible to all but the wealthiest farming units. Meanwhile, networked relations tend to be accessible to a wide range of people, and they often serve to disseminate benefits beyond the boundaries of the organizations that may initially have mediated them. The seed network is open to anyone residing in Gouana, and it also extends beyond the village boundary. High-quality seeds that have been commercialized through the seed office or the SCPC can be received in exchange or as a gift from fellow farmers.

Articulation

To understand how institutions are organized and accessed, it has been necessary to explore the linkages between them, because one adaptive practice may involve multiple institutions at once. The women's attempt to get land for a collective field (box 9) or the combined efforts of the youth, the Tree Protection Committee, and the chief to curb deforestation (box12) serve as illustrations. The findings section explored the linkages between physical organizations. Although it appears that many of the local institutions are not directly linked to each other, links between them are in fact made by the individual members (through their presence in multiple physical organizations) or by the family unit, because its members represent the majority of the physical organizations. Through these informal channels, men access seeds from CMDT via the SCPC and share them with fellow members in the cereal cooperative, who in turn go home and share them with their wives. Links between the various networks involved in mediating access to the means of production (seeds, equipment, labor) are also made by the participants of these networks.

The empirical data has shown that although some channels are closed to certain strata of the population, the diversity of channels available may mean that people can still access the same resource via an alternative channel—the multiple options for getting seeds, accessing credit, and dealing with cereal deficits or labor shortages serve as an example. Farmers are exposed to ideas and technologies from agricultural extension programs and development interventions, but also from families, neighboring villages, and from travels and migration elsewhere, None of these channels determines the design of adaptation strategies, but they make up the factors that may influence the design, and they are deeply embedded in the rhythm and flow of

personal and local social relations (Batterbury, 1996). This study has shown how male farmers incorporate commercial varieties of improved seeds into their own systems (which involve circulating a diverse type of seeds using multiple currencies) and how they draw on the advantages of agricultural inputs or equipment on credit to fuel their own extensive mixed farming strategies.

The practical implication of this finding is that development agencies need to consider how they can support or enhance diversity, allowing farmers to generate multiple robust channels for enhancing their adaptive capacities. In some circumstances, achieving this objective may involve not interfering too closely, and not making strict impositions about *how* benefits should be accessed or disseminated. Nevertheless, special attention may need to be given to women, because they may have fewer options directly available and may face additional barriers in accessing them.

Local institutions create incentive and disincentive frameworks

The findings provide a useful illustration of Agrawal's proposition that "institutions create incentive frameworks within which outcomes of individual and collective action unfold" (2008: 27). He explains that institutions can also create disincentives, and it is on the basis of these (dis)incentives that people make choices about adaptation practices—as an example, institutional norms that encourage labor-sharing may discourage people from migrating. The empirical data has illustrated many examples of how institutions create both incentives and disincentives. To cite a few, the structure of the SCPC has provided incentives for young men to play a more active role in agricultural and family decision-making, and through this, they have incorporated and appropriated new techniques and inputs. The labor offered by the youth and women's *tonw* and the mechanisms for paying at harvest serve as an incentive for families to farm large surface areas. The institutional arrangements that delay the plowing of women's fields discourage women from investing in agriculture because they may not be able to plant in time to hope for a harvest. Their dependency on their husbands' timetables leaves them with little incentive for safeguarding local knowledge about weather and climate because they are unable to apply it in agricultural decision-making. However, the same institutional arrangements may have contributed to a shift in livelihood emphasis, for example, toward market gardening. A similar trend has been remarked elsewhere in Mali (Diawara, 2012). Women are encouraged to engage in such activities collectively as they are used to working together in the women's *ton*. This example shows that one arrangement can fuel a series of diverse outcomes, some of which enhance people's adaptive capacity while others inhibit it.

Recognizing individual agency

The words "within which" are crucial to Agrawal's proposition: institutions do not *create* the outcomes, but they play a role in configuring the possibilities available to people. Actual outcomes come about as a result of individual choice and creativity, and it is important to recognize people's agency in adaptation. Decisions and responses are made in light of a mix of conditions and risks in a dynamic and ongoing process (Smit and Skinner, 2002). Recognition of individual agency has practical implications because too much enthusiasm for local institutions

without enough recognition of individual agency can lead development agencies to consider institutions as an end rather than a means. For example, women's membership in the SCPC is seen as an indicator of their increased participation in decision making, but membership alone does not change their situation. When individual choice and agency is recognized, it becomes clear that women are not interested in being members of the SCPC in order to engage in dialogue with men, but because it may enable them to access credit. This is the case not only in Gouana, but in other areas of the cotton zone (Jonckers 1994). Also, even when institutions are identified as having favorable criteria for entry, they should not be assumed to guarantee equal and effective distribution of benefits (Bernard, Collion, et al. 2008). In Gouana, the SCPC has opened its doors to female members, but women have not yet been able to access credit through this channel.

Institutions impede adaptation practices

Although it is important to recognize individual agency within sets of institutional configurations, sometimes institutions go beyond creating disincentives by actually impeding adaptation practices, leaving no room for individual choice. It has become clear that where structural inequalities exist, certain strata of the population face barriers in enacting adaptation strategies whichever channel they pursue. This situation is illustrated by the cases describing women's attempts to diversify income through wood collection or farming a collective field. Similarly, where resources are consistently channeled through one particular node, some strata may be consistently disadvantaged. Because benefits are channeled through the SCPC, the elderly heads of families who are excluded are unable to put their own qualities and assets (such as their wealth of meteorological knowledge or their experience in managing family resources and making farming decisions) into use in adaptation strategies. Extra-local actors have identified difficulties that members of the community encounter in accessing institutions, as well as weak linkages between institutions, and have made attempts to improve both access and articulation. These attempts are outlined in the discussion.

Local institutions as media for external interventions

Agrawal proposes that "institutions are the media through which external interventions reinforce or undermine existing adaptation practices" (2008: 27). He explains that instruments used by development partners in the hope of increasing local adaptive capacity may end up having a neutral or debilitating effect on certain actors who are unable to access the prerequisites or benefits of interventions. For example, social groups that do not possess land rights will find it difficult to diversify asset portfolios or engage in market exchange. This situation has already been exemplified in several cases with respect to women and the structural inequalities they face in accessing land and diversifying their activities. It is important, as Agrawal (2008) notes, to seek a better understanding of how institutions structure access to prerequisites and benefits of interventions, but this understanding should take into consideration the multiple layers of institutions involved in adaptation rather than just the physical organizations that can more easily be scrutinized. Also, it is not sufficient to seek to lay bare the inner workings of local institutions without also reflecting on the development agencies' own agendas and strategies—

and the impact of their partnership choices on adaptation practices. In other words, at the same time as recognizing the agency of the community members in shaping adaptation outcomes, it is also important to acknowledge the agency of the development organization, because the channels it selects for providing support and engaging with beneficiaries bear a significant role in shaping adaptation. This aspect is dealt with more closely in the following section.

INTERACTIONS BETWEEN EXTRA-LOCAL ACTORS AND LOCAL INSTITUTIONS

The second research question asked how extra-local actors have interacted with local social institutions in development and adaptation efforts. The principal extra-local actors active in the research area are CMDT and AOPP. Their agendas, strategies, and entry points were given in the first subsection of the findings, and the effects of their interventions on local dynamics have been illustrated throughout the second and third subsections of the findings. This section examines the various styles of interaction with local institutions—and the effects of pursuing these styles.

Supporting and engaging local institutions

The first style of interaction involves supporting local institutions in the pursuit of their strategies or engaging them in the pursuit of the extra-local actor's own strategies. CMDT (and to a lesser extent AOPP) have provided support to the institutions that organize and control the means of production by facilitating access to equipment and providing inputs on credit and improved seed varieties. This support has resulted in a strengthening of farming units' capacities to deal with the shortening of the rainy season.

Notably, although such benefits have primarily been directed at cotton production (in line with CMDT's own agenda), farming units have maintained their own autonomy in the organization of resources by choosing to redirect these benefits toward their own mixed and extensive farming strategies (for example, by reallocating cotton fertilizer to the cultivation of maize or introducing commercial high-quality seed varieties from CMDT into their own mechanisms for seed saving, gifting, and exchange).

CMDT has also supported the institutional arrangements that affect economic and social development and access to credit through integration of cotton producers into the cash economy. Nevertheless, the benefits to producers vary considerably, and CMDT has been blamed for contributing to an increasing disparity between small and large producers (Jonckers 1994; (Bonnassieux, 2002) (Djouara et al., 2006).

The policy of facilitating access to credit for producers was intended to benefit cotton production, but a lack of strict control as to how producers use the credit they access via CMDT has meant that this credit is in fact used for wider economic and social development goals. Social development used to form a much bigger part of CMDT's work; aside from the building of

roads and donations of village infrastructure, a specific extension program for women was being carried out until about a decade ago. Since then, the cotton producer organizations formulated by CMDT have continued to act as a channel for support aimed at social development from a range of extra-local actors, in particular AOPP.

Working with the most robust institutions

CMDT and the seed office have chosen to work with the better-equipped and wealthier farmers or farming units in order to channel high-quality seeds, because these farmers are able to afford the seeds (or membership fees in the first place) and are more likely to be able to reproduce the seeds under appropriate conditions. As an effect of this choice of partnership, farmers across Gouana and in neighboring villages are able to access the same varieties that were originally sold to wealthier and better-equipped farmers, either by buying directly from the local representative of the seed office or through the mechanisms of seed saving, gifting, and exchange. CMDT adopts a similar partnership strategy for supplying inputs and loans to farmers: the better-equipped farmers are entitled to borrow more inputs and bigger loans, because CMDT assumes they are more likely to be able to produce sufficient quantities of cotton to repay their debts. This policy has contributed to an increase in disparity between farming units, although disparity also brings advantages by making certain types of interaction possible (such as food for work, or providing cereal on credit).

Developing links between local institutions

Several authors have identified the need to increase institutional linkages and improve institutional coordination across scales (Agrawal, 2008, Ruijs et al., 2011). The findings section described a number of incidences where AOPP has been involved in improving linkages between institutions, for example, between the SCPC, Oxfam, and Kafo Jiginew, and between the women, the SCPC, and the chief. In the first instance, AOPP's actions contributed to faster delivery of larger loans. In the second instance, the intervention was limited because further coordination was required between the actors already involved and an additional institution (the *gwatigiwele*). SNV and the Chamber of Agriculture imposed the requirement that women and men should work together and make a joint application for the grinding mill (box 13), and this requirement has effectively created a new line of collaboration between the women's and the men's cooperatives. Although AOPP is involved on the ground in brokering the links between organizations, SNV and the Chamber of Agriculture have left the women and men to design their own model for cooperating.

Bypassing or ignoring local institutions

CMDT has generally not engaged with the local institutions involved in dealing with labor and equipment shortfalls (apart from providing training sessions for the women's *ton* in harvesting quality cotton). These institutions have nevertheless been affected by the introduction of cotton cash-cropping; the commercialization of youth labor is one example. Jonckers (1994) notes that in the past, the youth *ton* offered its services to the lineage communities and was considered as a strengthening of the workforce. Each member would take his turn to receive the group in his

family's field, and then members or nonmembers requesting additional services would be required to pay the *ton* and feed the labor force. The *ton* could also be mobilized by the village chief to assist those members who were in difficulty. Jonckers notes that the *ton* has now become a group of paid laborers, hiring their services to richer producers. Gouana's youth *ton* has evolved in a similar way, although recent changes were in fact triggered by the nonpayment of the group's labor (as a result of a severe drought). This example serves as evidence that local institutions are being weakened under the weight of multiple climate and non-climate-related pressures.

Similarly, CMDT has never engaged with the traditional institutions involved in governing natural resources, but its presence has indirectly fueled the changes in institutional arrangements for land allocation as well as rules about forest exploitation. In addition, its strategies to increase production, incite competition between producers, and facilitate access to credit for traction equipment have all contributed to land scarcity and deforestation. The dramatic reduction in forest cover was a major motivation for the chief and the Tree Committee to devise new rules banning exploitation of forest resources. Although women were said to be responsible for recent forest exploitation, the loss of trees over the past four decades was attributed by male farmers in Gouana to the expansion of farmland. Regarding both forest and land resources, the changes in institutional arrangements have had an adverse effect on women.

CMDT has also ignored the local institutions involved in generating information about weather and climate when providing their own guidance to farmers, even though it eventually realized that the elderly farmers had been right about some aspects. CMDT has used a different calendar and channeled information to the younger heads of the farming unit rather than the elderly. Environmental changes have already rendered some aspects of local meteorological knowledge systems less accurate, and CMDT's strategy of ignoring these systems is contributing to further weakening. The conflict of legitimacy between various knowledge and power bases and reference points for generating weather and climate information and applying it in the field has demonstrated what happens when scientific meteorology operates in isolation from local knowledge systems. Unfortunately, this phenomenon is common; even outside of the Sahel region in areas where predictive capacity is more reliable, effective integration of scientific forecasting into local production and livelihood systems remains a challenge (Roncoli, Ingram, et al. 2002).

Challenging local institutions

Both CMDT and AOPP have challenged the institutional arrangements that structure responsibilities and set constraints and opportunities for different members of the family and strata of the community. They have created these challenges by giving responsibilities and providing training to the younger or female members of the family; creating new bases for cooperation between women and men; supporting them in making their own decisions; and providing them opportunities to access power, information, or other benefits via external partners rather than through the channel of the family hierarchy.

These actions have often created disagreements or even rifts within families. The elderly heads find themselves still in possession of the responsibility to provide for the family, but they do not have direct access to the resources to ensure the family is cared for. Meanwhile, the younger male farmers have to make choices between following CMDT's advice or drawing on the rich body of accumulated experience and knowledge to which their fathers have greater access. Jonckers (1994) argues that CMDT's choice to address the heads of the farming unit rather than the elderly heads of the family is one factor that has contributed to the erosion of respect for the elderly, who were already struggling to satisfy the family members in the redistribution of wealth. Many youth have since then split off from the family unit and begun to manage their own unit, often because of disagreements about how to divide the cotton revenue (Bonnassieux 2002). Whereas projects that accord a significant amount of power to older people may be less likely to inspire participation of younger people, bypassing older people exacerbates social differentiation and enables the "new elite" to establish power (Jonckers 1994). One argument for continuing to work through institutions that are still dominated by the adult or elderly men of the village is that because family revenue is still basically centralized and the means of production are still managed by these elderly actors, efforts to enhance a family's ability to adapt also supports them in their goal of ensuring their families' well-being. The less these actors are able to do this, the more they become dependent on their sons and wives to assist them.

AOPP meanwhile has rocked the boat by sending a female adviser—who has negotiated for access to the chief's foyer and advocated women's participation in decision making. AOPP's actions form part of a legacy of programs aimed at increasing equity, which have chipped away at the institutions that allocate tasks and responsibilities and accord the eldest men the responsibility of making decisions on behalf of women and youth. On the positive side, AOPP's steps have led to new models for cooperation between women and men, new voices in the debate, and changes in ideas. The quote by the President of the men's cooperative is hugely significant in light of the Bambara proverb ('God proceeded to create, but not to install equality in society'), even though what people say should not be interpreted as a strict sign of what individuals or communities think or of what happens in practice. Although the men are cooperating with the women to manage the grinding mill, women still face constraints in their attempts to generate income, even if the income is to be used as a contribution to the family economy. The women's struggles to diversify income through exploitation of forest resources relate to men's unwillingness for women to be generating income, but also because customary rules for governing resources reiterate the same hierarchy based on gender.

Summary

This section has reviewed a number of styles of interacting with local institutions, each of which has had mixed effects on the institutions and the practices they mediate. Generally, supporting local institutions has contributed to the strengthening of both the institutions and the adaptive practices linked to them. This result has particularly been the case when extra-local actors have stood back and allowed farmers to select and adapt support to suit their own livelihood choices, or when they have responded to needs expressed by the beneficiaries. In some instances, selecting the robust institutions to work with has been successful for meeting partners' goals,

channeling benefits to the selected institutions, and sharing these benefits with the rest of the community; in other instances, this strategy has contributed to increasing disparities between families. Developing links between institutions (either by brokering or leaving the space for members of the local institutions to create their own links) has proved successful to a certain extent, although efforts have reached their limit when the extra-local actors themselves have been unable to access the institutions that they have attempted to link together. Bypassing or ignoring local institutions has tended to contribute to their gradual weakening or, alternatively, has created conflicts in legitimacy. Challenging local institutions has contributed to the weakening of—but also the transformation of—local institutions, and has also opened up access and created space for new voices to be heard.

EQUITY, LEGITIMACY, EFFECTIVENESS

It is in recognition of the types of structural inequalities mentioned that NGOs such as Oxfam have sought to understand institutional access and to then identify the most equitable institutions to channel their support. This strategy has also been advocated in research (Agrawal 2008; Osbahr, Twyman, et al. 2008), and it is important to consider how it might work in practice and which impacts it might have. For Oxfam, "equity" signifies access to benefits and support for all members of the community, particularly the more vulnerable groups such as women and the elderly. This definition means that crosscutting lines of gender, age, lineage, and ethnicity that traditionally structure the social organization of a village should not curb the flows of resources and benefits from local institutions—or from the extra-local actors that channel their resources through these institutions. Institutions with entry barriers that effectively prevent certain individuals or groups from participating, leadership structures that promote unequal access to benefits, or mechanisms that allow for internal division and differentiation (in terms of wealth) would all be classed as inequitable.

Taken at face value, Oxfam's commitment to working with local institutions that support strongly and fairly all sectors of the community poses a challenge. When development agencies use their own criteria for defining legitimate terms for partnership and effective adaptation in terms of equity, they are necessarily denouncing the structural divides based on gender, age, and lineage that organize most communities in Mali and continue to be perceived as legitimate by the members of those communities. Legitimacy and equity have both been identified as important criteria for success in adaptation, but both are contested and context specific (Adger et al., 2005).

So, are effectiveness and equity and legitimacy necessarily compatible goals in the context of local institutions? The social mechanisms that underpin customary law often reproduce asymmetrical power relations on the basis of social identity, for example, gender, ethnicity, and age (Agrawal and Gibson, 1999) and frequently favor the interests of the elite (Ribot, 1999). Deeply rooted gender and ethnic biases are unlikely to be altered by policy reform, such as the devolvement of power to local governments or a stipulation that a village cooperative should also include women (Benjamin, 2008). Perceptions of legitimacy do change over time; just as

NGOs redefine their goals in response to donors' priorities, community members incorporate and appropriate new ideas where they see benefits. Changes in collective conscience may be fueled by wider and more generic political and social changes or consistent messages from multiple partners, but these changes do not generally happen within the time frame of a project cycle and may not be considered welcome or beneficial to everyone in the community. In the meantime, the following two points must be considered.

Limiting the criteria for partnership to the institutions that are equitable may result in limiting diversity in adaptation. The strength of many adaptation strategies is that they coexist with a diverse range of alternatives. Certain options may favor wealthier farmers or traders (such as being able to buy high-quality seeds, engage in cereal speculation, or employ the youth *ton*). Nevertheless, most farmers in Gouana (even those with no cash available and nothing physical to exchange) have several options for receiving seeds and dealing with shortfalls in equipment, labor, cereal, or cash.

It is important to consider not only the potential impact of those institutions that partners choose to support, strengthen, or use as intermediaries to channel resources, but also the consequences on other institutions. **Some institutions that are not identified for support (because they are less equitable or because they escape the radar of intervention programs) may be playing an important role in the adaptive capacity of individuals or the community at large. Their capacity to do so may be weakened when they are bypassed.** The example of the seed office has shown that at times institutions or programs that do not promise equal access to benefits (or that set high entry barriers and exclude certain individuals and groups) may in fact be better able to operate effectively or efficiently.

Similarly, the mechanisms in place for procuring cereal on credit from local traders against the promise of cereal or cotton, or of working on other families' land in exchange for food, are only possible because wealth, labor, and other resources are unevenly distributed across the population. The uneven distribution is what creates a situation of mutual dependency: wealthier farming units exploiting larger surface areas can make use of additional laborers, while families struggling to find cereal can avoid going hungry. These mechanisms give a double advantage to the wealthier party and a double disadvantage to the poorer party, but they are nevertheless effective ways of securing food when the head of the family has no cash. With respect to cereal trading, Kent and Berg (1998) advocate the role of middlemen, arguing that no society in the world has been able to develop its agriculture and rural economy without the development of a class of private service providers to supply inputs, purchase crops, and transform, store, and transport those crops. Approaches that try to cut out or avoid the middlemen and replace them with cooperative principles generally haven't proved viable and can even be counterproductive.

The warnings given here are not intended to advocate inequity, but simply to propose a broadening of partnership terms. Meanwhile, the findings have shown that there have undoubtedly been some instances (especially in respect to gender inequalities) where it has been beneficial to intervene more closely and actually challenge the way that local institutions control access to benefits. However, this level of involvement is a delicate and lengthy process,

and is more likely to be successful if it is done by multiple development agencies as part of a long-term development goal.

CONCLUSION

This research has sought to shed light on the workings of the local institutions that play a relevant role in adaptation in one particular setting in the cotton zone of Mali, and on the impact of interactions with extra-local actors on local dynamics. It has shown that people's responses are certainly shaped by their ability to access institutions and by the influence of institutions on their status and their activities. Nevertheless, when individual agency is recognized, it is clear that institutions do not do everything by themselves. People select and appropriate what suits them based on the range of institutional channels and options at their disposal, and while one channel may be inaccessible, others remain open. Support to institutions that organize the means of production and promote economic development has contributed to adaptation, but it has also brought unequal benefits.

Nevertheless, disparity between farmers allows a situation where mutual support can exist (although extreme events or decreasing availability of natural resources eventually hit everybody). While certain physical organizations and structures may set barriers to entry, networks tend to disseminate benefits based on a variety of currencies and enable different strata of the population to access the same benefits eventually. Economic development has also had an effect on solidarity and reciprocity, but behind the commercial transactions, networked relations of nonproductive solidarity still exist.

The web of interactions between individuals and social groups crosscuts traditional structural divides and has arisen from internal and external triggers. The resulting picture is dynamic and complex. Where extra-local actors have deliberately bypassed or worked against traditional institutions that structure responsibilities, changes have been remarked, although these are not beneficial for everyone: increased autonomy for women and youth is part of the same process in which the elderly experience an erosion of respect or are unable to utilize their responsibilities, knowledge, or experience. As a final point, this research has argued that it is difficult to combine goals of equity, effectiveness, and legitimacy when choosing which institutions to work with, especially given that equity and legitimacy are both contested and context specific.

The approach used in this study for exploring institutions and their role in adaptation is significant for four reasons. First, it has taken a multilayered view of institutions, focusing not only on the physical institutions that are frequently selected by development agencies for support, but also on the networks and social structures. The roles of these underlying institutions are often ignored or misunderstood by policy makers and NGOs. Second, it has explored institutions as dynamic configurations that are shaped and molded in response to ongoing social, economic, and environmental pressures, rather than seeing them as static. Third, it has applied theoretical propositions about the role of institutions in adaptation to a concrete empirical case, using ethnography to provide colorful illustrations of interactions. Admittedly, this is an approach that donors and NGOs cannot usually afford to engage in, despite the benefits. Fourth, it has sought to build a bridge between adaptation and

development by considering how people are attempting—with the support or hindrance of institutions—to adapt their livelihoods to a variety of social, economic, and environmental pressures, although adaptation to drought has been the starting point.

Two limitations to this study, however, should be noted. First, because the research took place in only one village, insight on institutions and interactions with extra-local partners should be extended with caution. Although there are commonalities between the local institutions in Gouana and elsewhere in Mali, and there are strong parallels in the way that partners have engaged with local institutions across the cotton zone, the actual outcomes of interactions depend on the individual actors—the specific field staff and community members. Second, this study has made a stark analytical divide between local institutions and extra-local actors, but the divide is often not so clear-cut in practice. Local institutions such as the SCPCs have actually been created or reconfigured by extra-local actors and could also be considered as extensions of their territories. AOPP meanwhile has been considered as an extra-local actor whereas actually it is a national network of local organizations. Nevertheless, the way that farmers shape and use these institutions remains at the center of analysis; the fact that the major partners have a strong local presence has rendered the analysis of interactions more interesting.

In follow-up research, it could be important to explore in more detail how networked relations based on trust, reciprocity, and social obligations are played out during particularly difficult years. For example, seed gifting and exchange practices appear to have withstood the test of market integration while other types of relations have become more commercial, but it is unclear what happens during consecutive drought years when there is a greater pressure to consume seed stocks and when commercialized seeds are in shorter supply. It could also be useful to explore the influence of the gender and profile of the field staff of organizations such as AOPP and CMDT on the interactions between local and extra-local actors, bearing in mind the significant role staff play by embodying the politics of their organizations in transforming agendas into activities, and—if they are trusted and respected—by serving as role models.

RECOMMENDATIONS

This section outlines five recommendations for NGOs working to aid in climate-adaptation efforts in areas such as Mali. Although these recommendations are based on insight gained during research in one particular village, they are applicable not only in Mali but in other contexts where development agencies seek to participate in a dialogue with local farmers and institutions and to identify effective ways of collaborating with them.

1. Encourage new voices in decision making without imposing the form it takes.

Cases from this research, as well as in supporting literature, showed that women's responses to stressors are sometimes limited because they are not able to access certain decision-making forums. It may therefore be beneficial to encourage new voices in decision making, but doing so is a delicate process that takes time and that may ultimately lead to other voices becoming more marginalized. Groups and communities must be given the freedom to accept and appropriate ideas about gender and to create their own culturally accepted channels for women to participate in decision making. Field staff can support this process by acting as brokers or advocates in forums where women's direct participation is not appropriate. Women's marginalization is not an issue limited to adaptation, and major changes will not be made within the short time frame of a project cycle. In the short term, development agencies may be able to encourage new voices by employing more female extension staff—who can set a positive example to both women and men.

2. Broaden the criteria for selecting institutions and actors to engage with.

Although development agencies can contribute to a dialogue on equity by introducing new models for partnership or providing incentives for people to innovate such models themselves, they cannot and should not expect to induce major changes to the types of local institutions that structure responsibilities, constraints, and opportunities on the basis of gender, caste, and age within the time frame of a project cycle. They should not therefore insist on channeling their support only through the most democratic and equitable organizations. In some cases, it may be more beneficial to provide support through the channels that are already familiar and culturally legitimated, or to work with players who have greater social and economic standing and are more resilient to shocks. Meanwhile, the networked relations that connect people on the basis of trust, reciprocity, or social obligations often serve to disseminate resources to the wider community. Rather than NGOs stipulating how this dissemination is accomplished, these networks should be granted the autonomy and freedom to do it in the way that best suits the people who participate in them.

3. Provide low-level flexible support and involve local actors in the planning process.

Technical or financial support may be necessary for enabling people to increase the number of or viability of the adaptive strategies they are able to access. For this support to be appropriate,

beneficiaries should be involved in identifying problems, making connections between different livelihood goals, and designing solutions that are robust in a variety of circumstances. Similarly, the field staff delivering the support must be given adequate opportunities to provide staff members' input during program planning and evaluation, and must be accorded sufficient autonomy and resources to implement tailor-made activities developed in partnership with each of the communities the field staff work with. The individual skills, charisma, and gender of these staff members are crucial factors affecting the quality and appropriateness of the support offered.

4. Work to enhance diversity of adaptation strategies, especially for women.

In all intervention programs, efforts should be taken to encourage diversity and leave people the space to make their own choices, adapt and appropriate new ideas and technologies, and combine them with existing strategies. However, women may require additional support to increase the diversity and robustness of options available or to overcome institutional barriers to access. For example, while men currently enjoy a variety of channels for accessing seeds, women mainly receive seeds from their husbands. Their options are generally limited by the seeds that their husbands have chosen to plant or stock. However, because the planting conditions in their own fields differ (later planting, soil is often poorer quality), the seeds they receive may not always be the most appropriate. It may be beneficial to generate additional channels for supplying affordable and appropriate seed varieties tailored to women's needs, for example, on credit via their savings circle. Any seed program should, however, take into consideration that women's main difficulty in the field is the delay in plowing. In order to enhance the robustness of such a program, it might be useful to tap into the channel of interdependency that ties cotton farmers to the female hand harvesters, and support women's groups to enhance their bargaining position with their male contractors. For example, the service they provide for the cotton farmers could be compensated not only with the cash payment to the women's association, but also with timely plowing of individual women's fields.

5. Work toward synergies between goals and actors.

Given the complexity of livelihoods, the variety of stressors that people encounter, and the multiple livelihood goals that people pursue, it is not helpful to extricate projects aimed at supporting institutions to play an effective role in adaptation from projects focused on social and economic development, capacity building, and good governance. Effective synergies between adaptation and development have been created elsewhere by means of local-scale capacity-building. Such interventions have simultaneously reduced sensitivity to climate variability and change and built overall capacity for decision making among vulnerable groups (Lemos et al., 2007).

In this empirical context, there is hope that a similar process is under way: the AOPP local adviser's remit to increase women's participation in decision making has triggered an iterative process whereby women are being supported to access credit, engage in new income-generating activities, and articulate their struggles to access land with the heads of farming units and the chief himself, but the process is far from complete. Factors that may have contributed to

the success of AOPP's program so far include the strong local presence of the extra-local actor represented by the local adviser; engagement with multiple sectors of the population rather than working in isolation with one social group; attempts to address the multiple concerns of the beneficiaries rather than only pursuing the development agency's starting goal; and collaboration with the other partners who are channeling benefits to community members. Synergies are therefore possible, but need to be developed at multiple levels: between the local institutions, field staff, development agencies, and policy makers.

It is important to emphasize that the environmental, social, and institutional change processes under analysis are dynamic and ongoing. Just as the long-term effects of the droughts are still unfolding (Crane, 2010), so are the accumulated impacts of the past four decades of political upheaval and economic and development interventions; people are continually facing new challenges and finding different ways to respond. We need to make use of hindsight and share learning across epistemic communities, and use both to continue to seek more effective ways of supporting people to move autonomously within this dynamic process.

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226 CAUSEWAY STREET, 5TH FLOOR
BOSTON, MA 02114-2206
(800) 77-OXFAM

POLICY & ADVOCACY OFFICE
1100 15TH STREET, NW, SUITE 600
WASHINGTON, DC 20005
(202) 496-1180

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