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Changing Climate Adaptation Strategies of Boran Pastoralists in Southern Ethiopia

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Working Paper No. 15

CGIAR Research Program on Climate Change,
Agriculture and Food Security (CCAFS)

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Abstract

This report contains information on a rapid field assessment of Boran pastoralists of southern Ethiopia to: (1) gauge local communities' perceptions of the need for local climate change adaptation strategies and their degree of satisfaction with existing interventions; (2) identify emerging climate risk adaptation strategies; and (3) evaluate how existing and new strategies including efforts by non-governmental organizations and the Ethiopian government might complement or be compromised by index-based livestock insurance (IBLI).

Researchers found that the Boran perceive changes in the frequency and intensity of drought conditions over the last several decades. The Boran also recognize the need to adapt to these shifts, and along with the government and NGOs who work in the region, are undertaking a number of climate change adaptation strategies. Some of these traditional and new responses to drought are likely to interact with the potential implementation of IBLI in both complementary and conflicting ways. Still, there are significant opportunities for IBLI to reduce exposure to risk while supporting existing veterinary services and rangeland management.

Keywords

Pastoralists; Climate change; Index insurance.

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Acronyms

CCAFS	Climate Change Agriculture and Food Security
CCAM	Climate change adaptation and local mitigation
CGIAR	Consultative Group on International Agricultural Research
DA	Development agent
FDG	Focus group discussion
IBLI	Index-based livestock insurance
ICT	Information and communication technology
IGERT	Integrative Graduate Education and Research Traineeship
ILRI	International Livestock Research Institute
NDVI	Normalized Difference Vegetation Index
NGO	Non-governmental organization
NSF	National Science Foundation
PA	Peasant/pastoralist association
PSNP	Productive Safety Net Program
USB	Universal Serial Bus

Introduction

The Horn of Africa is currently experiencing a drought that is projected by organizations such as the United Nations and the World Bank to be the worst in the region in nearly six decades. Over the last decade, drought has recurred in southern Ethiopia more frequently and for longer periods than documented previously. The region's changing climate has resulted in diminished quantity and quality of local water and forage resources, thereby severely and negatively impacting the region's livestock and the nomadic pastoralists, such as the Boran, who depend on these animals for livelihoods and subsistence. Lower than average rainfall in 1999-2005 (Conway and Schipper, 2010) and again in 2011 have caused mass die-offs of livestock, and have forced Boran pastoralists to adopt new coping mechanisms to manage increased risks associated with the region's changing climate. Although new coping strategies may enable the Boran to better adapt to new or more severe climate-related events, stress and hardship for Boran pastoralists are likely to continue, or even increase, as climate scientists project increasingly frequent and severe drought events in the Borana region of southern Ethiopia (Ellis and Gavin, 1994).

Index-based livestock insurance (IBLI) is being developed for this area as one tool for helping pastoral communities manage drought risk. IBLI makes indemnity payments based on a response function of the normalized difference vegetation index (NDVI), which is highly correlated with livestock death in the region, is precise

and objectively verifiable, and cannot be manipulated by either party to the insurance contract. In order for IBLI to be successful in Boran, it must be synergistic with successful coping mechanisms currently in place, as well as risk management modalities under development. It is therefore essential to have a thorough inventory and critical evaluation of



Photo 1. Boran pastoralist, Dirre, July 2011

recent, current and potential strategies that might help pastoralist households and communities manage drought risk associated with climate variability.

Using participatory methods such as focus group discussions (FGDs) and key informant interviews, the authors of this report: (1) gauged local communities' perceptions of the need for local climate change adaptation strategies and their degree of satisfaction with existing interventions; (2) identified emerging climate risk adaptation strategies; and (3) evaluated how existing and new strategies might complement or be compromised by index-based livestock insurance. This report presents our inventory and critical assessment of existing and potential climate change adaptation and local risk mitigation strategies among pastoralist and agro-pastoralist communities in the Borana zone of southern Ethiopia.

The Boran: Livelihood Strategies in the Current Climate Regime

From focus group discussions with the Boran, there is a consensus that the Boran possess cultural values that include strong kinship ties, migratory livestock herding, and a multifaceted political and cultural system of traditional practices (the *gada* system) that is based on defined roles and responsibilities for different stages of life. The Boran seem to have a strong value system that includes a deep connection to and respect for animals and the land, and a lifestyle based mostly on transhumant pastoralism. Before substantial land tenure changes by the Ethiopian government were implemented (Ogbaharya, 2009), Boran pastoralists subsisted on the resources provided by their environment, even in the face of periodic droughts.

Boran interviewees reported that, until forty years ago, drought typically recurred every 7-10 years. However, the timing, duration, and severity of drought were relatively predictable, and the effects could be mitigated using available coping strategies. The Boran have traditionally associated cyclical weather patterns and societal shifts with the cycles of their *gada* political system. At the head of the *gada* system is the position of *abba gada*, a political office that transfers between clans every eight years. A *gada* cycle is comprised of five of these eight-

year terms, or 40 years. The Boran associate certain social or environmental characteristics (e.g., high conflict) or events (e.g., floods, disease) with specific clans filling the *abba gada* position. Study participants reported that the current *abba gada* (Mr. Guyo Gobba) is from the clan known for filling the *abba gada* position during the most difficult droughts. However, the recent drought cycle and the current drought are even more severe than was projected by the *gada* cycle.

Traditionally, the Boran have been almost totally dependent for their livelihoods on the products of their cattle, using them as food or in trade for grain. In turn, the cattle depend on the stewardship of the Boran people, as well as the regeneration of grazing lands through frequent and intense seasonal rains. The sustained drought over the year 2011 has caused large herd die-offs in some areas, eliminating the livelihoods of some Boran. The sustained drought, in combination with human and animal population pressures, is a critical contributor the current humanitarian crisis in the Borana region. Although new and/or additional strategies may be needed by the Boran to cope with the region's changing drought- and climate-related risk profile, the roles, strengths and weaknesses of the Boran's traditional coping mechanisms must first be understood.

Methods

The IGERT research team is composed of five members from the fields of economics, hydrology, livestock, nutrition, public health, and water resources. The team gathered information during a field visit to Ethiopia from July 9th to July 29th, 2011. This report summarizes 17 FGDs (focus group discussions) in six rural communities, more than 20 formal interviews with pastoralists, NGOs, development workers, and countless informal discussions. The IGERT team chose to rely primarily on FGDs and key informant interviews in order to collect a wide variety of perspectives, ensure that we would be able to pursue topics that seemed important, and cross-check information. The following section provides a brief description of how the FGD sites and participants were selected and the protocol used when the interviews and discussions were performed.

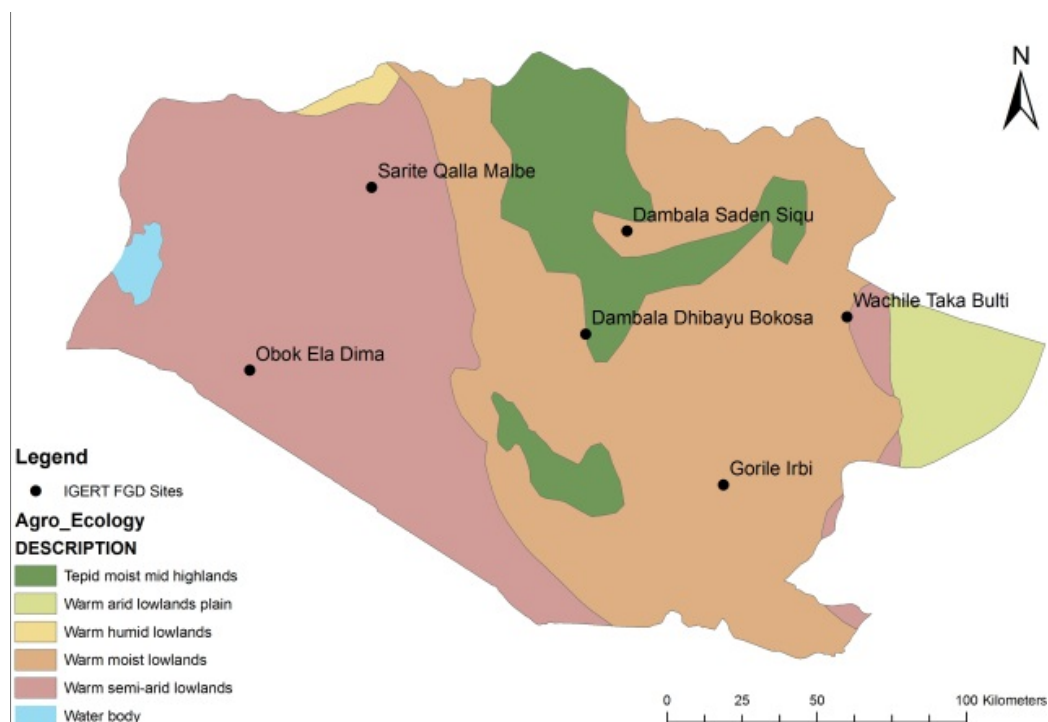


Figure 1. IGERT FGD sites and agro-ecological zones of the Borana

Site Selection

Site selection was performed by two support staff from the International Livestock Research Institute (ILRI) with the help of the Pastoral Area Development Commission office, Livestock Development Zone office, and representatives of the local Pastoral Associations during an exploratory trip to the region.¹ Six FGD sites were selected to ensure variety among agro-ecological zones, woredas (administrative districts), and access to infrastructure such as markets and roads (Figure 1). Sites were restricted to those reeras (communities) that contained greater than 50 households and were accessible by 4X4 vehicles (Table 1).

Participant Selection and FGD Logistics

In each community, community members and local government development agents (DAs) helped ILRI staff members identify 6-8 individuals in each target category: elders, individuals who currently herd, and non-retired women. Invitations to participate were delivered by the DAs in advance of the FGDs. On the day of the FGD, the IGERT team arrived with at least three translators whom we felt confident had command of



Photo 2. Elders FGD in Sarite

Oromiffa (the Oromo language) and understood our objectives well. In most communities, three FGDs were performed in parallel using a list of discussion questions generated and updated by the entire team. This process took advantage of the diverse backgrounds of the research team members and helped to focus the discussions.

¹ For more information on site selection see: Shibia, M. and B. Tadesse. Preliminary Findings: Preparations for the visit of IGERT students, deployment of collars and designing of questionnaires for the Pastoralists (whose herds are collared) and FGD to solicit historical mortality in the Borana Zone.

The FGD participant categories were: elders, current pastoralists, and women. Elders were restricted to retired herders older than 60 years. Discussion questions posed in the elders' FGDs focused on, but were not limited to, participants' perceptions of long-term climatic and social trends. The current herders groups were middle-aged heads-of-household who currently perform herding activities. Their discussion questions focused on the impact of current droughts, coping mechanisms, and experiences with outside interventions. The final category was composed of women ages 32-65. Here, participants discussed aspects of climate change and drought that specifically impacted women and children, including perspectives that may not have been revealed in a mixed group. The FGDs typically took between two and three hours.²

FGDs were typically followed by key informant interviews with officers of the local Pastoralist Associations (PA), active community members, and/or DAs. We also performed a number of less formal individual interviews after the FGDs in order to follow up on topics discussed during the FGDs. In addition to the interactions with community members, spending time in the communities provided team members with an opportunity to observe local conditions including geography, access to pasture, water, and infrastructure.

Other Interviews

Before entering the field, the IGERT team spoke with a number of experts in Addis Ababa. These meetings helped to bring the team up to speed on critical issues that were to be investigated in the field. Information from these interviews was used to focus the FGD discussion outlines on the most important issues. These interviews also provided the team with a better idea of additional research currently taking place, as well as a local perspective of the state of the ongoing drought. Once the field visit to Borana was completed, the team returned to Addis Ababa for follow-up interviews with staff from various NGO and government offices.

² See Appendix B for the research schedule and details.

While in the field the team visited the two largest livestock markets in the region and a number of different types of water points. At the markets we were able to speak to sellers and traders and hear their drought stories, where they had come from, and the constraints that they faced. At the water points, we gathered information on how and to whom access was granted.

Data Analysis

Field notes, digital recordings, and photographs were taken at each site providing anecdotal data that informs much of the discussion contained in the subsequent sections. When possible, information was triangulated among a number of different sources and examined for consistency with existing literature. We have attempted to clearly state when we are expressing the opinion of an interviewee, our interpretation of a situation, or are relying on a general body of knowledge.³ This report also incorporates a number of comments and suggestions generated when a preliminary copy of this report was made available to researchers with experience in the region and the facilitators who aided us during the FGDs and interviews.

³ Most of the general information about the history and livelihoods of the Borana, and climate change in the Borana zone, was acquired through FGDs and interviews with community members. For the sake of readability of this report, sources are sometimes omitted.

⁵ Corresponding months for these seasons cycles are found in Appendix A.

Climate Risk Adaptation Strategies

It became clear in our interviews that the Boran understand that local weather changes cyclically, in seasonal cycles and then in larger yearly cycles. Boran interviewees seem to possess the following understanding of the seasonal cyclical weather patterns in the Borana zone. A typical year consists of four seasons: (1) a long rainy period, (2) a long dry period, (3) a short rainy period, and (4) a short dry period. Drought conditions occur when lower than average rainfall occurs during one of the seasons.⁴ In focus group discussions with elders, a general consensus emerged that droughts are predicted in the coming season utilizing traditional weather forecasting techniques. Some traditional forecasting techniques are inventoried in Appendix C.

Weather patterns and herd movement are interrelated in this pastoralist system. The rapidity and distance of livestock migration derives primarily from the availability of grazing land and distance between watering points. Focus group discussions with pastoralists gave the impression that grazing land and distance between watering points impact where pastoralists choose to move herds. Traditionally, one factor that allows herd mobility to be maintained is the availability of large areas of land where herders can choose to graze. In discussions with experts on Boran culture (Personal communication Abebe, 2011; Personal communication Bule, 2011), the assured access to grazing land and water resources of all Boran communities, even those separated by long distances, in times of drought is a traditional way that herd mobility is maintained.

In focus group discussions with elders, interviewees noted that significant climatic shifts began occurring about forty years ago. For example, the duration and periodicity of rainfall have changed and are no longer as predictable utilizing traditional weather predicting practices. In all of the six focus group discussions conducted, elders report that drought has

become more frequent. Drought strikes predominantly in lowland areas, while flooding frequency has increased in other areas (Personal communication CARE Ethiopia Borana Program, 2011). Interviewees expressed an impression that rainfall is “patchy” now, concentrated in certain areas, whereas it used to spread over a larger total land area. The Ethiopian government also began recognizing in the early 1990s that the increasing frequency of drought required a comprehensive national drought plan, now known as the National Policy for Disaster Prevention, Preparedness and Management (Catley et al., 2009).

Traditionally, the Boran have relied on several different strategies to mitigate the effects of recurrent drought. A number of more recent strategies were also observed during the course of this study. We discuss the drought-related risk mitigation strategies, new and old, in the following sections: (1) weather-related; (2) livestock-related; (3) rangeland-related; and (4) water-related.

Weather-Related Risk Prediction

Pastoralists’ interpretation and understanding of available climate information is an important component of their decision-making processes (Lybbert et al., 2007). Within pastoral communities, Luseno et al. (2003) described probabilistic forecasts, use of indigenous climate forecasting methods, and awareness and access to external information as three important sources of climate information. Pastoralists in the FGDs seem to value careful planning in response to forecasts as a means of mitigating the impacts of drought. However, the concept of probabilistic forecasts did not appear to be universally understood during the FGDs; for example, sometimes examples of events that contradicted forecasts were brought up as evidence against modern methods.

The traditional system of weather prediction includes a variety of techniques: reading livestock intestines; locating and identifying specific species of plants that are in leaf or flower; and interpreting astrological signs (more details can be found in Appendix C). Elders reported that the results of these traditional practices were cross-referenced against the *gada*

calendar's predictions of drought cycles. Traditional practices and the *gada* cycle were used jointly to predict the likelihood and the severity of drought, allowing the Boran to plan ahead.

The elders in FGDs noted, as is also noted in Luseno et al. (2003), that traditional methods recently (as in the past 20 years) seemed to be less predictable. In an interview with some Boran leaders, they noted that the younger generations of Boran were more adept in interpreting external information and that government and NGOs have been attempting to implement more and better warning systems. Interviewees expressed that the information on these warning systems was valuable but sometimes difficult to understand. More information on external information sources and dissemination channels may be found in the “Enhanced dissemination of information” section.

Livestock-Related Risk Mitigation

Cattle comprise the bulk of the diet and the livelihoods of the Boran.

Maintaining a sufficiently large herd size will be vital to ensuring sufficient caloric intake among the Boran if animal sources continue to constitute the vast majority of their calories.

Although a shift to non-traditional forms of pastoralist livelihoods is occurring, livestock still constitute the most crucial component of Boran livelihoods (Wassie et al., 2007).

Although large herds may represent economic and food security, livestock herd size is also correlated with animal well-being and herd mortality. Larger



Photo 3. Unconsumed remains near Moyale in August 2011 point towards high livestock mortality during the current drought

herd sizes can increase herd mortality especially during conditions of drought and stress (Lybbert et al., 2004).

Elders reported that due to reduced quality and quantity of rangeland, milk production has decreased. In current drought conditions, the number of lactating animals needed to sustain a household could be as high as 10-20 animals, as compared to forty years ago when one or two lactating animals was sufficient.

In pastoralists systems, when herd size falls below a certain threshold, transhumant livelihoods cannot be maintained (Lybbert et al., 2004). The following animal husbandry practices help the Boran maintain sufficiently large herds: (1) herd mobility is maintained to ensure that herds can find pasturelands not decimated by drought; (2) certain traditional communal grazing areas are not utilized for a season to provide extra nourishment for sick, young, and lactating animals in times of scarcity; (3) sick animals are isolated from healthy animals to prevent the spread of disease; and (4) animal injuries and diseases are treated using local knowledge. In addition to these practices, a strong social welfare system (detailed more extensively in Appendix D) has developed to ensure that all Boran can continue to herd livestock. For example, Boran pastoralists reported that households with more than five cattle can be called on to redistribute cattle to those who have sustained severe losses, as part of the social welfare system (called *busa gonafa*, and detailed in the Traditional Social Insurance section).

Herd Mobility

As nomadic pastoralists, the Boran travel with their livestock in search of water and pasture. Movement is dictated by season and the availability of forage, as well as personal relationships, family structure, and immediate demands. In addition, herd mobility is aided by a network of watering points and wells maintained throughout Borana. Operation and maintenance of these points is controlled through the *gada* system. Prior to the emergence of recent climate-related changes, migration was limited to mainly wet and dry grazing areas, meaning that different pastures were used during the wet and dry seasons, and that traditional

laws governed the use of these resources. As climate change has accelerated, the Boran have altered how they migrate, when, where, and for how long.

The Boran now travel significantly greater distances to reach pasture and water, which takes more time and requires men to be away from home for longer periods. Increasing the time demands on herders places financial stress on families who must essentially support two households, and impacts the education of children as some may be removed from school to help at home or to help herd. Traveling greater distances also places extreme caloric demands on cattle and exposes them to disease. Livestock walk farther for food and water, and may expend more energy than they consume. They may also travel from areas that are disease-free to areas where disease is endemic. For example, Dr. Roobaa Basaayyee, the head of Borana Zone Livestock Development and Health Agency, expressed concern that cattle traveling from the south where there are no tse tse flies to the north where the flies are abundant would contract trypanosomiasis, which could result in massive cattle die-offs (Yabello, July 2011). Additionally, there is concern that as the Boran cattle migrate to novel geographic regions there will be increased opportunity for the Boran cattle breed to cross-breed. Depending on which breeds the Boran cattle breed is crossed with, the impacts could include improved or diminished hybrid vigor, disease tolerance, and drought tolerance.

Unfortunately, simply changing traditional migration patterns as a means of coping with climate change will not mitigate all of the climate change-related risks. Migration over extremely large distances exacerbates the negative energy balance of the cattle in the region, an imbalance that can be compounded by exposure of naïve populations to novel disease. In the short-term more cattle will survive, but in the long-term more cattle will perish.

Traditional Social Insurance

In the event of massive die-offs of cattle, the Boran rely on a traditional three-tiered insurance system. The first tier is *busa gonafa*, a community-based re-stocking program in which several Boran families, whose cattle have survived, give a cow to a Boran family that has lost their entire herd. The cow is a permanent gift and is intended to help the family begin to

rebuild their herd. The second is *ames*, a short-term loan extended from one Boran family to another in the form of a lactating cow. The Boran family that receives the lactating cow may keep the cow and use her milk for one lactation cycle (typically less than six months in Borana) and then must return the cow. The third tier is *rebaray*, a charitable donation in which a single Boran family gives a cow to another Boran family following the complete loss of their herd. The cow is a gift, and the family that receives the cow has full rights to the cow, her milk, and her offspring. In order for this system to work and be perpetuated, the families that are donating and lending cattle must have a minimum of five cows. Families that do not meet this minimum requirement are not asked to make donations. In the face of climate change, this traditional system is failing primarily because families cannot meet the minimum required livestock holdings in order to participate in the system.

In the past, the provision of feed to cattle by women (cut and carry) within the Boran system was only extended to the young and the debilitated. Women would cut and collect grass and bring the feed to the animals housed at the homestead. This served two important animal health functions: (1) it minimized the spread of infectious disease by limiting the movement of sick cattle, and (2) it facilitated growth and healing by reducing the caloric expenditure associated with grazing activity. This system has now become a coping mechanism. In anticipation of drought, farmers collect and store hay in open protected structures, an activity never previously undertaken among the Boran. Farmers who can afford to do so purchase feed for one to two individual animals in hopes that if they can supplement the diet of a few individuals, they can avoid complete herd loss.

These activities require more inputs from the women in the household to collect the hay, and place more financial strain on households as they must re-direct income for the household to maintenance of the herd. This coping mechanism requires extensive planning and knowledge of impending climate conditions so that hay may be cut when it is abundant, which occurs less often now that drought conditions are becoming more frequent and severe. The purchasing of feed is not a feasible coping mechanism for the vast majority of the Boran, who simply do not have the disposable income to support this practice.

Drought-Tolerant Livestock

As the landscape in southern Ethiopia has become drier, the presence of drought-tolerant livestock has increased. Currently, proportions of different types of cattle in Boran herds are being reduced relative to goats and camels, which are more drought tolerant and disease resistant. Livestock diversification has become one of the most universally adopted coping mechanisms in Borana. Nearly all Boran have multispecies herds that include goats, with increasing numbers of herds adding camels. While this strategy has been widely successful, constraints exist. First, Boran interviewees expressed concern over their lack of knowledge about the husbandry and management of camels. They are unfamiliar with camelid diseases, and lack knowledge of both traditional and non-traditional treatments. In focus group discussions conducted with Boran pastoralists, interviewees stated that the care and housing of these animals was novel to them, and that they were unsure of how to manage animals in order to prevent (not simply to treat) disease.

Secondly, camels are expensive relative to cattle. They can cost nearly six times more than a healthy cow. Furthermore, most camels cannot be sold before three years, but preferably six years, of age. It is therefore a relatively large financial investment and the return on the investment cannot be realized rapidly. While the Boran will drink camel milk, the amount of milk produced by a camel is significantly less than that produced by a cow. Therefore, ownership of camels does not contribute as greatly to the direct subsistence of the farmers.

Lastly, ownership of camels in place of cattle is in direct conflict with Boran culture. Many Boran in focus group discussions spoke passionately about their relationship and history with cattle. To paraphrase one group of pastoralists in Dhas (August, 2011), Boran culture is defined by cattle ownership and husbandry, and without cattle the Boran feel they can no longer call themselves “Boran”. Among the Boran, livestock diversification is even sometimes perceived as a threat to Boran identity.

Direct subsistence on cattle and their products is waning in Borana as a result of climate change. Fertility of cows may be compromised due to a poor plane of nutrition, and those who

do become pregnant and give birth to live offspring have shortened lactation cycles which produce lower volumes of milk. Consequently, there is simply not enough milk available to sustain the calf and the people. As drought conditions worsen, lack of calories and lack of water results in a continued decrease in milk production. Animals approaching starvation are being sold in the market. Previously, selling animals was a rare event, as a large herd is a sign of prestige and is culturally valuable among the Boran.

Destocking

The Boran appear to be reducing their herd size as a coping mechanism for several reasons. First, it minimizes risk and allows the Boran greater financial gain than would be possible if the animal were to die. Secondly, income from the sale of livestock can be used to buy household goods or other urgent needs. While this offers immediate relief, it is problematic with respect to the market. The Boran are selling their livestock when the market is flooded and prices are low. When asked about this practice, the focus group participants at all interview sites anticipated having to sell some cattle during the dry season, but indicated a preference for trying to maintain large herds as long as possible through the dry season. Reasons for this are unclear, but might be attributable to cultural prestige associated with having a large herd and risk-reducing behaviors. The perception seemed to be that a larger, less healthy herd had better odds of having some members survive, whereas a smaller, healthier herd risked losing all members. The alternative would be to sell cattle after the rains when the market price was high, and voluntarily reduce herd size, but this behavior was not reported. Therefore, the selling of livestock appears to be an emergent coping mechanism designed to buffer against extreme shocks within an already unstable system.

Maintaining Animal Health

Animal health is one of the Boran system's greatest strengths. Local knowledge of cattle husbandry and health is substantial, and appears to be very accurate and well applied. The government vaccination program is well organized and executed, especially in light of resource constraints in the region. When asked about the health of their cattle and death due to disease, all of the focus groups consistently reported that deaths due to disease had been

significantly reduced in the last 40 years, and all expressed satisfaction with the government vaccination program.

When asked about strategies to improve the health of their herds and increase drought tolerance, no mechanisms were volunteered. However, when asked about the impact of castration on animal health, all focus groups reported that they believed castration improved animal health, weight gain, and drought tolerance. Nevertheless, castration has not been adopted as a coping mechanism. When asked why so few animals were castrated, the explanation provided by several focus groups was that there was no longer a market for the meat of castrated animals, and that they did not fetch the same price as an intact animal at market. Some Boran reported that 10 to 15 years ago, a very strong market for castrated animals existed in northern Kenya, but that it no longer existed. No one was able to speak to what caused the change but speculated that the change was driven by a large and increasing demand in the Middle East for reproductively intact animals, which provided a desirable marbling of fat and muscle. All Boran interviewees stated that they would be willing to castrate their animals if they believed they could sell them in the market, and some elaborated on traditional methods used in the past for castration, and identified castration services available through the local government veterinary office.

Coping mechanisms being adopted by the Boran to maintain their livestock herds are generally not perceived to be sufficient or sustainable by the Boran, in part because frustration abounds over how these mechanisms are impacting Boran culture, (e.g., through altered migration patterns, consumption of camel milk instead of cow milk, and reduced herd size), and because fear over the financial hardships associated with these practices exists. In order to keep cattle alive, men are away from home for longer, which is an added expense for little return. The market cannot support the large influx of cattle during drought periods, and the amount of income generated by the sale of a cow does not match the investment made to keep the cow alive. While the animal health system is generally very strong, and the animals that come to market are relatively healthy from a disease perspective, this could potentially change as animals migrate to new regions and become exposed to new diseases, or carry in new disease to naïve regions. The Boran consistently express an interest in and desire for having

better climate information, but how this information would be utilized for the management of livestock is unclear, especially with respect to the decision to de-stock and sell animals in the market.

Rangeland-Related Risk Mitigation

The primary means by which pastoralists, like communities everywhere, will feel the impacts of climate change is in changes in land and water resources. The Boran have been living with scarce pastureland and water for generations. A number of rangeland-related risk-mitigation measures have been undertaken by Boran communities, as well as initiated by the government and NGOs. Many of these measures have been in use for at least decades, and were developed in response to local climatic fluctuations without specifically being in response to recent climate change. However, these measures may still be relevant in conjunction with other, more “modern”, methods as responses to climate change, and are mentioned here.

Traditional Systems of Wet/Dry Grazing Areas

The Boran have sophisticated traditional systems of managing land and water resources. Regions are designated as wet season grazing areas and dry season grazing areas. The dry season grazing areas tend to be areas of relatively lower elevation where water accumulates, thereby allowing pasture growth even in the absence of significant rainfall. From several interviews, the IGERT team learned that this system has reportedly come under increasing pressure. The pressure is possibly due to growth of cultivation (see below) and population (human and livestock) increase, among other factors such as conflict, political boundaries, and private enclosures. Rangeland degradation may be both cause and effect of the disruption in the traditional systems. Focus group discussion participants mentioned attempts to revitalize this system, with some initiative on the part of the local government. This system may be especially useful if droughts become more frequent and/or severe since it allows Boran communities to together reserve a part of pasture for drier times of the year. While this system alone is not adequate, having some pasture reserved for the dry season might allow the communities some additional time to plan responses in a bad year.

Kallos

Kallos are enclosures which are reserved for lactating, sick or young animals, so that these animals do not have to travel the much larger distances traveled by the rest of the herd for pasture particularly in the dry season. Though the traditional enclosures for calves were smaller and called *seera yabbiye*, or “calf reserve” (Helland, 1994), *kallos*, which are an “imported” strategy have become very common. The *kallos*, which may be for the use of the whole village or a group of households, are built by clearing a patch of land of bushes, and are often fenced by dried bush. *Kallos* range in size from one to tens of hectares (Solomon et al., 2007), and account for almost a tenth of the total land area surrounding communities (McCarthy et al., 2003). Communities often build *kallos* under government and NGO initiatives. In times of drought, *kallos* may mitigate to an extent the distances that weaker animals have to travel for pasture, and like wet/dry grazing areas may provide at least temporary relief.

Bush Clearing Programs

Bush encroachment will likely interfere with the ability of the Boran to adapt to increased climatic pressures as it effectively reduces the pastureland available. Moreover, areas which have been encroached by bush have little grass seed left in the soil, making reestablishment of grass very difficult. Thus, although bush clearing programs such as controlled burning do not occur strictly in response to climate change, they are relevant to climate change adaptation. Some FGD participants mentioned bush burning as having other beneficial effects such as promoting growth of preferred grass species. Though the government ban on bush-burning was brought up as an issue in many discussions, many interviewees asserted that rather than an absolute ban on bush-burning, a regulation passed against burning forests during the Derg regime was widely interpreted by local authorities to mean that burning for bush clearing was also banned. Bush encroachment has increased steadily, though not necessarily related solely to the stoppage of burning. Solomon et al. (2007) report that the species of bush (*Acacia brevispica* and *Euclea shrimperii*) identified by community elders to be problematic are different from the species reported in previous studies. Bush clearing is very difficult due to the tendency of these species to grow back, as well as their long thorny branches. Government agencies and NGOs promote communities to undertake bush clearing through cutting. There

have been some studies on burning as a method for controlling the bush, but burning is currently not as prevalent as cutting. A lack of grass to spread the fire between bushes was also raised as a reason for burning not being practiced. However in some areas visited by the IGERT team, the bush appeared dense. As bush encroachment reduces useful pasture, which is a scarce resource in times of drought, bush clearing can be an effective strategy to bolster other adaptation measures. Improvements in efficiency and effectiveness of bush clearing methods are however needed urgently for this approach to be feasible.

Establishment Of “Ranches”

There are a number of government and private “ranches” in Borana. The Dida Tuyura government ranch north of Yabelo also houses a breeding center. Some private ranches are run by cooperatives, but there have been reports of more powerful pastoralists controlling these (McCarthy et al., 2003; Temesgen, 2010). Not much was mentioned about ranches



Photo 4. The greener area to the center left marks the edge of the government ranch

in focus group discussions. While these ranches might enable mitigation of risks associated with drought for those with access to them, they may increase pressure on those in their vicinity who do not have access by reducing the total pasture available communally. However apart from being places for breeding of cattle, government ranches may also serve as places for learning and experimentation on land management techniques (e.g., experiments on burning bush) that may help in climate change adaptation. The role of “ranches” in helping the majority of the Boran mitigate risks related to climate change is therefore uncertain with respect to the rangeland perspective.

Resettlement Programs

Land in Ethiopia is owned by the national government, which often reallocates land for cropping and pasture as well as for resettlement. The government has resettled some villages, including one of those visited by the IGERT team, in the interest of promoting better use of the rangeland. The reason given for the resettlements is that the haphazard settlement and growth of villages had resulted in conflict over grazing areas. Moreover, it is difficult to provide government services far away from the road. Therefore some villages have been relocated by the government closer to the main road, with designated satellite grazing areas for each village to reduce conflict. The effects of this resettlement on the rangeland and grazing practices, particularly traditional ones, are unclear. Better access to roads may help government and NGOs more easily provide services such as water, food aid, health, and extension, while also facilitating community access to markets, education, and alternative sources of employment. While such services and opportunities if designed and delivered appropriately could help communities mitigate risks associated with climate change, their current effectiveness is debatable. Additionally, the effectiveness of resettlement as a climate change adaptation measure is also dependent whether or not it impedes rangeland-related practices, such as wet/dry grazing areas, that may more directly help in adaptation.

Crop Cultivation

Cultivation of crops has reportedly increased in Borana. In the last four decades, there has been a change among the Boran from almost no households involved in cultivation to a large majority of households involved in some form of cultivation, usually of maize and/or beans (Desta, 2011). In 1997, only about 18% of Boran cropped (from a personal interview with Dr. Desta; see also Coppock, 1994; Desta, 1999; Desta and Coppock, 2004). Desta (2011) reports that in a survey of 140 Boran households, 93% engaged in cultivation. This transition was encouraged at least in part by government policy promoting agriculture particularly among pastoralists who had lost livestock (Desta, 2006). Crops are grown in dry season grazing areas, as these areas retain water for a longer period of time. Households now petition to the elders of the community for the right to fence in an area for cropping. If that right is granted, they must then go to the PA and pay a tax on the land that they wish to crop. The household then has the right to fence the field and crop there. In many cases, households apply for and

fence in larger plots than they crop with the intention of maintaining a small private pasture. The result is a first-come, first-served tenure system that is transforming the most fertile and well-watered communal pastures into private cropland. This is a contributing factor in the disruption of the traditional movement between seasonal grazing areas, and has contributed to conflict over land and water resources (Yirbecho, 2004). Many pastoralists mentioned trying to grow crops but doing so without much expectation of success as the chances of crop success were highly dependent on rainfall. In FGDs, participants mentioned irrigated cultivation as being a potential strategy to cope with climate change if water became available. Although cultivation has been adopted as a risk mitigation effort, the way it is currently being practiced in Borana does not seem to bring much benefit to the majority of the Boran both due to potential competition between crop-cultivation and dry-season grazing areas as well as due to meager chances of success for the cultivator. The potential for irrigated cultivation seems very limited at best due to the region's dry climate and recurrent droughts. Crop cultivation is therefore unlikely to be a sustainable adaptation strategy in Borana. There are also some conflicts arising because of this issue between the Borana and other communities who practice farming, for example the Konso (further detailed in "Emerging Climate Change Adaptation Strategies").

Irrigated Cultivation of Cattle Feed

Though not in practice yet, some interviewees mentioned the possibility of the government cultivating or encouraging cultivation of forage crops and/or crops for livestock feed using irrigation. This is being envisaged as a potential benefit of the Water Network (see below). Few details appear to be available at this stage on these plans. Though this might seem encouraging as a means of adapting to times of pasture-scarcity, it is unclear if adequate consideration has been given to the sustainability of irrigated cultivation in light of the limited water availability and frequent droughts, as well as on practices such as wet/dry grazing areas.

Forest Management

Some parts of Borana (Arero and Yabello) and nearby areas (e.g., Negele in the Guji zone) have forests of *Juniperus procera* (Tache and Irwin, 2003). Though relatively small in area

(exact numbers proved hard to find), they provide important services to the communities who live close to them. These services include environmental services such as erosion control and water retention, forest products such as wood and resins that may be processed for various uses, grazing areas, and sources of water. SOS Sahel Ethiopia is an NGO that works to promote community involvement in the management of forests. For the communities close to these forests, the services provided by forests provide risk-mitigation opportunities and sustainable forest management may be developed as part of an adaptation strategy. For example, processed forest products may form livelihood diversification opportunities, or at least fall-back options for times of difficulty, particularly for women.

Traditional rules of governance appear to be well known among the Boran. Penalties for violation of established rules, often set by a council of elders, have tended to be heavy. For example, in one of our FGDs it was mentioned that if a herder were to graze on common land that has been set aside for other purposes, he would have to pay a penalty of up to five heads of cattle. However, a number of times during our interviews and discussions the weakening of traditional institutions was mentioned, and as the management of rangeland is rooted in traditional institutions, this may have, in combination with other factors, affected the ability of the Boran to collectively adapt rangeland management to a changing climate. Some of the strategies above, apart from directly contributing to risk mitigation, may also be developed into opportunities for employment and therefore livelihood diversification.

Water-Related Risk Mitigation

The Borana have long been adapted to a landscape with little water. However with more frequent droughts, water availability has declined. Water management is therefore an important part of adapting to climate change. A number of strategies at various scales have been initiated by Boran communities as well as the government and NGOs to deal with the issue of water availability.

Traditional Water Systems

Water management is deeply integrated into the Borana social structure. There are nine clusters of traditional deep wells, called *tulas*, around the region. Each well is administered by an *abba ela*, or “father of the well.” Tula wells, whose exact origins are unknown, can often be tens of meters deep and are said to contain water even in very severe drought. These are therefore an integral Boran strategy to mitigate the effects of drought. An *abba hirega* monitors the use of the well, which usually has a trough from which cattle



Photo 5. The entrance to a traditional tula (well)

are allowed to drink. Water is brought up to the trough from the well shaft by men standing in a vertical chain on a ladder. Preference in usage is generally given to members of the clan to which the *abba ela* belongs. However, in general, any Boran may make a case to the community for permission to use the well. In addition to the deep wells, there are additionally many shallow wells, called *Adadils*, also exist, and function for shorter periods of time. Many of these wells are still in use, and several which are damaged are being “rehabilitated” by NGOs or the government. Helland (1980) provides an extremely interesting discussion on these traditional water sources. These traditional water sources, particularly the *tulas*, are notable for having served the Boran for the duration of their existence in this region. They may therefore remain important in promoting sustainable water use while providing much needed water during times of drought.

Major Water Projects

There are several large water projects present in the Borana, some of which go back several decades. For example, a water storage reservoir can be found near the Haro Bake livestock market. Many of these, however, have been reported to have problems such as siltation (interview with Dawit Abebe). Moreover, in many of these storage reservoirs, including the one we observed, livestock actually enter into the water. Since humans also use these reservoirs, this presents a danger in terms of zoonotic, particularly intestinal, diseases. In some FGDs, participants expressed the view that the overcrowding of livestock around some of these water points has disrupted the traditional seasonal grazing cycles and has caused degradation of the surrounding pastureland. While these may have been intended to provide water particularly in times of drought and many of them do serve this purpose, it appears that their utility has been hampered by these problems.

Smaller Ponds and Wells

In many areas, communities and individuals have been encouraged to build shallow ponds (which may hold water for a few weeks or months per year) by both government and NGOs. Ponds are often found in wet season grazing areas so as



Photo 6. Livestock watering pond near Haro Bake market

to extend the period during which livestock herds can use these areas before returning to dry season grazing areas, which may have more permanent sources of water (Desta personal communication). Deeper wells have been constructed by government and NGOs. There were reports of some of these wells not working due to mechanical failure and others due to lack of water. The zonal government water department keeps track of various water bodies, and at the time of the IGERT team's visit was sending out technical staff to check on the functioning of wells in advance of the dry season. Despite the extensive construction of ponds and wells, in many Boran communities women travel several hours to collect water. It is very common to see women traveling with huge cans of water on their backs. Sometimes camels or donkeys

may be used to bring the water. There seemed in general to be little local expertise in repairing mechanical faults, and a consequent dependence on governments or NGOs to ensure functioning, sometimes making water availability difficult at times for communities even when a well was accessible. When wells do function, smaller wells and ponds seem to be relatively more useful and easily accessible sources of water. Although wells appear to be a useful form of risk mitigation, it is difficult to anticipate whether and how frequent droughts might affect their effectiveness, either through potential decreases in recharge or through increased demand.

Water Trucking

Particularly in emergencies, the government and NGOs send water trucks to villages. Storage of trucked water tends to be in cisterns, which are often located at schools or other community structures. The quantity of water that can be sent in this way is limited due to infrastructure but also because of limited storage facilities in each village. Moreover, as water cannot be trucked very far, particularly under poor road conditions, the utility of this approach is limited if the entire region suffers drought. Water trucking is therefore at best an emergency measure for short durations. Better roads would facilitate the timely provision of water in periods of acute shortage.

Water Network

The Water Network is a 1500-2000 kilometer pipe network project that could change the Borana region a great deal. It is intended to supply water to much of the region, including villages and towns. The water is drawn from groundwater wells in the Borana region and is expected to reach almost 900,000 people (i.e., around 90% of the population) (FDRE Population Census Commission, 2007) and two million livestock by the time it is complete. However, the timeline of the project is unclear, and there have been issues of materials costs. In general the communities we spoke to seemed optimistic about the project, noting that if they received piped water, women and children would not have to spend as much time and effort collecting it. Many also expressed the desire to use the water to irrigate crops. However, it is unclear if the Network would be able to sustainably support a growing human and

livestock population in addition to potential migration from other regions, particularly given limited water availability and recurrent droughts.

The IGERT team is unaware of forecasts of water demand and availability under various scenarios such as those mentioned above. Yet without such assessments, ensuring the sustainable use of water resources in general and groundwater in particular, whether with large or small projects, may be very difficult. It is also unlikely that irrigated cultivation would be sustainable in the region. In areas with such large water quantity issues, water quality is often a secondary consideration. Though some testing is done by the government on local wells, water quality testing and subsequent treatment measures do not seem to receive much attention in the region. Limited quantities of water purification packs are distributed by the government and NGOs. Though improving water quality may not be an adaptation strategy in itself, it should be an important consideration in the adaptation strategies related to water. Improving hydrological and meteorological data collection would go a long way towards a better understanding of the impacts of climate change on the hydrology and water resources of the region.

Women, Children, and Climate Change

Roles of Women in Boran Society

Many of the issues raised in this document pertinent to livestock health, herd mobility, and rangeland management are traditionally the responsibility of men in Boran society. Domestic activities are the primary role of women. Therefore, labor is often divided along gender lines. In FGDs, women noted that their responsibilities included: taking care of children, food preparation, medical care for the family, and other activities which involved maintenance of the household. In contrast, typical responsibilities of men include tending to livestock, locating suitable grazing land and water points, and animal health.



Photo 7. Boran woman, Dillo, July 2011

The difference in livelihood roles seems to create a difference in spaces occupied by men and women. Men often will leave the homestead during a season to find rangeland for livestock. Women are left to tend the home. As a result, sometimes roles such as intra-village commerce may be more predominantly occupied by women. However, these apparent dichotomies in gender roles or space are not as clear-cut and distinct at first glance. Women do engage in tending to livestock because a large part of the traditional Boran diet is derived from livestock products. In addition, women reported that a major activity was gathering grass feed for livestock, in particular to feed lactating animals or calves that can be left behind when men leave the homestead. Men engage in business and commerce and, from our perception, the vast majority of administrative and civic leadership roles are occupied by men.

The increased persistence and frequency of drought perceived by pastoralists in this region has direct and unique impacts on women because of their roles in society. Boran women engage in a range of activities distinct from those of men to cope with the loss of livestock and limited access to food and water. In order to understand the ways in which Boran women cope with drought, the IGERT team conducted six FGDs composed entirely of women ages 30-70, all of whom were mothers. Additionally, the team spoke with NGOs, local experts, and key informants, such as local women's group leaders and health extension workers. Further information on methods may be found in the Methods section of this report.

Income Generation

When men leave the homestead, women have a responsibility to find ways to generate income for the family. In many communities, women's groups or savings cooperatives have been established to provide financial support to women hoping to engage in petty trade businesses. The cooperatives are often set up by NGOs such as CARE, Gayo, or SOS Sahel; however, in some communities, the groups are initiated by the women themselves. The cooperatives differ in their operating schemes, however in general, women put money into the cooperative during the rainy season when they are able to sell livestock, butter, and milk and borrow from the cooperative during the dry season to engage in business or to purchase food for their families. Cooperatives may also work together to buy and sell maize and sugar to make a profit, which is then available for women to borrow.

If women are financially able, they often engage in petty trade during times of drought. These activities are encouraged by NGOs, such as CARE, but are more often initiated by women themselves. In general, petty trade involves the woman traveling to town to purchase sugar, alcohol, coffee, tobacco, and tea leaves and then returning to the village to sell these items, thus earning a small profit. In some cases, women may also purchase grain in the highlands and sell it in the lowlands to earn income, which, according to Charles Hopkins of CARE Ethiopia, may serve as one mechanism to stabilize grain prices during drought. Children may also engage in petty trade, either traveling to town with their mothers or going alone to buy sweets or sugar to sell in the village. In some cases where villages are very far from town

(sometimes up to six days walking) women may form groups to raise enough money to rent a donkey or a camel that can be used for a trip to town, where items will be collected, returned to the village and sold. Depending on their distance from town, some women and children shift entirely to the town in order to engage in petty trade. Children living in town may fetch water, do housework for wealthier families, or look after other families' livestock in exchange for a wage.

Women who live in close proximity to forests or wooded areas may use products from the forest to supplement their incomes. Organizations such as SOS Sahel encourage forest management and teach women how to use products from the forest to generate profit. Women can produce a scented wood product that is used as a perfume. They may also collect gum from trees or produce and sell incense. Trees can also be harvested from the bush and sold for use as perfumed wood.

Women have begun to keep goats, considered to be a more drought-resistant livestock compared to cattle, in order to survive during times of drought. Women can use the goats to supply milk for their children. They can also sell livestock in the market to pay for school fees for their children or to purchase maize, other grains, salt, oil, tea, and sugar at the market in town for consumption in the home.

Overall, women seem to survive by supporting each other. For example, women may donate milk to each other within a village for consumption or sold in the market to buy maize for home consumption. Moreover, women and children who do not have livestock may borrow food from their neighbors who still have livestock. Additionally, women support each other through the savings and credit cooperatives where they deposit small sums of money, borrow when they need to, and then return the money when they are able.

Food, Nutrition, and Health

Alongside income-generating activities, women also engage in activities to maintain the health and nutrition of their children. In Boran culture, children, especially those under five, are given priority access to food. During times of food scarcity, such as prolonged drought, food is distributed to the youngest child first, then older children, followed by the husband, and lastly the wife. During times of food scarcity, adults will often reduce the number of meals they eat from three per day to two per day. Moreover, because women must travel further to reach water sources during drought, they have less time available for meals and are forced to reduce the amount they eat during the day.

Women in the Borana region are typically in charge of food within a household. During drought periods, consumption may shift from preferred foods to less-preferred foods. For example, women substitute camel milk for cow milk even though women tend to prefer cow milk because it tastes better and can be used to make butter. Often, during drought, there is no animal milk so women must alter the foods they feed to their children. In those cases, children are fed boiled sugar water, strong tea, or maize powder in place of milk. In addition, women collect roots and wild fruits from the bush; however these products tend to be difficult and time-consuming to prepare.

Many people in the Borana region are food-insecure due to the recent pattern of droughts. As a result, food aid is common in the region. Women depend on food aid and supplementary food to survive. This food is distributed by the government and is donated through the World Food Program. Distributed food often includes maize, vegetable oil, and cowpeas. As reported by FGD participants, some communities receive no food aid, while others receive aid every three or six months. According to the manager of the Productive Safety Nets Program (PSNP) at Save the Children-US, various government and non-governmental organizations take responsibility for food distribution in different areas and at different times. Therefore it seems that these differences in food aid distribution may reflect local needs assessments and/or the responsible donor-agency.

Public works programs are common and many women participate in these schemes. Projects range from bush clearing, to digging ponds, or fencing in pasture or grazing areas. Both the government and NGOs, such as Gayo, Mercy Corps, and Save the Children, encourage women to participate in projects in order to preserve the local natural resources. In exchange for work, women receive cash and/or food.

Education

Lastly, education is utilized as a type of “insurance” by women. NGOs such as CARE recognize that the potential skills accrued by education for pastoralist girls could lead to alternative forms of income generation. All women who participated in the FGD discussions recognize the importance of school and most send at least one child to school. Some communities have built schools using juniper trees from protected forests. If there is no local school, children are sent to live in the town so they may attend school. Sending children to live in town requires that living space is rented and represents a financial burden for poor families. In some cases, such a financial burden limits opportunities for less well off families who are unable to afford to rent places in town for their children. In spite of the financial hardship, women interviewed in focus groups believe that educated children will be able to find jobs and support the family if the livestock die. Women in these groups also realize that educated children tend to find jobs elsewhere and often do not return to the land.

Problems Facing Women

Recurrent droughts place additional and unique burdens and stresses on women. When asked to rank the problems of most importance to women, the resounding majority of women chose water scarcity as the biggest challenge. One prominent coping strategy by women in focus groups was to cultivate crops alongside traditional pastoralist life. The recent lack of rain has decreased or eliminated the option of farming for those involved in cultivation as an income-diversification strategy. Additionally, lack of water decreases the volume of milk that animals produce, thereby reducing the amount of food available for families. As drought becomes recurrent, small and locally available water sources tend to dry up first forcing women to travel farther to fetch water each day. There is a notable relationship that as distance from

water source increase for a family, illness risk increases (Wang and Hunter, 2010). In focus group discussions, women stated that women, young, old, and pregnant, now walk for up to six hours in each direction to collect water and return home carrying 20 kilograms or more on their backs. The extra time needed to fetch water during drought displaces time spent on other women-centered activities, such as caring for children, preparing food, or engaging in business.

The second most pressing problem facing women in the region is the scarcity of food. During the current drought, during our field visit in July of 2011, most women have struggled to feed their families. Many women noted that this struggle to provide food, especially to children, causes great psychological stress because it is more difficult to accomplish. As a result of cultural practices, women are served food last which seems to place a disproportionate burden on women in times of food scarcity. During times of food shortage, women may go an entire day without food because the limited resources were given to the children and men first. Food shortages are especially difficult for pregnant women as they are given no special food privileges despite their condition. One woman noted that 11 women have miscarried in her village in the past six months.

Moreover, women are concerned about access to health care. The distance to health facilities is perceived to be a long distance from some communities that were interviewed and the women noted that many times ill individuals will avoid traveling to a health post until the condition is severe. In these cases, it is common for a severely ill person to die before reaching the health post. The distance to health posts also makes it difficult for women to receive antenatal services or to obtain medicines for themselves or their children.

Other problems facing women include lack of pasture and health facilities for livestock. Due to the current drought there is severe food shortage for animals. To cope with this food shortage for animals, women fetch grass for calves. In focus group discussions, women reported that they walk long distances or climb mountains and trees to find suitable food for calves.

Women's Needs, Recommendations, and Satisfaction with Existing Interventions

In response to the problems women mentioned, they had several solutions to mitigate these problems. Women had many ideas on how to improve access to water during drought. They suggested interventions such as: digging boreholes closer to the villages, building ponds near the villages, providing villages with water tanks or cisterns, and building more traditional wells. Some women even suggested that constructing ponds for women only would ease their labor burden in providing water to the household. Additionally, women suggested improvements in infrastructure, such as: bringing in piped water from Yabello or building roads to increase water access.

There were problems reported in response to lack of human and livestock food. The most common solution mentioned by women in response to human food shortage was increasing food aid. Women are particularly interested in receiving supplemental food for children since most of the food distributions include only maize, dried peas, and vegetable oil. When probed about alternate solutions to food aid, women suggested aid in the form of cash, which they could use to buy supplemental food or to begin small businesses. There were limited ideas among the women about how to mitigate the problems of lack of livestock food. Women suggested that food aid for livestock, particularly during the dry season would help to preserve herd size and health, and decrease the burden of labor placed on women to find food for livestock during drought.

While, in all communities, women noted that there was support for health problems on the group in terms of health extension workers, women recommended constructing additional health posts in the villages and staffing them with health extension workers. Moreover, many health extension workers were male and women reported that this made it more difficult for women to talk about women's health related issues.

Some communities have participated in food-/cash-for-work programs, however the women noted that these programs are generally only for the poorest members of the community.

Other communities have women's savings and credit cooperatives. In particular, one women's group mentioned that Gayo had plans to start a women's credit cooperative in their village. When discussing types of aid, women unanimously agreed that they would prefer to receive food rather than cash due to the following reasons: grain can be consumed and fed to children, money can be used in ways that does not benefit the household, and distances to markets are long making it difficult to purchase food.

Communication services in the region are lacking. None of the women in any of the six focus groups owned a mobile phone. However, all of the women agreed that they would like to have mobile phones. Women listed numerous ways in which they would use mobile phones, including: communicating with family, contacting men during herd migration, and requesting assistance from the government when problems arise.

As noted previously, the Ethiopian government has plans to build a Water Network in the Boran region. Some women had heard of this water project while others had not. All the groups had positive opinions of the water network and a positive concept of personally having access to piped water. Women believe that the water network will be particularly beneficial to women: it will save them time and provide them with a source of reliable, clean water. There was also a perception of several focus group discussions with women that when the water network came, such water could be used for cultivation.

Finally, it is important to note that not all women believe that the pastoralism is sustainable. Some of the women believe they could have better lives by leaving pastoralism and starting businesses. Others simply hope that their children will leave the traditional pastoralist livelihoods, become educated, get good jobs, and support them.

Emerging Climate Change Adaptation Strategies

As seasons shift, access to quality pastures decreases, usefulness and applicability of technologies change, and opportunities vary. Households respond by adapting the strategies that they use to construct their livelihoods. Often adaptation takes place in the form of small changes in current activities, such as buying a little extra sugar at market to sell in the community or cutting grass for fodder a little more often than before, but some changes are expressed in larger investments in time and money, requiring a major redirection of resources. The following section inventories those adaptations that either seemed most important to the interviewees and FGD participants or seemed most promising in the eyes of the authors. In many cases, these strategies are practiced (to varying degrees) by most households, although a few of the strategies were often mentioned but rarely practiced.

Livelihood Diversification

As households cope with changing climate and social structures, many of them are choosing to increase the diversity of their livelihood strategies (also listed in Appendix E).

Diversification reduces the proportion of total investment and relative exposure to risk associated with a single activity while opening up new opportunities for generating welfare. Most diversifying strategies discussed in this section are extensions of the coping strategies mentioned above, but in this context are meant to emphasize a more permanent shift in the activities on which the household relies. The following section brings together those various diversification activities in order to examine them more thoroughly. The first part focuses on changes taking place within pastoralism. The second part focuses on strategies beyond pastoralist activities. The respondents' perceptions of those activities and prevalence of integration are included where available.

One additional point should be mentioned here. The Ethiopian government has recently conducted a *Good Governance* class at the *kebele* level through its system of DAs. In those classes the participants were encouraged to: (1) keep money in banks, (2) diversify

livelihoods into small business, and (3) build houses in urban areas to rent out or buy a truck to transport goods. Although these three strategies were mentioned in nearly every FGD, to the knowledge of the authors, none of the participants had actively pursued any of them.

Diversification of Pastoral Practices

Diversification of Herd Composition

Diversification into different species of livestock allows the household to maintain animals that feed on different species of plants, increasing their options for extracting resources from the rangeland. Camels and goats are thought to be more drought tolerant than cattle. Camels and goats are browsers which enables them to take advantage of the increased availability of shrubs and trees caused by bush encroachment. Most of the households among the focus group participants already include goats in their holdings, and camels are becoming increasingly popular. Camels are able to fetch high prices in a market that exports them to the Middle East. The two largest barriers into camel herding for respondents were the initial price of a calf and lack of experience with camel care. The negative social stigma that the Boran once attached to camel and goat ownership seems to have been eroded as these animals prove that they are able to weather droughts more successfully than cattle.

Reduced Dependence on Mobility

The increased use of private *kallos* and ranches, purchasing supplementary feed, and collecting hay from marginal or buffer areas are strategies that reduce dependence on mobility between wet and dry season pastures. Although all of the pastoralists continue to practice transhumant livelihoods, many are increasing their use of other methods for securing the feed their livestock need. At the time of this research, some households were not maintaining herds at satellite camps, either because those satellite herds had died in the drought or the herders felt that there was little opportunity to find better pastures elsewhere. Instead, those herders depended on their ability to secure feed at the base camp. Although this strategy is a direct consequence of the current drought, the perception that population pressures had reduced the benefits of mobility was widespread.

Increased Participation in Livestock Markets

Recently, droughts and the need for cash income have increased the dependence of some Boran households on livestock sales. Households often use young bulls as a form of liquid asset. According to interviewees, bulls are most often sold at a young age (three to five years old) in order to pay for education costs and to purchase goods for the household. The majority of those bulls are exported from the region to urban areas and in some cases, from these urban areas to other countries (Desta and Coppock, 2002). The results of selective sales are evident in herd composition of the Boran, which is primarily composed of cows, calves, and a small number of bulls. Even though most households *do* participate in livestock markets, they do so somewhat begrudgingly. In general, the preference is to build up herd sizes, selling cattle only when necessary. It may be that as households increase their exposure to livestock markets their perception of livestock herds will change from an asset used for household production and a form of liquidity when necessary, to a productive asset used to produce large marketable goods. Market depth is one barrier to increased participation in livestock markets by both buyers and sellers. During non-drought years, few herders sell their cattle so the infrastructure and markets surrounding livestock sales are not large. Droughts lead many herders to shallow markets that respond by reducing prices dramatically. In addition, livestock quality is negatively affected by drought, further reducing the price that herders receive. Increased market depth is a key component to stabilizing prices.

Diversification into Activities Outside of Pastoralism

Cropping

Transitioning into agro-pastoralism is one of the most common forms of diversification. Because wide use of cropping is new to the Boran, their traditional political and social structures have needed to adapt to include a land tenure institution that was not required in the past. Though there appear to be major problems with cropping, most notably the disruption of the traditional seasonal use of grazing areas, there are some positive aspects to cropping. Poorer households that have few or no livestock report that cropping provides them with new opportunities to generate much needed income and consumption goods (Gemtessa Emana and Tiki, 2006). FGD participants mentioned that cropping provided grains for the household to eat and residue for cattle. In Siqu, one elder stated, “No one can survive without farming. If

there is rain then you get food from the harvest. If there is little rain, the livestock can still eat whatever comes up even if there is no harvest” (Elder FDG participant, Siqu, July 17 2011).

Investments into Petty Trade

Many of the women and men mentioned that diversification into petty trade was a popular diversification strategy. Households can offset the fixed costs of traveling to market and take advantage of price differentials between the communities and market towns to generate income by selling community produced goods at market (e.g., forest and livestock products) or reselling manufactured or value-added products (e.g., grains and tea) back in the communities. Theoretically, there is the added advantage that increased petty trade may increase access to outside goods and stabilize prices in the communities. There are also a number of organizations and traders, such as the Gum Arabic Association, that facilitate trade by establishing pickup points in the communities or by helping community members to organize sellers’ cooperatives. For example, SOS Sahel has helped a number of women create a cooperatively run soap and lotion business. From the observations of the IGERT team, it appears that women and children are more likely than men to diversify into petty trade, although men mentioned beekeeping and charcoal-making as possible activities.

Investment in Real Estate

As part of the Ethiopian government’s development program, Boran households are able to lease a lot of land in Yabelo (the regional capital) for a highly subsidized price. The DA’s *Good Governance* classes encourage leasing urban lots as a means for investing in capital whose value does not co-vary with the climate. Community members reported that they could build houses on the lots to generate income through rental agreements. Although respondents cited this activity, the IGERT team was unable to collect evidence that any of the focus group participants had actually tried it. There was a great deal of house and hotel construction in Yabello, but little of it was being done for or by local community members. None of the FGD participants leased land in a regional town.

Transportation Sector

Similar to investment in real estate, a number of individuals mentioned purchasing a truck to open small transportation enterprises. There was little evidence that any of the FGD participants had successfully followed this path in the past, or that they were actively working towards pursuing this strategy.

Off-Farm Employment (Local and Distant)

Currently, households do not depend heavily on off-farm employment or remittances (Desta and Coppock, 2004) but many of the participants in this research expressed the desire to find employment. From their perspective, education is key for their children *because* it provides them with the opportunity to find off-farm employment. Yet many of the boutique, hotel, and restaurant staff in the region were immigrants from other regions of the country, not Boran.

As households continue to experiment with new combinations of activities, their success will depend, in part, on the response of the Boran society, the Ethiopian government, and NGOs. Households require the support of their communities and institutions so that they can adapt together to the changes taking place around them. The next section outlines a number of areas in which there are opportunities to support changes that require community organization or institutional adjustments.

Improved Livestock Management

Boran Cattle Breeding Center

Another potential opportunity in the region is via collaboration with the Boran Cattle Breeding Center. This center is dedicated to the preservation and improvement of Boran cattle breed, and raises several hundred cattle



Photo 9. Boran cattle at the Boran Cattle Breeding Center

on government land. The center has excellent knowledge of husbandry, as well as of regional impediments to cattle health. Furthermore, the center identifies outstanding farmers annually in different *woredas* and sells breeding stock to those farmers in order to perpetuate the breed and to introduce genetic diversity. The center could be utilized for extension and training in order to preserve the Boran breed, and to facilitate farmers in maintaining optimal cattle health in order to enable cattle to survive periods of drought.

Castration

As mentioned in the Livestock section, it is reported by the Boran that castration of bulls increases their drought resistance and reduces their calorie requirements. This observation does not appear to be substantiated in the literature, and the authors are not aware of any formal studies that have been conducted describing the impact of castration on the Boran cattle breed, and suspect that no formal studies exist. However, for other breeds of cattle, the impact of castration has been described. While lean, intact males produce a higher carcass yield grade they usually produce a lower quality grade. In general, steers (castrated bulls) tend to have more desirable composition of external fat and marbling, but this is offset by their tendency toward decreased rate of weight gain and a lower feed conversion efficiency (Schanbacher, 1984 and Seidemen et al., 1982). Given that the Boran breed is a unique breed of cattle that differs significantly in conformation, as well as disease resistance, when compared to other *Bos taurus* or *Bos indicus* breeds, it is not clear whether these published findings can be extrapolated to the Boran population of cattle. Further research in this area is warranted, and is being addressed at the Boran Cattle Breeding Center in Yabello.

Currently households do not practice castration because young bulls are used as a liquid asset and sold in the market, where bulls receive about double the price of steers per kg when both animals are in good condition.⁵ The few male cattle that each household maintains are used to impregnate cows and are thus kept uncastrated.

⁵ The IGERT team was unable to track down the fundamental reason why the per kilogram price of bulls was double the per kilogram price of steers.

Enhanced Rangeland Management

Management of and access to rangeland are changing quickly in a variety of ways. As communities and individuals continue to restrict access to greater portions of land (e.g., *kallos*, crop fields, ranches, buffer areas, protected forests), existing oversight institutions (*gada* system and government institutions) struggle to meet the needs of all of their constituents and encourage equity when interests conflict. For example, crop fields are often established on the most fertile lands replacing public fertile pastures and reducing community access to pastoral resources. As described above, “privatizing” a field for cropping purposes can easily favor wealthier households that are able to pay the taxes levied on crop fields and that have more political influence. The result is evident in the fertile fields on the foothills near Yabello, where a few individuals own large tracts of land and huge herds of cattle. Alternatively, Desta and Coppock (2004) find that continued open grazing favors those with large herds, while cropping provides an avenue for those households that are not livestock-wealthy enough to generate income. In that case, it is the rate of taxation on cropland that will determine if the poor are able to benefit from potential cropping activities.

Other methods for restricting access to land such as the construction of private *kallos* and ranches can also favor the wealthy or provide poorer households with greater opportunity. Although restricting access to land provides opportunities for households to diversify and generate income, the transition to increased exclusion rights can easily lead to greater inequity. In cases where existing institutions are inadequate there may be a role for outside organizations to help facilitate the equitable sharing of land resources.

The resettlement program provides an opportunity for Boran communities to create long-term landscape plans. Currently, the resettlement program includes the delineation of wet and dry pastures but, from our understanding, does not set objectives for the future use of the landscape or standards for how land-use changes are realized. A more developed land-use plan could protect continued access to herding routes, pastures, and water points. Aside from the advantages of creating a land-use plan for preserving access to land resources, it could

also facilitate the adoption of land-use initiatives that require community-wide acceptance and participation. The following are four land-use initiatives that seemed to hold promise but require a great degree of organization and management from the communities that they would impact.

Destocking

Although uncommon, a community-wide destocking plan, a means of reducing grazing pressure, was reported in one community. Possibly, if multiple neighboring communities all agreed to destock large-scale benefits could be realized.

Community Ranches

Community pasture preserves reduce grazing pressures within the pasture and increase the incentives to manage the land sustainably. In a fee-for-use arrangement, the ranch can redirect resources towards maintaining and improving pasture quality. Implementation should include measures to protect against favoring the wealthier, increased grazing pressures outside of the preserve, and the creation of new poverty thresholds.

Buffer Zones

In some areas of high conflict, no grazing or cutting areas known as buffer zones have been established between communities with the help of NGO mediators and government support. This strategy of delineating property rights has met with some success in reducing violent incidents. In addition to reducing violent conflicts, buffer areas between conflict zones also act as a pasture of last resort. During droughts when access to pasture is critical, there seems to be a relaxing of the exclusion rules for the buffer areas between the conflicting communities. According to herders in Wachile, Mercy Crops helped them to establish a buffer area between their region and the Somali region. Currently the drought has driven most of the households and their cattle away from the buffer areas. Those that remain near them feel that they can cut forage for their cattle from the buffer areas without fear of conflict because there are fewer people and livestock in the area competing for resources. Also, according to a key

informant from CARE Ethiopia, there is less armed conflict during droughts because individuals are focused on trying to stay alive.

Forest Preserves

SOS Sahel's juniper forest preserve (see Rangeland-related risk mitigation and Climate Change Adaptation Strategies of Women and Children) meets a variety of community members' needs by providing pasture during times of drought, seed pods used to supplement livestock feed, wood for construction, and resources that women can use to generate income. Furthermore, it reduces land degradation, provides grazing and water sources for livestock, provides a habitat for animals, increases diversity of the landscape, and sequesters carbon.

Information and Communication Technology in Climate Risk Adaptation

According to the World Bank, access to information and communication technology (ICT) increasingly has the potential to reduce poverty and foster growth in developing countries (2006). There are a number of ways that ICT, usually by way of cell phones, are helping Boran become more efficient pastoralists and reduce their exposure to livestock related risks. The following section outlines the current state of access to ICTs in the Borana region, how they are currently used, and potential opportunities for increasing their utility to the Boran.

Information Technology

Radio

Five of the six FGD communities received the government radio signal which broadcasts news, weather, educational, and recreational programs. Generally, individuals seemed to have a positive perception of the radio. In Sarite one individual stated “radios are very instrumental because we can hear about weather in places that we cannot see” (Sarite, July 2011). The participant mentioned hearing about precipitation in other regions of the country as well as climate issues across the globe.

Cell Service

Similar to other regions in Africa, Ethiopia has seen a rapid uptake of cell phone technology and continued increases in service areas. Although only 1.4% of the land and 10.1% of the population were covered by cell service in 2006, the same statistics were essentially zero in 1999 (Buys, 2009). In four of six FGD communities (Bokosa, Sarite, Wachile, Siqu), there is cell service nearby (<1km) and individuals own cell phones. In the Obok and Irbi, participants expressed a desire for access to service.

In all communities participants had very high opinions of the usefulness of cell phones. When asked what they were useful for, participants initially stated that they were used to talk to relatives. Once probed, it became evident that those who did use cell phones, used them extensively for gathering information on markets, locating pasture and water for cattle, communicating with satellite camps, locating lost cattle, and communicating with traders. In Wachile, one individual described using his cell phone to contact his scouts when determining where to take the *forra* (satellite) herd (Wachile, July 2011). In another community, participants mentioned that they could call a radio station for forecast information but that none of them had used it because they did not know the phone number. This raises a significant point for any initiative that relies on cell phones; there are many more people that own phones and can receive calls than are willing to put credit on their phone and place calls. In this case, even while stating that they had a need for better climate information services, individuals were reluctant to use services that required them to call in, using phone credit. The two most common complaints surrounding cell phone are high cost of air time and lack of service.

Internet

The most common way to access the internet in Ethiopia is via wireless USB router that is supported by the Ethiopian Telecommunications Corporation (ETC). The wireless routers provide fairly cost-effective and reliable access to the internet in communities that would otherwise have no access. Although we did not see any computers or internet use in the rural communities, the wireless ETC routers can provide access to the internet even in remote areas. Some community members mentioned that they had heard of the internet through their children but did not have access or the skills to use it.

It bears mentioning here that much of the Borana zone has poor road access. There is one asphalt road from Addis Ababa to Moyale that runs through Yabelo. There are some roads in the region that are not asphalt, but many/most villages can be only be accessed through dirt-tracks. This makes access to services (such as markets, health services, and education) as well as information about these services difficult.

Enhanced Dissemination of Information

There are many potential benefits to increasing access to information. The IGERT team was able to observe and discuss those benefits with individuals from communities with widely varying levels of information access. If increased, four general types of information seem to have the greatest potential to improve the livelihoods of community members.

Weather Forecasting

As climate trends diverge from those anticipated by traditional climate forecasting, participants expressed a desire for alternate climate information sources. Although many felt there were other options for attaining forecast information, they were not well understood or perceived to be sufficient. The available options mentioned were radio reports, reports accessed by phone, government extension agents, and their own children. Notably, the participants said that educated young people understood the new sources and formats of climate information much better than the older generation did. The ability to use and understand new sources of climate information was mentioned as one of the benefits of education. Participants reported that in many cases it was younger people who had first understood how severe the current drought would be, because of their greater access to information. They had encouraged their families to take action early on by selling animals and diversifying their livelihoods. Government agents also facilitate the delivery of forecast information to the communities as well as provide advice on how to react to the weather information. In a number of discussions the participants preferred government forecast information to traditional sources because of the advice that came with it.

The most common complaint regarding both traditional and nontraditional weather forecasting was that by the time households received a drought prediction, it is too late to respond in a meaningful way. Most of the households have few diversification options beyond selling portions of their herds in hopes of keeping their families and remaining livestock alive during the drought. But, when the government informs communities of a coming drought and advises them to sell livestock, the price drops dramatically reducing the benefits of selling and

the options perceived by households. For example, when the community of Bokosa was informed by their DA that there would be a drought they collectively agreed on a strict herding protocol that included massive destocking of livestock and diversifying into non-herding activities. However, their plan relied on receiving good prices for their cattle, and because it was already the end of the dry season when their plan was made, the animals were thin and their market price poor. In response to the market prices, the community decided to wait until after the livestock had benefited from the next rain before selling. That rain never came, the cattle's health continued to degrade, and market prices fell as many other herds entered the market.

Households currently draw on both traditional and nontraditional methods of climate information. Although they both have advantages and disadvantages, the newer sources seem to be gaining ground, especially with younger more educated individuals. Because there does not seem to be a stigma associated with using traditional or nontraditional methods, use of specific sources is mostly an issue of access, usefulness, and perceptions of accuracy.

Provision of Animal Care Information

In some communities, herders expressed frustration at their own inability to diversify their herd composition because of their own inexperience and lack of knowledge concerning camel and goat care. Providing herders with information on camel and goat care may help them to diversify their holdings into drought tolerant animals.

Increase Market Access and Information

Currently, herders have very little market power due to high transaction costs and their poor negotiating position. They trek many miles with their animals to get to market. Upon arrival, herders are required to pay a per-head tax (one birr). During drought seasons their cattle may be too weak to make the trek back home. Even when their livestock are healthy enough to make the trek back, the herder has wasted days of labor and does not recoup the tax paid at market. In communities with cell service, herders use their phones to determine market

conditions and, at times, set prices with buyers before making the trek to market. The areas without cell service are most likely the furthest from the tarmac and markets. These communities are at the greatest disadvantage when selling in markets. Providing them with access to market information (e.g., via radio) or communication with sellers (e.g., via shortwave, CB, or cell) may reduce the disadvantages associated with poor road access.

Climate and Pasture Conditions

Those with access to cell phones mentioned that they used them to learn about pasture and water conditions in other areas from friends and relatives. Weather, pasture, and water reports by radio or distribution of satellite imagery to the PA offices may be an avenue for disseminating similar information without the need for phones. As access to the internet increases via USB wireless modems this program could transition into central locations for accessing up-to-date information on demand.

Considerations For Implementing Climate Change

Adaptation Strategies

Work with Existing Networks and Systems

An existing system of government and non-governmental agencies such as Peasant Associations, Development Agents, and Cooperatives can play useful roles in promoting adaptation in the Borana zone. PAs, which are constituted at the *kebele* level, serve as an interface between pastoralists and the *kebele*, *woreda*, and zonal government, and were established several decades ago. Because the PA system has power over the administration of many matters that were traditionally decided through the traditional *gada* system of government, some Borana people who work with them fear that the PAs undermine the traditional system. Occasionally, however, PAs work closely with the *gada* system. Because of their access to higher levels of government and other government and non-governmental agencies, PAs can be useful in promoting climate change adaptation strategies due to their influence and reach. However, as mentioned previously, traditional systems can play an important part in climate change adaptation. A system under which PAs acknowledge and work with traditional leaders may be beneficial.

DAs are a network of young Bachelor's degree recipients who work in a few villages as extension agents, with each DA specializing in an area such as livestock or natural resource management. The DAs work with the Peasant Associations (*kebele* level government) and several of the government-promoted projects at the village level mentioned above such as village ponds and water wells are designed and implemented by the DAs. All of the DAs whom the IGERT team met spoke of having involved the communities in design as well as having had the community supply the labor needed. The IGERT team was made aware that there is a perception that DAs are overburdened with other work such as collecting taxes, which harms their efficiency and efficacy (due to lack of trust from communities) in being able to implement projects that benefit the community. While the DAs have some positive impact, particularly due to their ability to transfer information between communities and the

government, it is possible that with good training and proper support they may be more effective at helping communities design and implement climate change adaptation strategies.

Cooperatives in Borana have a multitude of missions. Some focus on marketing livestock, others on selling milk, and still others on maintaining “fattening” or “finishing” ranches. While in some cases, (for example the ranching cooperatives) they have been accused of controlling resources to the exclusion of non-members, the formation of cooperatives may also be a useful way for communities to plan and implement adaptation strategies (such as livelihood diversification, either involving livestock such as selling milk, or not, such as women’s cooperatives for credit or trade) that may not be as feasible or effective when undertaken by individuals. Cooperatives also may benefit their members through their collective bargaining power. For example, cooperatives may be able negotiate with traders for better prices on livestock than could individuals. In times of drought or anticipated drought, this improved ability to negotiate could be important in addition to the ability to make collective decisions on how many animals to supply and when.

The existing systems (e.g., DA system, NGOs) in place to reach communities seem to have an extensive reach, which may be an advantage in enabling communities to adopt climate change adaptation strategies. As mentioned above, the *Good Governance* program raises awareness among pastoralists on climate change and livestock diversification. While such programs may serve to raise awareness, additional support is needed for communities to actually undertake these recommendations. Also, it may not be advantageous for everyone to build houses; it is important to know what section of the population is most likely to be helped by these recommendations. For example, it may not be the poorest, or even the relatively poor who can act on the recommendation to build houses, but they are more likely than those of better means to need help coping with and adapting to climate change.

Promote Sustainable Resource Use, and Take Externalities into Account

While measures are undertaken to deal with water scarcity, care must be taken to use the available resources sustainably. A program such as the Water Network, the government’s

large piped water project, could alleviate the shortage of water for Borana communities, and have concurrent benefits such as a reduction in time spent by women gathering water. To maintain the benefits however, the groundwater resource must not be overexploited. This means that certain uses which might be attractive may not be feasible in the long run. For example, irrigated cultivation would likely not be sustainable on a large scale. Similarly, consideration needs to be given to potential "externalities" of these projects. For example, some pastoralists and researchers in the area believe that new water projects have exacerbated land degradation. Though the topic was not raised in discussions, care must also be taken to prevent the unsustainable use and rapid decline of groundwater through independently operated wells, which occurred in other parts of the world such as the Ogallala aquifer in the southwestern United States and in the state of Punjab in northern India.

Strengthen Common Property Management

Strengthening institutions to manage commonly held land would likely facilitate many of the adaptation strategies mentioned. For example, livestock overpopulation and lack of initiative to clear bush were mentioned frequently in the team's discussions and interviews as being a problem of individuals acting against the interest of the larger group or community (due to the lack of incentive to do so). The extent of this "tragedy of the commons" needs to be determined, and steps must then be taken to strengthen measures that align the interests of individuals with those of communities. While many issues need to be resolved with respect to carbon sequestration, and it is uncertain if it will ever be feasible as a supplemental source of income in the area, the issue of how land tenure affects the sharing of benefits from sequestration programs would need to be better understood for it to even be considered.

Concerns and Complements for IBLI in the Ethiopian Borana

Traditional and new coping mechanisms are likely to interact with index-based livestock insurance in both complementary and conflicting ways. If successfully implemented in Borana, IBLI could act synergistically with current adaptation strategies, both directly reducing Boran exposure to risk and supporting other mechanisms that benefit households. On the other hand, there are a number of concerns that community members expressed when IBLI was discussed. The following section describes one concern and two potential complements that should be kept in mind as IBLI is implemented in Ethiopia.

Potential Concerns

Due to large and ongoing changes that are taking place across Borana, a better understanding of the impact of changes in human and environmental systems that will affect NDVI measurements would be beneficial. Although the IBLI index is calculated at the regional level, there is some concern amongst community members and researchers that current changes in human activity and environmental conditions could impact NDVI measurements. An interviewee at the Borana Pastoral Development Commission office raised the question of whether bush encroachment could give a deceptive picture of drought conditions in NDVI measurements. The bush may cause the NDVI to indicate a high degree of vegetation, even while there is little vegetation edible by cattle. Ranches, which may be very large, often have very different conditions compared to surrounding areas, affecting the NDVI but not providing open pasture to all. Additionally, recent and future changes in cultivation might be relevant. As mentioned in the Rangeland section, there has been a large increase in the number of households practicing cultivation (Desta, 2011). It is unclear at what degree cultivation will continue to grow or at what level it will finally level off. The Water Network might add a further level of uncertainty as it may create the potential for irrigation, further encouraging cultivation, and the redistribution of communities and livestock. At this point, it is unclear at what resolution (or scale) these changes will have in vegetation-based indexes.

Potential Opportunities

There are a number of opportunities for IBLI to both help reduce livestock mortality and help households adapt to their changing environment. Two areas of important potential complements between IBLI and adaptation strategies lie in supporting improved rangeland management and improved access to veterinary services and extension.

As mentioned above (see Enhanced Rangeland Management), there are a number of natural resource management strategies that appear to have high potential for benefiting communities but require a great deal of organization and cooperation within and between communities. If IBLI's implementation strategy supports community-level rangeland management capacity and promotes the creation and implementation of a sustainable land-use plan, it could have large positive and lasting impacts on the landscape. According to community members; forest preserves, buffer areas, and community ranches reduce livestock mortality through increased access to pasture during drought and provide potential income sources for community members. Rangeland management has the potential to reduce exposure to risk, reducing payouts and premiums, while providing access to income that could be used to increase welfare or even to purchase insurance contracts.

Supporting current livestock illness and disease management infrastructure is a second opportunity for IBLI. There is already a strong vaccination program in Ethiopia and some access to veterinary care and livestock medication. IBLI activities should ensure that they strengthen those institutions in their activities. Opportunities vary widely from simply including animal health workers in IBLI community education sessions to a more complicated premium structure that encourages aggressively addressing animal health issues. One realistic option could be to provide reduced-fee vaccinations (for vaccines not currently provided through the government vaccination program) or reduced-fee veterinary care for insured cattle. This could potentially be an extension of the existing government voucher program for veterinary products and services. Currently, the government provides vouchers to citizens and these vouchers are honored at private businesses which provide the veterinary products and

services to the farmers. For example, veterinary retailers may be more willing to extend credit to pastoralists whose cattle are insured through IBLI with the knowledge that if those cattle perish, the business may still be able to collect payment once insurance payouts are received by the insured. Therefore, by coupling IBLI with veterinary services, the health and wellbeing of livestock may improve overall, and may further strengthen the private provision of veterinary services, which would be a substantial indirect benefit of IBLI. Perhaps, as animal health improves, and animals are less likely to perish, the premiums may potentially be reduced, and therefore may be more widely accessible to the marginalized poor with very few (less than five) cattle.

Conclusion

At the time of writing this report, southern Ethiopia and other parts of the Horn of Africa were facing one of the worst droughts in decades. Though adapted to a climate where droughts occurred once every 7-10 years, the Boran have noted an increase in the frequency of droughts in the region. These frequent droughts, which are likely to be characteristic of future climate in this region, have had grave impacts on the Boran including loss of livelihood, food scarcity, and loss of cultural identity. The Boran recognize the need to adapt, and along with the government and NGOs who work in the region, are undertaking a number of climate change adaptation strategies. Some strategies, including livestock diversification and improved access to information, appear to be beneficial and sustainable. While it is clear that many adaptation strategies are beneficial, they are neither sufficient nor capable of being maintained over the long term for everyone. For example, even though strategies such as livestock sales and increased crop farming have gained popularity, many households are either unable to practice these strategies or receive minimal benefit from them. This report inventories and critically assesses a number of existing and potential adaptation strategies. It also outlines the possible challenges and complementarities between those strategies and index-based livestock insurance. IBLI's index should take the changing vegetation composition into consideration. There is also an opportunity for IBLI to reduce exposure to risk while supporting existing veterinary services and rangeland management.

Appendix A: Calendar and Seasons

Table A-1. Calendar

English	Oromo	Borana	Season	Season
Jan	Amajjii	Amajjii	Bona	Short Dry
Feb	Gurraandhala	Gurraandhala	Bona	Short Dry
march	Bitoottessa	Bitattessa	Gana	Long Rainy
April	Ebla	Caamsa	Gana	Long Rainy
May	Caamsaa	Buufa	Gana	Long Rainy
June	Waxabajjii	Wacabajjii	Adolessa	Long Dry
July	Adolesa	Hoboraa Guddaa	Adolessa	Long Dry
Aug	Hagayya	Hoboraa Diqqaa	Adolessa	Long Dry
Sept	Fulbana	Birraa	Adolessa	Long Dry
Oct	Onkololessa	Ciqaawaa	Hageya	Short Rainy
Nov	Sadasa	Sadaasa	Hageya	Short Rainy
Dec	Muddee	Abraasaa	Bona	Short Dry

Table A-2. Seasons

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Season	Short Dry		Long Rainy			Long Dry				Short Rainy		Short Dry
Season (Oromifa)	Bona		Gana			Adolessa				Hageya		Bona

Note: The seasons vary across the Borana region in Ethiopia by location and year. The above table illustrates an approximation for the region geographically and when the seasons are usually expected.

Appendix B: Schedule of FGDs and Interviews

Table B-1. Schedule of FGDs and Interviews

Date	Location/ Site	Activity	Participants
11-Jul	Addis Ababa	Interview	CARE: Charles Hopkins
		Interview	PhD Researcher/Tufts Feinstein Center: Dawit Abebe
		Interview	MARIL Group: Solomon Desta, Seyoum Tezera, Getachew Gebru
13-Jul	Yabello	Interview	Borana Zone Pastoral Development Commision: Liban Areero Huqqaa, Atilaw Belayna
		Interview	Care Ethiopia Borana Program: Lamessa Laberu (Global Water Initiative), Alake Dida (Regional Corrdinator), Gamechu (Learning and Knowledge Management Officer)
		Interview	Goal Borana: Girma Getachew
14-Jul	Yabello	Interview	SOS Sahel: Borana Zone Field Coordinator: Huka Ali Halake
15-Jul	Dubluk Livestock Market		
16-Jul	Dire/ Dambale Dhibayu/ Bokosa	FGD*	Elders & Pastoralists
		FGD	Women group
		Interview	Kebele Head: Wariyo Bagacha
		Interview	Borana historian: Borbor Bule
		Interview	Kebale Head: Jarsa Dambala Dibayu
		Interview	Matacho Head of Women's Affairs: Dama
17-Jul	Yabello/ Haro Bake		Visit to Haro Bake Market Livestock Market
18-Jul	Yabello/ Dambala Saden/ Siqu	FGD	Elders
		FGD	Pastoralist
		FGD	Women group
		Interview	PA Administrator
		Interview	DA NRM: Makkole
19-Jul	Teltele/ Sarite/ Qalla Malbe	FGD	Elders
		FGD	Pastoralist
		FGD	Women group
		Interview	Health Extension worker
		Interview	PA Administrator: Dice
		Interview	DA NRM: Kupsa
21-Jul	Yabello	Interview	Borana Zone Water, Mines and Energy Office: Abdinasir Guyo (Deputy Head)
		Interview	Gum Arabic Association

		Interview	CISP
22-Jul	Dhas/ Gorile/ Irbi	FGD	Elders
		FGD	Pastoralist
		FGD	Women group
		Interview	DA Livestock: Roba Jarso
		Interview	PA Administrator
23-Jul	Arero/ Wachile/ Taka Bulti	FGD	Elders
		FGD	Pastoralist
		FGD	Women group
		Interview	PA Administrator
24-Jul	Dillo/ Obok/ Ela Dima	FGD	Elders
		FGD	Pastoralist
		FGD	Women group
25-Jul	Yabello	Interview	Oromiya Construction Enterprise: Shimels (Director), Girma Mekonnen (Engineer)
28-Jul	Addis Ababa	Interview	MARIL Group: Solomon Desta, Seyoum Tezera
		Interview	Climate Change Forum Ethiopia: Gebru Jember (Program Officer)
		Interview	International Water Management Institute: Tilahun Amede (Researcher)
		Interview	United States Agency for International Development: Dubale Admasu (Program Coordinator), Yitayew Abebe (Mission Environmental Officer)
29-Jul		Interview	Oromiya Water Works Design and Supervision Enterprise: Gezahegn Boru (Deputy General Manager)
1-Aug		Interview	Oromiya Water Works Design and Supervision Enterprise: Taye Alemayehu

*FGD= Focus Group Discussion

Appendix C: Climate Information Sources

Table C-1. Traditional and Non-traditional Climate Information Sources

Traditional	Non-traditional
Reading intestines of a slaughtered goat	Radio
Reading the stars	Cell phones
The <i>Gada</i> cycle	Government Officials
Cattle body language	NGO's
Cattle appetite	Educated people
Environmental variation (changes in leaves on trees)	

Appendix D: Drought Coping Mechanisms for Boran Pastoralists

Table D-1. Traditional Coping Mechanisms

Traditional Coping Mechanism	Definition and Explanation
Rotational Grazing	(wet/dry grazing)
Community-based re-stocking (<i>busa gonafa</i>)	Community-based re-stocking program where the Boran permanently donate (or gift) individuals from their herds to other Boran Pastoralists who have experienced catastrophic loss (usually total loss of the herd). There is full transfer of ownership of the donated livestock.
<i>Ames</i>	A rich family with a lactating cow lend the lactating animal to a poor family on a short-term basis - the family may keep the cow for 1 lactation cycle and then must return it
<i>Rebaray</i>	A rich family with a milk cow gives the cow as a permanent gift to a poor family, and they keep the cow, its offspring, and its milk
<i>Busa</i>	Immediate life-saving action, for example, giving food to some who is at imminent risk of death due to starvation

Table D-2. Non-Traditional Coping Mechanisms

Buy cereals
Store hay
Livelihood diversification
Livestock diversification
Opportunistic crop farming
Purchase feed for a few animals
Join co-operative and credit unions
De-stocking
Migration

Appendix E: Alternate Sources of Income for Boran Pastoralists (Livelihood Diversification Strategies)

Table E-1. Alternative Sources of Income for Boran Pastoralists

Bee-keeping and honey
Aloe-vera products (soaps and lotions)
Scented wood (similar to perfume)
Incense
Chewing gum
Poultry farming (for sale of birds in the market; not for direct consumption)
Charcoal
Real estate (purchase house in town for use as a rental property)
Employment (local)
Employment (distant - e.g., a family member relocates to Nairobi to seek employment)
Milk (for sale in the local market only)
Gold mining
Salt mining
Cut firewood

References

- Abebe, D., A. Cullis, A. Catley, Y. Aklilu, G. Mekonnen, and Y. Ghebrechirstos. 2008. Impact of commercial destocking relief intervention in Moyale district, Southern Ethiopia. *Disasters* 32(2): 167-189.
- Buys, P., S. Dasgupta, T. S. Thomas, D. Wheeler. 2009. Determinants of a digital divide in Sub-Saharan Africa: A spatial econometric analysis of cell phone coverage. *World Development* 37(9): 1494-1505, DOI:10.1016/j.worlddev.2009.01.011.
- Catley, A., D. Abebe, B. Admassu, G. Bekele, B. Abera, G. Eshete, T. Rufael and T. Haile. 2009. Impact of drought-related vaccination on livestock mortality in pastoralist areas of Ethiopia. *Disasters* 33(4): 665-685.
- Conway, D. and E. L. Schipper. 2010. Adaptation to climate change in Africa: Challenges and opportunities identifies from Ethiopia. *Global Environmental Change* 21(1): 227-237.
- Coppock, D. L. 1994. *The Borana Plateau of southern Ethiopia: Synthesis of pastoral research, development and change, 1980-91*. Addis Ababa: International Livestock Centre for Africa.
- Desta, S. 1999. "Diversification of livestock assets for risk management in the Borana pastoral system of Southern Ethiopia." Ph.D. Dissertation, Department of Rangeland Resources, Utah State University, Logan.
- Desta, S. 2011. Transitions in pastoral practices and livelihoods under changing climate: the case of Borana pastoralists in Southern Ethiopia. Paper presented at "Climate Change Vulnerability and Risk Assessment of Agriculture and Food Security in Ethiopia: Which Way Forward?" July 6-7, 2011. Addis Ababa, Ethiopia.
- Desta, S., G. Gebru, S. Tezera, and D. L. Coppock. 2006. Linking pastoralists and exporters in a livestock marketing chain: Recent experiences from Ethiopia. In J. McPeak and P. Little (eds.) *Pastoral Livestock Marketing in Easter Africa: Research and Policy Challenges*. Warwickshire, UK: Intermediate Technology Publications. 109-108.
- Desta, S. and D. L. Coppock. 2002. Cattle population dynamics in the Southern Ethiopian rangelands, 1980–97. *Journal of Range Management* 55: 439-451.
- Desta S. and D. L. Coppock. 2004. Pastoralism under pressure: Tracking system change in Southern Ethiopia. *Human Ecology* 32(4): 465-486. DOI: 10.1023/B:HUEC.0000043516.56037.6b

- Gemtessa K., Emanu B. and W. Tiki. 2006. Livelihood diversification in Borana: Pastoral communities of Ethiopia – Prospects and challenges. Downloaded from Gemtessa_Livelihood Diversificationin Borana_Brief_Final
- Helland J. 1994. Development interventions and pastoral dynamics in Southern Ethiopia: A discussion of natural resources management in Borana pastoralism. Working Papers in African studies, no. 186: Boston University MA.
- Luseno, W. K., J. G. McPeak, C. B. Barrett, P. D. Little, and G. Gebru. 2003. Assessing the value of climate forecast information for pastoralists: Evidence from Southern Ethiopia and Northern Kenya. *World Development* 31(9): 1477-1494.
- Lybbert, T. J., C. B Barrett, S. Desta, and D. L. Coppock. 2004. Stochastic wealth dynamics and risk management among a poor population. *Journal of Economics* 114(489): 750-777.
- Lybbert, T.J., C. B. Barrett, J. G. McPeak, and W. K. Luseno. 2007. Bayesian herders: Updating of rainfall beliefs in response to external forecasts. *World Development* 35(3): 480-497.
- McCarthy, N., A.B. Kamara, and M. Kirk. 2003. Cooperation in risky environments: Evidence from Southern Ethiopia. *Journal of African Economies* 12(2): 236-270.
- Neely, C., S. Bunning and A. Wilkes, eds. 2009. Review of evidence on drylands pastoral systems and climate change. Implications and opportunities for mitigation and adaptation. Land and Water Discussion Paper, Number 8. Food and Agriculture Organization.
- Ogbaharya, D. The impact of institutional degradation on pastoral livelihoods in the horn of Africa: The case of the Borana of Ethiopia. 2009. *Journal of Third World Studies* 26(1): 123-150.
- Schanbacher, B. D. 1984. Manipulation of endogenous and exogenous hormones for red meat production. *Journal of Animal Science* 59: 1621.
- Seideman, S. C., H. R. Cross, R. R Oltjen and B. D. Schanbacher. 1982. Utilization of the intact male for red meat production: A review. *Journal of Animal Science* 55: 826.
- Shibia, M. and B. Taddesse. 2011. Preliminary findings: Preparations for the visit of IGERT students, deployment of collars and designing of questionnaires for the pastoralists (whose herds are collared) and FGD to solicit historical mortality in the Borana Zone. Unpublished field report.
- Solomon, T.B., H.A. Synman and G.N. Smit. 2006. Cattle-rangeland management practices and perceptions of pastoralists towards rangeland degradation in the Borana zone of southern Ethiopia. *Journal of Environmental Management* 82: 481-494. DOI: 0.1016/j.jenvman.2006.01.008
- Tache, B. and B. Irwin. 2003. Traditional institutions, multiple stakeholders and modern perspectives in common property. Accompanying change within Borana pastoral systems.

- Securing the Commons Series, Number 4. International Institute for Environment and Development.
- Temesgen, A. K. 2010. Climate change to conflict? Lessons from Southern Ethiopia and Northern Kenya. Fafo Report 2010: 09.
- Tolossa, D. 2008. Livelihood transformation from pastoralism to agro-pastoralism as an adaptation strategy among the Urrane of North-Eastern Ethiopia. *Quarterly Journal of International Agriculture* 47(2): 145-165.
- Wang, X. and P. R. Hunter. 2010. Short Report: A systematic review and meta-analysis of the association between self-reported diarrheal disease and distance from home to water source. *American Journal of Tropical Medicine and Hygiene* 83(3): 582-584.
- Wassie, B., D. Colman, and F. Bichaka. 2007. Diversification and livelihood sustainability in a semi-arid environment: A case study from southern Ethiopia. *Journal of Development Studies* 43(5): 871-889.
- World Bank. 2006. Information and communications for development 2006: Global trends and policies. Washington, DC: World Bank.
- Yirbecho, A.T., C. B. Barrett, and G. Gebru. 2004. Resource conflict in the rangelands: Evidence from Northern Kenya and Southern Ethiopia. Global Livestock Collaborative Research Support Program Research Brief 04-08-PARIMA.



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