THE RAIN DOESN'T COME ON TIME ANYMORE

POVERTY, VULNERABILITY, AND CLIMATE VARIABILITY IN ETHIOPIA

22 April, 2010

Oxfam International

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Executive Summary

Climate variability in Ethiopia is not new—its diverse agro-ecological zones have brought a dazzling variety of micro-climates, and corresponding weather patterns, and people have developed ways to respond successfully to these challenges. But now, in addition to the usual struggles, Ethiopians living in poverty are additionally suffering the effects of climate change—both more variable climate and more extreme weather events. Women, men, families, and whole communities are struggling with how to understand this new variability, identify new patterns, and establish what resources they need to be able to move beyond reacting and coping to adapting to the new realities and being resilient. Policy makers, likewise, face the daunting challenge of how to refine policies, especially investments in and related to agriculture, to focus on poverty and vulnerability reduction in context of the new realities of climate change.

People who are already poor and marginalized are struggling with the added burden of climate variability, and it is likely that this variability will only increase. As established by the Intergovernmental Panel on Climate Change (IPCC) and other studies, climate change will continue to increase variability in weather patterns and make them more extreme. Variability means that it is harder for families and communities to predict the ever-changing, inconsistent weather. For now, this means that the little that they have goes to dealing with the current unpredictable weather because their livelihoods are so dependent on it. Often this exposes them to a whole range of other shocks, such as illness, which makes them even more vulnerable. When selling off assets becomes a mean to cope, there is little left to plan for the future. Thus, communities are faced with simultaneously increasing climate variability, and with it increasing risk and vulnerability.

In 2009, Oxfam commissioned research on climate variability in four woredas, or administrative areas, in Ethiopia. The land use systems and woredas constituting the foci of the study included:

- Highland mixed farming (Ofla Woreda in Tigray National Regional State)
- Rift Valley mixed farming (Adamii Tulluu-Jido Kombolcha Woreda in Oromia National Regional State)
- Pastoralism (Yabello Woreda in Oromia National Regional State)
- Coffee farming (Wansho Woreda in Southern Nations, Nationalities and People's Regional State (SNNPR))

The research set out to answer three fundamental questions:

1. Do Ethiopian farmers and pastoralists perceive changes in weather patterns? If so, what are they? What meteorological information is available in the four study areas?
2. How have farmers and pastoralists been coping with and adapting to these changes in weather patterns?

3. What policy recommendations emerge from these specific case studies that will increase the resilience of poor men and women in Ethiopia?

These questions are especially important to explore in Ethiopia because it is one of the poorest countries in the world, where eighty-five percent of the population depends on agriculture. The agricultural sector in Ethiopia is especially vulnerable to the adversities of weather and climate: it is rainfed, done using relatively basic technologies, and on tiny plots of land. Another climate and weather sensitive activity is pastoralism. When there is not enough pasture or water, pastoralists encounter enormous losses of livestock, their most important asset.

Ethiopia has always suffered from great climatic variability, both yearly and over decades. Rain failures have contributed to crop failure, hunger and even famine in the past. Even relatively small events during the growing season, like too much or too little rain at the wrong times, can spell disaster. Farmers and pastoralists, who are already struggling to cope effectively with the impacts of current climatic variability and poverty, will face a daunting task in adapting to future climate change.

Ethiopia's Variable Climate:

- Between 1951 and 2006, the annual minimum temperature in Ethiopia increased by about 0.37°C every decade.
- Between 1960 and 2006, the mean annual temperature increased by 1.3°C, at an average rate of 0.28°C per decade.
- Some sources assert, "the past 10 years have been substantially warmer than the 1986 – 1999 average (about one standard deviation warmer)."
- According to the National Meteorological Agency, average countrywide annual rainfall trends remained more or less constant between 1951 and 2006. However, both seasonal and annual rainfall has exhibited high variability.
- Some studies indicate that certain rainfalls have been declining. Considerable declines in March-September rainfall were observed in northeast, southeast, and southwestern areas of Ethiopia after 1997.

Most climate change models over Ethiopia suggest little change or modest rainfall increases, although some models indicate increases and other decreases. A recent study concludes that there has been a tendency for main growing-season (belg) rainfall to decline. This decline in eastern African growing-season rainfall is linked to anthropogenic warming in the Indian Ocean. This link to global warming implies that these precipitation declines are likely to continue or intensify. If precipitation declines continue or intensify this will have devastating impacts on poor farmers and pastoralists. Poverty, water scarcity, and food insecurity will escalate.

KEY FINDINGS:

Understanding the science and people's perceptions

The belg drying pattern that some recent climate models show is alarming. The people interviewed for this study are worried because they depend on the rains. The data gathered from the local weather states across the four study sites doesn't show what farmers are experiencing. The decline in the small rainy season (belg) reported by the community members in is supported by rainfall data from one local weather station: Adamii Tulluu-Jido Kombolcha.

This lack of congruence between local rainfall data and people's perceptions is understandable. Farmers, for example, assess rainfall in relation to the needs of particular crops at particular times. Small changes in the quality, onset, and cessation of rain over days or even hours can make a big difference, whereas meteorological data is more likely to measure totals and larger changes. When combined with deforestation (which can increase local temperatures), soil erosion, population growth, economic development (or lack thereof), and illness, it can feel like the climate is getting worse because even small changes can have terrible impacts. Both meteorological data and people's perceptions may be simultaneously different and "right."

In the Adamii Tulluu-Jido Kombolcha woreda people reported less rainfall and when it comes, it does with great intensity. Based on climate data gathered from near the study area, the total number of rainfall days has decreased. But the magnitude of total annual rainfall is more or less the same. When the rain comes, it falls hard. Such rainfall leads to flooding without recharging ground water resources. It is devastating for agricultural production—beating down crops and sluicing away soil—and silts up riverbeds, leading to further floods. River flow hydrology and morphology data for rivers in the study area also supported the residents' perceptions.

Overall, small-scale farmers and pastoralists reported that the short and infrequent rainfall has negatively impacted crop production and food security, livestock, forestry, energy, water, and health. Women and girls in particular are disproportionately affected by climate variability. Their workloads increase, and they have fewer options to find other ways of making a living and recover from impacts.

Doing everything to cope

With some assistance from non-governmental organizations and the government, small-scale farmers and pastoralists are adopting a variety of context-specific coping mechanisms. In the farming areas, farmers shift to more drought tolerant crops and varieties, improve forest conversation and management practices, diversify energy sources, and seek alternative means of income from off-farm activities. One strategy in the pastoralist area, is dividing pasture into wet and dry season grazing

areas—an approach that people have always used to manage risk. Haymaking is a new, increasingly popular strategy which provides animal feed during the dry months. And for those that can afford to do so, changing herd composition from cattle to camels and goats, which can better tolerate dry, hot weather, is becoming more common. Other techniques include introducing grass species that are adaptable to harsher climates. Some practices such as removing children from school so they can search for fuel or cutting trees for fuel wood can increase the cycle of vulnerability by depleting assets even further.

Vulnerability has many faces

Not everyone is equally vulnerable. Vulnerability is not the same for different populations living under different environmental conditions and confronting different social, economic, political, and institutional challenges. Land size is key constraint. In Wansho, for example, the average land holding per family is only .5 ha. There, the vast majority of households surveyed do not have sufficient land to sustain them throughout the year. Although average holdings are slightly larger in the other agricultural woredas (.75 to 3 ha in Adamii Tulluu-Jido Kombolcha, for example), the lack of land is an important contributing factor to vulnerability for all farmers.

This study also suggests that pastoralists in Yabello woreda tend to be more vulnerable to climate change than farmers. Food insecurity—amounting to 51.3 percent of the population—is severe. The levels of illiteracy in this zone are higher than in the other study zones, with nearly 90 percent of respondents reporting they cannot read or write. The kebeles that were studies are quite isolated—more than 30 km from the nearest town and market. Thus, when the rains don't come, or come too early or too late, it can spell disaster to the most important asset of pastoralists: their livestock. Loss of livestock exacerbates vulnerability to subsequent disasters. But even here some households are affected more than others: women-headed poorer households without large numbers of livestock; large households; and poorer households without cash reserves or savings.

Resilience is about putting people at the centre of adaptation

Poverty, limited resources (such as land and livestock), lack of alternative sources of income and livelihoods, lack of knowledge and expertise, and a lack of appropriate public policies and financing, increase vulnerability and decrease people's capacity to cope. What is required are holistic approaches to build people's resilience. Resilience is about being able to bounce back from a shock. It's about having the opportunities to shift strategies quickly as the need arises. In the woredas studied, people have few assets and even fewer opportunities to make swift adjustments for the better. Small landholdings, limited access to health and education services, poor credit, and a lack of access to information, markets, and productive technologies all hinder poor farmers and pastoralists, particularly women, from exercising options that would increase their resiliency.

Recommendations:

Based on the study, Oxfam recommends that the international community and Ethiopian government take the following actions.

At the National Level

- Invest in climate research and disseminate information to increase awareness of climate change and its impacts. Strengthen cooperation among policymakers, nongovernmental organizations, research institutions, and the media.
- Increase meteorological station density and make climate information available in an accessible format to farmers and pastoralists through methods such as radio broadcasts and mobile phones.
- Invest in agricultural research on the use of new crop varieties and livestock species that are more tolerant to drought.
- Strengthen the capacity of policymakers and institutions to effectively use climate information for development planning and to make informed decisions that consider climate risk, change, and variability.
- Ensure civil society and community participation, especially women's groups, both in formulating climate change policies and in integrating climate change into development priorities. Ensure priorities and investments address the gendered impact of climate change.
- Building on the National Adaptation Program of Action (NAPA), which contains 11 proposals, prepare and implement a national framework for guiding climate change adaptation and mitigation. This framework should also be integrated with the Plan for Accelerated and Sustained Development to End Poverty (PASDEP). The current PASDEP for 2005/06 – 2009/10 mentions climate change in passing only twice. Since climate change negatively impacts poor people the most, the next strategic framework for 2011 – 2016 should invest in economic activities to make them more resilient to greater climate variability and change.
- Recognize pastoralism as a viable mode of production and way of life. Develop a land use policy in harmony with traditional land use systems.
- Provide seasonal precipitation forecasts as part of a revitalized extension package that includes access to basic agricultural technologies, such as plows, new crop varieties, and fertilizers, as well as access to information, improved market linkages, and credit and insurance schemes.
- Support agro-ecological practices for adaptation and mitigation.
- Diversify rural livelihoods through the promotion of non-agricultural sectors to reduce pressure on land and avoid further fragmentation of agricultural lands.
- Address environmental degradation by drawing on community-based experiences and mechanisms.
- Invest in social protection mechanisms to give vulnerable communities quick support in times of crisis. Connect these protection mechanisms to longer-term development actions.

At the Community Level

- Immediately invest in livelihood opportunities and risk management strategies for poor farmers and pastoralists, particularly women.
- Prepare long-term adaptation plans based on the sharing of best practices through community participation, civil society engagement, and the participation of academic and research institutions, with regular monitoring to identify promising practices for scaling up.
- Build on what farmers and pastoralists are already doing to adapt to climate variability and change. Investigate these practices further for their sustainability and impact on poverty and inequality, and potential for replication or enhancement.
- Invest in new forestation programs, reforestation, and sustainable management of the remaining forests. Ensure that management systems guarantee a return to the communities that manage the resource—the only way to ensure genuinely sustainable use of forests and woodland.
- Use agroforestry systems as an economically feasible adaptive strategy to protect crop plants from extremes in microclimate and soil moisture.
- Invest in community environmental and drought monitoring systems.
- Improve community disaster risk reduction capacity.
- Promote greater community exchanges on adaptation strategies so that communities can learn from each other. One such possible strategy is micro-insurance.
- Invest in appropriate small- and medium-scale infrastructure to store and serve water for production and consumption.
- Because biomass energy will constitute the lion's share of household energy in Ethiopia in the foreseeable future, expand the use of energy-efficient cooking stoves.
- Increase use of renewable energy such as solar energy. Promote photovoltaic technology.

In Particular, for Pastoralist Communities

- Support pastoralists, especially women, through more efficient service delivery such as improved livestock, market linkages, and livestock health services. Improve access to feed and water for both livestock production and household consumption.
- Invest in better disaster and conflict management practices to address recurrent drought and conflict.

Developed countries have the responsibility to help Ethiopia adapt to climate change. They need to reduce their emissions and provide substantial financial support for adaptation. For Ethiopia, development and eradicating poverty will be challenging unless it receives financial assistance to help its people adapt to climate change.

1. Introduction

"I don't know the reasons, but I know the climate is changing," Medhin Reda, a 45-year-old farmer eking a living for her family from two rain-fed fields in northern Ethiopia, said. "I don't really remember drought seasons as a child… The rain was good."[1] In a different community in central Ethiopia, Xache Garmao, a 51-year old herder, explains that although cattle used to feed on natural grass, such pastures are rare and hard to find now due to poor and erratic rainfall. He details, "rainfall has been gradually reducing to the extent where we only had rain for two days and it didn't even rain properly."[2] Atakilti Ambeye, a 64-year old farmer in northern Ethiopia, recounts that, "now we cannot even feed ourselves for four months with the amount we produce, let alone earn income from our harvest." He recalls, "lately we have experienced complete crop failure and I think that it is due to lack of sufficient rain at the appropriate time. The drought in the area has a peculiar pattern which is really daunting and hard to cope for an average farmer."[3] Abba Ayalew Tegene, an 83-year-old farmer in northern Ethiopia, worries, "What is scary is how fast things have been changing in the last 20 years. We used to be able to grow all kinds of crops, but when the rain started becoming short and unpredictable, we switched to potato that grows fast with less rain. We ate and sold that which helped for the last few years. This year, the rain was even shorter and the land refused to give us even potato – what are we to do?..."[4]

The words of farmers and pastoralists across Ethiopia give voice to their shared struggle to understand, cope with, and thrive in spite of greater climate variability. People who are already poor and marginalized are struggling with the added burden of climate variability, and it is likely that this variability will only increase. As established by the Intergovernmental Panel on Climate Change (IPCC) and other studies, climate change will continue to increase variability in weather patterns and make them more extreme.

Variability means that it is harder for families and communities to predict the ever-changing, inconsistent weather. For now, this means that the little that they have goes to dealing with the current unpredictable weather because their livelihoods are so dependent on it. Often this exposes them to a whole range of other shocks, such as illness, which makes them even more vulnerable. There is little left to plan for the future. Thus, communities are faced with simultaneously increasing risk, vulnerability, and climate variability. As Dama Boruu, a 42 year old mother of five living in central Ethiopia, explains, "We used hear about drought but nothing like what is happening nowadays, it has been occurring too frequently….When such occurrences happen, before if a household had more livestock than their neighbor they would share their cattle with them but unfortunately everyone is the same now, we are all in the same position."

Variability in Ethiopia is not new—its diverse agro-ecological zones have brought a dazzling variety of micro-climates, and corresponding weather patterns, and, as Dama Borru mentions, people have developed ways to respond successfully to these challenges. But now, in addition to the usual

struggles, poor Ethiopians are suffering the effects of climate change—both more variable climate and more extreme weather events. Women, men, families, and whole communities are struggling with how to understand this new variability, identify new patterns, and establish what resources they need to be able to move beyond reacting and coping to adapting to the new realities and being resilient. Policy makers, likewise, face the daunting challenge of how to refine policies, especially investments in and related to agriculture, to focus on poverty and vulnerability reduction in context of the new realities of climate change.

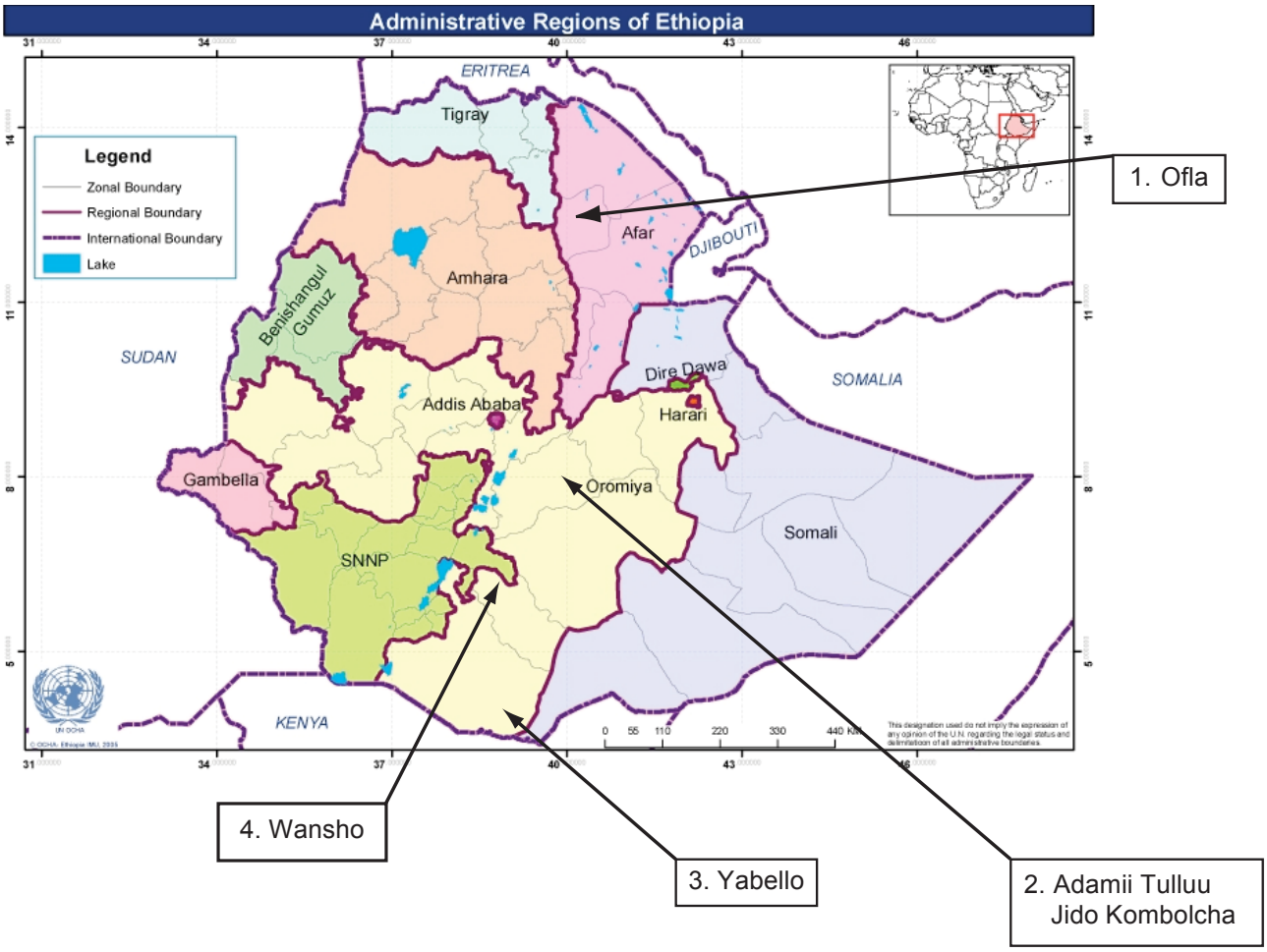
This report summarizes the findings of a study that set out to answer three fundamental questions. We felt these questions were critical to ask and answer in order to explore what it will take to reduce vulnerability and build resilience to climate variability and change:

1. Do Ethiopian farmers and pastoralists perceive changes in weather patterns? If so, what are they? What meteorological information is available in four particular study areas?
2. How have farmers and pastoralists been coping with and adapting to these changes in weather patterns?
3. What policy recommendations emerge from these specific case studies that will increase the resilience of poor men and women in Ethiopia?

Research was conducted in four administrative areas, or woredas. Each woreda had distinct rainfall patterns and variable land use systems. The land use systems and woredas constituting the foci of the study included (see Table 1 for more details about the woredas and Figure 1 for woreda locations):

- Highland mixed farming (Ofla Woreda in Tigray National Regional State)
- Rift Valley mixed farming (Adamii Tulluu-Jido Kombolcha Woreda in Oromia National Regional State)
- Pastoralism (Yabello Woreda in Oromia National Regional State)
- Coffee farming (Wansho Woreda in Southern Nations, Nationalities and People's Regional State (SNNPR))

Figure 1: Map of four study sites



Source: OCHA Reference Map modified by Oxfam[5]

The methodology was both qualitative and quantitative, consisting of in-depth interviews, focus group discussions, household surveys, and analysis of rainfall data from meteorological stations. In each of the four study sites, household surveys were conducted in two kebeles (wards or neighborhoods which are the smallest administrative units in Ethiopia) of 30-35 people. A total of 260 households were surveyed using a questionnaire. Researchers used a stratified random sampling to select male and female-headed households. The field component took place between November and December 2008.

Table 1: Descriptions of study sites

Woreda	Kebele(s)	Location	Elevation (meters above sea level)	Type of climate/ terrain	Population	Land use	Average temperature (ºC)	Average rainfall (mm)
1. Ofla	Sofia Zata	Southern Tigray, 605 km north of Addis Ababa.	2500	semi-arid, temperate	144,641 (49% male, 51% female)	Mixed farming (crop production and livestock rearing)	220C	800mm
2. Adamii Tulluu-Jido Kombolcha	Abinee Garmaamaa Warjaa Washguulaa	Oromia, 160 km from Addis Ababa	1500-2300	semi-arid/ dry, hills and lakes	159,159 (56% male, 44% female)	Mixed farming (crop production and livestock rearing)	19-300C	650-750 mm
3. Yabello	Harawayu Hidiale	Oromia, about 590 km from Addis Ababa	1400-2200	semi-arid, dry and warm	48,690 (51% male, 49% female)	pastoral and agro-pastoral	14-280C.	400-500 mm
4. Wansho	Bokasso Ferro 2	Southern Nations, Nationalities and Peoples' Regional State, 310 km south of Addis Ababa	1800-2200	moist to sub-humid warm	87,769 (56% male, 44% female)	Coffee growing	16-26 0C	1100-1400 mm

Source: Data drawn from B & M Development Consultants PLC (2009).[6]

This paper is organized into five sections. The second section gives an overview of Ethiopia's agriculture sector and the reasons it is highly vulnerable to climatic variability. It also looks at current evidence of climate variability and change for Ethiopia as a whole, and in four particular administrative areas or woredas. The third section presents people's perceptions of climate variability and describes how they are currently coping and adapting. Here, we wanted to look at activities outside of the traditional community based practices such as idir (funeral associations), debo (labor exchange) and iqub (saving groups) to decipher policy implications. Section four analyzes the data presented in section three to draw out emerging lessons. Section five provides recommendations for policymakers to help build the resilience of smallholder farmers and pastoralists.

2. Context

2.1 Ethiopia and Climate Change

Ethiopia is vulnerable to climate variability and change because large segments of its population are poor, dependent on income opportunities that are highly sensitive to the weather, and have low access to education, information, technology, and health services. They have low adaptive capacity to deal with the consequences of climate variability and change. It is one of the poorest countries in the world, where 77.5 percent of the people live on less than two dollars a day and 46 percent of the total population is undernourished (see Box 1 for more information).[7] Eighty-five percent of the population depends on agriculture to make a living. The average number of Ethiopians requiring food aid is growing by more than half a million people per year. These chronic and increasing aid requirements may soon extend beyond the capacity of early warning systems.[8]

Box 1: Ethiopia country profile

Population:	**85 million**
Human Development Index ranking (2009):	**171/182**
Population living below $1.25/day (2000-2007):	**39%**
Population living below $2/day (2000-2007):	**77.5%**
GDP per capita (at Purchasing Power Parity) (2009 estimate):	**$900**
Life expectancy at birth:	**54.7**
Infant mortality rate per 1000 live births:	**80.8**
Fertility:	**5.4 births per woman**
Number of hospitals:	**143**
Literacy rate (age 15 and over can read and write):	**42.7%**
Arable land:	**10.1%**
Urban population:	**17%**
Terrain:	**high plateau with central mountain range divided by the Great Rift Valley**
Lowest point:	**Danakil Depression, -125 m**
Highest point:	**Ras Dejen, 4533 m**

Source: Data drawn from United Nations Human Development Report 2009,[9] CIA World Factbook,[10] Central Statistical Agency Ethiopia Demographic and Health Survey,[11] and the Earth Institute at Columbia University[12].

Ethiopian agriculture is smallholder and rainfall dependent; it makes use of traditional technologies. Eighty-seven percent of rural households work less than two hectares (ha) of land, and 64.5 percent of them cultivate less than one[13]. Households with relatively small farm size are generally poor in cash income and have low access to extension services, oxen, fertilizer, improved seeds, animal drugs and vaccines, improved breeds of livestock, water, and credit. Such households have few opportunities to take risks.

Ethiopia's economy depends heavily on agriculture and faces increasing population growth. Ethiopia's agricultural sector contributes 47 percent of the country's gross national product and more than 80 percent of its exports. It also employs about 80 percent of the country's population of more than 85 million people.

A huge constraint to agricultural productivity is land fertility. Soil erosion is a serious problem: every year, 1.5 billion metric tons of topsoil erodes from the highlands, which in turn causes an estimated potential loss of 1-1.5 million tons of grain.[14]

Rapid population growth, limited arable land, reliance on biomass for cooking, and a shortage of employment opportunities in the industrial and service sectors have increased pressure on the forest and land resources in Ethiopia, thus increasing land degradation through exploitation and misuse. Climate change is expected to manifest itself in the frequency and intensity of floods and droughts, as well as in variable temperature and rainfall. If rainfall is more intense and frequent, even more soil will be stripped from farmers' fields, resulting in the loss of valuable nutrients which will affect crop yield. Just one extreme climate event—drought, flood, unpredictable rain—can devastate a year's crop and impoverish a family, nullifying the hard-won gains of several successful past growing seasons. Even relatively small events during the growing season, like too much or too little rain at the wrong times, can spell disaster.

Hardest hit by the growing instability and unpredictability of climate are those people, particularly women, who rely on rain-fed agriculture and pastoralism. Such communities, already struggling to cope effectively with the impacts of current climatic variability and poverty, will face a daunting task in adapting to future climate change. Although the situation they face is grave, it is not hopeless. There are strategies and policies that, if adequately funded and resourced, can empower poor people to step out of poverty and achieve well-being.

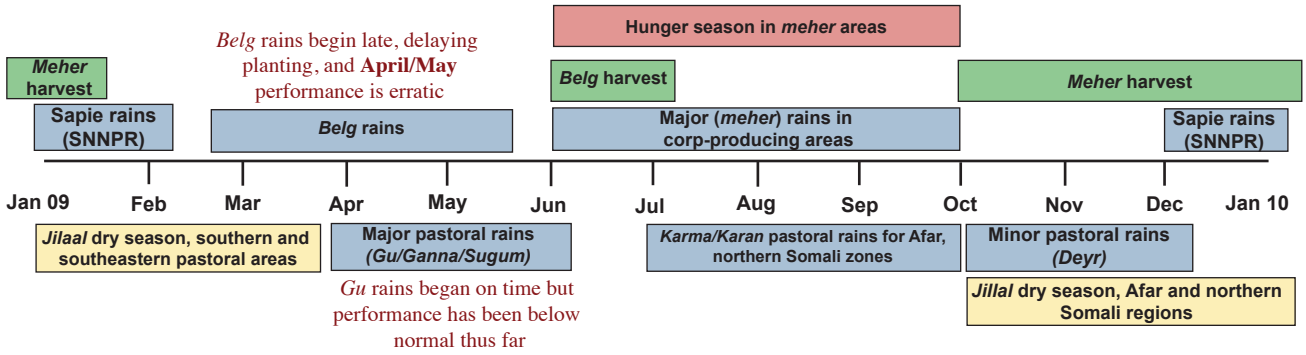
2.2 Ethiopia's Variable Climate

Ethiopia has diverse climates, ranging from semi-arid desert in the lowlands to humid and warm (temperate) in the southwest. Mean annual rainfall distribution ranges from a maximum of more than 2,000 mm over the Southwestern highlands to a minimum of less than 300 mm over the Southeastern and Northwestern lowlands. The mean annual temperature also varies widely, from lower than 15°C over the highlands to above 25°C in the lowlands. The three major climatic seasons in crop-producing areas are:

- The dry season (Bega) from October to January;
- The short rainy season (Belg) from February to May; and
- The long rainy season (Kiremt, also called Meher) from June to September.[15]

The names, and the start and end dates of the seasons vary between agricultural and pastoral areas, as indicated in Figure 2.

Figure 2: Seasonal calendar and critical events



Source: USAID/Famine Early Warning Systems Network (FEWSNET)[16]

Temperature

Several sources indicate that temperatures are rising:

- Between 1951 and 2006, the annual minimum temperature in Ethiopia increased by about 0.37°C every decade.[17]
- Between 1960 and 2006, the mean annual temperature increased by 1.3°C, at an average rate of 0.28°C per decade.[18]
- Some sources assert that "the past 10 years have been substantially warmer than the 1986 – 1999 average (about one standard deviation warmer)."[19]

Oxfam consulted with an expert from the National Meteorological Agency who analyzed the data collected from weather stations near the four study zones. The expert concluded that although maximum and some minimum temperatures have been increasing, the changes are not statistically significant.[20] However, people in the area report otherwise: they experience such variations as significant.

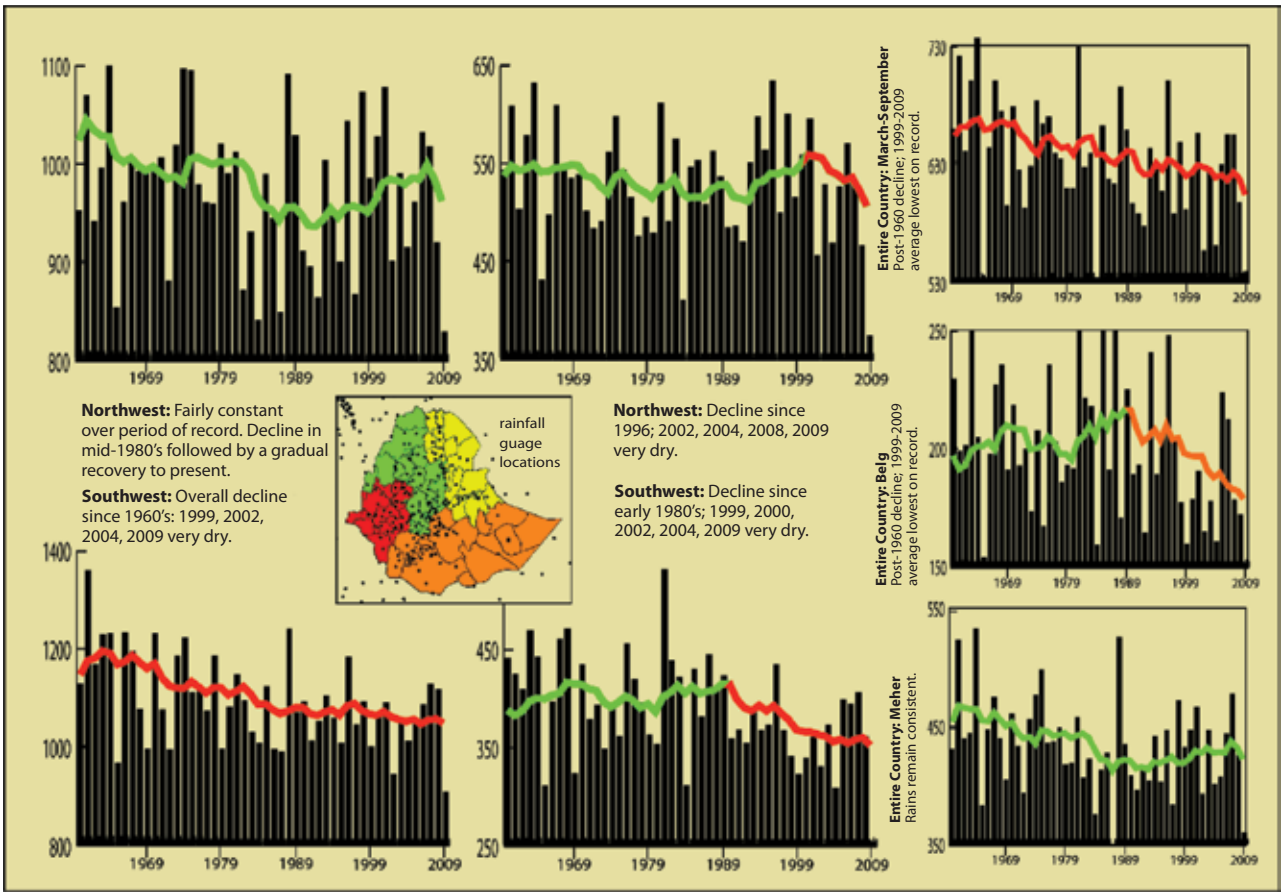
Rainfall

According to the National Meteorological Agency, average countrywide annual rainfall trends remained more or less constant between 1951 and 2006. However, both seasonal and annual rainfall has exhibited high variability. But some studies indicate that certain rainfalls have been declining. Considerable declines in March-September rainfall were observed in northeast, southeast, and southwestern areas of Ethiopia after 1997. In particular, rains have decreased during the belg (February-May) season. Belg rainfall in the east and southeast exhibit the largest percent reductions. Declines in belg rains may impact long cycle crop production with crippling consequences for agricultural production. One study characterizes the magnitude of these recent changes, especially in the belg as "dramatic" (see Figure 3).[21]

Declines in belg rains could have devastating consequences for agriculture because they are crucially important for:

- Growing belg crops in the central, southern and eastern areas;
- Seed-bed preparation for short and long-cycle meher crops;
- Planting of long-cycle cereal crops (Maize, Sorghum, Millet);
- Replenishment of pasture and drinking water for livestock in both crop dependent, pastoralist and agro-pastoralist areas;
- Formation and development of the inflorescence of coffee crop;
- Crop and livestock production in south and south-eastern parts of the country (for these areas the period from March to May is the main rainy season).[22]

Figure 3: National and regional March-September rainfall



Source: An updated (through 2009) rainfall analysis produced by FEWS NET USGS (C. Funk). This analysis includes a dense set of 1983-2008 gauge observations purchased from the Ethiopian Meteorology Agency. These data were screened for outliers and interpolated (please see Funk et al., 2005[23] and Verdin et al. 2005[24]) for details. More recent research linking these declines to a warming Indian Ocean can be found at Funk et al., 2008[25]

In the future, temperatures will continue to rise, but what will happen to rainfall is uncertain. Most climate change models over Ethiopia suggest little change or modest rainfall increases, although some models indicate increases and other decreases.[26] A recent study concludes that there has been a tendency for main growing-season (belg) rainfall to decline. This decline in eastern African growing-season rainfall is linked to anthropogenic warming in the Indian Ocean.[27] This link to global warming implies that these precipitation declines are likely to continue or intensify. If belg rains continue to decline, food insecurity will increase. Even now, the farmers and pastoralists who were interviewed for this report were having a hard time. They felt vulnerable to the small changes they were seeing with the weather. This is why it is so crucial to start now helping farmers and pastoralists to better adapt to the existing high climatic variability and prepare for climate change.

3. Perceptions of Changing Weather Patterns and Coping Mechanisms: Analyzing Four Woredas

3.1 Highland Mixed Farming Area—Ofla Woreda

Context

Mostly farmers live in the highly eroded mountainous terrain of Ofla woreda. The second most populous woreda in Tigray is characterized by high population pressure and food insecurity.

The kebele of Zata, only 40 km from the district capital and directly on a road, is the site of several development interventions. There, most households have access to electricity, telephones, and potable tap water. Almost all the farmers are within 10 km of a market, and about half the surveyed population is literate.

In contrast, the kebele of Sofia does not have outside development interventions and is more isolated. Households there do not have electricity, telephone access, or potable tap water. Only half of the farmers are within 10 km of a market; about one third of them are literate.[28]

The elders interviewed remembered that the area, once famous for its beef cattle and horses, has been subject to catastrophic cyclical droughts and famines over many generations. According to information from household surveys, women and children suffered the most from these events. In times of crisis, women tend to stay home with their children, while men move away to look for alternative means of survival.

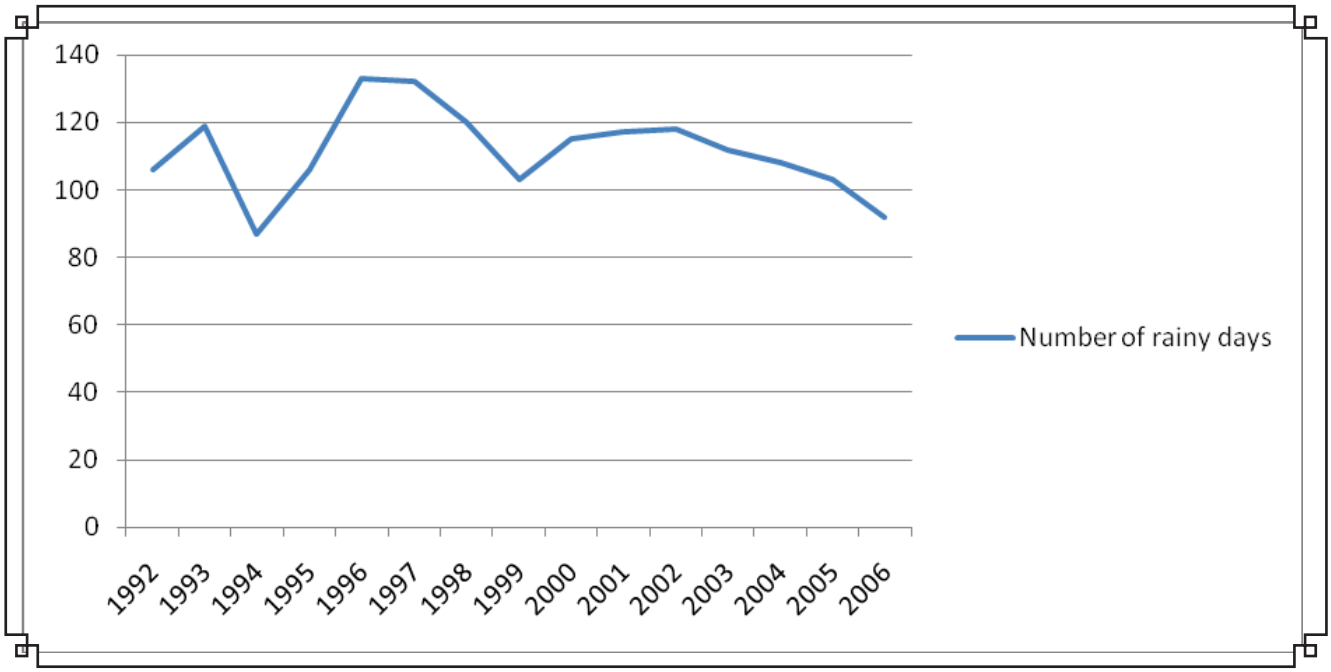
Table 2: Historical events of weather-related disasters in Ofla Woreda

Year	Weather-related disasters recalled by elders
1929	First remembered drought
1949	Excessive rain known as 'Beteko'
1959	Localized drought in the lower elevations: Raya, a woreda that borders Ofla, was severely stricken
1969-72	Widespread drought in Ofla; people went up to Wag to purchase survival food and straw for animals; infestation with newly introduced parasitic weed "akenchira" (Striga) that thrives under drought conditions
1982	Partial drought
1984	Heavy drought; widespread famine and death of people; Belg rains disappeared; consequently a major shift occurred in crops grown. Crops introduced were Bunign (a type of short-duration teff) and Weteko (a type of short-duration bean)
1987	Drought and mice infestation
1990	Rainfall fluctuation—rain as late as mid-July instead of early June
2001	Catastrophic drought
2003	Late start of the main rains 'Meher' accompanied by hail storm; crop yield decreased by 50%
2007	Early cessation of rain in 'Pagumen' (the period around early September) causing crop damage; then, abnormal rainfall in September-October damaging the remaining crop stand and causing considerable yield reduction or crop failure

Source: B & M Development Consultants PLC (2009).[29]

When the number of rainy days were analyzed, high variability was apparent but no major trend was observed (see Figure 4). A day was counted as a rainy day if more than 0.1mm rainfall were recorded within a day.

Figure 4: Number of rainy days in highland mixed farming area (Korem station)



Source: Graph prepared by author based on data from the National Meteorological Agency submitted by B & M Consultants PLC.

Impact of Climate Variability

- *Crop production*—In Ofla, small farmers grow crops on roughly 0.5 ha of land. But households generally need two hectares to sustain their families all year through their own agricultural production. Accordingly, such small landholdings are already highly vulnerable: what they have is not sufficient even in good times.

  Furthermore, the small farmers in Ofla are particularly vulnerable because they have not diversified into cash crops. They grow subsistence crops, and their yield is declining. In a normal season, the average yield of wheat, sorghum, barley, fava beans, and field peas can be as high as 20 qt/ha. But yields have declined. Elderly women informants indicated that yields have diminished so much that women do not need to take their grains to the flourmills anymore. Since the quantities are small, they grind it manually, increasing their domestic workload. Ninety percent of households interviewed reported that when there were crop failures, women-headed households were the first and the hardest hit since they lacked financial resources and other assets to replace the failed crops as a source of food.

- *Livestock*—Ofla residents also raise cattle and goats. But those animals now have to walk longer distances since the streams and water holes are reported to be drying up. During severe drought periods, the cattle stock may be wiped out, compounding food scarcity. Ninety percent of informants indicated that children, who depend most on dairy products, suffer the most when severe droughts kill livestock. Beyond children, women are most severely affected, particularly those who are breast-feeding. Women also value dairy products because they can make butter. They sell this butter or use it to cure "dry scalp," believed to be caused by a shortage of fat. When livestock did not produce enough milk to make butter during poor rainfall seasons, women recalled suffering from headaches due to "dry scalp."

- *Forestry*—All elderly residents interviewed said that forest resources have been extremely degraded. They attribute this mainly to firewood collection, logging, and agricultural expansion. There has been so much deforestation they explained, that "nowadays big trees and big (elderly) people do not exist." Researchers were unable to find any old indigenous trees in the study area—only patchy bushes and some forest. The forest can no longer provide fuel and construction material as it did in the past.

  Respondents explained that this degradation has impacted both men and women's chores.

  - Traditionally, the forest provides women with firewood, which they sell in urban areas or use for household animal fodder and traditional medicine. Women reported having to travel longer distances to access these resources; they spend more than 10 hours each week collecting firewood.

  - While men still use the forest for construction materials, degradation means it is becoming necessary to purchase these materials instead. However, most residents of the study area cannot afford to do so.

- *Energy*— The scarcity of firewood has forced people to change their traditional source of fuel from firewood to crop residues, especially maize stalk, sorghum stalk, and cattle dung. The availability of these fuel sources fluctuates with the rainfall. When rainfall is less predictable, fuel sources can be less reliable. Whatever is obtained is prioritized for firewood. When cattle dung is used as fuel for cooking rather than returned to the soil, this has negative consequences for soil fertility. Furthermore, informants reported that shortages of firewood forced them to pull their children out of school so they could search for biomass fuel instead.

- *Water*—Elders told Oxfam that the volume of perennial streams has decreased from what they remembered from their childhoods. For example, they observed that the Tirare River, near Zata kebele, has a lower volume now than it did a few decades ago. They reported that seasonal

streams dry earlier than they have in the past. In addition, some waterholes that once served people and animals have dried up entirely. Within the last two decades, both Lake Alemaya and Lake Sefi Degoa have ceased to provide water.

- *Health*—Climate variability is a factor in initiating malaria epidemics in the highlands of Ethiopia.[30] Despite the government's spraying campaign, which combats the mosquitoes that transmit the disease, seasonal malaria is a problem in Ofla. Since people are already chronically undernourished, their immune systems are weaker, so they are more susceptible to disease. Women tend to bear the burden of taking care of family members with malaria and often diminish their own food intake to feed their children during times of drought and food scarcity.

Ways of Dealing with Climate Variability

To cope with some of the negative events detailed above, the people of Ofla are turning to new ways of managing risk.

Picture 1: Women selling fresh-cut tena-adam to local dealers

Credit: B&M Development Consultants PLC.

- *Modifying farming techniques*—About 80 percent of the farmers in Ofla are modifying their way of farming to cope with erratic rain and drought. To increase crop production, they are adopting new, improved varieties of crops adapted to moisture-deficit conditions. They have also diversified into high-value crops like spices and cosmetic plants. The spice "tena-adam," for example, grows in infertile, moisture-deficit soils with little management. These cash crops fetch higher prices at city markets in Mekele and Addis Ababa. Farmers then use the money from cash crops to buy food. In addition to exploring new crops, some farmers are using manual or diesel-powered water pumps to expand irrigated farming.

- *Diversifying livelihoods*—Beyond farming, villagers are also raising small ruminants and chickens, as well as keeping bees to compensate for dwindling livestock. Farmers use credit given by the Dedebit Micro Finance Institute to buy the beehives, which are supplied by the Ministry of Agriculture.

  There is also a shift in animal husbandry: from an open grazing system to tethered feeding with collected and conserved crop residues. This practice is a response to the diminishing grazing resource due to both climate extremes and man-made environmental degradation.

Since 2001, an NGO has been helping farmers in the more accessible kebeles of Ofla to restock livestock lost due to droughts by using a "revolving fund" approach. First, a needy household buys sheep on credit. Then, when those sheep reproduce, the farmers give the first offspring to another household to pay for the incurred debt. Those households then continue the cycle. In this way, farmers in a specific community build up their livestock quickly.

- *Undertaking forest conservation/management practices*—To address deforestation, the government has introduced several new practices, including agro-forestry and forest conservation. Community forests with native and naturalized tree species on controlled sites have reached harvest stage. These forests have benefited both men and women during times of food shortage. Under local bylaws, men tap the woodlots for construction materials. Meanwhile, women use the forest for survival food, animal fodder, traditional medicine, and firewood, which they also collect and sell to earn cash and buy survival food for their households.

- *Diversifying energy sources*—To address the lack of adequate energy, regional government departments responsible for biomass resource development and modern energy expansion are undertaking projects in the two kebeles. The Woreda Mining and Energy Bureau, with financial assistance from various international NGOs, introduced biogas plants, solar energy, and improved cooking stoves on credit or at subsidized prices. The Bureau also demarcated degraded areas for reforestation programs. This has multiple benefits in terms of ecological conservation and energy supply.

3.2 Rift Valley Mixed Farming Area— Adamii Tulluu-Jido Kombolcha Woreda

Context

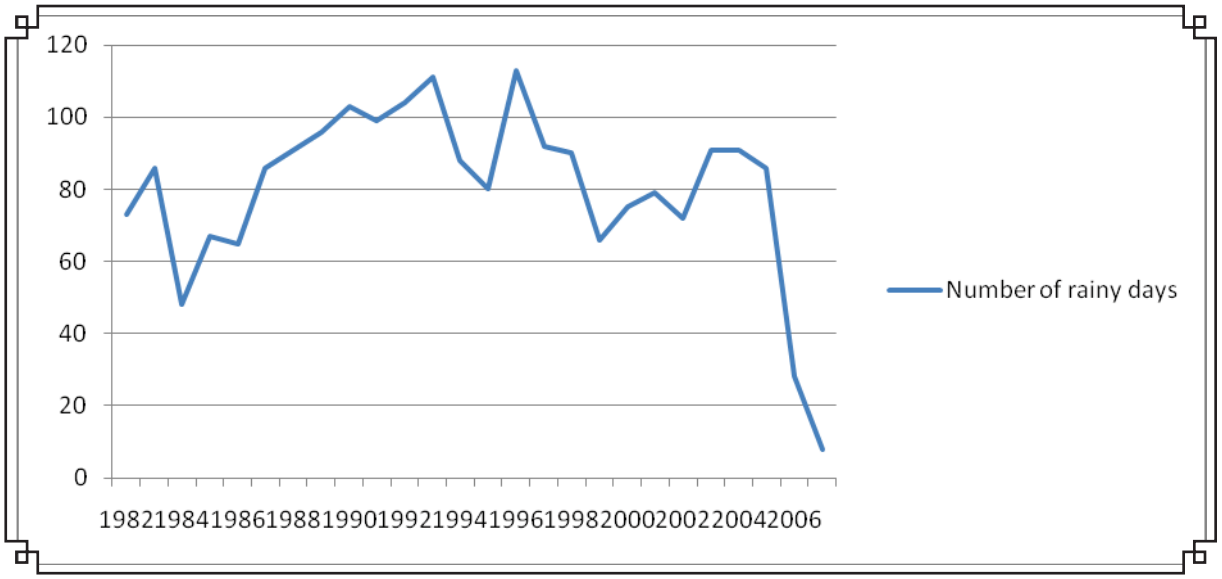
In Adamii Tulluu-Jido Kombolcha, the population is predominantly sedentary and agro-pastoral. Mixed farming is both the main economic activity and food source for most of the population. Residents reported that crop production began to be adopted widely in the 1950s; before that, livestock and honey were the major livelihoods. Major crops grown include maize, haricot bean, teff, and sorghum. Petty trade, fishing, and working at nearby commercial farms are supplementary ways that a few of the community members generate income.

About 60 percent of those interviewed indicated they could not read or write. Slightly over half of interviewees said they lived within 3 km walking distance of the Baatuu town/market center. Roads bisect most of the kebeles in this woreda, and its people have actively developed interventions such as micro-irrigation, water provision and conservation, and improved farming practices. There is limited access to potable water and electricity. And the only hospital is private, though there are lower-level government-run clinics and posts that are less expensive and staffed mainly by extension workers. In the past three decades, the hills have become bare as the forest has been destroyed for crops, charcoal making, and pit-sawing for locally made lumber. As a result, the woody biomass resource

in the Rift Valley area is highly depleted. The area has suffered a great deal of environmental degradation, desertification, and frequent crop failure. The heavy and direct reliance on natural resources, agriculture and pastoralism, as well as the lack of suitable options to cope with and adapt to climate shocks and changes in weather patterns are creating new risks.

Based on climate data gathered from near the study area, the total number of rainfall days has decreased. In 2007, for example, there were only eight rainy days. In 1982, there were 73 rainy days—a decrease of 81.3 percent. Of the four woredas studied, this was where people's perceptions were clearly backed up by meteorological data. Figure 5 demonstrates the decline in rainy days in this area.

Figure 5: Number of rainy days in Rift Valley Mixed farming zone (Baatuu station)



Source: Graph prepared by author based on data from the National Meteorological Agency submitted by B & M Consultants PLC.

Even though there are fewer rainy days, the magnitude of total annual rainfall is more or less the same. This reinforces what farmers say about the rain: when it comes, it does so with great intensity. Such rainfall leads to flooding without recharging ground water resources. It affects agricultural production—beating down crops and sluicing away soil—and silts up riverbeds, leading to further floods. River flow hydrology and morphology data for rivers in the study area also supported the residents' perceptions. Finally, for this woreda, time series analysis of rainfall showed that the belg rains had a 10 percent decrease over the past 10 years (about a -0.5 to -0.7 standard deviation decline).

Impact of Climate Variability

Normally, this woreda experiences two rainy seasons per year. However, residents interviewed said that the rainfall pattern in the last three to four decades has become highly variable and erratic in terms of amount and distribution. The rainfall, when it occurs, is usually heavy and often causes floods, with hailstorms and/or windstorms. They reported that the short rainy Belg season has failed repeatedly in the past 20 years; farmers have had to wait up to 10 months in recent years to see a drop of rain. They also said that most months of a year are dry even during the main Kiremt rainy season. This ruins livelihoods and destroys families, as Sefya Funge tells us (Box 2).

Box 2: "The biggest change is the rain doesn't come on time any more."

Sefya Funge, 38, Adamii Tulluu-Jido Kombolcha

My name is Sefya Funge. I am 38 years old. I have eight children, six girls and two boys. I live in the Adamii Tulluu-Jido Kombolcha woreda. My husband and I make a living as farmers. When the rain comes, we grow and sell crops. That is how we make a living. On our farms we grow maize, wheat, barley, and teff.

The biggest change is the rain doesn't come on time any more. The rain used to come regularly, and we were able to plant and harvest on time. However, since 1984-1985, the rain has become quite erratic. Sometimes it rains and sometimes it doesn't. After we plant, the rain stops just as our crops start to grow. And it begins to rain after the crops have already been ruined.

The change in climate is completely crazy. The change happened very gradually. After progressively getting worse each year, this year, it has completely ruined all our crops. The change in climate has impacted my cattle, too. I used to have 54 heads of cattle. But due to the change in climate, they couldn't get enough grass to feed on. Since Lake Abjatta has receded, there is no grazing land by the shore. Because of lack of feed and water, most of my cattle have died. The few that survived had to be sold so that we could buy food to live on.

The change in climate has ruined our livelihoods in many ways. Right now we make ends meet by renting out our land to those who have money and who can irrigate the land. Then we end up working on our lands as day laborers for the man who rented the land. Before the weather changed, it was unheard of to rent out one's own land. We worked on our own land and lived off the fruits of our labor.

As I no longer have the means to support my family, only three of my eight kids are still with me. Since I didn't have the means to educate them, I was forced to distribute them to relatives. It has been five or six years since I have been separated from my children. The fact that they live somewhere else is very hard for me. No one gives up his children voluntarily. I keep expecting a phone call that tells me that my children are dead or something like that. It makes me wish that I was never born. Losing our assets was bad, but the fact that our family is separated now is devastating.

Picture credit: Zeresenay Berhane Mehari

Produced by: Mango Production PLC

- *Crop production*—Average landholding per household in Adamii Tulluu-Jido Kombolcha is about 1.5 ha. According to the residents Oxfam interviewed, the amount of rainfall received generally does not cover the whole growing period of some crops. Short but intense precipitation has led to flooding and soil erosion, while the late onset and early cessation of rain has caused crop failures. A full 72 percent of the interviewed households said they cannot produce sufficient food to sustain their families year round.

- *Livestock*—The short and irregular rains negatively affect grazing pastures. With less pasture, livestock herd size and productivity diminish. Water shortages also mean that families have to spend more time traveling longer distances to get water for their livestock.

- *Forestry*—In addition to other sources of income, residents rely on the forest resources for their livelihoods. They sell firewood, make charcoal, and use the forest for food and fodder. The scanty rainfall and poor recharging of the underground water in the area have hit regeneration of the vegetation cover and contributed to the depletion of forest resources. This means that women and girls walk farther and spend more time looking for firewood.

- *Energy*—Historically, this area was the main source of woody biomass fuels for the major urban centers including Addis Ababa. At present, woody biomass is highly depleted due to illegal charcoal production. The energy resource at the two kebeles studied has been seriously affected by recurrent drought and other related factors; resulting in a critical energy deficit. At the household level, residents report a decrease in the adequacy and availability of all biomass fuels in the past 20 years. The respondents attributed this to drought and abnormal rainfall distribution as well as charcoal making and fuel wood production.

- *Water*—Seventy-one percent of the interviewed households said that the potable water supply from traditional water sources such as ponds and shallow ground water sources has been declining in the past 20 years. Half of the interviewees believed that the decline was due to drought and floods. The respondents also indicated that school children, especially girls, are taken out of school during droughts to help their mothers at home, especially to fetch water from distant sources. In addition, 21 percent of the respondents said that their animals had died due to lack of, or reduction in, the quantity of water during droughts.

  The changes in water reported by informants are confirmed by meteorological and hydrological data: shallow ground water tables have dropped, which means that ponds and hand-dug water wells with hand-pumps dry up. People in the community depend on these shallow wells for domestic water supply and animal watering. People now travel 15 – 36 km in search of water for domestic consumption. Searching for water for animals to drink can take up to half a day, and time spent doing this takes time away from engaging in productive activities. It also means children are taken out of school to look for water instead of studying.

- *Health*—Changes in temperature and erratic rainfalls are resulting in lower crop yields, and hence less food to eat. In Adamii Tulluu-Jido Kombolcha, informants reported that the first cause of mortality in children under five was malaria, while diarrhea due to scarcity of potable water was the second. Malaria remained the first cause of morbidity among those who attended outpatient clinics/hospitals in 2007/2008, many of whom traveled long distances to get treatment. Following the occasional erratic rainfall and flooding, malaria and other infectious diseases increased in both the kebeles, especially among children and pregnant women.

Ways of Dealing with Climate Variability

Community members manage the risks presented by climate variability and other factors in a variety of ways.

- *Diversifying livelihoods*—A few community members generate income through off-farm activities like petty trading, fishing, and seasonal work in nearby commercial farms.

  To cope with the decline in livestock, people are turning to beekeeping, changing to drought-tolerant livestock breeds, collecting and purchasing feed, and using hay as well as crop residues as alternative feed for livestock (especially during dry seasons). At times of feed and water shortage, some household members—usually adult men—migrate temporarily with their cattle to places with available feed and water.

- *Undertaking forest conservation/management practices*—In response to deforestation, residents, with the assistance of environmental organizations, have intensified their efforts to protect the remaining woodlands. Residents are encouraged to:
  - Reduce and gradually abandon charcoal making;
  - Use energy-saving stoves (in the Warjaa Washguulaa kebele);
  - Increase the productivity of land that is already under crop production rather than expanding to virgin land;
  - Make compost;
  - Prepare fodder; and
  - Adopt agro-forestry practices such as planting multi-purpose trees (in the Abinee Garmaamaa kebele).

3.3 Pastoral and Agro-Pastoral Area—Yabello Woreda

Context

It is estimated that about 15 percent of Ethiopia's population are pastoralists.[31] In Yabello woreda, Harawayu kebele is inhabited by pastoralists and Hidiale kebele by agro-pastoralists. Of the total land in the woreda:

- 53 percent is grazing area for livestock, including cattle, goats, and sheep;
- 27 percent is bush;
- 11 percent is arable, of which a mere 2.2 percent is cultivated; and
- 7 percent is forest.[32]

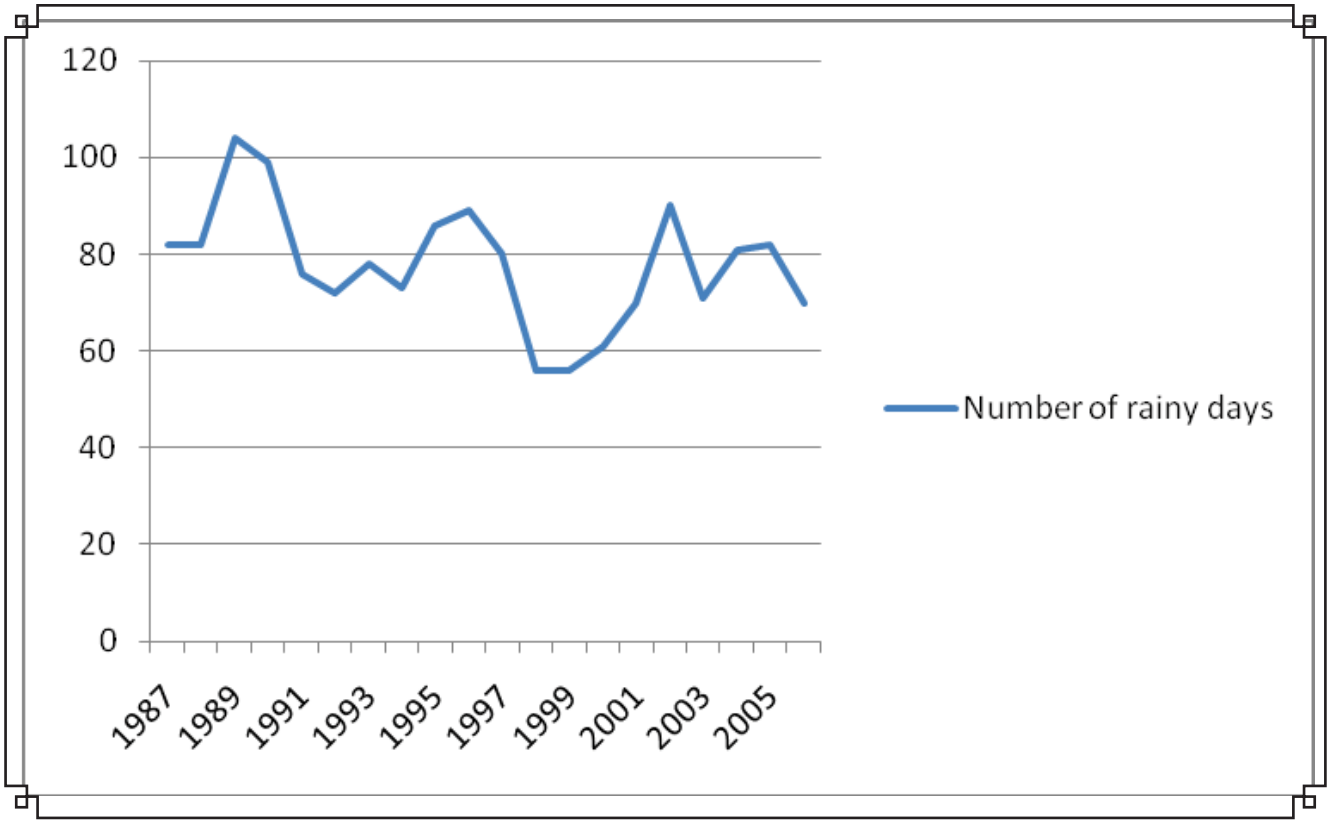
Food insecurity—present in 51.3 percent of the population of Yabello woreda—is severe. Of the 8,223 food insecure households, 19.3 percent are female-headed households. In Harawayu kebele, 300 households are food insecure. In Hidiale kebele, 434 households are food insecure.

The levels of illiteracy in this zone are higher than in the other study zones, with nearly 90 percent of respondents reporting they cannot read or write. Both kebeles are quite isolated—more than 30 km from the nearest town and market.

Residents recalled droughts in 1972 – 1974, 1984 – 1985, 1999 – 2000, and 2002 – 2003. A more recent drought in 2007 resulted in the loss of thousands of livestock. The two normal rain seasons have changed. Residents claimed that under normal conditions, Ganna (long rains) season is from March to April, while Hagaya (short rains) is from mid-September to mid-October. Now, no one knows when the rains come, and when they do, they are very short.

Figure 6 presents rainfall data at a Yabello meteorology station from 1987 to 2005. The number of rainy days shows high variation and a slight downward trend.

Figure 6: Number of rainy days in agro-pastoralist area (Yabello station)



Source: Graph prepared by author based on data from the National Meteorological Agency submitted by B & M Consultants PLC.

Here, time series analysis of rainfall revealed that kiremt rains were hit hard (~10 percent reductions), which is about a -0.5 to -0.7 standard deviation decline.

Impact of Climate Variability

- *Crop production*—Residents of Harawayu kebele are pastoralists who depend entirely on livestock husbandry to make a living. The households in Hidiale kebele are agro-pastoralists, growing crops and raising livestock. None of the respondents Oxfam interviewed could rely on their own production to feed their families, because their yields are insufficient. Residents indicated that most households did not get any harvest during the past three years due to rain shortages and subsequent crop failures.

  Females tend to suffer the most: with declining yields, their workload increases while their access to food decreases. Lack of manpower is a critical problem for female heads of households without sons. Twenty-nine percent of the households in Yabello are female-headed; of these, 28 percent are food insecure due to shortage of labor.

- *Livestock*—Pastoralists encounter enormous losses of livestock when food or water are insufficient. This tends to happen during the dry season, during which time pastoralists often migrate to cope. From December to February, men will trek with their herds looking for food and water. Distances covered can range from 18 to 80 km. Women and children are left behind to fend for themselves.
  Loss of livestock exacerbates vulnerability to subsequent disasters, but some households are affected more than others: women-headed poorer households without large numbers of livestock; large households; and poorer households without cash reserves or savings.

- *Forestry*—Informants reported that forest area has increased over the last 20 years with the expansion of acacia trees, which don't require much moisture to germinate and grow. This is a mixed blessing. Acacias have led to a decline in grazing area, because they grow quickly and their canopies suppress the growth of grasses. Yet, they help to:
  - Maintain soil fertility, since they are nitrogen fixers;
  - Act as a windbreak:
  - Provide wood for fuel and construction; and
  - Fight erosion by making the soil better able to absorb water during the rainy season.

  As in other areas, forests are important sources of food here (the research team saw schoolchildren collecting and eating wild foods at lunchtime), especially during times of drought.

- *Energy*—Residents of Harawayu and Hidiale depend on fuel wood collected from forest and bush land. Dung usage is low because it is not available in the required amounts and many don't like it because of its aroma and the undesirable taste it gives to food. In both kebeles, people felt there was greater availability in the supply of energy. There is some tree planting for firewood occurring.

- *Water*—Yabello woreda faces a severe water crisis. It lacks potential sources of underground and surface water. There are no perennial rivers, and the rains are short. The seasonal ponds cannot hold enough water for residents and their livestock for the entire year. Villagers indicated that drought has become more frequent in the past 5 – 10 years. Almost everyone interviewed said that declining water sources led to hardship, and all respondents indicated that adult females were affected most since they were forced to travel long distances to get water. They reported that children were unable to maintain their personal hygiene, and most respondents (77 percent in Harawayu and 97 percent in Hidiale) said fetching water from long distances is one reason why children drop out of school.

  There is a significant difference between the two kebeles in their access to adequate water supply for livestock. Harawayu kebele has a water supply scheme built by Action For Development (AFD) with support from Oxfam. Opinion is almost unanimous that the water supply for livestock

has increased in the past 10 years because of the project. In Hidiale kebele, on the other hand, most interviewees said water for livestock has declined over the last 15 – 20 years.

- *Health*—Food and water shortages create favorable conditions for disease outbreaks such as acute watery diarrhea. But, these conditions can be tackled with appropriate public policies. For example, people in Harawayu report a decline in malaria during the past five years due to the government's malaria control program, which sprays mosquitoes. On the other hand, in Hidiale kebele, half of the respondents said that malaria has increased in the last decade.

Ways of Dealing with Climate Variability

- *Migrating*—The most commonly reported response mechanism to drought was migration. Two thirds of the informants believed that temporary migration, despite its hardships, was an effective response, and indeed, the only option because of the lack of opportunities.

- *Conserving water and feed*—During rainy seasons, residents dig shallow ponds to collect rainwater; during drier seasons, they keep deep wells to overcome water shortages. Pastoralists continue a traditional practice of delineating, fencing, and scheduling pasture land into wet and dry season grazing areas. This is a way to overcome dry season feed shortage, as is hay making. Nowadays, a growing number of households, especially women, make hay and pile and store it at home to feed animals during the dry months. Those who can afford it—about a third of Harawayu and Hidiale respondents—purchase feed from other places and preserve it to overcome dry season shortages.

- *Modifying farming techniques*—In Hidiale, farmers are using early maturing and drought tolerant crops. More experimentation needs to happen: to date these crops have not performed well. Multi-purpose seedlings have also failed because of germination problems.

- *Undertaking forest conservation/management practices*—In the past 5 – 10 years, NGOs and government agencies have worked with communities to conserve forests and to introduce tree species adapted to arid and semi-arid conditions. In both kebeles, residents are participating in forest conservation. Some poorer households with few options are collecting and selling fragrant woods to generate income.

- *Modifying pastoralist practices*—Some households have changed herd composition from cattle to camels and goats. But poorer households cannot afford to replace cattle with camels, as the latter are more expensive than the former. Making the switch to camels also requires markets where cattle can be sold. That said, during times of drought, cattle fetch very low prices due to their weak body condition.

The Pastoral and Rural Development office is doing trials of new grass species like Lucenia, Saspania, Elephant, and Rhodes grass. Pastoralists are also being trained to use crop residues as animal feed; as a result, they have started harvesting and preserving crop residues for dry season feeding. Apart from training, the Pastoral and Rural Development office has provided livestock feed during times of drought, helping to save thousands of livestock during the 2007/2008 drought.

Finally, when raising livestock fails, some pastoralists are turning to farming.

Box 3: "These problems forced us to become involved in farming; before then, cultivation was unknown."

Dub Doyo, 57, Dhungoo

Dub Doyo is a 57-year-old pastoralist resident of Dhungoo village. Dub and his two wives and 17 children used to move from area to area in search of good grazing and enough water for their significant herds of cattle. Since the late 1980s, rainfall has steadily decreased leading to prolonged droughts and severe water scarcity. The cattle are dying. Fourteen years ago, Dub was a rich man with more than 600 cattle. The number has dropped to only 23.

"These problems forced us to become involved in farming," Dub says. "Before then, cultivation was unknown." Dub hopes to expand his farm plot, but the unpredictable weather patterns darken his hopes and ambition. "Crop cultivation is also nothing without appropriate rain," he says.

The milk the community gets from their cattle also helps to feed families. Now that milk is in short supply, and many are going hungry. Poor nutrition resulting from the lack of milk and animal meat and inadequate crop yields make Dub and his family more vulnerable to sickness and disease. Dub's wife Bora explains,
"Mostly, I feed my babies tea with sugar. They are not strong enough. They are weak and vulnerable to disease," she says. "Even for me, it is difficult to feed my baby with breast milk unless I can get enough food." With nutrition poor and people weak, colds, diarrhea and malaria have become common in the area.

In the past, there was plenty of ground water close to the surface, which people could rely on during the dry season when forest streams dried up. Now, they report some of the water sources have dried up, and the water table seems to have dropped significantly, too. The scarcity of water has a huge impact on Bora's life too. She spends seven hours each day fetching water, carrying 25-liter jerry cans on her back, along with her 27-month-old baby.

The decreasing access to water and grazing areas are provoking conflicts between neighboring clans, as they compete for these natural resources. Dub says they can no longer travel from the lowlands to the "cold area"—the higher land—in the dry season. "The route that we take to travel between these places has been given to the Somalis," he explains. "During the last worst drought in 2005, more than 300 people were killed in conflicts over water and land, and thousands of our cattle were stolen."

Credit: Argaw Ashine

3.4 Coffee Growing Area—Wansho Woreda

Context

Wansho woreda, in the southwestern part of the country in the SNNPR, is a coffee growing area. About two thirds of the respondents reported having access to extension services, 78.9 percent to health facilities, and half to water. Here, more than half the people interviewed live on less than 0.5 ha, and only 5.6 percent own more than two hectares.

In Wansho woreda, the two kebeles studied were Bokasso and Ferro 2. Bokasso kebele covers 880 hectares of land and has a total population of 7,710 people. Ferro 2 covers 880 hectares of land with a population of 6,387. Both kebeles are organized into two distinct cooperatives to facilitate coffee production and marketing. There is a shortage of credit and saving facilities and market input suppliers.

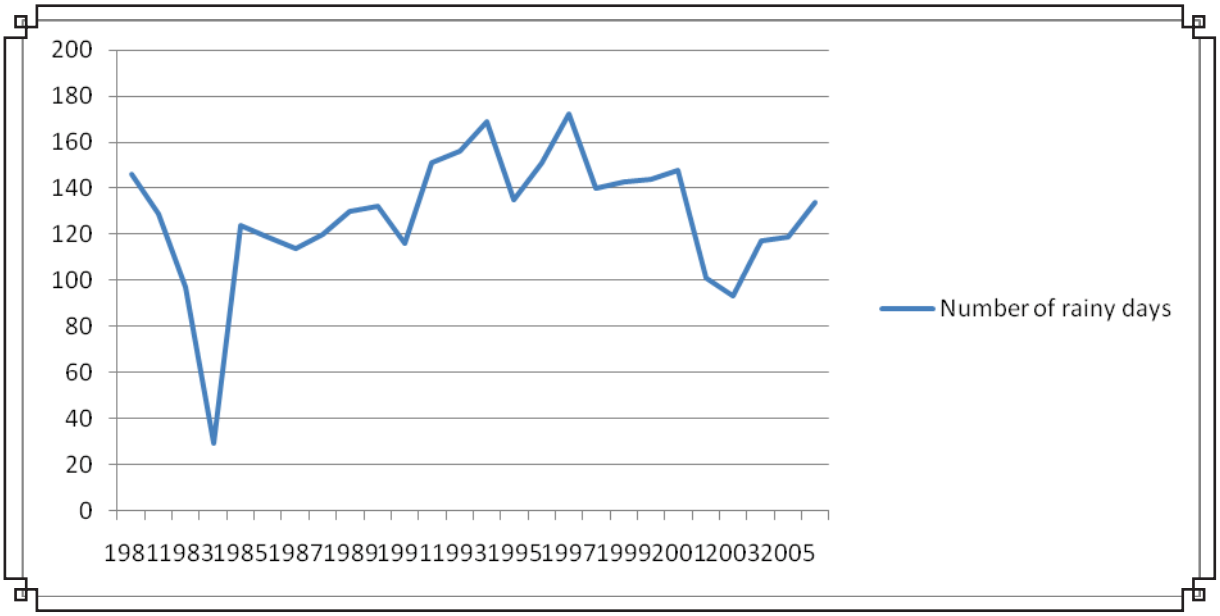
Among the three agricultural woredas covered for this study (Ofla, Adamii Tulluu-Jido Kombolcha, and Wansho), Wansho had the lowest average land holding per family. In Ofla, the average land holding is 0.5 ha, while in Adamii Tulluu-Jido Kombolcha, it ranges from .75 to 3 ha. (In Yabello, the pastoralist area, all land is communally owned.) The vast majority of households surveyed in Wansho woreda do not have sufficient land to sustain them throughout the year.

Here, residents have always done traditional agroforesty. They grow coffee under the shade of trees and intercrop it with fruit and vegetables, including enset. Enset is a root crop resembling a banana which is a traditional staple in south and southwestern Ethiopia. It is high yielding and contributes to household food security. Additionally, its leaves and spongy root systems minimize soil erosion and run-off, which help to improve the water holding and soil nutrient capacities of farms.

Coffee is an important cash crop in this woreda. Men predominantly control its sale. Upgrades in its production have played an important role in improving the livelihoods. Cooperatives provide services in the processing of coffee berries and marketing. A number of coffee processing mills operate in the woreda. Apart from its sensitivity to climate change, coffee is an international commodity, so its prices fluctuate according to a global supply and market demand.

The number of rainy days as illustrated in Figure 7 shows no consistent trend; this suggests that the declines and damages to crops are not related solely to the rain, but also to man-made factors, such as land degradation. In Wansho, time series analysis showed kiremt rains were hit hard (~10 percent reductions), which is about a -0.5 to -0.7 standard deviation decline.

Figure 7: Number of rainy days in coffee growing zone (Yergalem station)



Source: Graph prepared by author based on data from the National Meteorological Agency submitted by B & M Consultants PLC.

Impact of Climate Variability

- *Crop production*—In both Bokasso and Ferro 2 kebeles, crop diversity varies from farm to farm. Typically, farmers mainly grow enset and coffee in their fields, with minor crops such as soybeans, pumpkins, kale, banana, avocado, and other root plants. Because of the smallholdings, farmers concentrate on planting enset with a small proportion of coffee plants. Maize and other leguminous crops are produced around people's homes. Wheat, barley, and teff used to be grown here, but these crops have now been abandoned due to a lack of land.

  Farmers in both kebeles reported that the yields of coffee and other crops have fallen in the last four years. They attribute this to a loss of soil fertility, drought, and unusually high rainfalls at the wrong time (e.g., harvest time). A slight increase in annual maximum and minimum temperatures was recorded in recent years at Yirgalem, a meteorological station near Wansho woreda.

  High temperatures aggravate the problem of coffee berry disease during long dry spells. According to the coffee farmers, longer dry months in 1988, 1993, 1998, 2003 and 2004 reduced coffee production. About a third of the surveyed households experienced financial loss as a result of these long dry periods, ranging from ETB 500 – 3000 (equal to $40 – $600). Damaged coffee production does not appear to be isolated to Wansho. Based data from Colombia, Kenya, Tanzania, and Ethiopia, it is predicted that coffee will be severely affected by changing temperatures.[33]

One threat to coffee with the rise in temperatures is the coffee berry borer (Hypothenemus hampei), a pest that attacks coffee plants. In Ethiopia, the analysis of 32 years of climatic data from Jimma—a city in Oromia region, which borders the SNNPR region where Wansho is located—found that, before 1984, temperatures were too low for the beetle to complete one generation per year. But after temperatures began to rise, the insect began to complete one to two generations per year. So, if temperatures rise substantially, it's possible that the berry borer will destroy more coffee plants. But there are ways to cope. The traditional way of growing coffee under shade trees—as the residents here practice—is a good coping mechanism, since the trees can buffer coffee plants from micro climatic variability and extremes.

- *Livestock*—Households keep cattle, goats, sheep, equines, and chickens for food, farm power, manure, and as an emergency source of cash. About 82 percent of interviewed households in both kebeles own cattle. In general, productivity is low due to feed shortage and low levels of veterinary care. Animal feed has declined due to land fragmentation and expansion of agricultural crops. Crop residues are used for fuel rather than livestock feed. Everyone shares the responsibility of fetching water for livestock.

- *Forestry*—Historically, Wansho woreda was covered with dry and mostly evergreen forests. But over the last 50 years, this area has become deforested due to: agricultural expansion for crops such as wheat, maize, and teff; livestock grazing; and cutting trees for firewood and timber. Only patches of native evergreen forests remain. Population increases and the subsequent expansion of agricultural have made conservation a challenge. Co-managed by the government and communities, natural forests are exclusively limited to sacred compounds, remnants of hedges, very steep slopes, and the highest parts of the highlands.

  In their fields, farmers plant leguminous tree species for shade, fodder, and soil fertility alongside their coffee and enset. Although these trees provide important microclimate benefits and serve as shade for coffee and enset and sources of fodder for animals, they too are highly threatened due to overexploitation. Farmers are also choosing to grow exotic tree species such as Eucalyptus, Grevillia robusta, and Cupressus lusitanica. In focus group discussions, farmers indicated a growing preference to plant trees for fuel wood to get some cash income. This was coming at the expense of planting trees for construction and medicine. The decline in available trees has a particularly negative effect on women and girls: they must walk further to collect firewood.

- *Energy*—The sources of energy in the two kebeles are firewood, charcoal, agricultural residue, and kerosene. Availability of woody biomass depends on landholding size. About 65 percent of households have less than 0.5 ha; as such, they do not have enough forest products and must buy the products they need. A shortage of fuel wood from natural forests has been compensated by the promotion of fast growing tree species, such as eucalyptus.

- *Water*—There are 42 springs and rivers at the woreda level, which are for people and animals. Women and girls are responsible for collecting water for household use. As many as 61 percent of Ferro 2 and 83 percent of Bokasso residents have not felt a significant change in the quantity and quality of water. Though farmers described increases in flow and changes in color during the rainy season.

  Farmers did complain about the coffee factories polluting the rivers. Coffee factories use ground and surface water for coffee washing, and the precautions for the discharge of used water from coffee washing are inadequate. Contaminated water means girls and women must spend more time looking for clean sources.

- *Health*—The majority of respondents (68 percent in Ferro 2 and 93.3 percent in Bokasso) indicated that malaria was the number one killer disease in the woreda. They relate its prevalence to the changes in the weather. Malnutrition is also a serious problem. A 2008 study by the woreda revealed about 4,500 malnourished people (primarily children under the age of four and lactating women). Part of the problem is that the staple, enset, is a starch, low in protein and essential nutrients. But women, who serve as caretakers, unanimously said that health conditions in the kebeles had deteriorated. They cited more colds, tuberculosis, diarrhea, and typhoid. The lack of protection of water sources and proper sanitation means that water borne diseases are prevalent. But the kebeles have health centers, and access to health services has increased.

Ways of Dealing with Climate Variability

The traditional agro-forestry system of the study area plays a significant role in improving microclimates and in providing goods and services. Enset, avocado and other fruit-producing plants are resistant to short-lived climate stresses and provide food if cereal crops fail. Trees and shrubs can be used to generate income, which can be used to buy food and animal feed during drought. The agro-forestry system makes a significant contribution to local communities' resilience.

People in both kebeles remarked that gender roles tend to change during hardships, such as droughts. When drought comes, men will migrate looking for work in construction, factories, and hotels. This male migration puts more responsibilities on women's shoulders. Quarrels, violence against women, and divorce were cited as common during times of drought. Also during times of drought, women look for off-farm activities. For instance, women sell a local drink called keneto, engage in petty trade, and work for relatively better-off people or for people living in urban areas. The payment is often in kind (e.g., food for the family).

4. Emerging Lessons from the Four Study Sites

This study clearly illustrates that farmers and pastoralists believe that weather patterns are changing. As they experience and respond to extreme climate events such as droughts, the resulting vulnerability has many faces. Vulnerability is not the same for different populations living under different environmental conditions and confronting different social, economic, political, and institutional contexts.

In every study site, people perceived climate variations, especially in reference to the two important rain categories: belg (small) rainy season and kiremt (long) rains. The decline in the small rainy season (belg) reported by the community members in Adamii Tulluu-Jido Kombolcha is supported by meteorological data. Conversely, in the other three woredas, climate data and local perceptions of rainfall do not correspond. Yet, some recent climate studies attribute declines in eastern Africa growing-season rainfall to anthropogenic warming in the Indian Ocean. This link to global warming implies that these precipitation declines are likely to continue or intensify.

Climate science is extremely complex and the relationship between computer models, weather stations and people's perceptions of rainfall is not linear and straightforward. Farmers and pastoralists assess rainfall in relation to their needs at particular times; small changes in the quality, onset, and cessation of rain over days or even hours can make a big difference, whereas meteorological data is more likely to be measuring totals and larger changes. Both assessments may be simultaneously different and "right."

At the same time, people's perceptions of climate change and variability are affected by local environmental, social, economic, and psychological factors. When combined with deforestation (which can increase local temperatures), soil erosion, population growth, economic development (or lack thereof), and illness, it can feel like the climate is getting worse because even small changes can have terrible impacts. All these factors increase demands on limited resources, particularly water, and farmers and pastoralists perceive that resources are declining. So even though the total mean annual rainfall may be stable, as demand for it has increased, this gives the impression that rainfall has decreased.

These findings suggest that rainfall alone is not a reliable indicator of vulnerability to climate issues. Other environmental, social, economic, and political factors also need to be taken into account. How to adapt to rainfall—whether too much, too little, when it comes or stops, or how hard it falls—is only one factor that agriculturalists and pastoralists need to consider.

Additionally, the case studies presented in this paper offer strong evidence that the households surveyed have few assets—whether land or cattle—with which to respond when a crisis is unfolding. They have very limited resources on hand to prepare for difficult times. Inadequate plots of land are a particular problem. We see this clearly for Wansho, where landholdings are so small that farmers cannot grow enough enset to feed themselves. While health and education services are there, other economic opportunities are missing.

Within households, there are also differences in exposure to climate risks and response capacities. Women and girls are disproportionately affected by climate variability. Their workloads increase in times of hardship, and they have fewer options to find other ways of making a living, especially as the literacy rate for women (22 percent) is not even half of that of men (50 percent).[34] Women are often tied down by the need to care for children and the sick; they are also not given a say in household decisions and are frequently without cash savings or assets to sell to buy food and other basic items. In Ethiopia, as in many other places, poor women face many stressors, challenges, risks, and hazards; climate is just one of them.

This study also suggests that pastoralists tend to be more vulnerable to climate change than farmers. The reasons include exclusive dependency on livestock and the lack of adequate access to veterinary services, public health, and education in pastoral areas. The decreased availability of a crucial resource like water is generating conflict in pastoralist areas.

Farming and pastoral communities are coping with climate variability. Their short-term responses range from migration, selling livestock, etc. Some practices such as removing children from school or cutting trees for fuel wood can increase the cycle of vulnerability by depleting assets even further.

Both government and non-governmental organizations are working to diversify assets through a range of strategies that include:

- Changes in crop mix and herd composition in favor of crops and animals that are naturally adapted to drier conditions;
- Bee keeping;
- More emphasis on sustainable management of communal resources such as grazing land and forests; and
- Petty trading and working off-farm as day laborers.

Insurance is also an instrument that could help farmers and pastoralists protect their assets. In Ethiopia, Oxfam America and Swiss Re, in collaboration with the International Research Institute for Climate and Society at Columbia University, the Relief Society of Tigray, and Nyala Insurance Company are piloting an innovative way of using insurance as part of a holistic risk management approach. The project—Horn of Africa Risk Transfer for Adaptation (HARITA)—addresses the needs

of smallholder producers in Adi Ha through a mix of risk reduction, drought insurance, and credit. Under the HARITA risk management package, insurance complements disaster risk reduction and long-term, sustainable investments in agriculture.[35]

In a context of entrenched poverty and greater climate variability, we will need holistic approaches to build people's resilience. Resilience is about being able to bounce back from a shock. It's about having the opportunities to shift strategies quickly as the need arises. People are vulnerable to a variety of shocks, including climate. Building poor people's resilience to shocks will mean listening to them, addressing their rights, helping them to expand their livelihood options, and investing in those sectors that support the expansion of assets (such as health, education, and infrastructure).

A rich body of research indicates that adapting to climate variability often involves balancing risk and uncertainties in one area with those in other areas.[36] In making livelihood decisions, people juggle different kinds of risk, not only related to climate variation but also to livestock disease, price fluctuations, social marginalization, etc. Key determinants of household resilience are the diversification of options, flexibility of responses, and tactical decision-making. The capacity to adapt hinges on the availability of assets that allow for swift adjustments to fit changing environmental and economic conditions.

In the woredas studied, people have few assets and even fewer opportunities to make swift adjustments for the better. Small landholdings, limited access to health and education services, poor credit, and a lack of access to information, markets, and productive technologies all hinder poor farmers and pastoralists, particularly women, from exercising options. These opportunities and constraints are shaped beyond the farm and the household by the policy and institutional arrangements fashioned by the state, markets, donors, and international development agencies. In other words, these are all man made and as such can be changed.

5. Key Recommendations

Based on the study, Oxfam recommends the international community and Ethiopian government take the following actions.

At the National Level

- Invest in climate research and disseminate information to increase awareness of climate change and its impacts. Strengthen cooperation among policymakers, nongovernmental organizations, research institutions, and the media.
- Increase meteorological station density and make climate information available in an accessible format to farmers and pastoralists through methods such as radio broadcasts and mobile phones.
- Invest in agricultural research on the use of new crop varieties and livestock species that are more tolerant to drought.
- Strengthen the capacity of policymakers and institutions to effectively use climate information for development planning and to make informed decisions that consider climate risk, change, and variability.
- Ensure civil society and community participation, especially women's groups, both in formulating climate change policies and in integrating climate change into development priorities. Ensure priorities and investments address the gendered impact of climate change.
- Building on the National Adaptation Program of Action (NAPA), which contains 11 proposals, prepare and implement a national framework for guiding climate change adaptation and mitigation. This framework should also be integrated with the Plan for Accelerated and Sustained Development to End Poverty (PASDEP).[37] The current PASDEP for 2005/06 – 2009/10 mentions climate change in passing only twice. Since climate change negatively impacts poor people the most, the next strategic framework for 2011 – 2016 should invest in economic activities to make them more resilient to greater climate variability and change.
- Recognize pastoralism as a viable mode of production and way of life. Develop a land use policy in harmony with traditional land use systems.
- Provide seasonal precipitation forecasts as part of a revitalized extension package that includes access to basic agricultural technologies, such as plows, new crop varieties, and fertilizers, as well as access to information, improved market linkages, and credit and insurance schemes.
- Support agro-ecological practices for adaptation and mitigation.
- Diversify rural livelihoods through the promotion of non-agricultural sectors to reduce pressure on land and avoid further fragmentation of agricultural lands.
- Address environmental degradation by drawing on community-based experiences and mechanisms.
- Invest in social protection mechanisms to give vulnerable communities quick support in times of crisis. Connect these protection mechanisms to longer-term development actions.

At the Community Level

- Immediately invest in livelihood opportunities and risk management strategies for poor farmers and pastoralists, particularly women.
- Prepare long-term adaptation plans based on the sharing of best practices through community participation, civil society engagement, and the participation of academic and research institutions, with regular monitoring to identify promising practices for scaling up.
- Build on what farmers and pastoralists are already doing to adapt to climate variability and change. Investigate these practices further for their sustainability and impact on poverty and inequality, and potential for replication or enhancement.
- Invest in new forestation programs, reforestation, and sustainable management of the remaining forests. Ensure that management systems guarantee a return to the communities that manage the resource—the only way to ensure genuinely sustainable use of forests and woodland.
- Use agroforestry systems as an economically feasible adaptive strategy to protect crop plants from extremes in microclimate and soil moisture.
- Invest in community environmental and drought monitoring systems.
- Improve community disaster risk reduction capacity.
- Promote greater community exchanges on adaptation strategies so that communities can learn from each other. One such possible strategy is micro-insurance.
- Invest in appropriate small- and medium-scale infrastructure to store and serve water for production and consumption.
- Because biomass energy will constitute the lion's share of household energy in Ethiopia in the foreseeable future, expand the use of energy-efficient cooking stoves.
- Increase use of renewable energy such as solar energy. Promote photovoltaic technology.

In Particular, for Pastoralist Communities

- Support pastoralists, especially women, through more efficient service delivery such as improved livestock, market linkages, and livestock health services. Improve access to feed and water for both livestock production and household consumption.
- Invest in better disaster and conflict management practices to address recurrent drought and conflict.

The international community has a huge responsibility to help Ethiopia adapt to climate change. To date, it has failed to honor its responsibility and to show leadership in addressing the impact of climate change. In December 2009, when world leaders met at Copenhagen, they ended up producing an Accord—a mere political declaration—rather than the legally binding agreement that is so desperately needed.

The Accord[38] makes a weak commitment to keep the rise in average temperature below 2°C but

sets no targets for emissions in 2020 or 2050. The Accord commits developed countries to provide new and additional resources approaching $30 billion for the period of 2010 – 2012. But some of this is loans and re-pledges. The Accord also puts forth a goal to raise $100 billion for adaptation and mitigation by 2020. But again, the Accord fails to address how this money will be raised, how funds will be divided between adaptation and mitigation, and how much will come from public finance. The Accord fails to state that climate finance will be raised separately and in addition to rich countries' existing aid commitments of 0.7 percent of national income. Without this assurance, there is a risk that funds will be raised by diverting money from essential services in poor countries. Clearly, this would be unacceptable and would do little to build the resiliency of the most vulnerable.

But negotiations can still get back on track at the next UN conference in Cancun, Mexico, in December 2010. The international community still has the opportunity to show leadership in Ethiopia. Adapting to climate change is intertwined with long-term development and eradicating poverty. But development and eradicating poverty will be challenging unless Ethiopia receives financial assistance to help its people adapt to an unfamiliar and unpredictable climate.

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