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Nutrition and Food Security in a Changing Climate: Methods for predicting household coping strategy use and Food Security in the Ethiopian Context

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Nutrition and Food Security in a Changing Climate:
Methods for predicting household coping strategy use and Food Security in the Ethiopian Context.

A dissertation submitted in partial satisfaction of the

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in Public Health

by

Dana Ellis Hunnes

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ABSTRACT OF THE DISSERTATION

Nutrition and Food Security in a Changing Climate:
Methods for predicting household coping strategy use and Food Security
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by

Dana Ellis Hunnes
Doctor of Philosophy in Public Health
University of California, Los Angeles, 2013
Professor Gail Harrison, Chair

Climate change affects households, villages, countries, and regions worldwide. The populations and individuals most vulnerable to the negative impacts of climate change live in the poorest and least developed regions of the world, engage in climate-dependent livelihoods and have few assets. Ethiopia, one of the poorest countries in the world, with a history of climate- and politically-induced famines, has 80 percent of its population engaged in rain-fed agricultural livelihoods.

This dissertation sought to determine empirically how individuals and households in Ethiopia cope with climate change impacts on their livelihoods and food security. Ethiopia, one of the poorest countries in the world, where 80 percent of the population engages in rain-fed agricultural livelihoods, has a history of climate- and politically-induced famines. This

dissertation consists of three studies. The first two studies were qualitative primary interviews where recruitment, consent, structured interviews, and protocols were approved by the UCLA Institution Review Board, but used mixed methods including t-tests and Fisher's exact tests in the analysis. The third study was quantitative and used panel data from seven waves of the Ethiopian Rural Household Survey (1994-2009).

The first study involved 59 rural-to-urban migrants in Addis Ababa, Ethiopia. Findings indicated that migration for some individuals was induced due to having insufficient tangible and intangible assets as a result of decreased or variable crop-yields, forced sale of livestock, sale of other assets, or need for additional income. Small plots of land, low levels of education, fertilizer loans, and tax debts were additional contributors to low asset levels. Migration for others was induced by volition or the desire to increase social or economic status with better jobs or education. Individuals who migrated by volition often reported having sufficient land, crop-yields, and food. Few individuals had access to safety-net programs and those who did reported insufficient or undesired provisions.

The second study involved 35 heads or proxy-heads of household in three rural villages. Findings indicated that households cope with asset shortfalls and climate-change with a handful of strategies including selling animals, eating other less-preferred foods, decreasing the amount eaten, and selling other assets. Nearly all interviewees worried about money, land, and food, and needed more money, land, and animals. Climate change was reported to affect crop-yields. Ethiopia is a three-meal per day culture. In good-food months, adults and children eat three meals per day. In bad-food months, both adults and children eat fewer meals, and adults eat fewer meals than children to preserve child-nutritional status. Adults from households with the least amount of land and the most household members eat the fewest number of meals in bad

months. Only in the worst times did individuals report anyone migrating from the household though most reported a family member migrating in the past. Some believe they will migrate in the future, primarily for land or education.

The third study used longitudinal panel data from the Ethiopian Rural Household Survey, covering 1,477 households over 20 years. Analytical methods involved hierarchical linear modeling of bivariate and multivariate relationships between outcome and predictor variables and an interaction model to test the modification of irrigation on rainfall-adequacy and food-security status. Hierarchical linear modeling quantifies how much of the observed relationship can be attributed to household, village, region, and time-specific aspects.

Findings indicated that households continually vary in their food-security status over time. Where a household is located, its geography, and time were the most important predictors of household food-security status, and all are indicators of climate effects. Irrigation also demonstrated improvements in food-security status beyond rainfall-adequacy alone, indicating that while climate was an important predictor of food security, irrigation modifies the relationship. Household crop storage improved food-security status, while free-food distribution and household assets had no impact. Household assets however, do influence household resilience, the type, and choice of coping-strategies households' use.

The findings of these three studies provide new and supporting knowledge on coping-strategy use and food-security status over time in Ethiopia, demonstrating the influence of climate change as well as possible causes of migration in Ethiopia. These studies also confirm current literature describing the inadequate coverage and assistance of Ethiopia's safety-net program, guiding the way for improved pro-poor and climate-sensitive policy recommendations.

The dissertation of Dana Ellis Hunnes is approved.

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I dedicate this dissertation to my wonderful family and particularly to my mom, dad, husband, and sister whose constant love, support, and encouragement have made this experience easier and enjoyable. Also my dog Jack, who patiently sat at my feet waiting for me to play with him.

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Glossary

Adaptation/Adaptive Capacity: In climate literature, refers to the ability of a system (natural or human) to adjust to climate change (including variability and extremes), to moderate potential damage, to take advantage of opportunities, or to cope with the consequences.

Anthropogenic Climate Change: Anthropogenic refers to "human made." In the context of climate change, it refers to greenhouse gases, or emissions produced as a result of human activities.

Climate Change: the change in average conditions of the atmosphere near the earth's surface of a long period of time, taking into account temperature, precipitation, humidity, wind, barometric pressure, and other phenomena.

Climate Extreme: Extreme meteorological event, including drought, flood, storms, and wide temperature fluctuations.

Climate Variability: Refers to variations in the mean state and other climate statistics (standard deviations, occurrence of extremes, etc) on all temporal and spatial scales beyond those of weather events.

Coping Strategy: Individual, household, or population-level responses to adverse conditions that are strategically planned to minimize risk.

Displacement: The involuntary or forced movement that occurs in association with discrete events or hazards that challenge a household's safety, security, or livelihood.

Economic Mobility: Economic mobility is a voluntary, planned, and proactive move made to improve livelihoods and opportunities

Food Access: Having an adequate supply of resources (entitlements) to acquire appropriate foods for a nutritious diet.

Food Availability: Having food available depends on production, distribution, and exchange so that the supply is adequate, of appropriate quality, varied, and contributes to a healthy diet

Food security: The physical, social, and economic access to sufficient, safe, and nutritious foods that meet dietary needs and food preferences for an active and healthy life

Food Utilization: Describes how the body uses and absorbs food. Is directly linked to a safe and adequate diet and is influenced by water-borne, food-borne, vector-borne, and other infectious diseases

Greenhouse Gases: primary greenhouse gases in the atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone, which absorb and emit radiation and increase temperatures on Earth.

Labor-Migration: Migration of one or more members of a household as a way to diversify a household's livelihood strategies and allows a household or individual to earn additional income.

Land-Tenure: A legal regime in which land is owned by an individual, a land owner.

Livelihood-Assets: The tangible (natural, financial, physical) and intangible (social, human) resources and stores that households use to meet their basic needs for food, income, and shelter.

Livelihood-Security: Adequate and sustainable access to income and resources to meet basic needs (including adequate access to food, potable water, health facilities, educational opportunities, housing, time for community participation and social integration).

Mitigation: Any action taken to permanently eliminate or reduce the long-term risk to human life, property, and function from the hazards of climate change by reducing concentrations of greenhouse gases, either by reducing their sources, or by increasing their sinks.

Rain-fed Agriculture: Describes farming practices that rely on rainfall for water.

Resilience: The ability to withstand and recover from shocks such as food-crises, food-insecurity, and famine.

Risk-Reduction: A systematic approach to identifying, assessing, and reducing risk (of disaster) by reducing socio-economic vulnerabilities, and dealing with the environmental and other hazards that trigger them.

Stability of the Food Supply: Depends on local and regional food production and on the reliability and price of food imports.

Vulnerability: The propensity that human livelihoods and assets will suffer adverse effects when impacted by hazards, such as climate extremes

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CHAPTER 1: INTRODUCTION

1.1 Statement of the Problem: Climate Change and Climate Variability Impacts on Livelihood- and Food security

The Intergovernmental Panel on Climate Change (IPCC, 2007) predicts that climate change, as experienced through long-term changes in the distribution of climate variables—temperature, radiation, precipitation, water vapor pressure in the air, and wind speed—will affect the productivity of agricultural, forestry, and fisheries systems [globally] (Easterling et al, 2007). Climate variability, as manifested by shorter-term decadal and seasonal shifts is expected to have more immediate deleterious impacts on local environments impacting the livelihoods of rural farmers, pastoralists, and aqua-culturists who depend on the stability and predictability of the environment (Easterling et al, 2007; IPCC, 2007; NOAA, 2011).

In addition to livelihood impacts, the increasing rate of climate and environmental changes as a result of anthropogenic green-house gas emissions from fossil fuels, deforestation, livestock intensification, and land-use change will influence the growth, development, yield, and health of local and global ecosystems and the foods they provide to the individuals, households, and populations that depend on them (Denman et al, 2007; NOAA, 2011). In fact, climate variations and extremes such as storms, floods, and drought are predicted to decrease farming incomes below the long-term median. By 2020, crop yields are expected to decrease by fifty percent in tropical regions, and small-scale farmer net-revenues are expected to drop by ninety percent (NOAA, 2011).

A variety of technical adaptation strategies including small-scale irrigation, farming mechanization, and rotating and substituting crop-types may moderate these negative impacts; however, the costs to implement these strategies currently are outside of what most subsistence

rural agricultural households can afford (Easterling et al, 2007). Thus, the impacts and increased frequency of negative environmental events may push food-producing systems beyond what is recoverable (*ibid*).

Multiple stressors such as soil erosion, salinization, overgrazing, and over-extraction of ground water damage natural land and water resources decreasing the crop-growth potential of the land. Moreover, monocultures, an increasingly common farming strategy, increase crop susceptibility to disease, decrease crop resilience, and result in the loss of biodiversity (*ibid)*. Environmental degradation also increases individual-, household-, and population-vulnerability to food-insecurity and malnutrition while simultaneously decreasing coping-capacity, ultimately leading to negative economic and health outcomes for vulnerable groups (*ibid*).

The extent to which different populations are affected by climate variability and extremes is temporally and spatially dependent (IPCC, 2007). Vulnerability refers to the propensity that human livelihoods and assets will suffer adverse effects when impacted by hazards, such as climate extremes (Cardona et al, 2012). Vulnerable livelihoods are those that are almost entirely dependent on climate and weather patterns and lack adaptive capacity to recover from environmentally extreme events such as drought or floods (Perch-Nielsen et al, 2008).

Populations that are most vulnerable to the negative effects of climate variability and extremes tend to live in the least developed or developing regions that have relatively high exposure to negative environmental conditions (*ibid*). One of these most vulnerable regions is sub-Saharan Africa where "Endemic poverty, complex governance and institutional dimensions, limited access to capital, infrastructure and technology, [frequency of] disasters" including conflict, and disproportionately high population growth interact with climate stressors to increase

the likelihood of adverse poverty-, food-, and nutrition-related outcomes (Boko et al, 2007 and Easterling et al, 2007).

Moreover, sub-Saharan Africa is experiencing decreased precipitation and increased drought conditions as measured by stream flows, lake levels, and soil moisture (NOAA, 2011). Social and political factors in this region interact with these environmental changes thereby increasing the vulnerability of these populations to a waning food supply and malnutrition. Some of these social factors include living and farming in isolated and marginal locations on plots of land that are too small to meet livelihood- and food security needs. Political factors include unstable access to water, informal land tenure, and low levels of technological inputs or assistance from government characterizing these regions as complex, diverse, and risk-prone (Easterling et al, 2007).

Currently, twenty-seven percent (3.6 billion hectares) of the Earth's land surface is too dry for rain-fed agriculture, an area that is expected to expand during this century (IFAD, 2011). Rain-fed agriculture is commonly practiced in many of the most vulnerable rural areas by 1.4 billion of the world's poorest individuals who do not have access to or inputs for technological advances such as irrigation, and who live below the international poverty line of $1.25 per day (*ibid*). In Ethiopia, the majority of the population matches this description engaging in rain-fed agriculture with few to no technological inputs, and on average, earns only $0.50 per day, living with an almost constant threat to their livelihood- and food security (World Bank, 2011).

1.2 Ethiopian Context

According to the United Nations Development Programme's Human Development Report, Ethiopia ranks at number 160 out of 172 member states in its Human Development Index

(HDI). The HDI is a comparative measure of life expectancy, literacy, education, and standards of living for countries around the world and measures the impact of economic policies on quality of life (HDI, 2010). In Ethiopia, agriculture accounts for eighty-five percent of employment, fifty percent of exports, and forty-three percent of the country's Gross Domestic Product (GDP). The average daily per capita income of Ethiopia's rural poor, approximately eighty percent of Ethiopia's total population, is less than $0.50 per day, significantly less than the international poverty line of $1.25 per day set by the World Bank in 2008 (IFAD, 2011 and World Bank, 2011). Nearly all-Ethiopian livelihoods are vulnerable to climate variability and extremes, and result in food- and nutrition-insecurity for these farmers and their families. This vulnerability stems from the fragility of the land and insufficient plot-size, typically being less than or equal to one hectare ($\leq$ 2.47 acre) in area, that are too small to reliably and adequately feed a household (Cohen and Lemma, 2011).

Because Ethiopian livelihoods depend on climate and weather, they lack the adaptive capacity needed to recover from environmental degradation, and are therefore vulnerable to climate extremes. Drought, excessive heat, and floods decrease land's productivity and habitability, disrupt household coping strategies and adaptations, and increase the risk that households will experience negative health, nutritional, and livelihood outcomes (Cardona et al, 2012, Boko et al, 2007, and Black et al, 2011). Additionally, climate variations and extremes negatively impact the surrounding ecosystems. Degradation and loss of wild ecosystems further erodes household resilience to climate extremes reducing or eliminating a wild-food source or asset that can be utilized in the event of a poor harvest (Handmer et al, 2012 and Lavell et al, 2012).

Climate variability and extremes often result in illness and injury due to its effects on ecosystem services. Drought and floods increase human exposure to infectious or toxic agents from unsafe water supplies. Infrastructure damage may interrupt the use and availability of medical services further increasing the morbidity and mortality of the exposed populations prolonging the recovery period leaving households more vulnerable to future climate events while simultaneously eroding household resources for coping and adaptation (*ibid*).

Additionally, Long-standing social and political factors in Ethiopia interact with climate variability and extremes to influence the population's vulnerability to hunger and food-insecurity. Some of these factors include poor governance, low access and availability of social safety-net programs and buffers, unfavorable land-tenure arrangements, and liabilities requiring payment to the government often resulting in the use of increasingly negative coping strategies (Cardona et al, 2012).

1.3 History of Ethiopian Governance Structure

1.3.1 **The Empire Under Haile Selassie:** Under the rule of Emperor Haile Selassie, Ethiopia was a feudal agrarian society where a small minority group controlled the majority of the nation's wealth. The remaining rural population ended up as tenants paying one-quarter to one-half of their annual crop production to their landlords (Kebbede and Jacob, 1988). Under this system there was poor political commitment to develop adequate food distribution systems for the Ethiopian people and fragmentation of land holdings was common as the amount of arable land was limited and had to be shared among the increasing population. As such, land was divided and re-divided from one generation to the next, increasing the risk of famine, and leaving little safety-net for those poorest rural peasants (*ibid*).

The government also failed to develop risk-reduction strategies, mitigation strategies, or pro-poor policies to cope with drought, a common occurrence in this region. Poor political will encouraged environmentally destructive agricultural practices such as deforestation and promoted the unfair distribution of society's wealth forcing the poorest individuals onto marginal and unproductive land (Ravallian, 1987). Finally, corrupt trade policies resulted in misdistribution of food within Ethiopia and to exports of food when they were needed most, at the time of famines (*ibid*). Given the strong evidence that government failures were a primary cause of Ethiopian famines, mutiny ensued after the 1972-74 Wollo famine, and Haile Selassie's government was overthrown (Lautze et al, 2009).

1.3.2 **The Derg Regime:** The Derg regime which came into power subsequent to Haile Selassie followed a Marxist model, taking ownership of the land from the people, and nationalizing it. Individuals could not privately own land, which was reverted back to subsistence and pastoral activities as its primary use (Walker et al, 2003). The Derg mandated that individual land-holdings be used for cash crops such as cotton and sugar cane for foreign exchange and export rather than for producing food for personal consumption. These trade and export policies made households vulnerable to future famines as food stocks were depleted (*ibid*). Just as under Haile Selassie, food security, drought and famine prevention, environmental protections, and the socio-economic organization of the country were not prioritized under the Derg regime. As such, civil war and human rights violations ensued in conjunction with inappropriate food, agriculture, export, and trade policies, contributing to one of the worst famines in history, the Ethiopian Famine of 1984 (*ibid*). The famine affected nearly eight million people, resulted in nearly one-million deaths, and led to the fall of the Derg in 1987 and

the rise of the Worker's Party of Ethiopia. Upon installment of the Worker's Party, the country was renamed the "People's Democratic Republic of Ethiopia" (Henze, 2000).

1.3.3 **The People's Democratic Republic of Ethiopia:** The "People's Democratic Republic of Ethiopia" (hereinafter PDRE) has governed Ethiopia since 1987. The PDRE divided the country into nine administrative regional states, historically delineated by ethnic group (World Bank, 2011). The administrative states were further divided into administrative divisions, and then zones or districts governed by local leaders (*ibid*).

1.3.3.1 **Land Rights:** Under the PDRE, formal land rights in the pastoral and agricultural areas were and remain owned by the state on behalf of the peoples of Ethiopia (Constitution of Ethiopia, 1994). The constitution guarantees access to land for all Ethiopians who want to earn a living from farming; however, land distribution is left to subsidiary (local) legislation, which specifies the terms and conditions in which land is made available (*ibid*). Under these laws, property cannot be sold, or bought. Rather, land is parceled out to individual households from the government in return for high land-taxes or rent, which many poor rural farmers have difficulty paying (Belay and Manig, 2004). Where households are unable to pay their land tax, they may pledge their land to another household for up to twenty years and receive half the land's harvest in exchange for paying their tax (*ibid*).

1.3.3.2 **Inheritance Laws:** Inheritance laws dictate that property may be passed down to married sons. The laws also indicate that no additional land may be bought or sold by that family (Constitution of Ethiopia, 1994). Thus, a household that has been given two hectares of land by the government must divide and parcel that land among each of their married sons resulting in each subsequent generation's land-holding to be significantly smaller than the previous. These laws quickly make plots of land unsustainable economically or nutritionally to

meet a family's or household's livelihood needs (Belay and Manig, 2004). Where land is large enough, it is in constant use, with insufficient fallow or recharge time. Land is utilized year after year, without proper nutrient regeneration, and even with the increased use of synthetic fertilizer, yields are still declining, further increasing the risk for food-insecurity and famine over time (*ibid*).

1.4 Climate Impacts on the Four Dimensions of Food security:

The Food and Agriculture Organization of the United Nations (FAO) defines food security as "the physical, social, and economic access to sufficient, safe, and nutritious foods that meet dietary needs and food preferences for an active and healthy life" (FAO, 2002). The concept of food security has several dimensions: 1) food availability, 2) food access, 3) stability of the food supply, and 4) food utilization, each of which is vulnerable to climate change (*ibid*).

1.4.1 **Food Availability:** Food availability depends on production, distribution, and exchange so that the supply is adequate, of appropriate quality, varied, and contributes to a healthy diet (*ibid*). Climate change and variability directly impact agriculture- and water-resource sectors influencing food availability (Boko et al, 2007). While production, import, and export policies also influence food availability, "adequate domestic production, reliable import capacity, food stocks, [effective and adequate] social protection measures, transportation infrastructure" and adaptation strategies play the biggest role in food availability (Ziervogel and Ericksen, 2010; Coates, et al, 2007).

For some regions, specifically those of Sub-Saharan Africa, precipitation levels have become more labile, and their timing, less predictable over the last 40-50 years, leading to

variable or declining agricultural output (Stige et al, 2006). Boko et al (2007) corroborate this finding of an overall annual decline in African rainfall since the end of the 1960s. Globally, rainfall variability as demonstrated by a significant increase in the number of heavy rainfall events scattered among longer drought periods provides little respite to agricultural livelihoods as the water does not adequately penetrate the soil and is lost to runoff (*ibid*). Moreover, desiccation to the Sahel region of Africa has been occurring since the 1970s as a result of increasing equatorial Indian Ocean sea-surface temperatures evaporating soil moisture rapidly leading to regional water scarcity, salinization of agricultural lands, and destruction of crops, affecting food availability (*ibid*). If current trends proceed, by 2080, it is estimated that an additional 200-600 million people will suffer from hunger globally and disproportionately in Sub-Saharan Africa (Boko et al, 2007).

1.4.2 **Food Access:** Food access is defined as having "an adequate supply of resources (entitlements) to acquire appropriate foods for a nutritious diet" (FAO, 2002). Poverty is central to food accessibility by its impacts on household purchasing power. Amartya Sen (1981) theorized that having access to food is not a matter of having enough to eat, but is instead, a matter of there being enough to eat as a result having sufficient access to entitlements. Entitlements are a set of assets over which a person or household can establish command and which enable the acquisition of food within the legal, political, economic, and social arrangements of the community in which a person lives," including the use of production and trade opportunities (FAO, 2002 and Sen, 1981).

In other words, food production and availability alone do not determine access to food. Rather, some minimum level of individual or household assets and entitlements enable or

undermine one's access to food. For example, market prices, which fluctuate in response to food supply, often determine how much a household can afford (FAO, 2002). Additionally, household assets or entitlements influence a household's ability to purchase sufficient agricultural inputs or to have sufficient labor at the proper time; and any deficiencies may therefore result in a reduction in livelihood security and in access to food (Confalonieri, 2007).

1.4.3 **Stability of the food supply:** Stability of the food supply depends on local and regional food production (food availability) and on the reliability and price of food imports (food access) (Cohen and Garrett, 2009). "To be food secure, a population, household, or individual must have access to adequate food at all times and should not risk losing access to food as a consequence of sudden shocks (economic or climate crisis) or cyclical events (seasonal food-insecurity). Thus, stability of the food supply depends on both the availability and access dimensions of food security" (FAO, 2002).

As such, Ethiopia is vulnerable to a decline and instability in food production, seasonally and long-term. As climate change progresses, increased drought and unstable climate conditions will adversely affect food production, which depends on water availability, utilization, infrastructure, soil quality, and land management. Water availability and infrastructure are influenced by climate change, but also by political priority and governance. Inter-annual lake-level fluctuations and volatility have been the norm since the 1960s, and even during floods or heavy rains, water is lost to runoff and changes in hydrology result in decreased or stagnating levels of food production (Boko et all, 2007). The nexus of these changes in hydrology, decreased land productivity, lack of economic inputs, and water stress that account for the

majority of declines in food production and supply channels for both local and international markets; ultimately reduces the stability of the food supply (UNICEF, 2000).

1.4.4 **Food utilization:** Finally, the last aspect of food security is food utilization, which refers to the body's ability to use and absorb food efficiently. Food utilization is directly linked to a safe and adequate diet, water availability and quality, sanitation systems, and is influenced by water-borne, food-borne, vector-borne, and other infectious diseases (FAO, 2002; UNICEF, 2000). Clean, safe drinking water is affected by climate change, and directly affects sanitation. Therefore, changes to precipitation levels drive diarrheal disease incidence, the spatiality of disease vectors, and the prevalence of malaria and other infectious diseases in East Africa (Boko et al, 2007).

Additionally, food utilization directly affects health. Any time the body is challenged by infection, food utilization decreases. Infection and nutritional status are bidirectional; infection decreases dietary intake and intestinal absorption while increasing catabolism or the loss of lean body mass, and decreased nutritional status predisposes one to infection because of the negative impact on the host's immune function (Brown, 2003; Confalonieri, et al, 2007). Consequently, the food utilization dimension may negatively impact individual and household food security indirectly, by diverting household assets away food acquisition and onto health care, reducing household entitlements, and reducing or limiting access to food and to food security.

Finally, it is important to be sensitive to the fact that even within populations that are vulnerable to food-insecurity, there are sub-groups who are even more vulnerable to food-insecurity and its health implications, namely women, infants, children under five years of age, and the elderly. These groups are often even more vulnerable to malnutrition and the negative

impacts of environmental degradation as a result of biological factors, dependency, social norms, laws, and culture (Cardona et al, 2012). External factors already mentioned such as poverty, conflict, political insecurity, land-tenure, and the presence or absence of effective safety-net programs might also interact with climate and environmental stresses to contribute to food-insecurity and malnutrition. Combinations of these risk factors interacts with household adaptive capacities and ultimately influence the choice and use of strategies to cope with or adapt to these negative impacts (Ericksen, 2008).

1.5 Social Safety-Net Programs:

Generically, social safety-nets are programs that interact with and work alongside health, education, food, and financial services as ways to reduce poverty and manage risks (WFP & FAO, 2009). Typical safety-net programs provide food, cash transfers, or other consumable goods to help individuals or households cope with and prepare for potential shocks, such as climate change. Safety-net programs are supposed to fill certain social and economic gaps as a way to prevent the emergency sale of assets or livelihood loss while improving or smoothing over food consumption and nutritional status (*ibid*). While many countries have safety-net programs, some are more successful at reducing poverty and mitigating food-insecurity than others.

1.5.1 **Ethiopia's Productive Safety-net Program (PSNP):** In the 1990s, the government of Ethiopia and international community developed a National Policy of Disaster Preparedness and Management (Bishop and Hilshorst, 2010). This policy was designed to link relief to development by using food aid to mobilize labor for public works in soil and water

conservation (*ibid*). Soon thereafter, the Ethiopian Food Security Program (FSP) replaced the Disaster Preparedness and Management policy. The FSP was part of the Productive Safety-net Program (PSNP), one of Ethiopia's flagship reform programs.

The PSNP was designed to provide a safety-net against sudden income shocks and to prevent the poor from losing their assets and becoming destitute (*ibid*). The purpose of the program was to improve the efficiency and productivity of transfers to food-insecure households, to reduce household vulnerability, to improve resilience, and to promote sustainable community development (Slater et al, 2006). The goal of the PSNP was to replace emergency response to chronic food-insecurity with a predictable resource framework, cash transfers. Additionally, the PSNP was supposed to protect households from having to sell assets while at the same time, improving their chance of escaping poverty in the longer-term (*ibid*).

Currently, the PSNP provides some support to a small proportion of rural households in the form of seeds, fertilizer, food supplementation, cash-vouchers, and other consumables such as clothing or grain (MoARD, 2011). While eligibility for the PSNP is reportedly based on "need" as determined by local-government officials, the success and management of the PSNP program has been called into question (Bishop and Hilhorst, 2010). Social protections and agriculture in Ethiopia are tightly intertwined, leaving the program and its recipients vulnerable to rising food prices and the effects of climate change (Devereaux and Guenther, 2009).

The budget of the PSNP and other food security programs in Ethiopia is around six billion Ethiopian Birr (~$112 Million per year) over a three-year period, which is insufficient to fully cover the highly food-insecure, vulnerable country (Slater et al, 2006). Increasing food prices, economic constraints, and a limited budget therefore only allow the PSNP to cover

around ten percent of the total population, leaving an extremely high number of unsupported poor individuals (MoARD, 2011). Moreover, these constraints limit the length of time that the PSNP can provide assistance to households to only three months in a given year (Devereaux and Guenther, 2009).

1.5.2 **Weaknesses of the PSNP**: Some primary studies related to the PSNP indicate that one weakness of the PSNP is the type of assistance it provides. Recipients prefer food and grain distributions to cash transfers as food distribution represents more stable dietary intake than does cash due to the effects of fluctuating food prices (Slater et al, 2006). A second weakness of the PSNP relates to the timing of and communication of program distribution, the result of insufficient monitoring by federal and regional governments, as well as limitations in manpower and mobility (*ibid*). To prevent program leakage or waste, Non-Governmental Organizations (NGOs) have tried to insert themselves and help with the organization and distribution of the PSNP with the goal of increasing the program's breadth, coverage, and effectiveness while also improving the communication and timing of distribution (*ibid*).

A third weakness of the PSNP is the dissonance between the stated goal of the program: "To graduate recipients from the program" and the amount of assistance it actually provides. Graduation from the PSNP is defined as "a household achieving food security for one year." This time-defined goal lacks a sustainable long-term transition away from chronic food-insecurity and ignores the more-important concept of graduation from poverty, which goes beyond a food security purview (*ibid)*. These weaknesses challenge the goals of the PSNP to protect and promote rural assets and livelihoods (MoARD, 2011).

1.5.3 **How the PSNP may be helping:** For those households targeted by and able to access the PSNP, namely the poor, elderly, sick, and labor-constrained, their use of negative coping strategies may be mitigated or delayed. For those receiving the PSNP, it may serve as a buffer, improving consumption, protecting the few assets households control, and in some cases preventing the emergency sell-off of assets or animals, thus delaying or abating the loss of livelihoods and the need for more severe coping strategies (MoARD, 2011). For some, the PNSP may help to preserve the health and nutritional status of the most vulnerable individuals in the household by smoothing consumption, improving food-purchasing power, avoiding the removal and consumption of early immature harvests, and mitigating prolonged hunger and food-insecurity later in the season (*ibid*). Additionally, for villages where cash-transfers or cash-transfers plus food are distributed, spillover into the local village economy may make it possible for households to protect and build assets while applying for micro-agricultural loans that increase their likelihood for future food security (*ibid*).

While there are several weaknesses to the PSNP, with appropriate and targeted governmental, NGO, and international agency support, the PSNP may be able to extend its reach, and not only mitigate the worst effects of climate change on the lives and livelihoods of Ethiopians, but also strengthen and improve the long-term resilience of households, thereby reducing the need for strategies to cope with the worst effects food- and livelihood-insecurity.

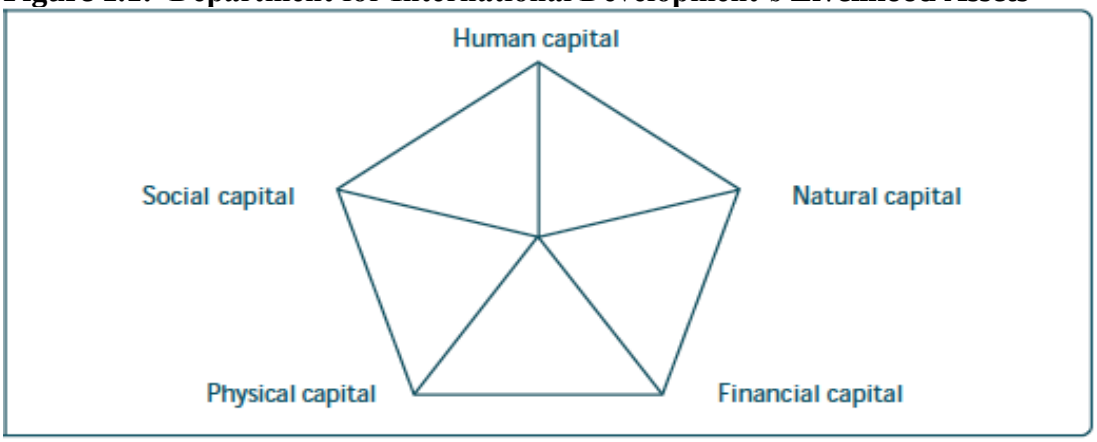
1.6 Livelihoods Literature, a Primer into Coping-Strategy and Migration-Theory:

Understanding how and why individuals or households use certain strategies to cope with food- and livelihood-shortfalls is increasingly important as climate and environmental stressors increase in frequency and severity. The literature on coping strategy use begins first with

understanding the bank of resources or "assets" households are able to choose from, and how these choices interact with external structures and processes (DFID, 1999). Chambers and Conway (1992) define household assets and how they interact within a larger livelihoods framework that incorporates "people, their capabilities—material and social—and their means of living, including food, income, and assets."

Livelihoods literature defines assets as tangible and intangible resources. Tangible assets include natural, financial, and physical assets that are resources and stores. Intangible assets include social and human assets that involve claims and access (Chambers and Conway, 1992). Figure 1.1 is a representation of Livelihood assets as developed by the Department for International Development (DFID, 1999). Of note, when livelihood assets are unable to meet a household's basic needs for food, income, and shelter, coping strategies will often be employed to protect and keep the household's livelihood solvent for as long as possible.

Figure 1.1: Department for International Development's Livelihood Assets[1]



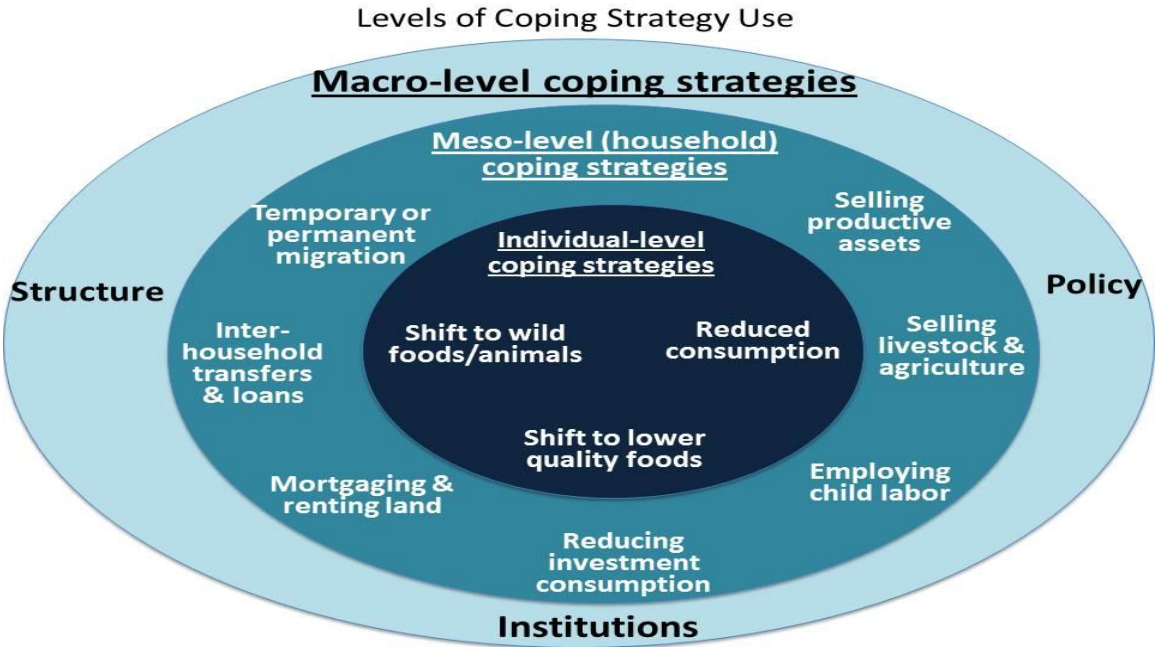
1.6.1 **Coping-Strategies Theory:** How households respond to adverse conditions, whether economic, social, or climate-related, are either proactive or reactive (Corbett, 1988).

[1] Department for International Development (1999). Sustainable livelihoods guidance sheets. Official Document. DFID, London, England.

The way that environmental changes interact with household assets as described above will influence the choice of coping strategies engaged in. Where environmental impacts are too extreme or the loss of assets too great, lower-level coping strategies are more likely to fail. Where higher-level strategies are engaged in, household assets have often been exhausted, or households are at risk of losing their food security, and ultimately, their livelihoods (Corbett, 1988; Reardon et al, 1988). There are a number of common coping strategies households use that vary in their degree of severity and sustainability. Campbell and Trechter (1982) and Corbett (1988) seminal writers on coping strategy use assert that societies, villages, and households which are vulnerable to recurrent food shortages, famine, and drought develop strategies for coping with them and plan strategically to minimize those risks.

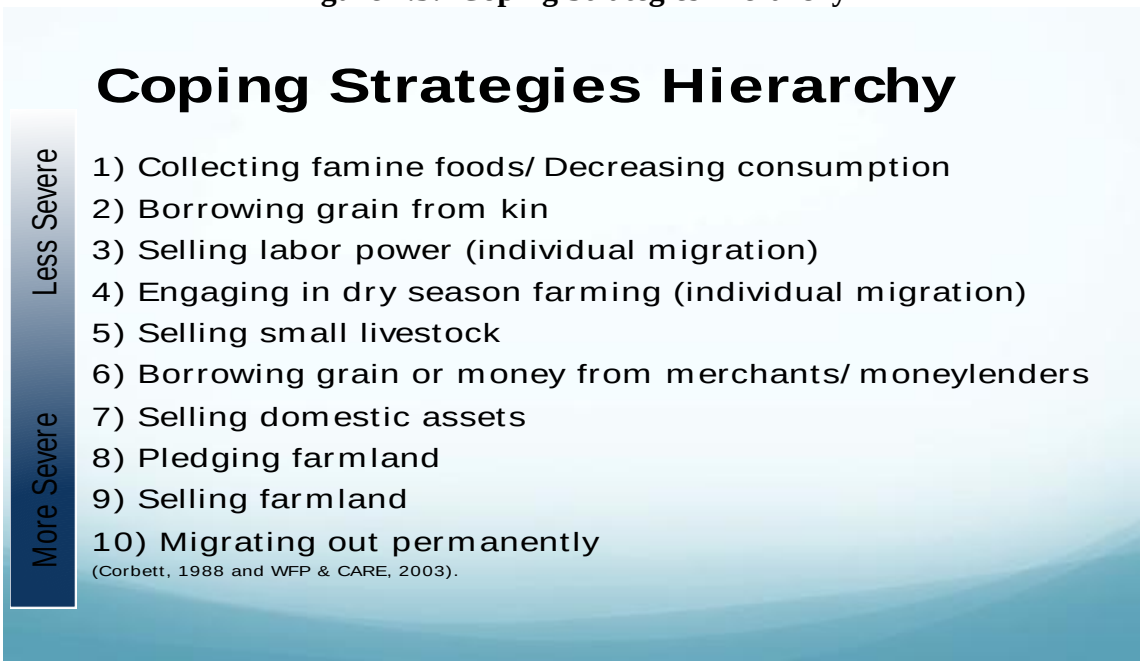
Common coping strategies observed at the household level include micro-level individual-consumption strategies including reducing current consumption, shifting to lower quality foods, and seeking new food sources including wild foods and wild animals (Corbett, 1988; WFP and CARE, 2003). When these lower-severity strategies prove to be insufficient to maintain the household's livelihood security, additional meso-, household-level strategies may be sought. These medium-severity strategies may include selling productive assets, selling livestock and agricultural products, reducing current investment and consumption, employing child labor, mortgaging land, using inter-household transfers and loans, and temporarily or permanently migrating (Deressa, 2010). Macro-, policy-level strategies that may or may not exist depending on governmental priorities include safety-net provisions, cash-transfers, and/or emergency food-aid from outside sources. The number and severity of strategies adopted can act as an indicator of household food-security status through time (Maxwell and Caldwell, 2008). These varying levels and degrees of coping strategies are depicted in Figure 1.2.

Figure 1.2: Coping Strategies by Individual, Household, and Government-level.
Note: Figures without footnote and reference have been created by the author of this dissertation (D. Hunnes)



Another way of demonstrating how coping-strategies are chosen as explicated by Corbett (1988) and the World Food Program and CARE (2003), is by the patterns of use within a population, which may help in the early detection of food shortages, impending famine conditions, or in the identification of the households that are most vulnerable to these conditions. The order in which households utilize coping strategies may have important consequences for the welfare or survival of some or all of the household members (*ibid*). Corbett (1988) and World Food Program and CARE (2003) cite the 10 most common strategies in this commonly observed hierarchical sequence (see Figure 1.3).

Figure 1.3: Coping Strategies Hierarchy



While there is some minor differentiation in themes from author to author, the extent to which households' move along this general sequence depends on their economic class or how much livelihood capital they control. For example, Demeke et al (2011) found that small stock serve as a form of insurance to agricultural households, which will often liquidate this asset where low or variable rainfalls have increased the risk for food-insecurity. As might be expected, poorer households, which tend to have the fewest assets, reach the more severe coping-strategies more quickly than do wealthier households. Moreover, wealthier households may have the ability to buy up livestock from poorer households who sell their assets at deflated prices further increasing their wealth, and resilience to future food- and livelihood-crises (*ibid*).

Of note, early works on food security and vulnerability focused on single measures of food security such as calorie availability, per-capita food expenditure, self-reported food-security status, or daily meal intake frequency (Demeke et al, 2011). Unfortunately however, these metrics take narrow views of food security and may lose the specifics of household reactions and

subsequent coping strategy use. Furthermore, coping strategies do not always directly influence food expenditure or intake and may instead address longer-term priorities of the household such as the paying of taxes to maintain rights to the land for future harvests or purchasing less-expensive livestock that buffer the household against future shortfalls in crop yields or food availability (Roncoli et al, 2001). Thus, narrow measures of food security will not provide an accurate picture of how households are responding to adverse conditions.

Unfortunately however, when coping strategies prove insufficient to uphold a household's livelihood, or where environmental impacts are too extreme and ultimately lead to a loss in assets, migration may prove to be one of the last viable options that remain.

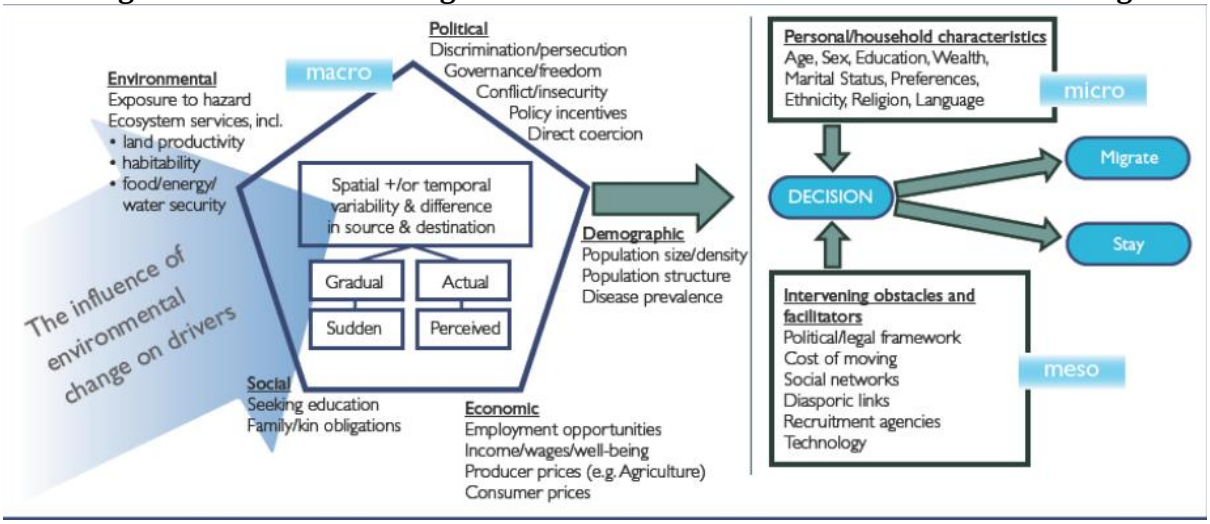
1.6.2 **Theories of Migration:** Historically, mass migration or distress migration to relief camps or roadsides has been used by international aid agencies as one of the first indicators that famine conditions threaten and that the initiation of relief programs is needed (Corbett, 1988). However, Corbett (1988), Reardon et al (1988), Roncoli et al (2001) and Deressa et al (2010) argue that distress migration is actually the last response households take to cope with climate-induced food-insecurity and/or famine conditions, and is a clear indication that other responses have failed. Corroborating this cause-of-migration assertion, McLeman and Smit (2006) also cite individual, household, or population migration as a common but often last-resort adaptation or coping response to negative environmental stressors, occurring only after the complete loss of assets or exhaustion of other coping strategies.

Perch-Nielsen et al (2008) similarly focus on establishing connections between climate, environmental change, and migration theorizing migration as a way to modify vulnerability to the negative effects of environmental events. Other more proactive theories of migration include

one by Afifi (2011) which describes labor migration; the migration of one or members of a household as a way to diversify a household's livelihood strategies. Labor migration allows households to earn additional income through daily labor-wage and is often used as a strategy to prevent or delay the onset of total-family migration (*ibid*). Portes (2013) similarly argues that migration takes a more optimistic view, where individuals migrate for economic advancement; that individuals with sufficient capacity or human-capital enter the labor market of their own volition seeking reward of higher wages than they can earn at home, rather than as a strategy to cope with the loss of household assets or livelihoods. Additionally, Tacoli (2009) and Henry et al (2004) describe mobility as part of an adaptive response strategy aimed at maintaining household well-being through the diversification of a household's livelihood portfolio.

Finally, Foresight (2011) asserts the cause of migration as a mixture of those made by McLeman and Smit (2006), Perch-Nielsen et al (2008), Portes (2013), Tacoli (2009), and Henry et al (2004) where migration is a response taken at the individual or household level to secure livelihoods, but may also be used to diversify income streams for economic advancement. Foresight (2011) conceptualizes five drivers of migration: Political, demographic, economic, social, and environmental, each of which influences the decision to migrate while also incorporating agency and the influence of environmental change. Please see Figure 1.4:

Figure 1.4: Drivers of Migration and the Influence of Environmental Change[2]



This model of migration argues the need to distinguish between mobility and displacement. Displacement is defined as the involuntary or forced movement that occurs in association with discrete events or hazards that challenge a household's safety, security, or livelihood, while mobility is a voluntary, planned, and proactive move made to improve livelihoods and opportunities (*ibid*). Effectively, this figure amalgamates the various migration theories described above.

Foresight (2011), describes these five drivers as push-pull factors that influence an individual- or household's-decision to migrate. The actual or perceived spatial and temporal differences in these five dimensions contend that a unique combination of qualities can exist at any one time and in any one context to influence the decision to migrate.

In brief, economic drivers include push-pull factors such as employment opportunity, income and wages, producer prices, and consumer prices, which, depending on the options may

[2] Foresight: Migration and Global Environmental Change (2011). Final Project Report, The Government Office for Science, London, P. 12

promote, or dissuade migration. Political drivers affect the decision to migrate via policy schemes such as land tenure, taxation, and governance pushing or pulling migration. The presence of conflict or insecurity may also influence the political drivers. Demographic drivers interact with other drivers, in particular economic drivers. Overcrowding, unemployment, or insufficient livelihood opportunities, problems often encountered by the young may trigger outmigration. Similarly, the perceived attractiveness of another area may similarly pull in-migration. Social drivers include family or cultural expectations, but are influenced by political and economic schema. In some cultures, migration is seen as a key part of social and cultural development, while for others, migration is seen as a social norm for providing remittance flows to maintain the household's livelihood. Finally, environmental drivers describe the exposure to hazards or availability of ecosystem services that influence the decision to migrate and obtain alternate sources of income until a sufficient level of services is restored (*ibid*).

Migration theories emphasize that the causes and motivations for migration must be analyzed in the context of alternative strategies, whether they be strategies for coping with adverse conditions—distress migration, or strategies to enhance or improve an individual's economic status—mobility. Both coping-strategies theories and migration-theories incorporate multiple levels, the micro-, meso-, and macro- that influence the decision of strategy to take, and offer a complex and holistic view of strategy use as proactive or reactive, depending on unique household-circumstances.

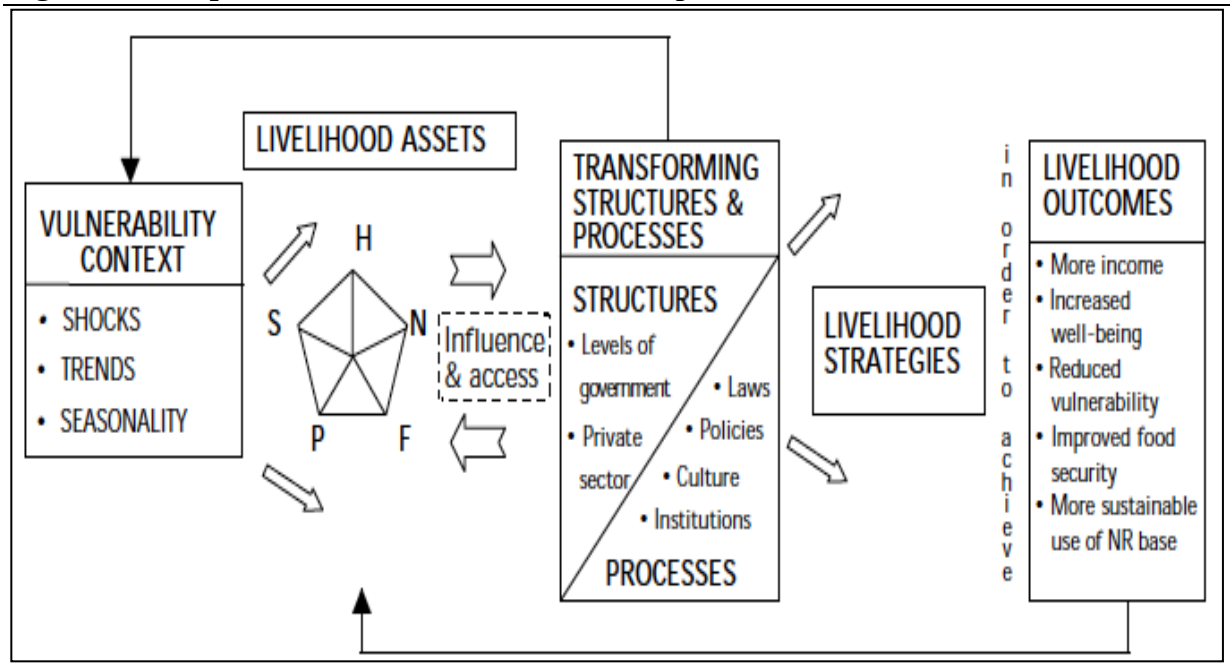
1.7 Gaps in the Literature:

While there is literature to describe the typical range and use of various coping-strategies, including migration, there remain gaps in the literature that analyze and compare between and

within household choice of coping strategy use as a function of household resilience to the negative impacts of climate change and variability. Resilience is the ability (or lack thereof) to withstand and recover from food-crises, food-insecurity, and famine. While some literature has looked at the use of strategies to cope with food-insecurity, the added dimension and interaction of climate change on this relationship is still sparse.

Because coping-strategy use, including migration can be theorized as the interaction of multiple influences on tangible and intangible livelihood-assets, as coping or mobility, as proactive or reactive, these strategies can be linked directly to household food-and livelihood-security status, demonstrated in Figure 1.5.

Figure 1.5: Department for International Development's Livelihood Framework[3]



In this model, the vulnerability includes seasonal, environmental, or climate-shocks or

[3] Department for International Development (1999). Sustainable livelihoods guidance sheets. Official Document. DFID, London, England.

trends which influence a household's livelihood assets with either positive or adverse consequences. The livelihood assets refer back to the tangible and intangible assets described in Figure 1.1 and represented in this Figure (1.5) by the pentagon. Livelihood assets further influence and are influenced by the transforming structures and processes which are synonymous with the "drivers of migration" pentagon demonstrated in Figure 1.4. Finally, transforming structures and processes influence a household's choice of livelihood strategies or strategies to cope with negative impacts of the vulnerability context, and ultimately influence a household's livelihood outcomes, one of which is food security (DFID, 1999).

This model presented in Figure 1.5 represents the theory I essentially will be testing throughout this dissertation within an Ethiopian context. I will be modifying this model to include household perceptions of climate-change in addition to identifying how households experience coping-strategies and migration. I have chosen the Ethiopian population as described above due to their recurrent and cyclical food-shortages, droughts, and famines and their high vulnerability to the impacts of climate change. Limited access to assets along with constraining structures and processes make the Ethiopian population a good one to study the influence of climate-extremes on coping-strategies use and livelihood-outcomes, namely food security.

1.8 Significance of the Dissertation:

The goal of this dissertation is to identify characteristics that differentiate households that can and cannot cope with or adapt to climate-change or sustain their livelihood- or food security. The goal of this dissertation is also to identify which variables and how they influence household-level food security over time. To do this, I explored the specific conditions that lead to the success or failure of households to cope with or adapt to food-insecurity, and I explored

climate-impacts on food security. I looked at the types of coping-strategies households' use currently, in the past, and expect to use in the future. I explored specific reasons individuals migrate to distinguish those who migrate proactively and those who migrate reactively. I also looked at what factors most significantly contribute to and predict household food-insecurity.

Finally, I reviewed perceptions of climate change through series of questions related to rainfall changes and adequacy, temperature changes, moisture-level changes, and crop-yield changes, and examined how these perceptions relate to actual levels of food security. By exploring these metrics with primary and secondary data, I was able to understand how Ethiopians experience climate-change, livelihood-, and food security with the goal of contributing to the literature and providing practical policy recommendations to reduce or prevent the worst negative impacts of climate variability and extremes, decrease recovery time in the worst-case scenarios, and target risk-reduction and adaptation strategies to increase household resilience and prospects for food and livelihood security (Roncoli et al, 2001, Corbett, 1988). This dissertation contributes to the literature and provides recommendations that are actionable, relevant and realistic, timely, and measureable for ongoing research in this area.

1.9 Research Question:

1) What are the differences in coping-strategy use by households with higher- or lower-perceived levels of tangible and intangible assets. 2) How are coping-strategy use and asset-levels influenced by perceptions of climate-change. 3) How are food- and livelihood-security influenced by the severity of household coping-strategy use. 4) How are food- and livelihood-

security influenced by climate-change. To answer these questions, three separate, but related studies were conducted.

1.10 Organization of the Dissertation:

The dissertation is organized as follows: Chapter 1 provided the background, context, literature review, specifies the research problem, and the scope of this dissertation.

Chapter 2 is the first of three studies. This study explored migrants' reasons for rural-to-urban migration, their perceptions of household asset-adequacy and climate-change using primary interviews in the Capitol city, Addis Ababa. Based on the findings, a conceptual framework was developed to model the findings. Policy and future research needs were recommended.

Chapter 3 is another primary interview study. This study explored individual perceptions of household asset-adequacy, perceptions of climate-change, and household coping-strategy use in the context of Ethiopian rural villages. Reasons for using various coping-strategies and individual expectations for future- migration need were also explored. Based on the findings, policy and future research needs were recommended.

Chapter 4 utilized a secondary data set, the Ethiopian Rural Household Survey (ERHS) to explore household perceptions of rainfall-adequacy through time and spatially. Coping-strategy use, food-security status, and household-asset changes over time and location were also explored. Based on the findings, policy and future research needs were recommended.

Chapter 5 summarizes the findings from all three studies and provides conclusions and future research recommendations.

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CHAPTER 2: An Analysis of Ethiopian Rural-to-Urban Migration Patterns from Primary Interviews.

2.1 Introduction

As described in section 1.1 of this dissertation, climate variations and extreme weather events including droughts, floods, and rising temperatures are increasing in frequency and severity around the globe, and are impacting the agricultural livelihoods of rain- and weather-dependent small-scale farmers of Ethiopia (Boko et al, 2007). Urbanization, specifically rural-to-urban migration is similarly, a growing phenomenon around the world. Ethiopia, the second most populated country in Africa has a rapidly growing urban population at nearly four percent each year, as well as a high national population growth rate of nearly three percent each year (CIA World Factbook, 2012).

Rural-to-urban migration is cited to occur for two main reasons. The first is considered a late-stage coping strategy that subsistence agricultural households use to sustain their livelihoods (McLeman and Smit, 2006). Nearly eighty-five percent of the Ethiopian population engages in small-scale farming, and the interactions among poor government infrastructure development, poor political will and resource allocation, and few adaptation and coping strategies, often result in rural households seeking out additional income sources to diversify their household's livelihood strategies (Tolossa, 2010, and Ellis and Allison, 2003).

As described in section 1.4, population migration is a common adaptation or coping response to environmental stressors such as drought or flood. However, in a country such as Ethiopia where small-scale rain-fed agriculture is the norm, environmental degradation may result in the depletion of natural and physical capital, and ultimately a reduction in livelihood

security. Decreased livelihood security may prompt the diversification of livelihood strategies, and necessitate the migration of one or more household members, typically unmarried sons, to gain employment in non-affected, non-agricultural sectors (Adugna, 2011). This labor-migration, or movement of able-bodied individuals from their village of origin, often brings individuals to other villages, or to cities, where they try to earn a labor-wage to supplement their family's income and purchasing power (*ibid*).

Mobility-related rural-to-urban migration, the second reason cited for migration focuses more on migration as a way to increase an individual's economic position (Portes, 2013). This type of migration is the proactive movement of individuals to earn better incomes, receive better educations, or better opportunities than they may have at home. The literature on migration as proactive or reactive adaptations by households is limited, but growing. The majority of migration surveys that exist to date focus on political, economic, or environmental prompts to population movement and often fail to acknowledge climate-impacts on this decision (Black et al, 2011 and Perch-Nielsen, 2008).

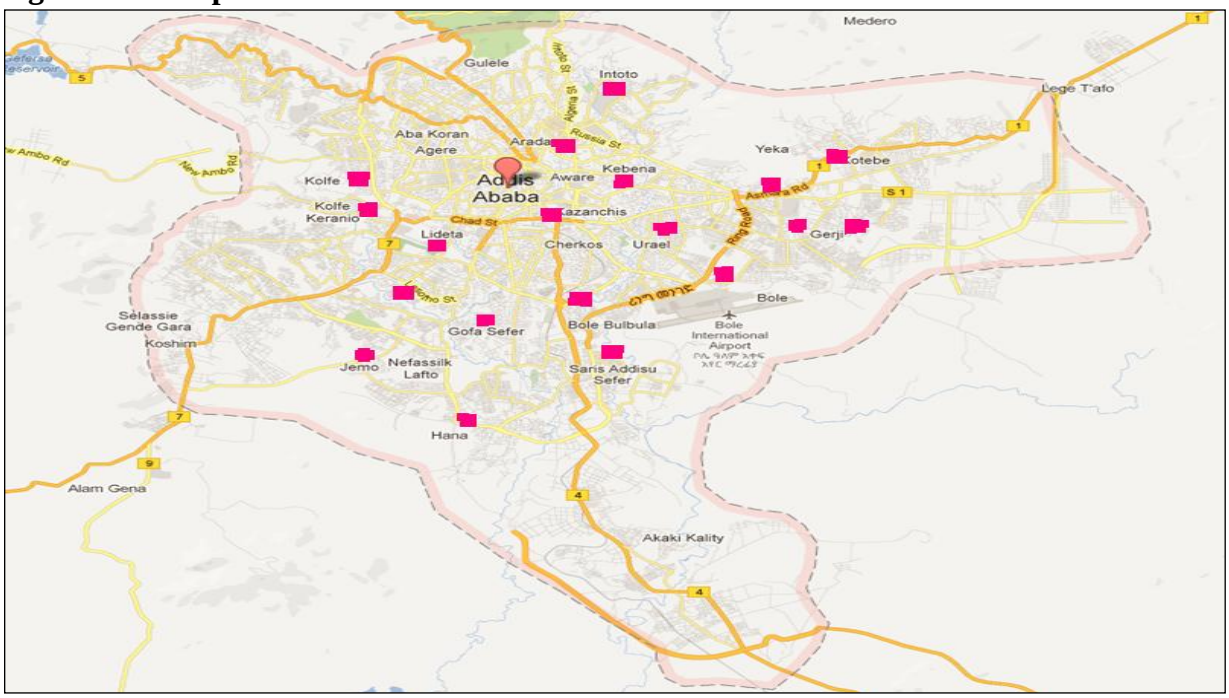
To understand more fully how climate variations, extremes, and environmental impacts may influence an individual or household's decision to migrate, primary interviews were conducted in the Capital city of Ethiopia, Addis Ababa, with rural-to-urban migrants. This study was grounded in livelihoods theory and migration theory as described in section 1.4 with the goal of understanding the proactive or reactive conditions that are pulling or pushing rural-to-urban migration into Addis Ababa, Ethiopia. Results of the primary interviews provide a foundation for policy recommendations, implications, and further directions for future research.

2.2 Methodology

2.2.1 Data Source and Collection

This study uses data from structured interviews with 59 individuals who migrated into Addis Ababa from rural villages. Interviews took place across eighteen sub-districts of Addis Ababa. Sub-districts were chosen based on where mini-buses dropped off and tended to be areas with large populations. See Figure 2.1.

Figure 2.1: Map and sub-districts of Addis Ababa Where Structured Interviews Occurred



Recruitment materials, methods of consent, and research methods were approved by the Institutional Review Board of UCLA prior to the study's commencement. The selection and recruitment of interviewees was based on a recommended list of criteria provided by World Vision Ethiopia (WVE) and included beggars, house-workers, shoe-shiners, labor workers, and other casual day-workers as likely rural-to-urban migrants.

With the assistance of an Amharic/English speaking translator (Nahom Atnaw), three to four individuals were selected within each of the eighteen sub-districts to be approached, with

convenience based on their meeting the recommended criteria above. Recruitment involved Nahom approaching the individual I selected, such as a shoe-shiner or a beggar and introducing this researcher and himself, reading the recruitment letter to each interviewee, explaining the purpose of the study, the expectation of their involvement, and explanation of remuneration, and contact information. Upon confirming that individuals met the selection criteria, and receiving their informed consent, we moved to a private area and the structured interviews began.

On only two occasions did the interviewee decline to start or complete an interview. The first occasion was a beggar who had a young child with her, and the second was a produce-seller who started the interview but did not want to finish after the first several questions. Snowball sampling was also employed so as to recruit more females into the sample, as culturally, it is males who typically migrate. It was important to oversample females so as to get an understanding of the female-migrant experience as females are vastly under-represented in livelihoods and migration literature.

In addition to the translated recruitment materials Nahom and I used for this study, WVE, a trusted Non-Governmental Organization (NGO) in Ethiopia, also provided a written letter on WVE letterhead explaining the purpose of this research study. Individuals who met the criteria of the study, including being older than 18 and having migrated from a rural village, gave their oral informed consent to participate. Remuneration of 10 Ethiopian Birr (~$0.60 US) was provided to each interviewee at completion of the interview, again, per the recommendation of WVE. For those two individuals who did not start or complete their interview, there was no penalty, and we thanked them for their time.

The structured interview and questionnaire that guided this study was developed based on existing migration research and identification of gaps. The questionnaire was written in English

and translated into Amharic prior to arrival in Ethiopia. The questionnaire covered topics such as reason for migration, type of employment, farming history, asset history, land size, types, number, and changes to crop yields, price of farming inputs, length of time in Addis Ababa, distance of village from Addis Ababa, and perceptions of changes in rainfall levels prior to their migration. For the full questionnaire (pre-translation) please see Appendix A.

To test the feasibility of the structured interview questionnaire, Nahom (translator) and I recruited, and consented two labor workers near WVE. Quickly, we discovered the that questionnaire was not feasible because 1) the questions were too cumbersome, lengthy, and complicated, and 2) they took far too long to ask, much longer than interviewees were willing or able to do. After these two attempts, the interview guide was re-worked in English, simplified, and translated again by Nahom into Amharic and read back in English from the translation to assure consistency. This new interview is in Appendix B. Pilot-testing this new interview guide proved to be much more successful in gaining meaningful responses, was less complicated while gaining similar information, and was successfully completed by our test-interviewees.

Structured interviews were conducted orally. The only records of the interviews are hand-written notes, written closely word-for-word while Nahom translated the response into English. If clarification or expansion was needed, I would prompt Nahom to prompt the interviewee so as to gain the most explicit and complete response possible.

The sample was made up of 59 individual rural-to-urban migrants. Thirty-nine (66%) were male, and twenty (34%) were female. Ages varied from 18 to 45 at the time of the survey, with the majority (76%) between the ages of 18-35, matching expected age demographics based on the population of Ethiopia (CIA World Factbook). Eleven individuals (19%) declined to state

their exact age, but were older than 18. Males varied in age between 18 and 38, and females between 18 and 45.

2.2.2 Data Management and Analysis

Upon completion of the 59 interviews, the raw written notes were transcribed into an excel spreadsheet where each column was a question and each row an interviewee. For each column (question) all rows (interviewee answers) were reviewed verbatim, and initial analytic concepts and themes were identified (Strauss and Corbin, 2008). These initial concepts were used to describe basic characteristics about the sample by asking questions of the data such as "what is happening?" and "what does it mean?" After describing characteristics of the sample with these initial questions and concepts, I formed categories of related concepts and themes so that I was able to make sense and understand the experiences of my interviewees (*ibid*). To form these categories, I asked "what are the most significant or most frequent initial themes/concepts?" These categories reflected what people were doing and what was happening.

As categories formed, their relationships or connectedness emerged and bivariate analyses were performed. Correlations were run on continuous variables, t-tests were run to compare sample means, Fisher's exact tests were performed to examine associations between categorical variables. Statistical tests were conducted with STATA 12.1 (Stata Corp, College Station, Texas). Statistical significance was measured at $p < .05$. These analyses help tell a cohesive story and help develop hypotheses that explain what was happening in the lives of the interviewees, promoting the best possible representation of the experience of my interviewees (*ibid*). I compared my theories based on the data with existing theories and literature related to the topics of climate variations, extremes, and migration. Due to the nature of theory development, I was not trying to obtain a representative sample of the Ethiopian population, but

rather, a sample that would represent the population I was trying to describe, the population whose behavior I was most interested in, rural-to-urban migrants.

2.3 Findings and Discussion

2.3.1 Basic Demographics

Twenty-six (44%) of the 59 interviewees migrated from the Amhara region, 26 (44%) from the Debub (Southern Nations, Nationalities, and Peoples (hereinafter: SNNP)) region, and 7 (12%) from the Oromia region with no statistically significant differences in where the sample was from by gender. Nearly two-thirds of the sample was male and one-third was female.

Table 2.1: Region of Origin by Gender

Region of Origin	**Male**		**Female**		**Total**	
	N	**(%)**	**N**	(%)	**N**	(%)
Amhara	15	(38)	11	(55)	26	(44)
Debub (SNNP)	21	(54)	5	(25)	26	(44)
Oromia	3	(8)	4	(20)	7	(12)
Total	39	(100)	20	(100)	59	(100)

p = 0.091

Figure 2.2: Map of Ethiopia by Region

The Ethiopian general population has some similarities to the group that resulted from this study. Nearly eighty percent of the whole Ethiopian population lives in these three regions. The gender distribution—here a 2 to 1 split—however, does not reflect the general population, which is more evenly distributed, since males typically migrate (CIA World FactBook, 2013). One factor that may be influencing who is migrating to Addis Ababa is Ethiopian infrastructure. The three regions Amhara, Debub (SNNP), and Oromia have better roads, more transportation, and infrastructure by which to come and go from Addis Ababa to outlying areas.

The self-reported ages of interviewees in my sample ranged from 18 to 45 years of age with over three-quarters of the sample aged 35 or younger. In Ethiopia, approximately one-third of the total population falls between the age of 18 and 35 with another approximately one-third under the age of 18. The majority of my sample fell into the 18 to 35 age-demographic which is well within expected distributions (*ibid*). There were no differences in age by gender.

Table 2.2: Age by Gender (N = 59)

	Male		**Female**		**Total**	
	N	(%)	N	(%)	N	(%)
18-23	24	(62)	9	(45)	33	(56)
24-29	5	(8)	3	(15)	8	(14)
30-35	1	(2)	3	(15)	4	(7)
36-41	1	(2)	1	(5)	2	(3)
42+	0	(0)	1	(5)	1	(2)
unspecified (>18)	8	(14)	3	(15)	11	(19)
Total	39	(100)	20	(100)	59	(100)

Fisher's exact p = 0.252

While all interviewees were from households with farming livelihoods back in their villages of origin, at the time of this study, nine of the 20 females (45%) were house-workers and 10 (50%) were beggars. Fifteen females (75%) indicated that housework is a desired occupation in Addis Ababa for women, paying a reasonable wage while also providing room and board.

"If you do not get housework or enough money to return, there are no other job. I am beggar because I cannot get housework."

Begging is a common outcome for female migrants when they cannot obtain work as a house-worker. One female interviewee (5%) was a shoe-shiner. Nearly an equal number of males in the sample were observed or stated to be labor-workers 15 (38%) and shoe-shiners 16 (41%), while another 7 (18%) reported that they engaged in other casual work. In general, males and females were engaged in significantly different types of jobs ($p = 0.000$) with males engaged in more outdoor/physical labor and females engaged in more house-work and begging activities.

Table 2.3: Occupation by Gender (N = 59)

	Male		**Female**		**Total**	
	N	(%)	N	(%)	N	(%)
Labor worker	15	(38)	0	(0)	15	(25)
Beggar	0	(0)	10	(50)	10	(17)
Shoe-shiner	16	(41)	1	(5)	17	(29)
House-worker	0	(0)	9	(45)	9	(15)
Other casual worker	7	(18)	0	(0)	7	(12)
Waiter	1	(3)	0	(0)	1	(2)
Total	39	(100)	20	(100)	59	(100)

Fisher's exact $p < 0.0005$

As for education, males on average reported significantly more education (5.4 years) than females reported (3.4 years) $p = 0.035$, see Table 2.4. While the range of years of self-reported educational attainment for both males and females was 0-10 years, a much higher proportion of females than males reported receiving no education. The median number of self-reported years of education for males was six years and for females two years.

Table 2.4: Average Years of Education by Gender

	Mean years of education	N	%
Gender			
Female	3.4	20	(34)
Male	5.4	39	(66)
Total	4.7	59	(100)

p = 0.035

According to the CIA World Fact book (2013), males on average have a school life-expectancy of nine years and females on average have an eight-year school life-expectancy. Education expenditures make up 5.5% of Ethiopian GDP, and on average, only about 50% of males and 35% of females over the age of 15 are literate. My sample was quite lower than the national averages on educational attainment.

According to the Department for International Development (1999), education is an intangible human- and social-asset. Education allows individuals to acquire knowledge, capacities, and capabilities that may help them to improve their existing assets while also creating new assets and opportunities. Low levels of education, represented in this sample, indicate gaps in human and social-assets, and may interact with other macro-level economic, political, and social forces to limit livelihood options that are available to these individuals in their villages or in cities, such as Addis Ababa. This will be explored further in the "technical inputs and farming practices" section.

2.3.2. Length of time lived in Addis Ababa and Reason of Migration

The length of time interviewees reported living in Addis Ababa ranged from less than or equal to one month, reported by three interviewees (5%) to a maximum of fifteen years, reported by one interviewee (2%). At the time of the study, the mean length of time interviewees

reported living in Addis Ababa was approximately 2.8 years, the median length of time, 2 years. To corroborate the response given for length of time in Addis Ababa, interviewees were asked what year they migrated. Of note, the Ethiopian calendar is eight years behind the Gregorian calendar, and there are thirteen Ethiopian months. The year interviewees reported their migration was changed into Gregorian, and for all 59 interviewees, the year of migration matched the length of time reported living in Addis Ababa.

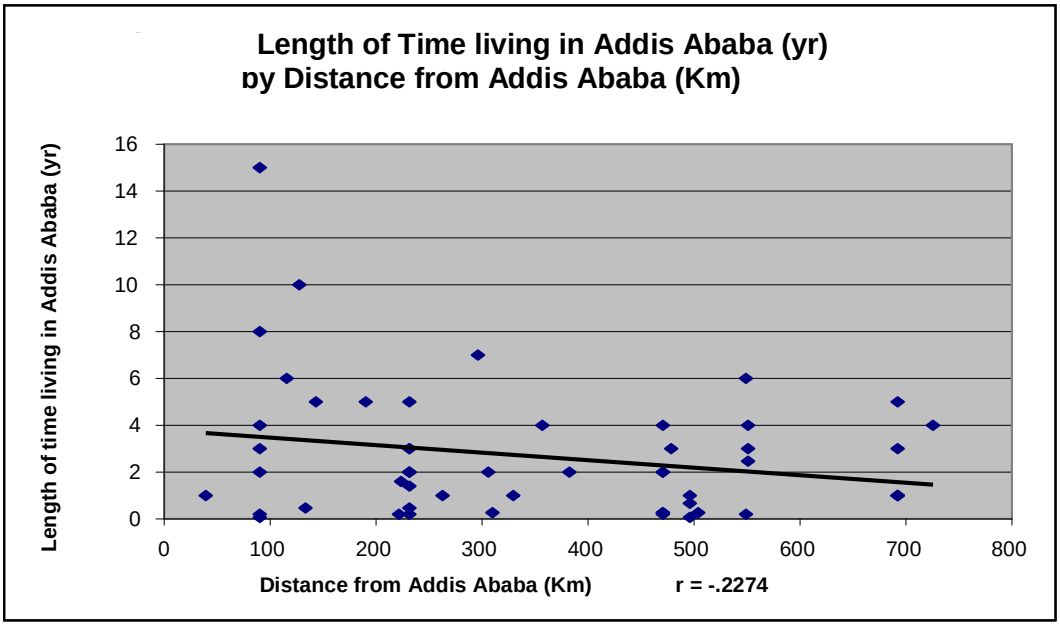
As reported in examples below, most interviewees did not have any pre-conceived notion of how long they would spend in Addis Ababa, though the occasional few did:

> *"I did not know how long I will stay before coming here. I stay long enough to get enough money and other things."* – 24 year old, male waiter.
>
> *"I did not have imagination about how long I will be in Addis."* – 22 year old, male labor worker.
>
> *"If I get enough money, and enough things, I only will stay 1 year in Addis, if not, two years."* – 22 year old, female house-worker.

These responses indicate that interviewees did not come to Addis Ababa with a specific length of time that they wanted stay, and that this migration was viewed as a temporary status, one that is conditioned on obtaining sufficient money or other needs as perceived by the interviewees. This assertion is based on the fact that the vast majority of interviewees reported that they wanted to return home upon obtaining enough money. It is important to note that individuals who were interviewed for this study have managed to stay and are "surviving" in Addis Ababa to some degree, rather than returning home, as of the time of the interview. In other words, the individuals interviewed for this study did not include individuals who had migrated to Addis Ababa but left.

Villages ranged from 90 kilometers (Km) away from Addis Ababa, such as Gurage in the Debub Southern region, up to 693 Km away, such as Walu in the northern Amhara region. The average distance away from Addis Ababa was 312 Km. There is a negative correlation (-0.2274) of time to distance such that the longer an interviewee reported living in Addis Ababa, the shorter the distance he or she travelled to get to Addis Ababa. However, this is not statistically significant (p = .1015) and so there is no difference in the length of time reported living in Addis Ababa compared to the distance travelled to get to Addis Ababa.

Figure 2.3



p = .1015

Worth noting are the few outliers on the left-side of the graph (short-distance) where two individuals lived in Addis Ababa for 10 and 15 years respectively, but travelled less than 200km respectively thus skewing the relationship and correlation somewhat.

Reasons for migration: Interviewees reported multiple reasons for their migration. Reasons for migration cited most frequently (see Table 2.6) included wanting more money or job opportunities stated by 39 individuals (66%), 26 males (44%) and 13 females (65%).

> *"I come to Addis because I imagine I will find good work as house-worker."* – 20 year old, female house-worker.
>
> *"I leave my village because I want more work and more money, I have no land, and so I need job opportunity."* – 22 year old, male shoe-shiner.
>
> *"I choose Addis because I have no choice, it is the biggest city in Ethiopia, Addis is a big city with job opportunity*." – 21 year old, male labor-worker.

The second most common reason cited for migration was not having enough land or food, stated by 18 interviewees in the sample (31%), 12 males (31%) and 6 females (30%).

> *"I leave my village because we do not have enough money at home to buy enough food. We farm in the summertime, and farming is not enough for the whole year. We do not get enough food for the whole year, so I come to Addis for more money, to be able to buy enough food at home."* – Older than 18, male labor-worker.
>
> *"I leave my village because I have no land. My parents only have small land, and it does not give us enough food all year."* – 18 year old, female beggar.
>
> *"I come to Addis because I have no land, I am a woman and I cannot get land, and I cannot do labor, so it is better for me in Addis*." – 25 year old, female house-worker.

Needing more money for school was reported as another reason for migration by 6 of the interviewees (10%), 5 males (13%) and 1 female (5%).

> *"I come to Addis while school is out so I can try and get more money than I can get in my village. I will return back when I earn enough money and things for school."* – 18 year old, male shoe-shiner.
>
> *"I come to Addis for only a short time, I make some money for my education."* - 23 year old, male shoe-shiner.

"I come to Addis to buy books and other things for school, to make some money. I will return on Monday to start 10th grade." – older than 18 year old, male peanut-seller.

Needing medical care was cited by 5 interviewees (8%), 2 males (5%), 3 females (15%).

"I come to Addis because I need treatment for my skin disease. I cannot get this treatment in his village." – 24 year old, male sugar-cane seller.

"I leave my village because I have fistula and needed surgery and treatment. I needed medical help because I cannot get in my village." – 19 year old, female beggar.

Three interviewees (5%), all male, reported migrating to earn more money for fertilizer/seeds.

"I come to Addis after harvest this year[1 month ago] because I do not get enough money this year from my harvest to pay for the fertilizer cost. I come to Addis for more money." – 38 year old, male labor worker.

"I come to Addis because I cannot pay for the fertilizer after the harvest season [1 year ago]. Fertilizer costs a lot of money, and I did not get enough money after harvest, so I have to come to Addis to make more money." 35 year old, male labor worker.

Three interviewees (5%), all female, reported failing out of school as the reason they migrated, and finally, a few interviewees did report more than one reason for migration.

"I fail out of 8th grade, after exam, since I cannot get land, it is better that I move to Addis." – 20 year old, female house-worker.

"I came to Addis because I fail 8th grade learning, I could not move up in my education, and I cannot get good work in my village." – 21 year old, female house-worker.

Table 2.5: Most Frequently Cited Reasons for Migration by Gender

	Male (n = 39)		Female (n = 20)		% of Total (n = 59)	
	N	(%)	N	(%)	N	(%)
More money/job opportunity	26	(67)	13	(65)	39	(67)
Not enough land/food	12	(31)	6	(30)	18	(31)
Earn money for school	5	(13)	1	(5)	6	(10)
Medical Care	2	(5)	3	(15)	5	(8)
Earn money for fertilizer/seeds	3	(8)	0	(0)	3	(5)
Failed out of school	0	(0)	3	(15)	3	(5)

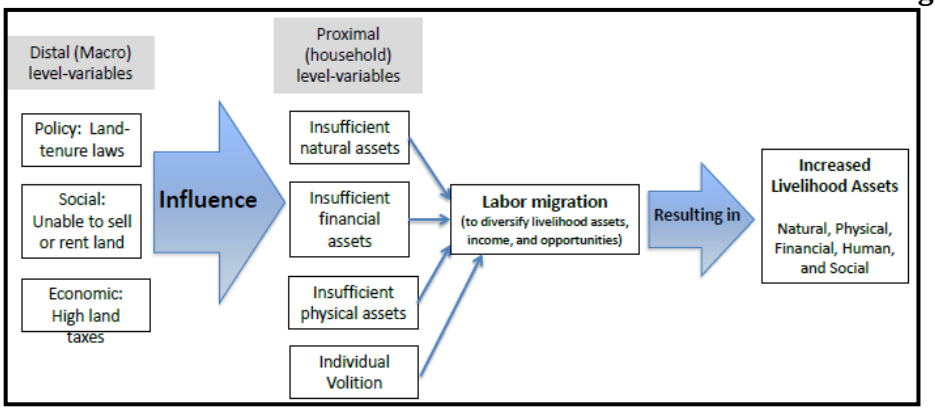
Fisher's exact p = 0.108

In reviewing the evidence, it appears as though reasons for migration were not significantly different by gender, and that the majority of interviewees migrated as a result of their households having insufficient livelihood assets or capital, in particular, insufficient tangible livelihood assets—financial, physical, and natural capital. However, there were also reported deficiencies in intangible livelihood assets including human and social capital. These assertions are plausible, but not sufficient to explain fully the reasons for migration as there were also a number of interviewees, approximately one-third, who reported that they would have migrated even despite their households having sufficient assets, which represents more of a proactive mobility point-of-view of migration as held by Portes (2013), Tacoli (2009), Afifi (2011) and Henry et al (2004).

In order to more fully understand the interviewee's stated reasons for migration, they must also be examined in the context of contributing macro-level forces. Some of these macro-level forces include political, demographic, economic, social, and environmental characteristics that influence the decision to migrate as a proactive or reactive response. While most interviewees reported migrating to increase their financial capital, to earn more money or obtain a better job, others reported migrating to increase their human capital (money for school) or due

to having sparse natural and physical capital (insufficient land and food). Still, other interviewees reported migrating despite adequate land, food, and capital. While there are a number of proximal household-level variables that influence migration such as having insufficient assets and individual volition, there are also a number of more distal macro-level forces that also influence these decisions (see Figure 2.4 and subsequent discussion).

Figure 2.4: Distal and Proximal Influences on Individual Decision to Migrate



As noted in section 1.3.3.1 and 1.3.3.2, political forces such as land-tenure laws, as well as social and economic practices, restrict the amount of land households have to farm, negatively impacting household-level assets. Similarly, economic policy and social institutions force already-strapped households to pay high land-taxes regardless of that year's crop output, yet do not allow the sale or rent of land to other family members or households. Moreover, per inheritance laws, as households parcel off their land to their married sons, they exponentially diminish their own and subsequent generations' ability to maintain or add additional assets to their livelihood portfolio since nearly all household assets are tied to agriculture and to the land. These forces may increase household's fear of losing their land and their livelihoods or developing and utilizing coping strategies to be discussed further below.

Why interviewees chose to migrate to Addis Ababa was another question of interest since some households came from 500-plus kilometers away. Several interviewees chose Addis Ababa because it is the closest big city. Others reported that they thought Addis Ababa would be the best place to get a job, while and others reported that someone else in their village came first and indicated that Addis Ababa is a good place to get a job, and so, came of their own volition to enhance their own economic well-being, similar to the arguments made by by Portes (2013), Tacoli (2009), Afifi (2011), and Henry et al (2004).

> *"I choose Addis because I imagine it to be better work, because I want to do sport things, like run and be famous. I did go to other cities before Addis, but only find short job opportunity there, so I come here to Addis, where it be better."* – 22 year old, male labor-worker.
>
> *"I choose Addis because I am a beggar, I have no education, and I can get some money in Addis, I thought it is a good choice to come here from my village*." – 40 year old, female beggar.
>
> *"I come to Addis because I have no choice, it is the biggest city in Ethiopia. Addis is a big city with job opportunity."* – 22 year old, male shoe-shiner.

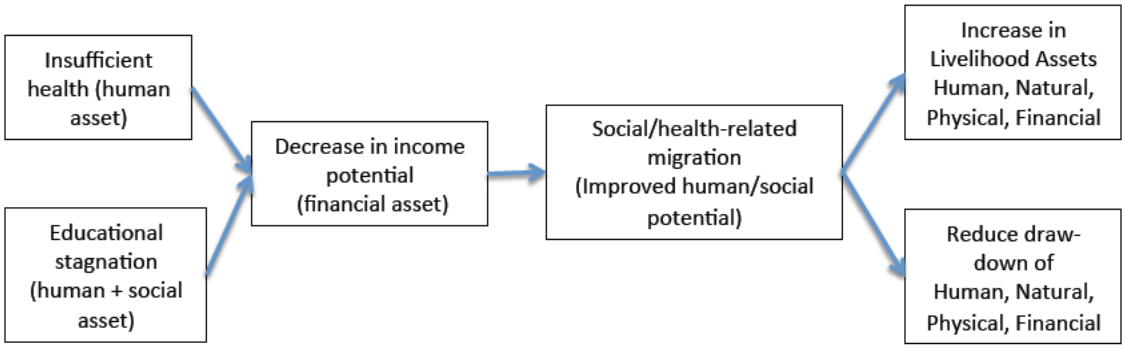
Additional reasons for coming to Addis Ababa were related to interviewees being unmarried or un-landed. Therefore, some interviewees came to Addis Ababa on their own initiative in order to make money for themselves, for their family members, or for their future desire to obtain land.

> *"I come to Addis because my older brother married and received land from my parents. My older brother must stay in the village to work, so I must come."* Older than 18 year old, male labor-worker.
>
> *"My older brother is married and stays on the farm. My younger brothers and sisters are trying to still go to school, so I come here to send money home so my brothers and sisters can go to school, and when I get enough, I will go back to school too."* – 24 year old, male shoe-shiner.

"After my grandparents die [she did not know her mom and dad] I am the only one left. I did not have any property in my village and I have no parents or grandparents, so I decide on my own to come to Addis." – 30 year old, female beggar.

As previously stated, insufficient tangible assets, while contributing to migration, do not alone determine migration. The other two reasons cited for migration—needing medical care and failing out of school—to a degree represent a failure or insufficiency in household intangible-assets. Having adequate health and the ability to contribute to the household physically and socially are critical intangible human assets. Health care services are lacking in the majority of rural villages of Ethiopia, and where medical treatment is needed, migration becomes a necessity, often a costly one (Tolossa, 2010). It is important to remember however, that there is a likely positive outcome to medical migration that allows the treated, newly-healthy individual to enter the work-force and contribute to household asset accrual (see Figure 2.5).

Figure 2.5: Potential Migration Effects on Deficient Health and Education



Education, another intangible human- and social-asset, helps improve existing assets while creating opportunity for new asset acquisition (DFID, 1999). Where individuals have failed out of school, or never participated in school, there is a large gap in human and social

resources. As noted earlier, a much larger proportion of women than men received no education. This may again represent the interaction of macro-level economic, political, and social forces whereby the deficit in education may limit the livelihood strategies that are available to individuals in their villages. As an example, insufficient education may limit an individual's ability to engage in technical inputs or farming practices while an inability to read or write may limit an individual's ability to access safety-net programs, or other supports, thus leaving migration as one feasible way to prevent the further draw-down of other household assets.

2.3.3 Perceived Adequacy of Household Assets

In agriculturally- and pastorally-based populations, land, animals, crop yields, and human labor are often cited as the most important household assets (Ellis and Allison, 2003). In my sample, 37 interviewees (63%) reported that they were members of households farming ≤ 1 hectare of land. Fourteen interviewees (24%) reported that they were members of households farming >1 hectare of land. Eight interviewees were unable to specify the amount of land their families farmed. A note of interest, when interviewees were asked how much land their family farmed, they answered in local terms, for example:

> *"We have small amount of land, it takes one day with one farming instrument to work the land"* - 23 year old, male shoe-shiner.
>
> *"We have small land, it is not enough during the year, it takes two days with one farming instrument. People that have big land, it is enough for the year, they get more labor because harvesting is hard work, but we only have small land."* - Older than 18 years old, male shoe-shiner.

To understand what these local "measurements" of land mean, the agriculture expert at World Vision Ethiopia, Mr. Tedessa, was consulted and explained that it takes approximately one day with one farming instrument to plough 0.25 hectare of land. Therefore, he explained

that for each additional day or additional instrument for farming, to add a factor of 0.25 hectare to the conversion. Thus for an individual who says it takes them 6 days with one farming instrument, it can be assumed that they farm approximately 1.5 hectares of land.

Interviewees reported the adequacy of their family's farm land in terms of the yield of crops it produced, and the amount of money or other assets—including food—it provided (see Table 2.7).

Table 2.6: Land adequacy (enough food) by land area (hectare)

	0-1.0		>1.0		Unspec		Total	
	N	%	N	%	N	%	N	%
Land gives enough food for the year								
Yes	7	(19)	7	(50)	2	(25)	16	(27)
No	30	(81)	7	(50)	6	(75)	43	(73)
Total	37	(100)	14	(100)	8	(100)	59	(100)

Fisher's exact p for land-area specified = 0.038

In total, 16 interviewees (27%) reported that their household's land provided enough food or other "things" including money for the year, while 43 (73%) reported that their household's land did not provide enough food or other "things" for the year. More specifically, of individuals who reported that their households farmed ≤ 1 hectare of land, 7 interviewees (19%) reported that their household's land provides enough food for the year, while 30 interviewees (81%) reported that their household's land did not provide enough food for the year. Conversely, of individuals who reported their households farmed > 1 hectare of land, seven (50%), reported that their household's land provided enough food, while the other seven (50%) reported that their household's land did not provide enough food for the year. For those individuals who did not specify their land area, two interviewees (25%) reported that their land did not provide sufficient food, and the other six (75%) reported that it did. For interviewees who specified how much

land their households had, there was a significant difference in whether their land was giving enough food for the year (p = 0.038) where those with more land reported that their land gave enough food more often than those with less land.

> *"My parents were farmers. The product we get from our land is not enough for the year. We also have ox and cows and sell milk product, and sometimes we borrow from other people so we can get other things and go to school."* - 25 year old, female house-worker whose family farmed approximately one-half hectare of land.

> *"The product you get depends on the capacity of the farmer. The land we have sometimes give us good product, but not enough for the year. We have no ox, cows or other things, so we do not have enough."* - 38 year old, male labor-worker whose family farmed approximately one-quarter hectare.

I examined whether households had any assets (animals, crops) beyond their land. Forty-two interviewees (71%) reported having no additional assets, two (3%) reported owning chickens, two (3%) reported owning cows, two (3%) reported owning oxen, and 11 (19%) reported owning cows and oxen. Table 2.8 shows the relationship.

Table 2.7: Additional Assets by land area (hectare)

	0-1.0		>1.0		Unspecified		Total	
	N	%	N	%	N	%	N	%
Additional Assets								
None	28	(76)	8	(57)	6	(75)	42	(71)
Chickens	1	(3)	1	(7)	0	(0)	2	(3)
Cows	1	(3)	1	(7)	0	(0)	2	(3)
Oxen	1	(3)	1	(7)	0	(0)	2	(3)
Cows and Oxen	6	(16)	3	(21)	2	(25)	11	(19)
Total	37	(100)	14	(100)	8	(100)	59	(100)

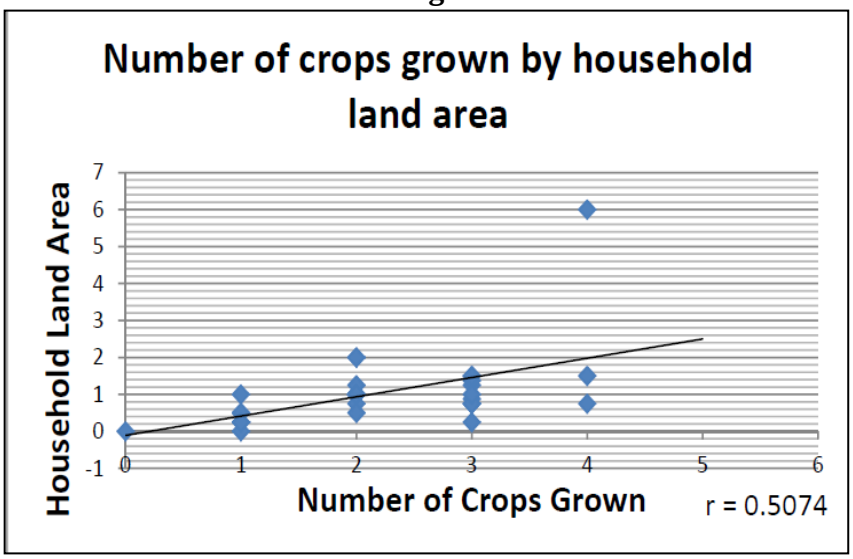
Fisher's exact for land-specified, p = 0.349

There was no difference in reported asset-ownership by land area. The majority of interviewees reported owning no assets, regardless of household land area with 28 (76%) of individuals from households farming ≤1 hectare of land reporting having no additional assets,

and 8 (57%) of individuals from households farming > 1 hectare of land reporting no additional assets. Similarly, of those interviewees who did not specify how much land their families farmed, 6 (75%) reported no additional assets and 2 (25%) reported owning cows and oxen.

Finally, since number of crops grown and crop-yields represent a level of wealth as well as an indicator of food diversity and food security, it was important to know how many crops households were growing on their land and whether there was a relationship between land area and number of crops grown (see Figure 2.6). The number of crops all households reported growing ranged from zero to four crops. There was a medium-strength positive correlation (r = 0.51) between household land area and number of crops grown, and it was statistically significant indicating a relationship between land area and number of crops grown. The number of crops grown increased as land area increased to a ceiling of four crops even when one individual had very large land area indicating that the land may be used for other purposes.

Figure 2.6:



p = .0026

The preceding tables and figure converge on possible reasons for migration. Most interviewees reported that their family's farmland does not provide enough food or other "things" for the year, particularly those with smaller plots of land. Most interviewees reported that they do not have any assets above and beyond their land. Moreover, as land area increases, the numbers of crops households grow increases, supporting the assertion that smaller plots of land are less able to provide sufficient food. While this analysis does not provide definitive explanations about why individuals migrate, it does establish trends for this sample. Moreover, these responses provide a counter-balance for the next set of questions related to, "Would you migrate even if your land provides enough." The rationale behind this set of questions was that if individuals were migrating only when their land does not provide enough, it may corroborate that insufficient assets or climate-influences on assets push migration. If however, individuals were migrating despite their land providing enough, there may be other important pull-factors for why individuals migrate.

> *"If we had more land and enough things in my village, I would not have come to Addis, but since I had no farm, I had no food, money, or other things."* - 30 year old, female beggar, reporting insufficient land.
>
> *"If I get more things in my village, I would not have come to Addis.*" – Older than 18 years old, male shoe-shiner reporting insufficient land.
>
> *"I went to Hara city first, but then I came to Addis because I know someone here.*" 20 year old, male selling pirated CDs, reporting sufficient land.

In total, 19 interviewees (32%) reported they would have migrated even though the land met their needs for the year while 35 (59%) reported they would not have migrated if the land met their needs for the year. More specifically, where land-area was specified, significantly more individuals would have migrated (57%) even where their land was providing them with

enough food and other things for the year compared with only 22% of the interviewees with less land (see Table 2.8).

Table 2.8: Migration "Anyway" by Land Area (hectare)

	0-1.0		>1.0		Unspec		Total	
	N	%	N	%	N	%	N	%
Migrate anyway								
Yes	8	(22)	8	(57)	3	(38)	19	(32)
No	25	(68)	6	(43)	4	(50	35	(59)
Missing	4	(11)	0	(0)	1	(13)	5	(8)
Total	37	(100)	14	(100)	8	(100)	59	(100)

Fisher's Exact For land specified, $p = 0.048$

Conversely, in looking at whether interviewees would have migrated anyway as a function of their perceived sufficiency of household assets rather than land-area, all interviewees who perceived themselves as having sufficient assets (land and animals) reported that they would have migrated anyway (100%), while only three (9%) of interviewees who perceived their households as having insufficient assets reported that they would have migrated anyway ($p < 0.005$) (see Table 2.9).

Table 2.9: Migration "Anyway" by Perception of Assets

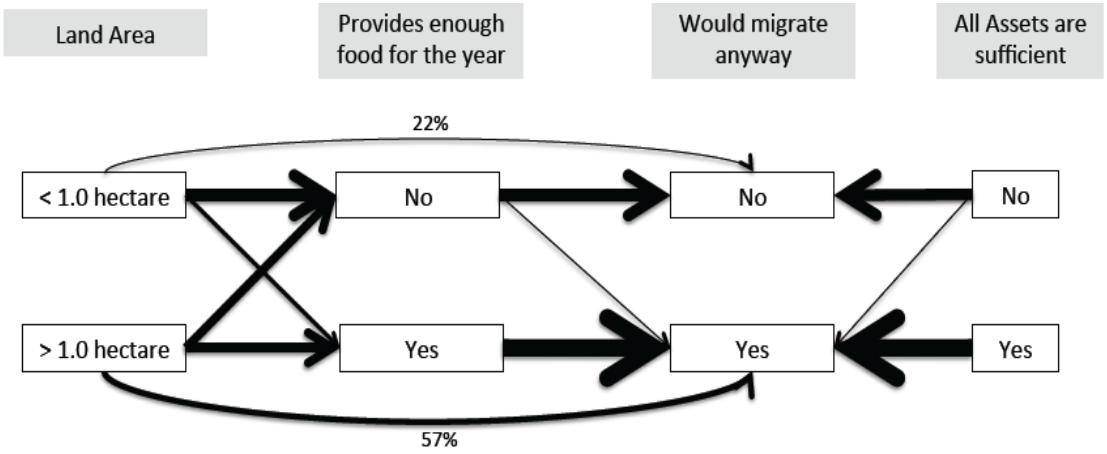
	Enough assets		Insufficient assets		Total	
	N	%	N	%	N	%
Migrate anyway						
Yes	16	(100)	3	(9)	19	(32)
No	0	(0)	35	(81)	35	(59)
Missing	0	(0)	5	(11)	5	(8)
Total	16	(100)	43	(100)	59	(100)

Fisher's Exact $p < 0.0005$

This was an interesting dichotomy in responses, as interviewees who reported their land was giving them enough food and other assets still would have migrated anyway while the vast majority of individuals whose land was not giving them enough would have preferred to not

migrate anyway supporting both push and pull assertions in the literature. The fact that some interviewees migrated while having sufficient assets points to a pull-proactive motivation for migration, such as the desire for economic mobility as described by Portes (2013), Tacoli (2009), Afifi (2011) and Henry et al (2004). The fact that other interviewees migrated with perceived insufficient assets, but did not desire to migrate supports the push-adaptation reactive-motivations for migration as described by Corbett (1988), Reardon et al (1988), Roncoli et al (2001), McLeman and Smit (2006), Foresight (2011) and Deressa et al (2010) (Please refer back to section 1.6.1). Figure 2.7 is a representation of this relationship.

Figure 2.7: Migration Despite Perceived Adequacy of Food or Land



$p < .0005$

In conclusion, there were many reasons individuals migrated. Some reasons were related to deficiency of assets, other reasons were related to the desire for economic mobility. This information adds additional knowledge to the migration theories cited above while raising new questions regarding motivations for migration. Moving forward, we must consider multivariate reasons for migration, such as migration for health reasons, migration by healthy able-bodied individuals, migration for social reasons, migration for more assets or income, or migration for

as of yet-unknown reasons. Unfortunately, some of these social phenomena and other reasons for migration were not explicitly sought out in this study, and were an artifact of the responses, and so, this represents an important area for future research.

2.3.4. Availability of Remittances

Migration literature cites remittances as common practice and as important reasons for migration (Yaro, 2004). The findings from this sample seem to contradict the literature. The majority of interviewees 35 (59%) reported that they were not sending remittances home. Significantly more males (38%) than females (10%) were sending remittances home ($p = 0.017$) (see Table 2.10).

Table 2.10: Sends Remittances (yes/no) by Gender

	Male		**Female**		**Total**	
	N	(%)	N	(%)	N	(%)
Sends Money home						
Yes	15	(38)	2	(10)	17	(29)
No	18	(46)	17	(85)	35	(59)
Missing	6	(15)	1	(5)	7	(12)
Total	39	(100)	20	(100)	59	(100)

Fisher's exact $p = 0.017$

There are a variety of reasons that interviewees were not sending money home. In several cases, individuals, mostly females indicated that they were unable to earn enough money to make it feasible to send any home. In fact, the ten Ethiopian Birr interviewees were given at the end of the interview in many cases represented more income than most make in a typical day. Other interviewees reported that if they send money home, it is only at the time of the Ethiopian New Year. The difference in remittances sent by gender may be related to different motivations

for migration between males and females, or may simply be an artifact of what happens post-migration, and should be explored more in future research.

2.3.5. Availability, Eligibility, and Adequacy of Safety-net Programs

As discussed in section 1.5, Ethiopia has a well-known, but under-funded and under-provisioned safety-net program, the Productive Safety-net Program (PSNP). To understand whether the availability and/or utilization of safety-net programs influence migration, I asked interviewees about the availability, accessibility, and adequacy of programs in their villages prior to their migration and whether they would have migrated if they received a safety-net program.

A little more than half of the interviewees (53%) reported not having a safety-net program available in their village while 47% reported that there was a safety-net program in their village. Of the 28 interviewees who reported having a safety-net program in their village, 15 (54%) were eligible to receive the program while 13 (46%) were not eligible. Thus, out of the entire sample, 15 interviewees (25%) had access and were eligible to receive program support (see Table 2.12).

Table 2.11: Availability, and Eligibility of Safety-net Programs

	Availability in village		**Eligibility to receive**	
	N	(%)	N	(%)
No	31	(53)	13	(46)
Yes	28	(47)	15	(54)
Total	59	(100)	28	(100)

"We have a supporting program in my village, but only for the poorest. We could not use the program because we were not the poorest, we had cows and oxen." – 20 year old, female house-worker (not eligible for safety-net program).

"There is a safety-net program. My family used it before, but it is not enough in a bad year. In a bad year, they give us money for seed and fertilizer, but it is not enough." Older than 18 years old, male peanut-seller.

"We had a safety-net program in my village, it provided food, clothes, and other support, but I was not registered to receive the program. I tried to register for the program twice, but they told me I could not receive the program." – 40 year old, female beggar (not eligible for safety-net program).

"There is a supporting program in my village, you can use it if you get erosion or damage to your product. We did not have erosion or damage to our product this year, so we did not get support from the program." – 22 year old, female house-worker (not eligible for safety-net program).

As noted by interviewees, lack of eligibility to receive the safety-net program was often related to having too many assets, having too much land, not registering to receive benefits on time, and in some-cases, not having any damage to crops yields or to land the previous year. Moreover, when interviewees were asked whether the program provided sufficient assistance or the type of assistance that was helpful, those who had received program benefits in the past overwhelmingly stated that it was not enough support, nor was it the type of support that would have been most helpful.

"The program that we got was not enough. The seed they give us did not grow, because we do not have fertilizer, so I had to come to Addis. If the program had been more, or give enough other things, [like fertilizer], I would have stayed in my village."- 24 year old, male shoe-shiner.

"If I had gotten enough support from the program, I would not have left, I would have stayed. As it was, the program was not enough to help us throughout the year. If I received more support, money, and some more land, I would have need to come to Addis." - 18 year old, male car-washer.

"If I get more support in my village, if I get enough, I would not come to Addis. When we get the program, it is not enough. So, I come here. If I get enough now, I like to go back to my village. It is better in my village." – 18 year old, male shoe-shiner.

Finally, in asking interviewees whether they would have stayed in their villages or migrated if they had received enough support from a program, 54 interviewees (92%) reported that with more assistance in their village, they would have stayed, and would not have migrated. The 5 interviewees (8%) who reported that they would have still migrated gave medical-need as their reason migrating.

> *The assistance we got from the supporting program was not enough, I had to come to Addis, but if it had been more, enough, I would have stayed in my village."* – 19 year old, female beggar.
>
> "*If I get opportunity to return and learn in my village, and get help of support program, I will go back, and I would not come to Addis."* 23 year old, female house-worker.
>
> *"The cost of fertilizer is increasing, the cost of seed and other farm products is the same, I would have stayed in my village with better program, because then I can get more things."* 29 year old, male labor-worker.
>
> *"If I get better medicine in my village, and if I get more things or more supporting, I will stay, but my religion does not allow medicine in my village and it is better for me here."* – 23 year old, male shoe-shiner.

Lastly, I examined whether the presence of a safety-net program made any difference in whether or not individuals were sending remittances home to their families. Based on this sample, safety-net program receipt made no difference in whether or not remittances were sent home.

Table 2.12: Remittances (yes/no) by Safety-net Program Availability (yes/no)

Sends money home	**Yes**		**No**		**Missing**		**Total**	
	N	(%)	N	(%)	N	(%)	N	(%)
Safety-Net Program								
Yes	9	(53)	14	(40)	5	(71)	28	(47)
No	8	(47)	21	(60)	2	(29)	31	(53)
Total	17	(100)	35	(100)	7	(100)	59	(100)

Fisher's exact p = 0.304

Developing-world literature focuses on expanding social safety-net programs, such as the PSNP, as a way to help boost up and graduate households from poverty (MoARD, 2010). However, from this sample, safety-net programs are not really affecting household receipt of remittances. However, my sample of interviewees does desire expansion of the safety-net program and what it provides, as the current program is reported by interviewees to be ineffective, low-reaching, and to not give appropriate or desired assistance. Currently, social, environmental, and political forces interact to prevent the PSNP from providing the types of services and products that people want or need to fill in their asset- and livelihood-gaps.

While literature on safety-net programs indicate that they may delay migration for those who do receive programs by providing some additional assets, it is not known based on this sample whether or not the program delayed their migration into Addis Ababa, and again, is an area where more observational and longitudinal research could be done (GCIM, 2005). Most interviewees did not report positive experiences with, nor did they look favorably upon safety-net programs. More in-depth studies on this phenomenon would be useful to generate tailored and specific recommendations to the government on how to expand and supply the program more effectively and with broader reach, thereby changing social, environmental, and political forces into assistance, rather than into barriers.

2.3.6. Crop and Weather/Climate Perceptions

Finally, I studied whether climate variations and extremes including frequency of droughts/floods or increasing temperatures influenced individual motivations for migration. While I cannot get a direct measure of these changes at each individual's household, I asked

interviewees if they perceived any changes to their crop output, rainfall levels, or temperatures prior to their migration and compared that with actual climate data that is available by the Central Statistics Agency (CSA) of Ethiopia. Among all the interviewees, 18 (31%) reported that there had been a decrease in crop output from year to year prior to their migration. Fifteen interviewees (25%) reported having variable crop outputs from year to year, and nine interviewees (15%) reported no change in crop output. Nearly one-third of interviewees (29%) were unsure. Overall, 56% of interviewees reported changes in their crop-output.

> *"The amount of product we grow decrease a little each year, in 2010 (2002 Ethiopian Calendar), there was no rainfall, and we have no product."* – 18 year old, male shoeshiner.
>
> *"The product we get depends year to year on God's will, not on our work, it depends on the amount of water. In 2008 (2000 Ethiopian Calendar) we make more money, but in other years the product is decreased and we make less money, and this is God's will."* – 21 year old, male labor worker.
>
> *"The harvest product is not increasing as fast as fertilizer price, and the total amount of product is decreasing from the land we have, but with enough rain, it increases."* - 29 year old, male labor-worker.

Reasons for decreasing or changing crop output may include climate-related reasons such as changes in overall rainfall, ill-timed rainfall, too-high temperatures, and soil-erosion, as well as other socio-economic reasons that may include an insufficient amount of fertilizer, a decrease in household labor, a loss of animal-labor, or household illness to name a few. In a few instances, interviewees believed it was God's will that crops were not growing as well, but in most cases, interviewees believed it was because of insufficient rain, water, labor, or fertilizer.

All 59 interviewees (100%) reported that the price of fertilizer was increasing year after year. Increasing fertilizer prices may impact whether households are able to hold onto or need to sell assets. In discussion with Mr. Tefera, the Water, Sanitation, and Health expert at World

Vision Ethiopia, the two most common types of fertilizer used in Ethiopia are manure, or chemical fertilizer: DAP or NPK, both of which have increased in price two- to four-fold over the last two to five years. Forty interviewees (68%) reported using chemical fertilizer purchased from the government, seven (12%) reported using animal manure, and 12 (20%) reported not using any fertilizer. Three-quarters of individuals who reported using chemical fertilizer also reported changes to their crop output (either a decrease or variable output) prior to migration, possibly indicating a change in the amount of fertilizer used and/or the impact of weather-patterns interacting with fertilizer use on their crop-yields. Conversely, no one using animal manure reported a decrease in crop output, though half reported variable output. Lastly, all twelve interviewees not using fertilizer were unsure if their crop yields had changed (see Table 2.13).

Table 2.13: Changes to Crop Output Prior to Migration by Fertilizer Type

Crop output	**No change**		**Decreasing**		**Variable**		**Don't know**		**Total**	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Fertilizer type										
Animal manure	2	(22)	0	(0)	3	(20)	2	(12)	7	(12)
Chemical	7	(78)	18	(100)	12	(80)	3	(18)	40	(68)
Does not use	0	(0)	0	(0)	0	(0)	12	(71)	12	(20)
Total	9	(100)	18	(100)	15	(100)	17	(100)	59	(100)

Fisher's exact $p < 0.005$

The changes to crop yields by fertilizer type is statistically significant ($p < 0.005$). This supports the assertion that there may be an interaction between fertilizer use and weather/climate patterns, or perhaps more likely, between socio-economic status and weather/climate-changes as fertilizer prices increase that affect crop-yields from year-to-year.

Finally, to confirm or refute the assertion that changing crop-yields might influence the decision to migrate, I analyzed whether a change in crop yield was associated with interviewee-

decision to migrate. Of the 18 interviewees reporting a decrease in crop yields, one-third would have migrated anyway and nearly two-thirds would not have migrated anyway. Of those with variable crop yields, 27% would have migrated anyway, and 73% would not have. With no change in crop yields, the proportion of those who would have migrated anyway was nearly the same as those who would not have (see Table 2.14).

Table 2.14: Changes to Crop Output Prior to Migration by Migration anyway

Crop output	No change		Decreasing		Variable		Don't know		Total	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Migration anyway										
Yes	5	(56)	6	(33)	4	(27)	4	(24)	19	(32)
No	4	(44)	11	(61)	11	(73)	9	(53)	35	(59)
Missing	0	(0)	1	(6)	0	(0)	4	(24)	5	(8)
Total	9	(100)	18	(100)	15	(100)	17	(100)	59	(100)

Fisher's exact p = 0.242

Whether crop yields decreased, were variable, or did not change made no difference in whether interviewees would have migrated anyway (p = 0.242). However, based on reports of why interviewees migrated, fertilizer price was an important factor on the decision to migrate, supporting the economic or insufficient-asset influence on migration. This assertion was based on the fact that some interviewees reported migrating to pay for their fertilizer.

2.4 Delimitations, Limitations, Strengths, and Implications

Delimitations: As stated in the methods section, the delimitations I set for this study included that interviewees had to be rural-to-urban migrants, they could not be born in Addis Ababa. Additionally, interviewees had to be older than 18 years of age, the age of majority. While I could have chosen to interview anyone who was a rural-to-urban migrant, based on consultation with World Vision Ethiopia, I delimited my sample to interviewees who were casual workers, laborers, or beggars. World Vision Ethiopia recommended these types of individuals

because their experience was that casual workers and laborers typically are not from Addis. Typically they are coming from outside of Addis looking for a way to make money. Moreover, individuals from Addis Ababa are typically more likely to be better educated, and to have more stable-type of work. Finally, I wanted to cover as many areas of Addis Ababa, a large and spread-out city, as possible, to try and obtain as much diversity as possible in the sample, and so limited the number of interviewees to 2-4 per subsection of the city.

Limitations: There are several limitations to this study, one of which includes generalizability as the scope of this research was restricted to 59 interviewees chosen from within 18 sub-districts of Addis Ababa, conveniently. Although generalizability was not the intended goal of this study, the rich descriptions and detailed information regarding the context and background of this study may allow the knowledge gained from this study to be applied appropriately for other contexts. Another limitation is transferability. Similar to the lack of generalizability, all interviewees came from within the three most populated regions of Ethiopia. Fortunately, these regions represent diverse agro-climate zones. Due to the nature of the prevalent sampling scheme used for this study, I must acknowledge that the conclusions from this study are applicable to this sample, may be biased, and that a different sample may have provided a different set of responses and conclusions.

Another limitation is interviewee recall error due to self-report. It is always possible that interviewees are influenced or affected by the researchers, offering responses they believe we want to hear, or may be guarded and therefore alter the truth. It will be impossible to ever know if the responses are fact or a departure from the truth. To reduce this possibility, attempts were made to create an interview-environment that was conducive to open and honest dialogue

between the interviewees, Nahom, and myself. Another limitation rests with my own subjectivity. Therefore, interpretations of the results, assumptions, and perceptions gleaned from the responses will be biased, however, all attempts were made to reduce this.

Another limitation to this study is that my sample consists of prevalent migrants to Addis Ababa. My sample is length-biased and over-represents cases with a longer-duration than a shorter-duration, of which I would have obtained with a weighted-representative sample of ever-migrated individuals from the villages of origin. Additionally, there is a high likelihood that other variables may be associated with length-of-time living in Addis Ababa that were not explored in this study, and so this again is likely not a representative sample. Moreover, my sample is censored as of the day that they participated in my survey, and had I followed these individuals for a longer period of time, some would have longer actual-time spent in Addis Ababa, than was reported in my findings. These limitations indicate that again, I can only extrapolate the results and findings to this specific study.

In recognizing these limitations, I tried to take the following measures. First, I acknowledged my research agenda and assumptions at the start. I reviewed responses blindly, without looking at who made specific statements. Additionally, I tried to corroborate my findings with literature-review. This is the nature of qualitative design, not to generalize all results to all circumstances and contexts, nor to assume that the findings from this study are the end all, be all. Rather, the goal is to gain an understanding of what is happening to the specific group used for this study to inform further and future research.

Strengths: While there are limitations to this study, there are also a number of strengths. Strengths of this study include its post-migration viewpoint that really seeks to describe and

understand the migrant-experience. Another strength of this study was the fortunate recruitment of the translator Nahom. Nahom is educated and speaks both English and Amharic, but more importantly, Nahom is extremely comfortable with the culture, utilizes appropriate behaviors, and has great rapport with the interviewees. Moreover, Nahom's father works for World Vision Ethiopia, he has been out in the field with his father, and understands many of the conditions and issues that are being addressed with this study, a jumping off point for the studies presented in chapter 3 and chapter 4. The study in chapter 3 was informed by this study, and takes on a pre-migration viewpoint with primary qualitative interviews occurring in villages. The study in chapter 4 is a quantitative study using data from the Ethiopian Rural Household Study to look longitudinally at household and village-conditions that may predict coping-strategy use, and possible migration.

Implications: There are several implications that result from this study's findings, which include implications for migration research, implications for public health interventions and practice, and implications for Ethiopian social and economic policy, and even environmental policy. As for migration research, some of the implications of this study are that rural-to-urban migration happens for many reasons and with many motivations, not all of which are explainable given the current state of knowledge. As noted above, for nearly all interviewees, migration is viewed as a temporary state, and ends when the goal of obtaining enough money or 'things' to fill in income and asset gaps is achieved. For many, their time spent in Addis Ababa is increased likely due to several interacting factors such as inadequate income generation and the prohibitive cost of travelling home to further distances.

Additionally, the reasons that individuals are migrating—insufficient tangible and intangible assets, as well as by volition, affect how future researchers may look at migration. These are important phenomena for migration research because, migration affects multiple levels of society, individual migrants, their families, but also the towns, villages, and cities they are migrating to. Migration can have health implications for the individual migrants, may strain the infrastructure of the under-developed cities they migrate to leading to overcrowding, strained water/sanitation and health services, and possibly to slums and unsafe housing conditions. Additionally, migration reduces the available labor at home and may contribute to the risk of a rural household's livelihood failure.

Moreover, for those individuals who are not migrating due to lack of assets, but instead are migrating out of volition, for a desire for more money, or a perception that they will have a better life, it begs the question of whether improvements are needed in villages to meet the needs of these potential migrants and therefore reduce the negative impacts their migrations have on the underdeveloped infrastructure of the cities they move to.

As for potential public health interventions and practice, food security in rural-agriculturally dependent countries such as Ethiopia is a primary and continuous concern. Adequate water and sanitation impact food security, the health, and well-being of individuals and may prevent some health-care related migrations. Therefore, it is important to expand health-care access and to provide additional health-related supports in the villages. This may allow women who develop birthing fistulas to seek some treatments locally rather than have to travel hundreds of kilometers to be treated in Addis Ababa. The same can be said for other health-care related treatments, including tuberculosis treatment. Another health-care related intervention

would be to place medical professionals in locations where they can provide care and train village health-care workers.

It would be prudent for the government of Ethiopia to explore policy options that improve access to education. The government can do this by training more teachers, providing an adequate number of schools in villages, adequate supplies, and providing meals in the schools, a well-described and demonstrated method for increasing school attendance and educational attainment in developing country literature (WFP, 2010). Additional education, particularly for females reduces infant- and under-5 mortality, undernutrition, and family size increasing calorie-availability to each member of the household, and decreasing the hosuehold's vulnerability to the negative impacts of environmental extremes.

Lastly, there may be implications to social, economic, and environmental policy that encourages individuals to stay in their villages by improving the economic and social-mobility opportunities that are present in those villages. These may include exploring policy alternatives that change land-tenure and ownership laws, allowing farmers and their families to own parcels of land. This may also include policies that reduce the tax burden and cost of fertilizer for farming households while increasing taxes on factory-farms, land-grabbers, exports, and being mindful of other potential consequences this can have on the country's economic status.

Climate and crop insurance for poor harvest years may offer farmers some reprieve from their low harvests. As it stands now, low harvests result in low income, insufficient food, and continuation of high land-tax. Climate and crop insurance would payout to households during a low- climate-related harvest allowing households to purchase food from markets and to buffer households so they do not have to sell additional assets to pay taxes they already cannot afford.

Similarly, climate and crop insurance could help subsidize the cost of imported foods that households need to purchase during poor climate conditions to prevent the two- and three-fold price increases that were observed in 2007-08 (FAO, 2010).

Improving access to local markets where individuals can buy and sell commodities at fair prices while increasing the budget and eligibility criteria of safety-net programs could also help to improve livelihood security, sustainability, and food security. Encouraging farming cooperatives, and other micro-businesses allows households and villages to have more self-sufficiency and self-efficacy. For many of these farming households, transportation and infrastructure are lacking, and for those who have products to sell, getting them to market is a challenge. Improving access and infrastructure to markets may aid in this goal.

While food aid is a necessity and has its place in famine-relief, hunger, and emergency situations, the long-term use of food aid should be discouraged. In the long-term, food aid is known to undermine the economy of developing countries by falsely reducing the prices farmers can obtain on their own products at market (World Bank, 2010). Once the food-shortage and nutritional status of individuals has improved, the government should move away from long-term food aid and towards a more sustainable approach. In fact, the government would be better off transitioning individuals and households into training opportunities that educate and teach individuals improved farming techniques, ways to store food and/or calories for future climate-exacerbated famines or hunger seasons, provide inexpensive yet effective farming technologies that ultimately increase the resilience of households and their food security.

These same methods may also be good ways to increase food-stocks in the country, that can be deployed to markets in low-food times. The government can purchase surplus food crops

and seed from rural farmers for a fair price that they can store for low-food times. These policies would not only increase incomes, but they would also increase rural employment, education, and opportunities while keeping consumer prices stable. These policy changes and infrastructure improvements in combination with appropriate disaster mitigation and climate risk-reduction plans may increase the benefits of staying in the village of origin, and dramatically reduce the desire or need for migration. However, there are likely many more reasons why individuals migrate which are not yet understood, and many more "fixes" that are needed.

This study uncovers why some individuals migrate to Addis Ababa, but it is not able to distinguish specifically which may be climate-related. It is known that climate change will likely influence the vast majority of reasons for migration cited in this study (Black et al, 2011). It is also known that as climate changes, water will continue to be an at-risk resource in supply and safety, impacting the health and nutritional status of individuals, rural communities, and entire nations. While Ethiopia is forward-thinking and already has policies in place to decrease carbon emissions, they appear to be lacking a number of fundamental safeguards to protect its population in the here-and-now, such as improved education, health care, infrastructure, and reconfiguration of safety-net programs to have larger impacts on the health of its people. The extent to which future climate change impacts the livelihoods, health, and safety of the Ethiopian people will only be known with time and with future additional research.

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CHAPTER 3: Household Perceptions of Climate Variability and its Influence on Coping Strategy use Using Primary Interviews.

3.1 Introduction

Chapter 2 studied rural-to-urban migration and coping strategy use from a post-migration view point and was the first study I conducted in Ethiopia. The first study helped inform the research questions for this chapter where I study climate impacts on coping strategy use in the pre-migration or village context. For this study, I wanted to identify how households experience or perceive climate change in their villages. Here, I compare available data on climate and weather patterns from the Ethiopia Central Statistics Agency (CSA) with first-person accounts and perceptions of climate variability. My assumption is that if interviewees are able to accurately perceive changes in climate by noticing changes in rainfall or temperature levels, then I may be able to accurately identify how they adapt to or cope with these changes.

The purpose of this study is to see how household perceptions of climate change influence coping strategy use in a sample of rural small-land farmers using primary interviews. This study uses qualitative analysis to identify implications and provide policy recommendations and further directions for future research.

3.2 Methodology

3.2.1 Data Source and Collection

This study uses data from two sources. The first source consists of individual farming and asset histories obtained from 35 interviewees in three villages of Ethiopia. The villages, Aleta Wendo, Teru, and Guder, are within 150 Kilometers of Addis Ababa (see Figure 3.1). The

interviewees were either heads of household or a proxy if the head was unavailable at the time of the interview. The most common reasons why the heads of household were unavailable included that they were out doing labor-work, out in the field or market to sell product, or had died.

Nahom Atnaw, the translator who worked with me on the study presented in Chapter 2, whose father works for World Vision Ethiopia (WVE), a trusted Non-Governmental Organization (NGO) was the interviewer for this study. The three villages used in this study were chosen both based on convenience—ease of travel to the villages—and familiarity. WVE has worked in these three villages in the past and so there was already trust among the community. The villages Nahom visited were discussed in advance with me by Skype, providing general information about each village which was compared in the analysis. It is likely that because WVE has worked in these villages, they are better off than other villages in Ethiopia, likely having more infrastructure and access to resources; as such, care is taken not to generalize results to all of rural Ethiopia.

Aleta Wendo (hereinafter: Aleta) is a village in the Southern Nations, nationalities, and Peoples (hereinafter SNNP) region. It is located near Lake Abaya, is 2,037 meters above sea level, and is located off one of the major roads of Ethiopia. This village has telephone, postal service, and electricity. Males make up 48.8% and females 51.2% of the village population (CSA, 2007). Teru is a village located in the Amhara region. This village is located near two rivers. There are two roads in the village, they are in poor condition. Deforestation is a problem here. The tallest point is 1,440 meters. There are four schools in the village, approximately 300 students, and fewer than 10 percent are female. Males make up 41.4% and females 58.6% of the village population, and there is an average of 6.8 persons per household (CSA, 2007). Guder is a village in the Oromia region. Its elevation is 2,101 meters above sea level and it is situated near

the Guder River. It is not far off of one of the major roads or Ethiopia. Males make up 46.9% and females 53.1% of the village population (CSA, 2007).

When Nahom arrived in the villages, he met with local leaders. Meetings were arranged with the help of WVE. Once permission was granted from the village leaders, Nahom approached eleven heads (or proxies) of household each in the Teru and Guder villages and seventeen heads (or proxies) of household in the Aleta village. The first household was chosen by recommendation of the village leader. After which, every fourth household was selected from the list provided by the village leader. The village-leaders keep well-maintained lists of households. Eleven heads of household were approached in Teru and Guder because in each village, one individual declined to participate. Seventeen heads of household were approached in Aleta Wendo because two declined to participate. In total, ten individuals were interviewed with convenience in Teru and Guder each, and fifteen individuals were interviewed in Aleta. Each interview lasted between one hour forty-five minutes and two hours thirty minutes, depending on how in-depth interviewees went in their responses. Nahom moved around with the interviewee to accommodate their time and work needs.

Recruitment materials, methods of consent, and research methods were approved prior to the study's commencement by the Institutional Review Board of UCLA. Because this study takes place in rural villages, and is designed to capture perceptions of climate change, the recruitment of interviewees was based on accepted cultural norms in rural villages and was delimited to heads of household, or their proxy, who were older than 18 years of age. Upon meeting with the head/proxy of the household, Nahom introduced himself and read the Amharic translated script explaining the purpose of the study, the primary investigator--Dana Hunnes--and why participation was important. In addition to the translated recruitment materials, WVE also

provided a written letter on WVE letterhead explaining the purpose of this research study which was presented to the village leaders and to the individuals who were interviewed.

Recruitment materials included expectations of the interviewee's involvement, an explanation of remuneration, and contact information for both Nahom and Dana Hunnes should they have questions or concerns about the study. Nahom was trained in the protocols, approved by the UCLA Institutional Review Board, and perhaps more importantly, understood cultural norms and attitudes, the permissions that were needed in each village, with each household, and how to approach village leaders and potential interviewees. Nahom and I were in frequent contact during the recruitment and interview process via skype, after interviews occurred, and in the write-up of the methods to correctly and accurately describe the process..

On only four occasions did potential interviewees decline to participate in the interview process. Reasons cited for not wanting to participate included not wanting to share personal information, lack of trust, and competing demands. Individuals who met the study criteria and consented to participate received remuneration of 10 Ethiopian Birr (~$0.60 US) at completion of the interview, at the recommendation of WVE. For those four individuals who did not start or complete their interview, there was no penalty, and Nahom thanked them for their time.

The questionnaire that guided this study was developed based on existing climate change and coping strategies research by Corbett (1988), Reardon et al (1988), Roncoli et al (2001), Deressa et al (2010), McLeman and Smit (2006), Foresight (2011), Perch-Nielsen et al (2008), Afifi (2011), Henry et al (2004), and Tacoli (2009) and the identification of gaps in the literature. Literature by these authors describes coping-strategy use for food insecurity and possible proactive and reactive reasons for migration and is described in detail in chapter 1.

The questionnaire that guided the research for this study was written in English and translated into Amharic prior to the start of the study. The questionnaire was back translated into English to confirm the accuracy of translation. The questionnaire covered topics such as employment, farming history, asset history, land size, types, number, and changes to crop yields, price of farming inputs, perceived changes to rainfall and temperatures, number of meals consumed by adults and children in good and bad months, and coping strategy use including questions about present or future need for migration. For the full questionnaire (pre-translation) please see Appendix C.

To test the feasibility of this questionnaire, Nahom recruited, consented, and asked two rural-farming heads of households in Teru the questions. Given my experience with the first study, I understood the types of questions that were feasible for this type of study. After these two pilot-tests, the interview guide was finalized in English, translated again by Nahom into Amharic, and back translated once again to insure accuracy. Interviews were conducted orally. The only records of the interviews are scrupulous hand-written notes from Nahom written as closely to verbatim as he could, translated into English and emailed to me. If clarification or expansion was needed, Nahom went back to that household for additional information. This only happened on three occasions.

The nature of this study, in rural villages with permanent dwellings made finding interviewees for additional questioning simpler and more feasible than in the original urban study presented in Chapter 2. While the sample-size is small, made up of 35 individual heads/proxies of household, the qualitative nature of this study was designed to gather in-depth, descriptive, rich information to explore the interviewee experience. Some statistical inferences were made to assist in hypothesis-generation.

Twenty-four interviewees (69%) were male, and 11 (31%) were female. Ages varied from 18 to 60 at the time of the survey, with the majority (63%) between the ages of 18-35, matching expected age demographics of the Ethiopian population (CIA World Factbook). The second source of data comes from the Ethiopian Central Statistics Agency (CSA) and includes data on rainfall levels and temperatures over a seven year period (CSA, 2011).

3.2.2 Data Management and Analysis

At completion of the 35 interviews, the raw manuscripts were transcribed into an excel spreadsheet where each column represented a question and each row an interviewee. For each column (question) all rows (interviewee answers) were reviewed verbatim, and initial analytic concepts and themes were identified (Strauss and Corbin, 2008). These initial concepts are used to describe basic characteristics about the sample by asking questions of the data such as "what is happening?" and "what does it mean?" After describing characteristics of the sample with these initial questions and concepts, I formed categories of related concepts and themes so that I can make sense and understand the experiences of my interviewees (*ibid*). To form these categories, I asked "what are the most significant or most frequent initial themes/concepts?" These categories reflect what people are doing and what is happening.

As categories formed, their relationships or connectedness emerged and bivariate analyses were performed. Correlations were run on continuous variables, t-tests were run to compare sample means, and Fisher's exact tests were performed to examine associations between categorical variables. Statistical tests were conducted with STATA 12.1 (Stata Corp, College Station, Texas). Statistical significance was measured at $p < .05$. The presence or absence of relationships help to tell a more cohesive story and allow the development of

hypotheses to explain what is happening in the lives of the interviewees. Ultimately, I was able to create one-such representation of the experience of my interviewees (*ibid*).

I compared my theory based on the data with currently existing theories and literature related to the topics of climate variations, extremes, and coping strategy use. Due to the nature of theory development, I was not trying to obtain a representative sample of the Ethiopian population, but rather, a sample that represents the population I am trying to understand, whose behavior I am most interested in, rural small-land-holding farmers and the coping strategies they use in the face of climate variation and extremes.

3.3 Findings and Discussion

3.3.1. Basic Demographics

Ten interviewees (29%) were from Teru in the Amhara region, 10 (29%) from Guder in the Oromia region, and 15 (43%) from Aleta in the Debub (SNNP) region with no difference in where the sample was from by gender. A little more than two-thirds of the sample (69%) were male, and nearly one-third (31%) were female.

Figure 3.1: Villages and Regions Where Structured Interviews Occurred

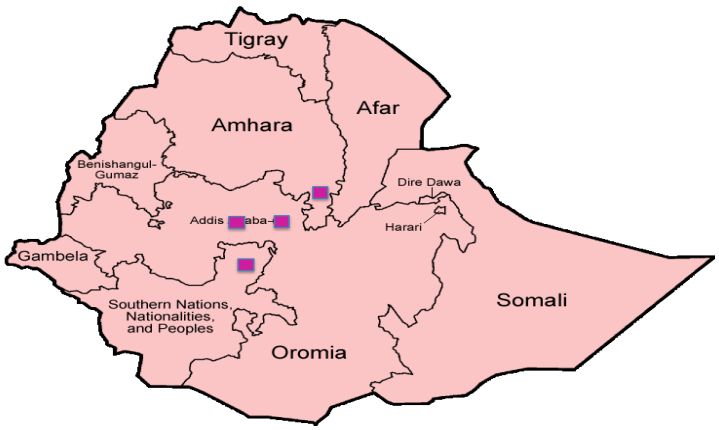


Table 3.1: Region of Origin by Gender

Region of Origin	Male		Female		Total	
	N	**(%)**	**N**	(%)	**N**	(%)
Aleta	10	(42)	5	(45)	15	(43)
Guder	6	(25)	4	(36)	10	(29)
Teru	8	(33)	2	(18)	10	(29)
Total	24	(100)	11	(100)	35	(100)

Fisher's exact p = 0.731

Eighty percent of the Ethiopian population lives in these three regions however, the gender distribution, an approximately 2 to 1 split (males to females), does not reflect the general population, which is more evenly distributed (CIA World FactBook, 2013). One reason for the gender distribution demonstrated here is that males more frequently are heads of households.

The self-reported age range of my sample was from 18 to 60 years of age with nearly two-thirds (63%) of the sample age 35 or younger. Approximately one-third of the Ethiopian population falls between the age of 18 and 35, with another approximately one-third under the age of 18 (*ibid*). There is no significant difference in age distribution between males and females, and there is no difference in age by village with all p-values of two-sample t-tests > .05 (see Table 3.2).

Table 3.2: Mean Age by Gender and Village (N = 35)[4]

	Male	**Female**	**Teru**	**Guder**	**Aleto**	**Total**
Mean	34.3	29.7	34.1	30.6	33.9	33.0
(SD)	(11.0)	(8.5)	(11.7)	(11.6)	(7.9)	(10.3)

Twenty-two interviewees (63%) were farmers, 7 (20%) were students, 3 (9%) sold farm-products as their primary means of income, 2 (6%) had no land and were fisherman, and 1 (3%) had no land and was a laborer on someone else's land in the village. These interviewees who did not have land had pledged it to someone else to pay their land tax, a common practice in Ethiopia

[4] Fisher's exact p = .387 (by gender), p > .407 for Teru v.Guder, Teru v. Aleto and Guder v. Aleto

for households that want to keep their land and maintain a future ability to farm, earn an income, or keep their livelihoods that is preferred to losing the land to the government or being forced off the land permanently.

> Nahom reported during a skype conversation that one of the interviewees said, *"Households that cannot pay their land tax give their land to another family member or friend. The family/friend farms the land, pays the land tax, and shares half the harvest. The original household keeps their home, but does not "have" land, this is what is done in Ethiopia."*

A higher proportion of males engaged in farming and physical labor, while a higher proportion of females engated in house-work or were students. There was no difference in occupation by gender, or by village.

Table 3.3: Occupation by Gender and Village (N = 35)[5]

	Male		**Female**		**Teru**		**Guder**		**Aleto**		**Total**	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Farmer	17	(71)	5	(45)	8	(80)	6	(60)	10	(67)	22	(63)
Student	3	(13)	4	(36)	2	(20)	3	(30)	2	(13)	7	(20)
Farm-product seller	1	(4)	2	(18)	0	(0)	1	(10)	2	(13)	3	(9)
Fisherman	2	(8)	0	(0)	0	(0)	0	(0)	2	(13)	2	(6)
Laborer	1	(4)	0	(0)	0	(0)	0	(0)	1	(7)	1	(3)
Total	24	(100)	11	(100)	10	(100)	10	(100)	15	(100)	35	(100)

As for education, males on average obtained 4.3 years of education, females 3.0 years of education; however, this was not statistically significant. Males ranged from 0 to 12 years of education and females, 0 to 11 years; however, a much higher proportion of females than males had received no education. The median number of years of education for males was four years, and for females, one-half of a year. The lack of difference in education by gender may be an artifact of small sample size versus a true lack of difference. Similarly, interviewees in Teru had

[5] Fisher's exact p = .186 (gender), p = .815 region

on average 4.2 years of education, in Guder 4.9 years of education, and in Aleto 3.1 years of education (see Table 3.4 below). There were no significant differences in educational attainment by village, but Aleta had the lowest level. Again, this lack of difference may be an artifact of small sample size versus a true lack of difference.

Table 3.4: Mean Educational Attainment by Gender and Village (N = 35)[6]

	Male	Female	Teru	Guder	Aleto	Total
Mean	4.3	3.0	4.2	4.9	3.1	3.9
(SD)	(3.5)	(3.6)	(4.1)	(2.9)	(3.5)	(3.5)

Similar to chapter 2, educational attainment was very low in this sample, much lower than the average school life-expectancy in Ethiopia (CIA World FactBook, 2013). Education is an intangible human- and social-asset allowing individuals to acquire knowledge, capacities, and capabilities that help them improve their existing assets and create new assets and opportunities (DFID, 1999). The low levels of education in this sample indicate that there may be large gaps in human and social-assets in this population, which may interact with other macro-level economic, political, and social forces to constrain coping options available to these individuals in their villages.

3.3.2 Perceptions of Asset adequacy

The area of land households farm ranged from 0 to 1.75 hectares with the mean area of land, 1.06 hectares. Family size ranged from 4 to 9 individuals with the mean at 6.0 individuals per household. A little more than half of the interviewees (57%) reported having households with 4 to 6 members and the other 43% reported 7 to 9 members. Both land area and family size data converge with available literature (IFAD, 2011, MoARD, 2010). By village, Teru and

[6] Fisher's exact p = .387 gender, p =.665 Teru v. Guder, p = .479 Teru v.Aleto, p = .192 Guder v. Aleto

Guder are significantly different in land area (p = .022), Teru and Aleta are significantly different (p < .0005), but Guder and Aleta are not significantly different (p = .254). As for number of household members, there were no significant differences by village (see Table 3.5).

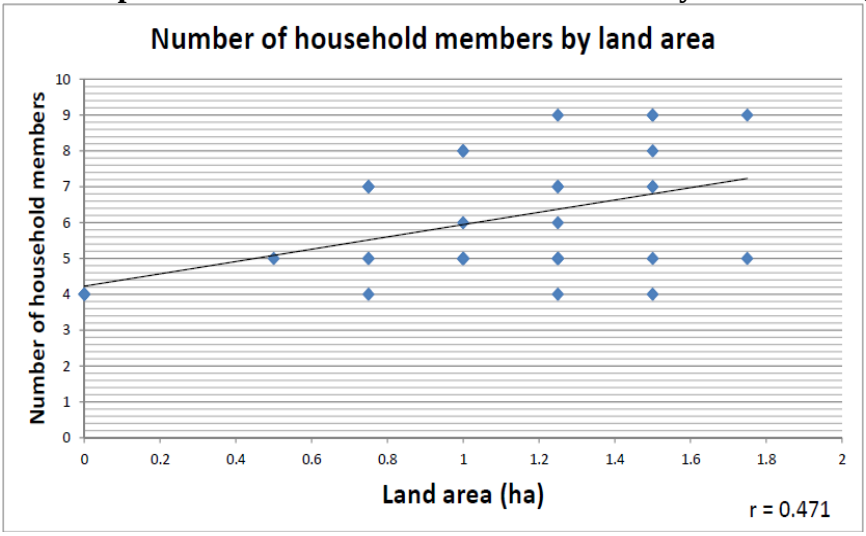
Table 3.5: Mean Land Area and Number of Household Members by Village (N = 35)[7]

	Mean (SD)	
	Land Area (ha)	**Number of HH members**
Teru	1.4 (.22)	6.2 (1.6)
Guder	1.025 (.42)	6.3 (1.5)
Aleta	.867 (.26)	5.7 (1.2)
Whole sample	1.064 (.34)	6.0 (1.4)

I also tested whether there were observable trends between household size and land area (see Figure 3.2). The data show an upward trend. As household size increases, land area increases (p = .0043) with a moderate strength correlation r = .471. This supports the idea of "carrying capacity," that smaller farmland may reduce family size or that households match their size to the land that supports them (Ehrlich, 1971).

[7] T-test p-values: Land area: Teru v. Guder p = .022, Teru v. Aleto p < .0005, Guder v. Aleto p = .254
T-test p-values: HH members: Teru v. Guder p = .887, Teru v. Aleto p = .381, Guder v. Aleto p = .279

Figure 3.2: Scatterplot of Number of Household Members by Land Area (Hectares)



p = .0043

This trend in land area and household size led to the question of whether there was a relationship between perceived land-adequacy and the number of household member or land area. To measure perceived land sufficiency, interviewees were asked two questions: whether their land provided enough food for the year and whether their land provided enough money throughout the year (see Table 3.6). These questions were derived from the previous study where several interviewees reported having insufficient land, food, money, or other things.

Table 3.6: Perceived Land Adequacy by Number of Household Members and Land Area

Perceived Adequacy of land	**# of Household Members (%)**		**Land area (hectare) (%)**			
	4-6	**7-9**	**0-1.0**	**>1.0**	**N**	(%)
Provides enough food for the year	(65)	(27)	(35)	(61)	17	(49)
Does not provide enough food for the year	(35)	(73)	(65)	(39)	18	(51)
	Fisher's p = 0.041		Fisher's p = 0.181			
Provides enough money for the year	(10)	(7)	(12)	(6)	3	(9)
Does not provide enough money for the year	(90)	(93)	(88)	(94)	32	(91)
	Fisher's p = 1.000		Fisher's p = 1.000			
Total N	20	15	17	18	35	(100)

There was an even split in the number of interviewees who perceived that their land did and did not provide enough food for the year (49% v. 51%). This lack of difference held across villages ($p = 1.00$). However, when breaking this question down by number of household members there was a significant difference ($p = 0.041$) in how adequate interviewees perceived their land to be. A larger proportion of interviewees from smaller households (65%) perceived their land to provide enough food as compared to the proportion of interviewees from larger households (27%).

In reviewing the same responses by land area, there was no difference in interviewee perception of whether the land did or did not provide enough food for the year ($p = 0.181$). This lack of a relationship was surprising, as I expected households with more land to be able to grow more food and to be more likely to report that their land provides enough for the year. This lack of relationship may again be a function of low-power and insufficient sample size as the proportion of interviewees who perceived their land to provide enough food for the year increases with larger land areas.

> *"We use our land for food, but sometime it is not enough. When we can, we use it [our land] for income. The money we get from the land, we use it to buy food product. We cannot get all our food product and income from our land."* – 27 year old, male farmer.
>
> *"The land we have is not enough for the year, it does not give enough product, or things for the year, our land is not enough."* – 45 year old, male farmer.
>
> *"Our land does not give us enough money or other things throughout the year, the land does not feed our family or give us enough income for every thing."* – 35 year old, female fish-seller.

In investigating these same relationships by whether land provides adequate money/things for the year, across the board, nearly all interviewees (91%) reported that their land

did not provide enough money for the year, with no difference by number of household members, by land area, or by village (p = 1.000). With this knowledge, it is not surprising that the majority of interviewees (60%) desired more land, at least two hectares more. What was surprising was that forty percent of interviewees did not report wanting more land, but rather that they had enough land or good land (see Table 3.7).

Table 3.7: Land Area Desired by Household Land Area, Number of Household Members, and Village

Land Area desired (Hectares)	Land area (hectare) (%)		# household members (%)		**Total**		Teru (%)	Guder (%)	Aleta (%)
	0 – 1.0	> 1.0	4-6	7-9	**N**	(%)			
0	(29)	(44)	(60)	(13)	14	(40)	(40)	(30)	(47)
1	(0)	(0)	(0)	(0)	0	(0)	(0)	(0)	(0)
2	(24)	(22)	(10)	(40)	8	(23)	(10)	(20)	(33)
3	(29)	(22)	(10)	(40)	8	(23)	(30)	(30)	(13)
4+	(18)	(11)	(20)	(7)	5	(14)	(20)	(10)	(7)
N	**17**	**18**	**20**	**15**			**10**	**10**	**15**
Total	**(100)**	**(100)**	**(100)**	**(100)**	**35**	**(100)**	**(100)**	**(100)**	**(100)**
	Fisher's p = 0.793		Fisher's p = 0.004				Fisher's p = 0.673		

Of the 14 interviewees (40%) reporting that they did not want more land, 12 (86%) had six or fewer members in the household. Meanwhile, of interviewees with more family members (7-9), the vast majority (87%) reported wanting at least an additional two hectares of land. The amount of land desired by number of household members was statistically significant (p = 0.004). These results corroborate the results of whether household land provided enough food for the year by size of household. In both cases, it was the households with fewer members that reported their land provides enough food and that they did not need more land.

There was no difference in the amount of land desired by household land area (p = 0.793). There was also no difference in the amount of land desired by village (p = .673). These

results were surprising again as I had expected that interviewees from households with smaller land area, such as individuals from Aleta, to more often desire more land.

> *"I do not complain about my land. I have a good amount of land, more than others. I don't know how much more land I need, I think 2 more hectare is good, but more than just for eating."* – 20 year old, male farmer.
>
> *"I have no land, so I need land. More than 4-5 hectare is land I need."* - 35 year old, male fisherman without any land.
>
> *"We do not need more land for food, we have good amount of land, but we need more land for better income. For that, we need 2 more hectare."* – 48 year old, female farmer.

Based on these responses, it appears that household land serves two functions. The first is to provide food and sustenance, the second is to generate income for the household, when and where possible. In general, larger households were less likely to report that their land was providing adequate food and were more likely to report a desire for more land. Overall however, land was not providing sufficient money, regardless of land area. Worth remembering, households are unable to obtain more land, as land is all owned by the government; households therefore, cannot purchase or rent out more land as was discussed in section 1.3.

These themes: Overall land adequacy, food sufficiency, and income relate back to food security; in particular, the aspects of food security related to food availability and access. For these rural farming households, sufficient land can make food available, but having or obtaining insufficient income can make food inaccessible.

3.3.3. Perceptions of Food security

Certain crops are more resilient to climate change, variation in rainfall and temperatures and can withstand poor soil or weather extremes such as sorghum or millet. Other crops, cash

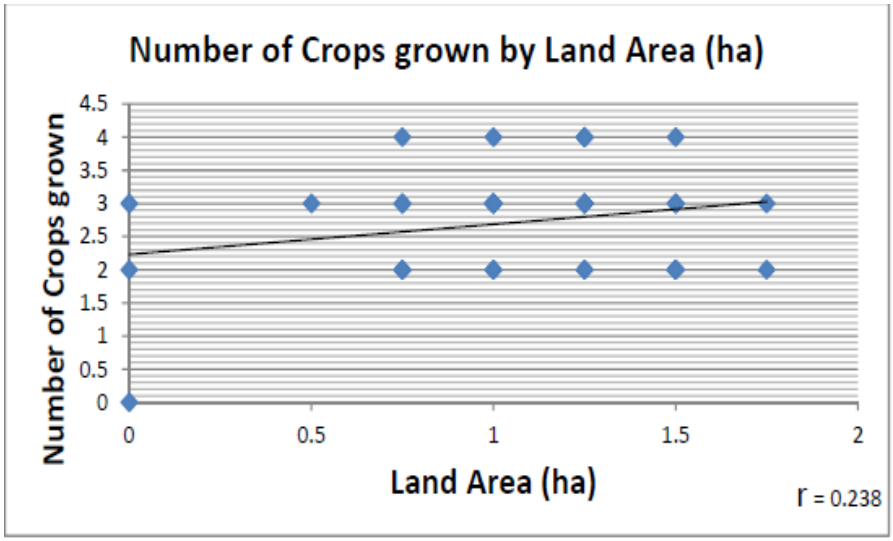
crops, such as coffee bean or sugar cane, which are often used to generate income for households tend to have lower climate-resilience. The types of crops that households grow may determine both their food- and livelihood-security. Households that grow primarily resilient food-crops tend to grow a reliable quantity of crops. Other households, which grow cash crops may earn a relatively high income in boon years, but suffer in drought years with few coping strategies available. To understand how interviewees perceived their current and future levels of household food security, questions were asked regarding the types and numbers of crops their households grew, whether they needed more crops to be food secure, and how certain they felt they would be able to feed their family in the coming year, and in future years.

The vast majority of households (94%) grew two or more crops with no difference observed by land area or by village (see Table 3.8 and Figure 3.3). Land area was cited across the board as a constraining factor to growing enough or more crops.

Table 3.8: Number of Crops Grown by Land Area and Village

Number of crops grown	Land Area (hectare) (%)		**Total**		Teru (%)	Guder (%)	Aleta (%)
	0-1.0	> 1.0	**N**	(%)			
0	(12)	(0)	2	(6)	(0)	(0)	(7)
1	(0)	(0)	0	(0)	(0)	(0)	(0)
2	(35)	(39)	13	(37)	(40)	(50)	(27)
3	(47)	(39)	15	(43)	(50)	(30)	(40)
4+	(6)	(22)	5	(14)	(10)	(20)	(27)
Total	17	18	35	(100)	10	10	15
%	(100)	(100)			(100)	(100)	(100)
Means	2.59	2.83			2.7	2.7	2.8
	t-test p = 0.2970				Fisher's exact p = 0.838		

Figure 3.3: Scatterplot of Number of Crops Grown by Land Area



P = 0.168

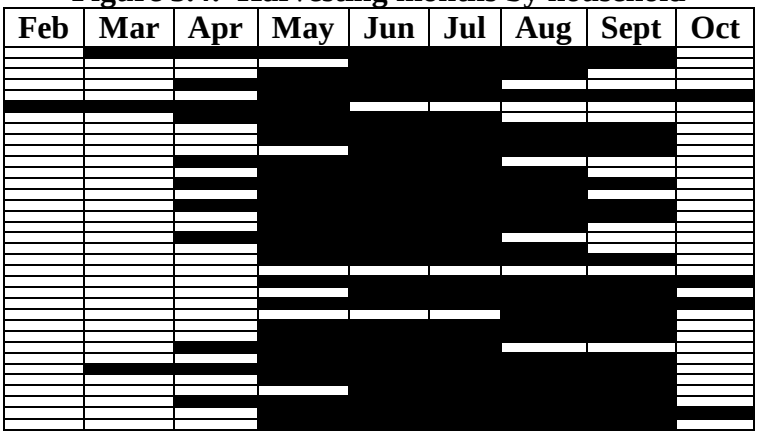
"If I want more crop, I will need 2 more hectare to feed my family and grow more food. The product that I could get from the 2 more hectare will be enough. But my land now, my crop is not enough." – 25 year old, male farmer.

"To get more crops, more land than we have now would be good. I can feed my family with more crops, but, first I need more land." – 28 year old, male farmer on someone else's land.

The most commonly grown food crops include wheat, maize, teff, and cereals. The majority of households (74%) grow wheat, two-thirds (66%) grow maize, about half (46%) grow teff, the grain used to make national flat-bread of Ethiopia—Injera, and approximately one-third of households grow cereals. Banana plants, "famine" food, are grown by 20% of households, while celesta, beans, sorghum, and sugarcane are grown by 11%, 11%, 11%, and 6% of households respectively. Beans are particularly good crops as they are a good source of protein and are nitrogen-fixing, assisting in soil fertilization (Maingi et al, 2001).

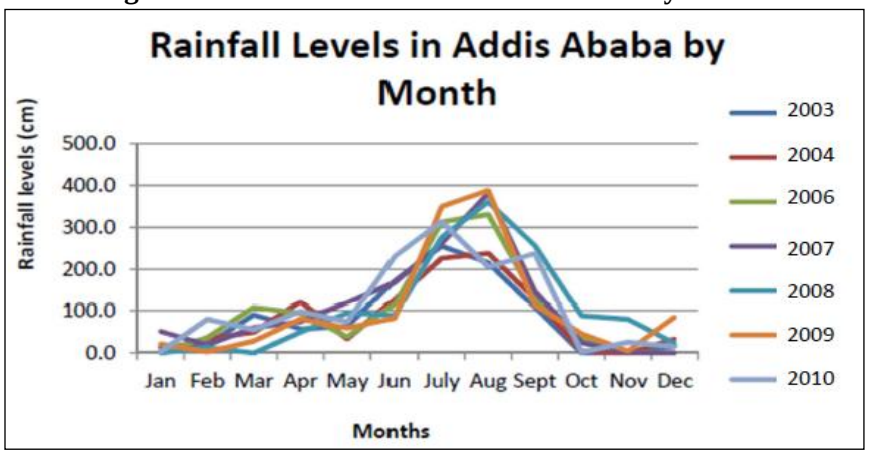
For most households, the primary harvest season runs from May to September with occasional outliers based on location and crop type (see Figure 3.4).

Figure 3.4: Harvesting months by household



Based on rainfall data from the Ethiopian Central Statistics Agency (2011), May through September in also corresponds to the primary rainy season (see Figure 3.5). Figure 3.5 is a graphical representation of rainfall levels over a seven-year period in Addis Ababa, Ethiopia, approximately 150Km from the villages of these interviewees.

Figure 3.5: Rainfall Levels in Addis Ababa by Month



Rainfall deviations from the norm impact crop yields and the types of crops households are able to grow. Thus, unanticipated change in the timing or length of the rainy season, overall rainfall levels, and wetness, impact the harvest, crop yields and household food- and livelihood-security. To gauge just how important interviewees perceive rainfall to be I explored how food-secure interviewees perceive they will be in the current year and in the next three years, a longer-term outlook.

The majority of my sample, 71%, felt sure that they would be able to obtain enough food this year. There was no difference by village ($p = .301$). When asked why, most often interviewees believed they had good rains this year, a boon to the harvest season. Other reasons cited included having sufficient land, or having back-up foods, including some "famine" and easily grown foods.

> *"I am sure that we get good product this year, we get good rain in this year."* 60 year old, male farmer.
>
> *"I think we will get five quintal of crops from our land this year, but I am not 100% sure, it is a good year for rain this year."* 27 year old, male farmer.
>
> *"We are sure, because we have a banana plant, so even if we do not get rain, we will eat that."* 29 year old, male farmer.

Conversely, when asking interviewees the same question with the longer time-frame—three years—the responses were almost completely reversed. Only 17% of my sample felt sure they would obtain enough food in the next three years. Again, there was no difference by village ($p = .347$). The few interviewees who were sure cited larger land area or banana plants as their reason for feeling sure. The other 83% of the sample was very unsure they would obtain enough

food in the next three years citing primary reasons as not knowing how the rains will be that far into the future or having small land that may not produce enough food.

> *"We are not at all sure [we will have enough food in three years] because we do not know what the rain will be like."* 37 year old, male farmer.
>
> *"We are not sure, but are pretty sure because the banana plant will give us product for 4 years and more, so that we will get food, but we are not sure, fully."* 48 year old, male farmer.
>
> *"We are not sure at all because we cannot see the rain that we get. If I see it, I can tell you, but now, I am not sure."* 55 year old, male farmer.

The difference in how sure individuals felt that they would have enough food in one year versus three years was significant (Fisher's exact $p < 0.0005$). These responses demonstrate how important rain is to the stability of crop-yields, food- and livelihood-security.

In ideal, food-secure situations, Ethiopians eat three meals per day. Understanding how household meal consumption changes in good versus bad harvest years was important to examine (Selinus, 2013). I examined whether food-shortfalls influenced or changed the number of meals eaten each day compared to the number of meals eaten each day during months of plenty.

3.3.4. Meal Consumption Patterns

Literature on food-insecurity, famines, and coping mechanisms generally indicates that adults decrease their food intake and consumption by skipping meals or stretching foods in order to protect their children from food shortages. This phenomenon is known as sheltering child-nutrition (FAO/WHO, 1992h). If the food-situation continues to deteriorate as in the case of prolonged drought or food-shortage, and parental intake is sufficiently compromised, the food-

intake of children will eventually also decrease. Since I wanted to be able to compare the results obtained from this primary study of interviewees from rural villages to the quantitative data from the Ethiopian Rural Household Study (ERHS) in Chapter 4, I asked interviewees the same questions about meal consumption as were asked in the ERHS study.

The questions were, "How many meals per day do you [adults] eat in a good month/How many meals per day do you [adults] eat in a bad month" and "How many meals per day do your children eat in a good month/How many meals per day do your children eat in a bad month."

Figure 3.6 and Table 3.9 below demonstrate that on average adults and children were eating nearly three meals per day across the board in good months (solid black and solid red respectively) regardless of household size. Results were non-significant across the board comparing adults and children in good months. There are two slight deviations where adults from households with eight members ate slightly fewer meals and children from households with four members ate slightly more meals. Meanwhile, in food-short months, the number of meals consumed by both adults and children (dotted black and dotted red respectively) are on average fewer than for good months, but worst off for those households with the most members. Worth noting is that households with four and six members had no significant difference in the number of meals consumed by adults in good versus bad months, but all larger households, households with seven or more members were significantly different in the number of meals eaten per day by adults in good and bad months. Comparing the same data for children, the number of meals eaten per day by children in good versus bad months differs for households with four, five, seven, and eight members in them, but is not significantly different for households with six or nine members in them.

For both adults and children, non-significance may be an artifact of small-sample size, or may represent that there is no difference in number of meals consumed. Tthere was no difference by village in the number of meals consumed by adults and children in good or bad months, with the exception of the number of meals consumed by adults or children in good months in Aleta (see footnote). Based on these trends from Figure 3.6, adults are eating fewer meals than children in bad months, which corroborates the literature.

> *"In bad months we try to feed our children the same, but for us, we skip meals, or change how we eat."*—27 year old, male farmer.

> *"When we cannot pay back our fertilizer loans or our land tax, when we do not get good harvest, we will change how much we eat. It is only in the worst times, do children eat little."* – 45 year old, male farmer.

Figure 3.6

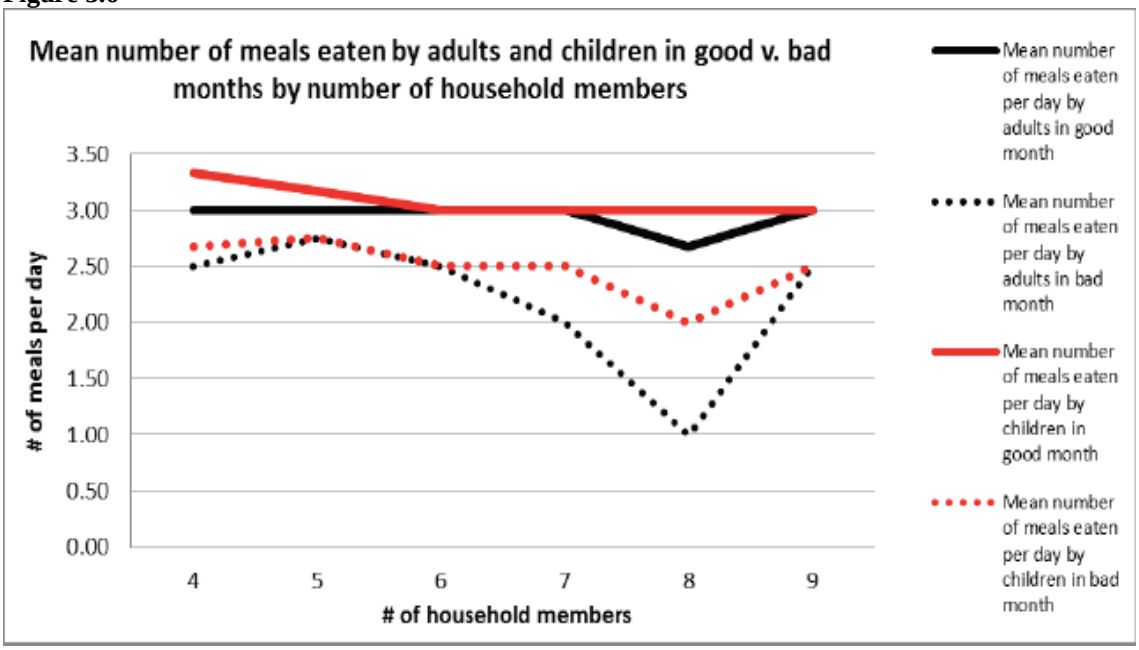


Table 3.9: Mean Number of Meals Eaten by Adults and Children in Good v. Bad months by Number of Household Members and by Village (N = 35) [8]

Mean # of meals eaten/day	Number of Household Members						Grand Mean	Village***		
	4	5	6	7	8	9		Teru	Guder	Aleta
AGM*	3.00	3.00	3.00	3.00	2.67	3.00	2.97	3.00	2.9	3.00
ABM*	2.50	2.75	2.50	2.00	1.00	2.50	2.34	2.30	2.00	2.60
CGM**	3.33	3.17	3.00	3.00	3.00	3.00	3.09	3.00	3.10	3.07
CBM**	2.67	2.75	2.50	2.50	2.00	2.50	2.57	2.44	2.30	2.80

Examining the same data by household land area in Figure 3.7 and Table 3.10 below, adults and children are again eating nearly three meals per day across the board in good months (solid black and solid red respectively) with no significant difference by land area. There is an increase in the number of meals eaten by children in households without land, and may be related to those households having alternate sources of food—namely fish. In food-short months, the number of meals consumed by both adults and children—dotted black and dotted red respectively—are on average fewer than for good months. As land area increases from 1 to 1.75 hectares, the number of meals consumed in bad months trends up slightly such that at 1.75 hectares of land there is no difference ($p = 1.0$) in the number of meals consumed by adults or children in good or bad months.

For adults and children, there are significant differences in the number of meals eaten per day for household land sizes of 1, 1.25, and 1.5 hectare. There is no significant difference for

[8] AGM = Adults, Good Month, ABM = Adults, Bad Month, CGM = Children, Good Month, CBM = Children, Bad Month**

*No statistically significant difference in number of meals consumed by adults/children in good months by number of HH members
**No statistically significant difference in number of meals consumed by adults/children in bad months by number of HH members.
***No statistically significant difference in number of meals consumed by adults/children in good months by village except for SNNP. No statistically significant difference in number of meals consumed by adults/children in bad months by village.

either adults or children at 0 hectare of land, and since only one household had 0.5 hectare of land, it was impossible to obtain a significance level. Children also were eating more during bad months at 0.75 hectare, and there was no significant difference in good versus bad months for 0.75 hectare of land. However, for the majority of households, adults were eating fewer meals than children in bad months, regardless of land area, which again corroborates the literature that adults/parents try to protect their children from food short-falls when and where they can. Again, there were no differences by village as described in the preceding table.

Figure 3.7:

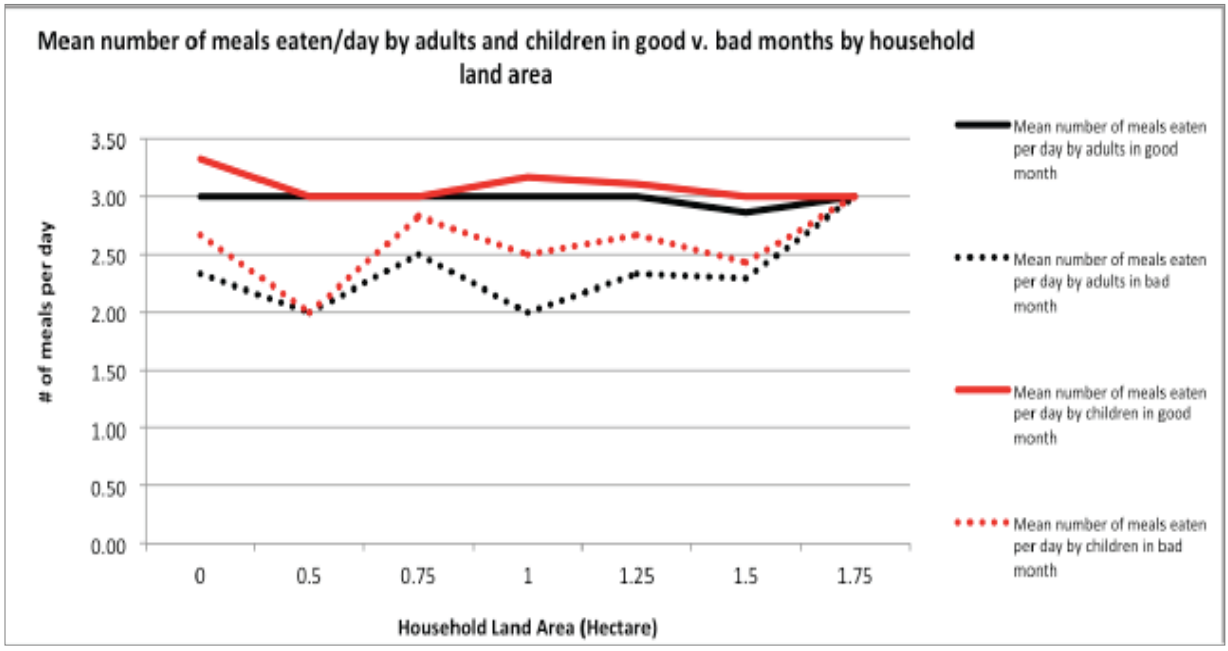


Table 3.10: Mean Number of Meals Eaten/day by Adults and Children in Good v. Bad Months by Household Land Area (N = 35)[9]

Mean # of meals eaten/day	0	0.5	0.75	1	1.25	1.5	1.75	Grand Mean
AGM*	3.00	3.00	3.00	3.00	3.00	2.86	3.00	2.97
ABM*	2.33	2.00	2.50	2.00	2.33	2.29	3.00	2.34
CGM**	3.33	3.00	3.00	3.17	3.11	3.00	3.00	3.09
CBM**	2.67	2.00	2.83	2.50	2.67	2.43	3.00	2.60

The number of meals consumed per day in good and bad months for adults and children converged at 1.75 hectares. This may support the notion that there is a "wealth" or land-area cut-off in which the effects of food-shortages are not felt. One question that arises however, is, whether there is an area of land that adequately fills or prevents food and livelihood gaps that are felt at smaller land-areas. This question indicates an area for future research.

3.3.5. Coping Strategy Use

In addition to consumption-based coping strategies, I explored other strategies households use to cope with adverse conditions. Interviewees were asked to describe the types of strategies they and their households have used in the past. Please refer to Table 3.11.

Overwhelmingly, the most common strategy reported by 94% of interviewees was the selling of animals. The next most common strategies reported were eating other foods, reported by 91% of interviewees, stretching meals by eating less at each meal, reported by 60% of interviewees, and skipping meals, reported by 54% of interviewees. Coping-strategy use does

[9] AGM = Adults, Good Month, ABM = Adults, Bad Month, CGM = Children, Good Month, CBM = Children, Bad Month**

*No statistically significant difference in number of meals consumed by adults/children in good months by number of HH members
**No statistically significant difference in number of meals consumed by adults/children in bad months by number of HH members.

not differ by village with two exceptions. Significantly more households are stretching or skipping meals in Guder than in any other village (p = .04).

Other strategies interviewees reported with low-use and only in the worst conditions included sending children to other relatives, reported by only 9% of interviewees and going a whole day without food, reported by only one interviewee, or 3% of the sample (see Table 3.11). Interviewees in my sample did not report the use of migration or eating wild foods as typical coping-behaviors, this was because migration is only used in the worst of times and because eating wild foods is not culturally acceptable, per interviewees.

Table 3.11: Utilization of Various Coping Strategies by Percent of households and by Village[10]

	(%) of all HH Engaging	(%) of households engaging by village		
Coping Strategy	N = 35	Teru	Guder	Aleta
Selling animals	(94)	(90)	(100)	(80)
Eating other Foods	(91)	(90)	(100)	(73)
Stretching meals*	(60)	(60)	(90)	(40)
Skipping meals*	(54)	(50)	(90)	(33)
Sending children to other relatives	(9)	(0)	(10)	(7)
Going whole days without food	(3)	(0)	(10)	(0)
Eating wild foods	(0)	((0)	(0)	(0)
Migrating	(0)	(0)	(0)	(0)

> *"In the worst of times, I will sell my animals, skip meals, eat other foods, and eat less. In the last famine, I go whole days without eating, but now is not the worst time, so I do not have to do that. We will not eat wild foods because it is not good in our culture, and we must only do what is good."* – 60 year old, male farmer.

> *"When we do not get good crop, we cannot pay our land. If we cannot pay our land, we will sell animals. If we do not get good money from sell of animals, we will change WHAT we eat, before change HOW MUCH we eat."* – 26 year old, female farm-product seller.

[10] There are no differences in coping strategy use by village with exceptions for stretching meals and skipping meals.

*Households in Guder uses these two strategies significantly more often than households in either Teru or Aleta (p = .04).

> *"In bad time, I will sell animals. When we have a shortage of money, we have to sell animals for income. With that money we buy food that are cheap, like celesta. When we have no more celesta, we will skip meals. In the worst time, I have sent my children from this village, to relatives."* 37 year old, male fisherman.

Given the coping strategies typically used, I explored the actions households take during the worst or most extreme food-short years. The responses to this question corroborated the responses from Table 3.11 above. In the worst years, 60% of interviewees reported that their households ate other crops including cereals, bananas, maize, or some combination of these. Twenty percent of interviewees reported that their households sold animals for money to feed their families during the worst years. The remaining 20% of households reported that they engaged in labor work or both sold animals and ate other crops. These few strategies were named multiple times by interviewees as how their households address food and income shortfalls.

3.3.6. Perceived Household Shortfalls

In addition to coping strategy use, it is important to understand what assets interviewees report needing to feed their families or to cope with shortfalls. The most common needs reported in order of frequency were money, animals, and land, comprising 83% of all responses (see Table 3.12). There was a difference noted at the village level ($p = 0.016$) with individuals from Guder citing the most need for animals and individuals from Aleta citing the most need for money. Individuals from Teru varied most in their desired needs.

Table 3.12: Frequency of Perceived Worries and Needs of Households[11]

Biggest Needs	(%) N = 35	**Biggest Worries**	(%) N = 35
More money	(31)	Money	(57)
More animals	(26)	Food	(23)
More land	(26)	Land	(9)
Safety-net program	(9)	Food + Money	(6)
Fertilizer	(6)	Land Tax	(3)
other	(3)	Land + Food	(3)
	(100)	**Total**	**(100)**

"My biggest worry is our land tax, it difficult to pay, when we can not pay, we must sell animals. If we have no animals, we eat different. To feed my family for the year, we need more animals, ox and cow are most important." – 31 year old, male farmer.

"I worry to get food and money, in bad year, we do not get both from our land. Animals are the most important thing we need to feed the family, with enough animal, we get good income." - 55 year old, male farmer.

"Our big worry is money. It is hard to get money because our product sells at low cost and it takes a long time to sell. We need roads so we can sell our products outside of this place." – 30 year old, male farmer

Similarly, I wanted to know what the biggest worries are for interviewees. Overwhelmingly, interviewees reported that their biggest worries were over money, food, and land, comprising 89% of responses (also see Table 3.12). There was a difference noted at the village level ($p = 0.0035$) with individuals from Teru worrying most about food, individuals from Aleta worrying most about money, and individuals from Guder varying in their responses.

"More land is the most important thing that we need." - 28 year old, male farmer.

"If we get more money, we can change our life, and get more thing that we need. That is the most important." 48 year old, female farmer's wife.

"We need more land to get money. If we get land, we can use it to get money. Land is the most money maker." – 40 year old, male farmer.

[11] Note: By village, biggest needs differ at $p = 0.016$, biggest worries differ at $p = 0.0035$.

"We need fertilizer and ox for farming, is what are most important to feed family for all year." 55 year old, male farmer.

The majority of worries and needs coincided and represented insufficient tangible assets, money, food, and land. It is important to note however that the concepts of better infrastructure, roads, access to markets, and technology, or human and social/service capital were also miscellaneous themes reported by some interviewees.

To understand the importance of money, food, and land for these rural households, it is important to look at household incomes and expenditures. As stated in chapter 1, average GDP is approximately $0.50 per day or approximately 9-10 Ethiopian Birr per day. This equals 3,350 Birr per year. Reported land taxes ranged from 200 to 800 Birr per year with an overall average annual land tax of 411 Birr. The average land tax in Teru was 435 Birr, in Guder, 435 Birr, and in Aleta, 373 Birr. There was no difference in land tax in Teru and Guder (p = 1.0), however, there was a difference between Teru and Aleta (p = .042) and nearly a difference between Guder and Aleta (p = .079) (see Table 3.13). Land tax therefore represents anywhere from 6-24% of annual household income.

Table 3.13: Mean Land Tax value by Village (N = 35)[12]

	Teru	Guder	Aleto	Total
Mean	435	435	373	411
(SD)	(75)	(102)	(67.5)	(80.2)

According to Mr. Lambisso, an official at the Ministry of Agriculture, the price of fertilizer is near 1000Birr per 100Kg. The vast majority (91%) of the sample reported using modern chemical fertilizer which they purchase from the government with no difference by village. Depending on household land area, this may represent an additional 20-30% of

[12] Fisher's exact p = 1.0 Teru v. Guder, p = .042 Teru v.Aleta, p = .079 Guder v. Aleta

household income (Lambisso in-person interview, 2011). Thus, it makes sense that money, food, and land are the assets that individuals worry most about and report needing more of. When households lack these assets yet have to pay back their land and fertilizer loans, they engage in a number of already-stated coping strategies. There was no difference among villages (see Table 3.14).

Table 3.14: Percent of Households Utilizing Various Strategies to Pay Land Tax/Fertilizer by Village

	% of total Engaging			
Strategy	**Teru**	**Guder**	**Aleta**	**Total**
Selling animals	(70)	(80)	(53)	(66)
Change amount/what is eaten	(50)	(40)	(30)	(40)
Sell other HH assets	(10)	(0)	(13)	(11)
Give land to others for money/food	(0)	(10)	(13)	(9)
Get a loan	(0)	(10)	(13)	(9)
Work other job/migrate	(0)	(10)	(0)	(2)
n/a (no difficulty paying)	(30)	(10)	(13)	(17)

Fisher's exact p = .882

> *"I use cultural fertilizer (from animals-manure, animal product, or compost) and modern fertilizer. If we do not use cultural fertilizer, we buy or loan fertilizer from the government. It is hard and expensive to get fertilizer from government, and we have to sell animals to pay for fertilizer."* – 45 year old, male farmer.

> *"We use fertilizer, modern fertilizer. We buy the fertilizer from the government, or we get government loan. It is hard to buy fertilizer. It is expensive. We will sell animals to pay for the fertilizer."* 25 year old, female farming-wife.

> *"We use modern fertilizer. We get the fertilizer from buying it. To buy it, we will sell things, or give land to others who will give us money to pay back the fertilizer, and animals, we will sell animals sometime."* 43 year old, male farmer.

3.3.7 Availability of Buffers/Safety-nets

In chapter 2, very few interviewees reported availability or access to safety-net programs in their villages. In this study, all 35 interviewees reported no safety-net programs in their

village. Two households (6%) reported that in the past, there had been a safety-net program in their village.

When interviewees were asked whether they thought a safety-net program would help them obtain more food or money, about one-quarter (26%) of the sample responded in the affirmative. The majority of this sample (74%) however reported that they did not believe a safety-net program would help. Reasons cited for believing the safety-net program would not help included that the program would perceive households as having "too many assets" or that children were not sufficiently undernourished or underweight and so would not provide assistance to their households. The literature indicates that once children are visibly underweight and undernourished, household food security is already too far compromised (WFP, 2013).

> *"We do not have a safety-net program in my village. I don't think a safety-net program would help us get more food, but it might get us more income."* – 27 year old, male farmer.

> *"In the past there was a safety-net program, but at this time there is no safety-net program. When we had the program, they were providing money, but we could not access it because we get good farm product, so, it is given to other. But, if we can get it again now, it will provide us more money."* – 30 year old, male farmer.

> *"We get no program now. If you have children, they measure its kilo, and if it is underweight, the government will support that family. The will provide only for children. I do not think we get any money or supports from a program."* 56 year old, male farmer.

3.3.8 *Sale of Assets*

To incorporate climate- and coping-strategy relationships into this study, I examined whether there was a link between negative climate conditions and the years in which interviewees reported selling animals or other assets. All but one interviewee reported that their household had ever had to sell animals or other assets. The year with the most sales was 2011 with 15 (44%) interviewees reporting sale of animals or other assets. The second highest year

was 2012 with six households (18%) (see Table 3.15). By village, there was no difference by year, with 2011 being the most common year for all three villages (p = .073).

Table 3.15: Percent of Households Having to Sell Animals or Other Assets

HH having to sell animals/assets	N	(%)
No	1	(3)
Yes	34	(97)
Total	**35**	**(100)**
Year of sale (n = 34)		
2008	1	(3)
2009	3	(9)
2010	3	(9)
2011	15	(44)
2012	6	(18)
Unspecified year	6	(18)
Total	**34**	**(100)**

According to USAID (2013), 2011 was the most recent record drought in Ethiopia; 2012 was also reported as having abnormal rains affecting crop yields and harvests. In most cases where interviewees reported the sale of animals or other assets, they also reported engaging in other coping strategies, such as eating "other" drought-resistant foods such as cereals, banana, maize, potato, celesta, and cabbage. The most commonly named drought-foods were cereals (48%), banana, and maize (27% respectively).

These choices of strategies indicate that households try to use less-severe, less-dangerous, and most easily-reversible coping strategies first.

> *"We ate cabbage during the worst years because it can be grown easily, but it is not enough. We must also eat crops that grow most easy, like maize and cereals."* - 45 year old, male farmer.

> *"We sell animals to get money, and buy food that are cheap from the market, like maize, or potato."* 60 year old, male farmer.

> *"Last year, we have to sell animals to get money for food, we also eat banana plant, it grows easy."* – 29 year old male farmer.

"I sell much of my fish last year, to get money, fish is the only thing we get to feed, that is all we have, no land to grow food." – 25 year old, male fisherman.

3.3.9. Crop and Weather/Climate Perceptions

In conjunction with selling animals and assets, I explored interviewee perceptions of crop, weather, and climate trends (see Table 3.16). In total, 15 interviewees (43%) perceived that rainfall was increasing over time, 4 (11%) perceived that rainfall was decreasing over time, 3 (9%) perceived no change in rainfall over time, and 13 interviewees (37%) were unsure. The worst year reported by interviewees was 2011 (23%), followed by 2007 and 2005 with 9% each. There was no difference by village ($p = .976$). Unfortunately, nearly half the sample was unable to specify a "worst" year.

As for temperature changes, 94% of the sample reported that it was getting hotter over time, and 6% reported no change in temperature over time. The hottest year reported was 2012 by 34% of the sample, followed by 2011 and 2010 with 6% and 3% respectively. There was no difference by village ($p = .885$). Forty percent of interviewees were unable to specify which year was hottest. Approximately, half the sample (54%) was unable to tell if it was becoming wetter or drier over time with no difference by village. One-third of interviewees (34%) perceived it was becoming wetter, and 9% perceived it was becoming drier or that there was no change over time. Most interviewees (75%) were unable to specify which year was driest, but of those who could, 2011 was considered to be the driest.

Finally, regarding crop yields, more than half the interviewees (60%) reported crop yields were increasing over time, nearly one-quarter (23%) were unsure, and 15% reported a decrease in crop yields. The worst years for crop yields were 2011, 2007, and 2005 with 26%, 9%, and

9% of interviewees each. Forty percent of interviewees were unable to specify a year. Again, there was no difference by village (p = .39).

Table 3.16: Perceived Changes to and Worst Years for Climate Parameters and Crop Yields[13]

	Rain	**Temperature**	**Moisture**	**Crop Yield**
	(%)	(%)	(%)	(%)
Increasing	(43)	(94)	(34)	(60)
Decreasing	(11)	-	(3)	(16)
No change	(9)	(6)	(6)	-
Hard to tell	(37)	-	(54)	(23)
N/A	(3)	-	(3)	(3)
Total	(100)	(100)	(100)	(100)
Fisher's exact p < .0005				
Worst Years				
Unspecified or n/a	(46)	(57)	(75)	(40)
1991-1993	(3)	-	(3)	(3)
1998	(6)	-	(3)	(6)
2005	(9)	-	-	(9)
2007	(9)	-	-	(9)
2009	(3)	-	(3)	(3)
2010	(3)	(3)	-	(6)
2011	(23)	(6)	(14)	(26)
2012	-	(34)	-	-
Total	(100)	(100)	(100)	(100)

Based on these data, 2011 was most-often the "worst" year specified for all parameters. More specifically, most interviewees perceive that it is getting hotter over time, that rain may be increasing over time, along with moisture, and that crop yields may be increasing over time, but there were no differences by village (all p-levels > 0.6). This combination of responses was surprising in that interviewees were also reporting great need to sell animals or assets in recent years to cope with shortfalls (see section 3.3.7). It is likely that in years with more rain, much of this rain is lost to run-off, or does not adequate penetrate the soil. It may also be that climate-

[13] No difference in perceptions of rain, temperature, moisture, or crop-yields by village. No difference in worst-years specified by village for each parameter with all p-values > 0.6.
**However, there is a difference in worst years for the overall sample, with 2011 considered the worst overall when the year was specified for each parameter (p < .0005).

extremes such as the drought of 2011 may strain household resilience into the future, and this may increase or contribute to household asset-shortfalls.

3.3.10 Rain and Water-Resource Need

As for the desire for more rain, interviewees from larger households reported wanting more rain significantly more often than interviewees from smaller households ($p < .0005$). Yet, interviewees from households with more land were no different than interviewees from households with less land in their desire for more rain ($p = 1.000$) (see Table 3.17). There was also no difference by village ($p = .978$).

Table 3.17: Percent of Households Wanting More Rain by Household Size and Land Area

	% Wanting More Rain	% N/A More Rain
HH size 4-6 (n = 20)	(25)	(75)
HH size 7-9 (n = 15)	(87)	(13)
Fisher's exact $p < .0005$		
Land area 0-1.0 Ha (n = 17)	(53)	(47)
Land area >1.0 Ha (n = 18)	(50)	(50)
Fisher's exact $p = 1.000$		

> *"We need five more months of rain so we can harvest three times during the year. We cannot get more rain. But, if we get more water resource, that will be good."* 60 year old, male farmer.

> *"If the rains start two months before [two months earlier], it will be good. If we cannot get more rain, we need irrigation. We need water resources more than we need more rain."* – 43 year old, male farmer.

That larger households wanted more rain is logical when going on the assumption that having more mouths to feed requires more crops and therefore more rain. It was surprising however, that there was no difference by household land area or by village. To see if these relationships held when taking agricultural advances into account, as 69% of interviewees

addressed a need for more water-infrastructure, resources, and technologies, I asked whether households had irrigation on their land. The presence of irrigation would indicate awareness that rain is not sufficient, and that back-up water sources are needed, and would also indicate an additional asset or buffer households have to increase their resilience against climate impacts.

Currently, two interviewees (10%) from smaller households (4-6 members) have irrigation, six interviewees (40%) from larger households (7-9 members) have irrigation, this was 26% of the total sample. This was borderline different by household size (p = .051). By household land area however, there is no difference in irrigation presence (p = .711). There is also no difference by village (p = 0.182).

Table 3.18: Percent of Households with and without Irrigation by HH Size and Land Area

	HH with Irrigation	HH without irrigation
HH size 4-6 (n = 20)	(10)	(90)
HH size 7-9 (n = 15)	(40)	(60)
Fisher's p for household size = .051		
Land area 0-1.0 Ha (n = 17)	(29)	(71)
Land area >1.0 Ha (n = 18)	(22)	(78)
Fisher's for land area p = .711		
Fisher's p for village = .182		

It is not surprising that smaller households were less likely than larger households to have irrigation, as larger households tend to have more human labor resources available to earn additional income, increasing that household's ability to acquire irrigation. I was surprised at the lack of difference by land area, as I expected households with more land to have more assets, and to be more likely to have irrigation. Given the low prevalence of irrigation in Ethiopia as a whole, I was not surprised at the lack of difference by village (CSA, 2010).

3.3.11. "Out of Harvest" Activities

Most households obtain the majority of their food and income from their harvests. To supplement this food and income, they also engage in "out of harvest" activities. Interviewees reported their most common "out of harvest" activities as: Working on animals (43%), doing labor work (20%), selling animal or farm products, for example milk, eggs, maize, etc (17%), and working on other plants (17%). One interviewee (3%) reported that his family worked on both animals and other plants. There was a significant difference by village. Households in Aleta most often worked on other plants while households from Teru and Guder most often worked on animals out of the harvest season ($p = .019$). There was no difference between Teru and Guder however ($p = .666$).

> *"Out of the farming season, we work on animals. It is not enough, we make some money from this, but it is still not enough."* – 28 year old, female farmer's-wife.
>
> *"when we do not farm, we do labor work. We get money from doing this labor work."* – 28 year old, male laborer on someone else's farm.
>
> *"When we do not work on harvest season, we work on banana plant, sugar cane, and on animals. We make money from doing this, and by selling some of these products."* 29 year old, male farmer.

While many interviewees reported that they do make money from these "out of harvest" activities, nearly all reported that this extra income was still not enough for the year, resulting in the use of coping strategies. As noted in section 4.3.4, migration was not a coping strategy interviewees reported engaging in with any frequency. However, I wanted to know if anyone in the household was migrating for any reason. I also wanted to use this as a counter-perspective (pre-migration perspective) to identify reasons for migration that were unspecified in the study in chapter 2.

3.3.12. Migration Stories and Histories

Interviewees were asked whether anyone in their household had ever migrated. Twenty-one interviewees (60%) reported that at least one family member had migrated in the past, with no difference by village. Of those 21 interviewees, approximately one-third reported that their family member returned home, while the other approximately two-thirds reported that their family member had not returned home (see Table 3.19). The reasons for anyone migrating were not specified, and were not usually known by the interviewees.

Table 3.19: Migration by Household Member (Anyone or Self) and Reason for Migration

Migration	Anyone	Self	Future Need
No	(40)	(63)	(63)
Yes	(60)	(37)	(37)
Total (+) migration	21	13	13
Reason for migration			
For money/job	-	(37)	(46)
Marriage	-	(23)	-
To learn	-	(8)	(30)
For land	-	(8)	(23)
Unspecified	(100)	(23)	-
Total	**(100)**	**(100)**	**(100)**

In contrast, when interviewees were asked whether they had ever migrated, the majority (63%) reported that they had never migrated (also see Table 3.19). Of the remaining 37% of interviewees who reported they had migrated in the past, 5 (37%) reported that they migrated to get more money or for a job, 3 (23%) reported that they migrated for marriage, 3 (23%) did not give a reason, and one (8%) each reported that they migrated to get land or to learn. There was no difference by village (.247). There was also no difference with regards to who thought they would ever need to migrate by village ($p = .134$).

Sixty-three percent of interviewees did not think they would ever need to migrate, 37% of interviewees thought they would. Those who never migrated believed they would not need to migrate in the future. Nearly all who reported having migrated in the past believed they would need to migrate in the future with reasons related to earning money or obtaining a job (46%), learning (30%) or obtaining land (23%). There was no difference in reason for past migration versus reason for possible future migration; however, this lack of difference likely accounts for past experience.

Given that so few interviewees reported the return of the family member who migrated, I examined whether interviewees believed they would return if they migrated in the future. The 13 interviewees (37%) who thought they would need to migrate in the future answered this question. Nine (69%) believed they would not return home due to getting a better life or better things elsewhere.

> *"If I leave [my village], I will not get back to my village. Because, if I get better life, why do I go back?"* - 45 year old, male farmer, similarly cited by 5 (56%) of individuals who believe they may have to migrate.

> *"I will not go back here if I leave, because if I get land in other place, why did I need to come back?"* – 29 year old, male fisherman, similarly cited by 3 (33%) of individuals who believe they may have to migrate.

> *"I will not go back to my village if I leave. In this village, the only work we get is farming. I did not want to do farming. If I get better job, I will not go back."* - 40 year old (11%).

Conversely, the 4 interviewees (31%) who thought they would return home reported it was either due to family obligation, or due to the completion of their education.

> *"After I finish learning, I will go back to my village."* – 19 year old, female "student", similarly cited by 2 (50%) of individuals who believe they may have to migrate.

"Yes, I would return if I ever left, because I need to help my parents. They do not farm now." -43 year old, female farm-product seller (25%).

Finally, I examined any differences in whether anyone had migrated or may migrate in the future by household size and land area. There was no significant difference in land area by anyone who had migrated from a household (p = .315) and there was no significant difference in land area by those who anticipated a future need to migrate (p = .725). There was also no significant difference by village (p = .689) (see Table 3.20).

Table 3.20: Migration (anyone and future need) by land area

	Land Area (hectare)			
	0-1.0	> 1.0	**N**	(%)
Migration by anyone				
Yes	(47)	(67)	21	(60)
no	(53)	(33)	14	(40)
	Fisher's exact p = .315			
Future Need				
Yes	(29)	(39)	13	(37)
no	(71)	(61)	22	(63)
	Fisher's exact p = .725			
Total	17	18		
%	(100)	(100)		

Table 3.21 shows the same information by number of household members. There were no significant differences in past or future migration need by number of household members or by village.

Table 3.21: Migration (anyone and future need) by # of HH members

	# of HH members			
	4-6	7-9	**N**	(%)
Migration by anyone				
Yes	(75)	(47)	21	(60)
no	(25)	(53)	14	(40)
	Fisher's exact p = .157			
Future Need				
Yes	(40)	(27)	13	(37)
no	(60)	(73)	22	(63)
	Fisher's exact p = .489			
Total	20	15		
%	(100)	(100)		

That there were no differences seemed counterintuitive. Based on literature review and expectation of asset-need by household size and land area from chapters 1 and 2, I expected interviewees whose households had less land area and/or more members to report more instances of past migration and more expectation of future migration need due to my anticipation of greater resource-strain at the household level for households with smaller land and more members. These departures from expected indicates that individuals may be migrating for reasons other than resource shortfalls, that migration may a proactive choice by some individuals to enhance or improve their social and economic mobility (Portes (2013), Tacoli (2009), Afifi (2011) and Henry et al (2004)).

3.4 Delimitations, Limitations, Strengths, and Implications

Delimitations: As stated in the methods section, interviewees had to be heads or proxy heads of household where the head of the household was not present. Interviewees also had to be older than 18 years of age, the age of majority. Out of convenience and ease of transportation, the study was delimited to three villages, Aleta, Teru, and Guder in the SNNP, Amhara, and Oromia regions, within 150 kilometers of Addis Ababa which represent the three

most-populated regions of Ethiopia. Finally, while in general males are heads of household in Ethiopia, female-proxy heads of household were oversampled to assess differences in responses, perceptions, or other variables between males and females.

Limitations: There are several limitations to this study, one of which includes generalizability, as the scope of this research was restricted to 35 interviewees from three villages that were relatively easy to travel to and within 150 kilometers of Addis Ababa. However, generalizability was not the intended goal of this study. Instead, the rich descriptions and detailed information obtained by this study in the context of other background information allows for more in-depth knowledge to be gained from this study.

Convenience but methodical sampling is another limitation of this study as it likely biases or skews the results. The fact that World Vision Ethiopia has spent time in these three villages is another limitation, as these villages do not likely represent most of rural Ethiopia given the level of support and resources provided to these villages. Likely these villages are significantly better-off than other villages in Ethiopia. This further contributes to the lack of generalizability of this study. However, this study still assists in understanding the coping strategies and stories of a particular segment of the Ethiopian population.

Another limitation of this study is transferability due to similar reasons as the lack of generalizability. All interviewees were from villages that are easy to get to, limiting the diversity of agro-climate zones, and limiting the variability in socio-economic status of interviewees. Moreover, as seen many times, there were few differences between the villages. This lack of differentiation makes it difficult to assess differences in coping-strategy use based on socio-economic status. Again I emphasize that the conclusions from this study are applicable to this

sample only, and that a completely different sample and different villages would provide entirely different sets of responses and conclusions.

Another limitation is interviewee recall error due to self-report. It is always possible that interviewees were influenced or affected by the interviewer Nahom, offering responses that they believe he wanted to hear. It is also possible that interviewees were guarded and therefore altered the truth. It is impossible to ever know for certain if the responses were fact or a departure from the truth. To try and reduce the possibility of recall error or false-responses, attempts were made to create an environment for the interview that was conducive to open and honest dialogue between the interviewees and Nahom.

While it is a limitation that only one interviewer, Nahom, interviewed all individuals, leaving no room for test-retest validation of responses, interviewees seemed willing to respond, and provide honest answers. Additionally, I worked with and trained Nahom both in the Addis Ababa study presented in Chapter 2, but also worked closely and trained him for this study. Nahom is extremely detail oriented, conscientious, and writes down all of what is told to him. Additionally, he asks questions as they are written and does not give opinions or commentary. Therefore, while only using the one interviewer may be a limitation, it may also be a strength as discussed below.

In recognizing these limitations, I took the following measures. First, I acknowledged my research agenda and assumptions at the start. I reviewed responses blindly, without looking at who made specific statements. Additionally, I tried to corroborate my findings with literature-review. This is the nature of qualitative design, not to generalize all results to all circumstances and contexts, nor to assume that the findings from this study are the end all, be all. Rather, the

goal is to gain an understanding of what is happening to the specific group used for this study to inform further and future research.

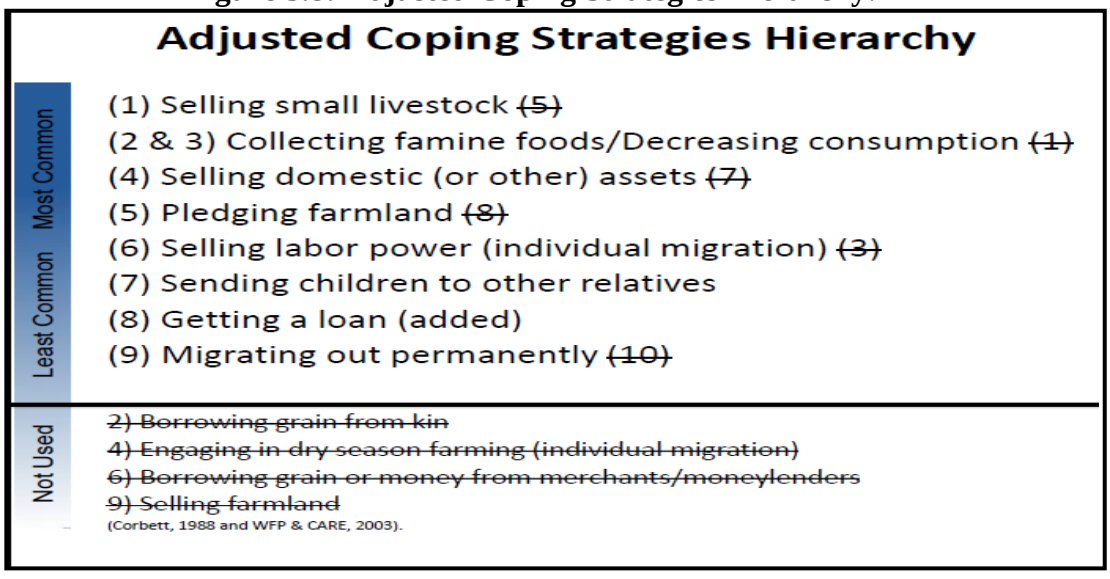
Strengths: While there were limitations to this study, there were also strengths. Strengths included its pre-migration in-village viewpoint to balance what was observed in the previous study (Chapter 2) with the post-migration in-city viewpoint. This study also sought to describe and understand the use of household coping strategies in villages, before migration occurs. Another strength of this study was the recruitment of Nahom, who served as both translator and interviewer. Nahom was trained by me during the first study. Nahom is an engineering student in University, and is extremely detail oriented and professional. While Nahom is not a researcher by training, he is educated, speaks both English and Amharic, and is easy to train in objective qualitative research methods. Perhaps most importantly, Nahom is native to Ethiopia, extremely comfortable with the culture, utilizes appropriate behaviors with both local leaders and heads (or proxies) of household, having great rapport with both. Additionally, Nahom's father works for WVE and Nahom has been out in the field and in the villages used for this study with his father. As such, Nahom has an appreciation for, and understands many of the conditions and issues that are being addressed with this study.

Finally, many of the questions for this study were guided and informed by the rural-to-urban migration study in chapter 2. Certain questions, such as meal consumption in good and bad months can also be compared with data from the Ethiopian Rural Household quantitative study that will be the subject of chapter 4 and looks longitudinally at village conditions that predict food-security status and coping-strategy use.

Implications: A number of implications result from this study, including implications to coping-strategy research and use, public health interventions and practice, and Ethiopian environmental, social, and economic policy involving the provisions and reach of social safety-nets. As for implications to coping-strategies research, it appears from this sample of rural Ethiopian households that there are four common strategies households use when they have shortfalls in food or income, or when they have difficulty paying their land tax or fertilizer loans.

The four coping strategies named by interviewees were to: 1) sell animals, 2) eat other foods, 3) change the amount of food that is eaten, stretch foods, or skip meals, and 4) sell other assets. While these were the primary strategies named, a few other strategies have been used, though infrequently. These strategies included pledging land to another in exchange for food or income, doing labor on someone else's land, sending children out to other relatives, getting a loan, or lastly, having one or more family members migrate out of the village in the worst of times. Based on these results, I adjusted the coping strategies hierarchy presented in chapter 1 to reflect the responses from this sample of interviewees. See Figure 3.8.

Figure 3.8: Adjusted Coping Strategies Hierarchy.



In this revised figure, the order of coping strategies as described by this sample differs from the original list (Corbett (1988) and WFP & CARE (2003)). Strategies that were not appropriate for this sample were moved to the "Not Used" section at the bottom, while other strategies were added up top. Additionally, based on this sample it appears as though there may be increasing use of coping- and prevention-strategies by poor, rural households, or essentially, the use of reactive and proactive strategies to prevent the worst-case options, sending children out, eating wild foods, going whole days without eating, or migrating out permanently. As noted by several interviewees, migration may be motivated by both the need for basic household assets, but also by the desire for increased social and economic mobility, as discovered in Chapter 2. Therefore, future research should recognize that both coping- and mobility-strategies, reactive and proactive strategies, are being used by poor agriculturally-based rural households.

Again, I must recognize that it is not only possible, but quite likely that had I selected different villages, the types and ordering of coping strategies used would be different; likewise, the motivations for migration may be different as well. In fact, the variability in the order and use of coping-strategies, and at times, prevention-strategies from my research and from the literature (Corbett (1988) and WFP and CARE (2003)) just demonstrates how household choice of strategy use is context- and culturally-specific and that there is continued need for research in this area.

As for economic implications, while approximately half the sample indicated that their land was sufficient to provide enough food, almost no one indicated that their land was providing them enough income. Shortfalls in money, food, and land in that order, therefore appear to be the most significant factors that influence the need for coping-strategy use. Interviewees

corroborate this assertion by describing their most important needs—money, animals, and land indicating that there is a gap between what households need, and what they actually have.

As such, advocating for pro-poor changes to economic and social policies that facilitate higher income generation for households is important. Some areas for improvement, as noted by interviewees include further extension to loans and markets, which will increase household ability to acquire more animals and land, two of the most important physical assets to these populations, and provide income and buffers to households where there are shortfalls. Additionally, the gaps between what households have and need points to an area where social safety-net programs, involving both economic and social policy, might be able to inject themselves into the local economy, providing services and infrastructure that better meet the needs of the people they are trying to serve.

Given the gap in educational attainment between this sample and the Ethiopian population at-large, it would be prudent for the government of Ethiopia to improve its educational policy and infrastructure. It is well known that low levels of education results in fewer opportunities to acquire assets, to engage with agricultural inputs and technology, and to increase the incomes of poor agriculturally-based populations (Population Reference Bureau, 2013 and Mekonnen and Worku (2011)). Moreover, improving education, particularly for women, often results in lower levels of infant- and under-5 mortality, undernutrition, reduces family size, and may improve health (*ibid*). Therefore, it would be beneficial for the government to provide an adequate number of schools in villages, adequate supplies, trained teachers, and meals in the schools, a well-described method to increase school attendance and educational attainment in developing country literature (WFP, 2010).

As for migration, there were no significant differences in the frequency of migration by interviewees from households with larger or smaller land, or with more or fewer members. The reasons for future and past migration, namely for more money or a job, to get land, or to learn, implies that there is a lack of money or other assets that may be driving migration in some cases. However, the fact that interviewees migrated regardless of land size, and the fact that migration was not cited as a coping strategy, indicates that there may be other reasons as well that drive migration.

As for governmental policies, laws governing land-tenure and land-ownership should be amended to permit farming households' larger parcels of land, in addition to **ownership** of that land. It is important to remember that the government owns all the land and rents it to the people for high land taxes. Larger parcels of land, combined with ownership, along with increased education could synergistically improve the food-security status of many rural households by increasing their natural and physical asset-levels, their ability to grow more food, and their ability to generate more income from the land. Moreover, increasing taxes for agricultural-business farms or conglomerations, increasing export-taxes, eliminating or reducing household land-taxes, and subsidizing the cost of fertilizer for farming households could also improve the food-security status of these households by reducing their expenditures and liabilities while at the same time increasing their earning and asset-acquisition potential.

Government investments to climate and crop insurance could offer farmers reprieve from years with low harvest yields, decreased income, and insufficient food. Concurrent reduction or elimination of land tax as described above should prevent emergency sale of assets for food purchases from markets or for fertilizer or tax payments that households cannot afford. Climate

and crop insurance could also help to subsidize the cost of imported foods that households may need to purchase in low-yield years as a way to prevent the two- and three-fold price increases observed during the 2007-08 food price crisis (FAO, 2010).

It is important to improve access to local markets by improving roads, transportation, and infrastructure, so individuals can buy and sell commodities at fair prices. Increasing the budget, spread, provisions, and eligibility for safety-net programs, and providing the types of provisions that households want, such as grains, seed, and cereals, rather than cash-transfers where the value depends on market fluctuations may help improve livelihood- and food security. Support for farming cooperatives and other micro-businesses may promote household self-sufficiency, self-efficacy, and resilience. Governmental buy-outs of surplus food or seed in boon years should help increase overall food-stocks. This not only supports household economy by increasing rural incomes and employment, but also helps to stabilize market-prices in low-food times when the food is appropriately deployed.

While food aid is a necessity and has its place in famine-relief, hunger, and emergency situations, the long-term use of food aid should be discouraged. In the long-term, food aid undermines the economy of developing countries and households by reducing the prices that farmers can obtain for their own products at market (World Bank, 2010). Once the food-shortage and nutritional status of individuals has improved, the government should move away from long-term food aid towards a more sustainable approach. In fact, the government would be better off transitioning individuals and households into training opportunities that teach individuals improved farming techniques, better ways to store food and/or calories for future

climate-exacerbated famines or hunger seasons, and provides inexpensive yet effective farming technologies that ultimately increase the resilience of households and their food security.

The policy recommendations described above, if implemented successfully, should increase rural employment and education, keep consumer prices stable, and increase incomes. These policy and infrastructure recommendations in combination with appropriate disaster mitigation and climate risk-reduction should help increase household livelihood- and food security while simultaneously decreasing the need to engage in more severe coping-strategy use.

This study corroborates some of the widely-used coping strategies that households engage in when they experience shortfalls in money, food, and income. Literature states that climate change will influence crop yields and land productivity in the future (IPCC, 2012). Literature also indicates that water resources will continue to be at-risk, both in supply and safety, impacting the health and nutritional status of individuals, rural communities, and entire nations (Black et al, 2011). While Ethiopia has policies to decrease carbon emissions, the country is lacking some fundamental safeguards, such as improved education, health care, infrastructure, and the use of safety-nets that could have larger benefits on the health of its people. The extent to which future climate change impacts the livelihoods, health, and safety of the Ethiopian people will only be known with time and with additional research.

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Chapter 4: An Analysis of Climate Impacts on Household Livelihood and Food security using Ethiopian Rural Household Panel Data

4.1 Introduction

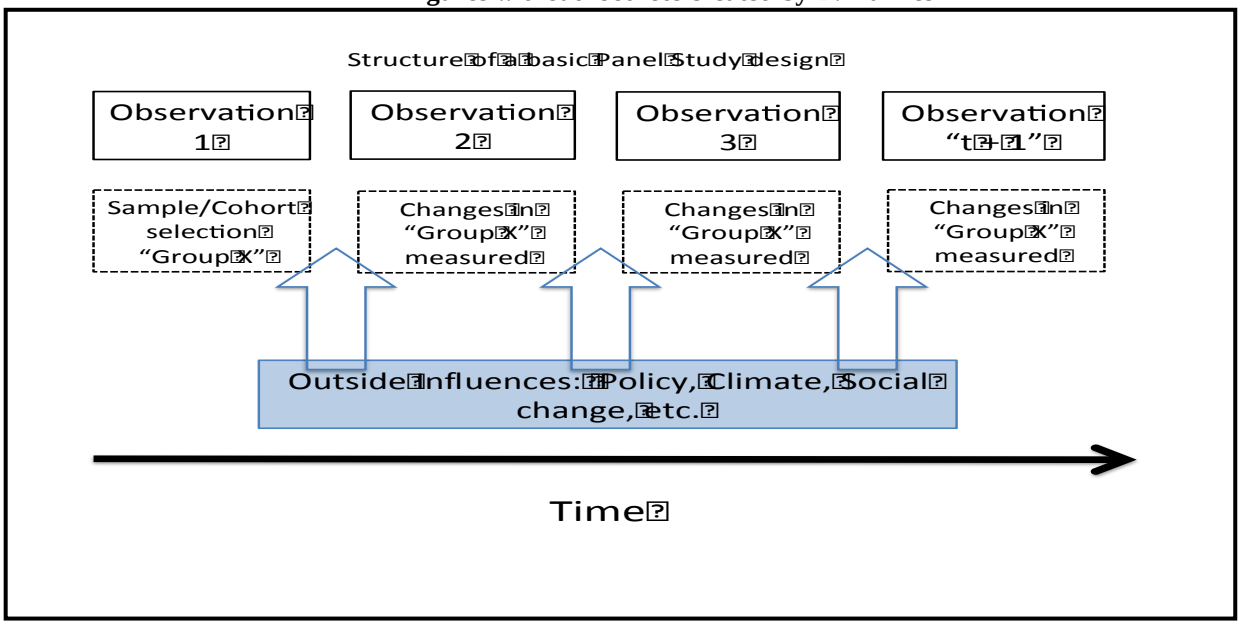
Chapters 2 and 3 demonstrate how some individuals cope with shortfalls in tangible and intangible livelihood assets. Chapter 2 takes a retrospective viewpoint of migration, identifying both reactionary- and volition-induced reasons for migration. Chapter 3 takes a prospective approach by identifying behaviors and strategies that households have used to cope with shortfalls in food security and household assets, while also asking interviewees to reflect on the future and the possible need for migration.

The results of chapter 3 indicate that there are four unique coping strategies that households use on a fairly regular and consistent basis to cope with an insufficiency in food, money, or other assets. The four coping strategies were: 1) to sell animals, 2) to eat other foods or change what is eaten, 3) to change the amount of food that is eaten, to stretch foods, or to skip meals, and 4) to sell other assets. Given that the first two chapters were qualitative in design, and gathered in-depth information from small samples, the ability to generalize the results was limited. Therefore, this chapter was designed to extend, corroborate, or refute the results of the first two studies by using a larger and more representative sample of rural Ethiopian households. Additionally, this study was designed to examine how variables change over time to influence household food-security status and coping-strategy use.

To carry out these goals, I used existing Ethiopian rural panel survey data (described in section 4.2) to examine how several variables observed repeatedly over time influence household food-security status.

One benefit to using longitudinal panel survey data, is that the surveys gather information about the same households with repeat observations over several years, or in this case, two decades allowing us to observe how characteristics of those households contribute to changes in our outcome of interest (Wooldridge, 2002). Figure 4.1 demonstrates the basic design and structure of a panel study.

Figure 4.1: Basic Panel Study Design and Structure
****Figures without footnote created by D. Hunnes****



Panel studies facilitate the identification of relationships among variables or behaviors by demonstrating dynamic characteristics of those variables. The change in these variables may represent incidence, pattern, duration, interrelation, or the impact of physical, environmental, or social change and trends at the individual or household level allowing a wider range of explanatory analyses and inference (Rose, 2000; and Harpham et al, 2003). Panel survey designs are well suited to answer research questions that seek to understand how exogenous macro-level changes influence the behaviors of households over time. It is not possible to do observe these changes with a cross-sectional study which provides one snapshot in time, is limited to

describing proportions of households or individuals experiencing a particular outcome at that time, and does not account for how the prevalence is changing, or why (*ibid*).

Well-designed panel studies use initial samples that represent the population of interest, implement panel-retention programs, and interview the same individuals or household members with each successive wave. Conceptual frameworks model the key variables which are measured at each round. More reliably than a single cross-sectional survey, panel surveys collect repeated measures of data that can be analyzed retrospectively. Panel surveys also are able to compare prospective respondent-expectations of change over time to actual changes, something a single survey cannot do (*ibid*).

Ultimately, while panel data themselves are rich in information at each successive wave, the ability to analyze data longitudinally helps inform, support, or further enlighten theories, and empirical findings. Here, panel data were used to validate and better-understand conclusions developed from first-person interviews of rural-to-urban migrants and first-person interviews of rural villagers in Ethiopia.

For this study, I examine the relationships between household food-security status, using the number of food-short months households experience as a proxy, and a number of predictor variables including the amount of land-area households farmed, the value of livestock owned, how adequate rainfall is perceived to be, whether households have irrigation on any of their land, and the participation in safety-net-type programs. My hypotheses are that all variables will have a negative relationship with the number of food-short months households experience with the exception of safety-net programs and sale of livestock for food, which I expect to have either no

relationship or a positive relationship respectively. Further descriptions, explanations, and evidence for these hypotheses will be described in detail in section 4.3.

4.2 Methodology

4.2.1 Data Source and Collection

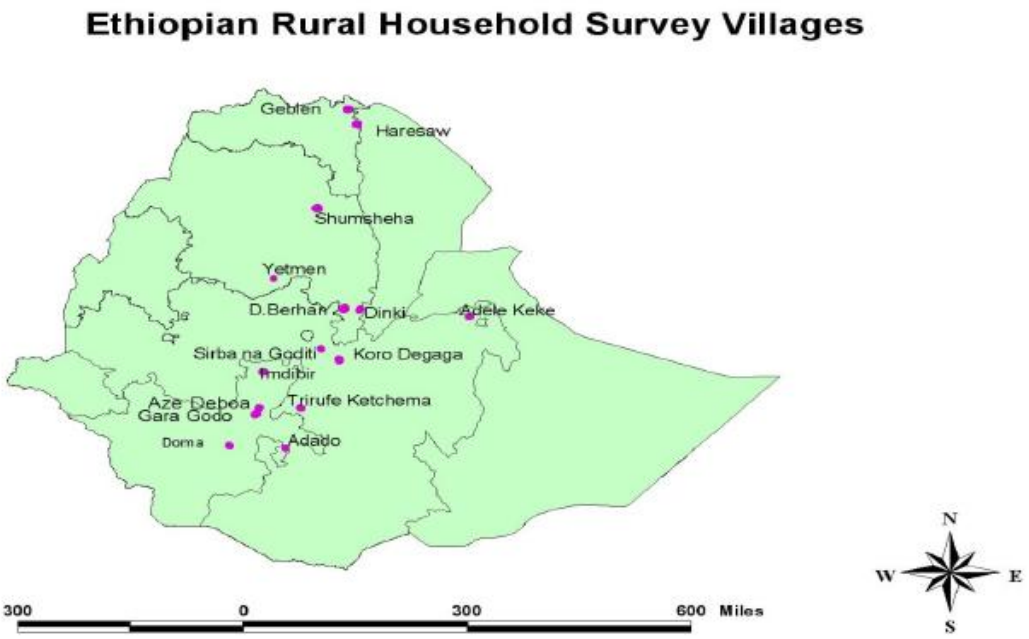
The data used for this paper came from the Ethiopian Rural Household Survey (hereinafter ERHS) conducted by the Economics Department of Addis Ababa University (Economics/AAU), the Centre for the Study of African Economies (CSAE), the University of Oxford, and the International Food Policy Research Institute (IFPRI) (Dercon and Hoddinott, 2011). The ERHS was a longitudinal household panel survey. Data collection started in 1989 after the Ethiopian Famine of 1984-85 to study how households responded to the food crisis. The original 1989 study covered six farming villages in the Amhara, Oromia, and Debub (now known as the Southern Ethiopian People's Association or SNNP) regions.

The six villages for this study were selected due to high mortality and hunger from the 1984-85 famine and other droughts that followed in 1987 and 1989. The study collected data on consumption, assets, and income of 450 households that were randomly selected from within each village. The Tigray region of Ethiopia was another desired location by the Principal Investigators (Dercon and Hoddinott) due to the high mortality the Ethiopian Famine had in this region; however, conflict prevented survey work from being conducted there (*ibid*).

In 1994 the study expanded to fifteen villages across Ethiopia and added 1,027 households to the sample, making a total of 1,477 households. By increasing the sample size, the goal of the study was to increase the study's coverage, breadth, generalizability, and representativeness, while also accounting for the diversity in farming systems including grain-plough areas in the North and Central highlands, far-growing areas, and sorghum-hoe areas.

According to Dercon (2011), the nine new villages were selected to balance their accessibility and remoteness. The new villages were also selected to match and represent the agro-ecologic characteristics of the Ethiopian rural population as a whole (*ibid*). Logistical considerations included district level permissions to conduct the interviews. Dercon and Hoddinott (2011) justify their sampling frame by arguing that farming systems are an important stratification basis due to the dependence on rainfall and other environmental factors. As such, they selected one to three villages per strata (see Figure 4.2).

Figure 4.2[2]:



Within each village, random sampling was used, based on a list of households that was provided by each Peasant Association (village association), which keeps accurate lists of households. The lists of households were stratified by female and non-female headed

[2] Map image obtained from: University of Oxford and International Food Policy Research Institute, Washington D.C. (2011). The Ethiopian Rural Household Surveys 1989-2009: Introduction. [Brochure] Dercon S, Hoddinott J: Author.

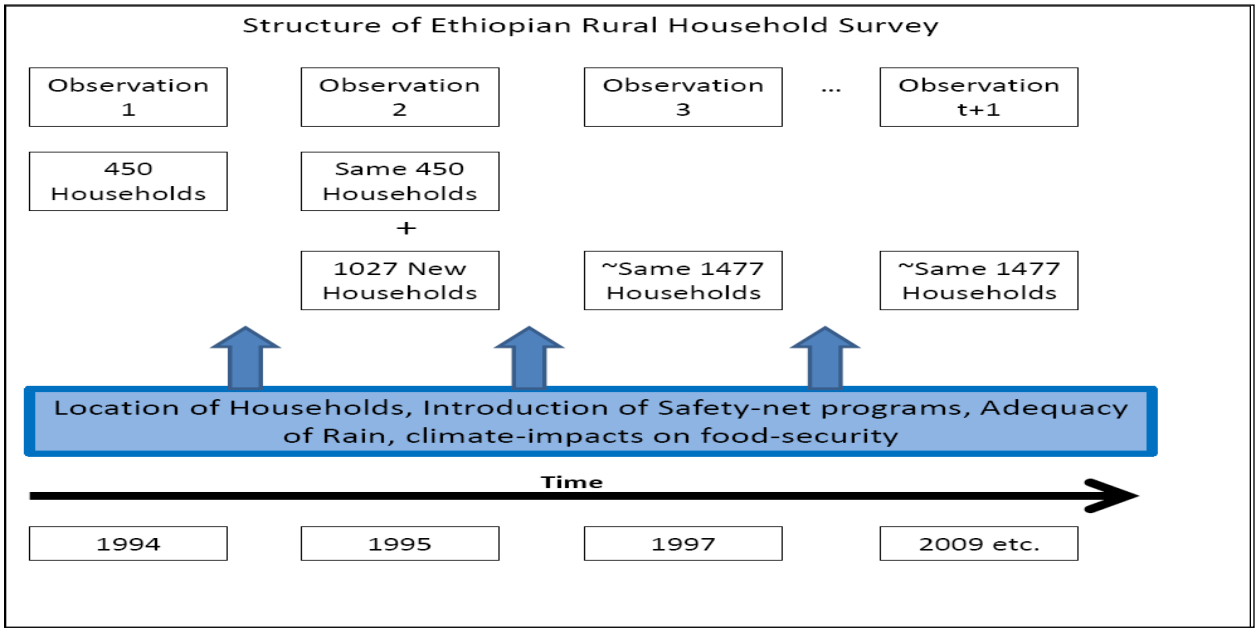
households. The sampling frame within each village was designed to obtain a self-weighting sample when considered in terms of farming system such that that each person approximately represents the same number of persons from the main farming systems. Dercon and Hoddinott (2011) state the advantage of this method was to simplify the pooling of the data.

In some areas, landlessness is increasing. The government owns the land, there has been no redistribution, and there is a ban on land sales. Thus, there is no legal mechanism for young or newly formed households to acquire land. Therefore, each village was stratified to include a representative number of landless households (*ibid*). Pastoralist households were excluded due to the longitudinal design of the study and inherent logistical problem of following nomadic households, a defining characteristic of pastoralists. Although the Principal Investigators covered a broad distribution of the national population, they recommend taking great care if trying to generalize the results from this data to all of rural Ethiopia (Dercon, 2011).

Additional rounds of the survey were conducted in 1995, 1997, 1999, 2004, and 2009 using the same villages. Survey rounds averaged one to two months to complete. The 1994a round was conducted between March and July over the various villages and then again approximately six months later for each village in the 1994b round. The 1995 round took place primarily between March and June, the 1997 round between June and November, the 1999 round between June and September, and the 2004 round between April and July. Survey rounds were conducted in different seasons to account for the various growing and harvest seasons (June to August), as well as the hunger season (March to June). The total sample size from 1994-2009 includes 1,477 households. See Figure 4.3: Survey design.

Figure 4.3: Structure of Ethiopian Rural Household Survey

****Figure by D. Hunnes****



While most of the 1989 survey households can be linked to the 1994 survey and beyond, the survey instruments and format of the study changed sufficiently to justify the exclusion of the 1989 data for analysis in this study.

Attrition at the household level was fairly low overall, approximately 1.3 percent per year between 1994 and 2004. More specifically, attrition was about 8 percent between 1994 and 1999 and 5.2 percent between 1999 and 2004 for a total of 13.2 percent over the ten-year period (*ibid*). Attrition was attributed primarily to migration that was related to either the loss of agricultural land or to the return of some households from resettlement villages to their original villages. Other household characteristics that affected attrition included tiny land holdings, less than one-quarter hectare, and small households, one or two persons. Loss to follow-up is important if it relates to the study outcome, food-security status, or is a systematic part of the data set and therefore results in bias. However, Dercon and Hoddinott (2011) indicate that hierarchical regressions purge estimates of non-random attrition. Therefore, this problem is not worrisome

for the purposes of this dissertation. Households were kept in the sample even if the head of household left or died. Similarly, sons or daughters from the 1989 households, who formed their own households after marriage, were also interviewed in later rounds. Where households were lost to attrition, replacement occurred with households, which were considered by village elders and officials as broadly similar in demographics and wealth to the households, which could not be traced (*ibid*).

Survey topics included household characteristics, agriculture and livestock ownership, food consumption, health, women's activities, community level data on water, electricity, sewage, health services, Non-Governmental Organization (NGO) activity, and also information on migration, wages, production, and marketing (*ibid*). In addition to household level data, community-level data were available, which supports, corroborates, or clarifies data from the individual household surveys. Variables selected for analysis based on existing research and information learned from the previous two chapters.

4.2.2 Variables Selection

The following variables were chosen for analysis.

Outcome Variable:

Number of Food-Short Months: This is the outcome variable of interest. This variable represents the length of the hunger season for each household and is a proxy measure of food insecurity. In rain-dependent agricultural livelihoods, the length of the hunger season depends on crop yields from the prior harvest as well as the household's ability to mobilize assets, liquidate as needed, and buy an adequate supply of food. Households that experience more food-short months should also be households that use more coping

strategies. Coping strategies include sale of livestock, and skipping or stretching meals, variables that are present in this data set. This dependent variable is represented in the data set by the question, "How many months in the last 12 months did you have problems satisfying the food needs of the household?" This question was asked in the 1994a, 1994b, 2004, and 2009 rounds.

Predictor Variables:

1) **Average Land Area**—Land area represents one form of wealth in Ethiopia. Land, a natural asset, is one factor that may determine the amount of food households can grow. Land also may influence household income and food intake since most households subsist and consume food grown from their own land (DFID, 1999). Land may also represent a household's potential to save money or seed from a boon-year's harvest, or potential to let portions of the land lay fallow to regenerate soil nutrients. Lastly, land area influences whether or not households can derive other uses from their land and diversify their livelihood strategies by using land for livestock rearing or the production of derivative products such as dairy or eggs (IFAD, 2011). Therefore, the independent variable "land area" is used to represent the total area of all land or plots that households farm on. Questions asked included the number of plots of land, and the area of each plot which were then summed together. These questions were asked in the 1994a, 1995, 1997, 2004, and 2009 rounds.

2) **Livestock Value:** Similar to land area, the value of livestock owned represents another household asset in Ethiopia, namely physical, financial, and in some cases

social capital (*ibid*). Livestock, specifically oxen, are a major form of labor for rural households used to help plow and harvest the fields, reducing human energy/labor consumption. Livestock are a liquid form of wealth that can be sold in markets for money to purchase food, seed, and other consumable goods, or may be sold to pay off debts (Corbett, 1988 and Reardon et al, 1988). Livestock also provide derivative goods such as milk, cheese, or other products, and can be used in exchange for a supplemental labor-wage on other households' fields. This variable was calculated and represents the total value of all livestock and animals owned by a household. Questions asked of respondents included types of animals owned, their value if sold, and how much was actually received for the sale of an animal. To calculate the total value of livestock, the number of animals owned was multiplied by the actual value received for the sale of those animals, then summed together. These questions were asked in the 1994a, 1997, 1999, 2004, and 2009 rounds.

3) **Forced to Sell Livestock to Buy Food:** This variable represents a household's active use of a coping strategy, namely, selling livestock (Corbett, 1988 and WFP & CARE, 2003). Whether a household is forced to liquidate a critical asset, such as livestock, may be used to measure livelihood and food-insecurity indirectly. The literature demonstrates that households take this action only if they have run out of other less-costly and more-reversible options including the use of wild- or famine-foods, skipping meals, or reducing consumption (*ibid*). Similarly, chapter 3 identifies "sale of livestock" as a strategy that is used to cope with food and income shortages. Thus, identifying households that are utilizing this coping strategy serves as an additional

proxy for livelihood- or food security. This variable has the caveat that it will not apply to households that do not own any livestock. Therefore, households that do not own any livestock are automatically treated as a "no" or as not being forced to sell livestock. However, only 64 households (4.3%) fell into this category. This question was asked as "Were you forced to sell any livestock to buy food?" This question had a yes/no response and was asked only in the 2004 round.

4) **Any Irrigation on Land:** Irrigation, a rare farming technology in Ethiopia, represents a physical asset that can buffer households from the negative impacts of suboptimal rainfall levels (DFID, 1999). Households that have irrigation are more likely to have higher levels of current and future wealth as they likely have a more consistent harvest over time (Asayehegn, 2012). Moreover, it is plausible that in the presence of irrigation, a household's harvest will be less dependent on rainfall thus nullifying the significance of rainfall. Therefore, households that have irrigation should present with higher levels of food security or fewer food-short months. This question was asked as "Is there any irrigation on any of your plots?" This question had a yes/no response, and was asked in the 1999, 2004, and 2009 rounds.

5) **Household storing any cereals, seed, etc.:** This variable represents another form of asset for households, a physical asset can be eaten during food-short months rather than wild or famine-foods (DFID, 1999). In good-harvest years they can be saved or planted for the next year's harvest. Seed, grain, and cereals are also financial capital because they can be "banked" like money, or sold to prevent the sale of more valuable

assets, (such as livestock) (Corbett, 1988 and Reardon et al, 1988). Thus, households that store seed, grain, or cereals are more likely to have higher levels of food security, fewer food-short months, and to use fewer coping strategies. This question was asked as, "Is the household storing any cereals, pulses, or any other food crops at present?" This question had a yes/no response, and was asked in the 1994b, 1999, 2004, and 2009 rounds.

6) **Public Works Participation:** The variable for public works participation represents safety-net program receipt and use. A second related variable is receipt of free-food distribution. A safety-net program that provides the goods and services that households should need in theory, shelter their productive assets from needing to be sold or whittled away and should reduce the number coping-strategies households use (MoARD, 2011). As noted in chapter 1, the availability of the Ethiopian Productive Safety Net Program and other safety-nets are insufficient, badly-timed, and offer inappropriate services (Slater et al, 2006). Therefore, I anticipate that there will be no relationship between public works participation and a household's food-security status or the number of food-short months that households report. The questions that were asked included, "Did anyone in this household work on a public works (food-for-work or cash-for-work)?" and "Did anyone in this household receive free food distribution?" These questions were asked in the 2004 round only.

7) **"Number of meals eaten per day:"** These variables measure the number of meals consumed each day by adults and children in good-food months and bad-food months.

These variables are important because they represent the use of a coping strategy, the reduction of food-intake in food-short months (WFP & CARE, 2003 and Corbett, 1988). Literature and results from chapter 3 indicate that adults will forego food to shelter children's nutritional status (FAO/WHO, 1992h). Therefore, identifying households where any individual let alone both adults and children, miss meals in food-short months should facilitate the observation of household trends in food security over time. These questions are asked as follows: "During the worst month, how many times a day did adults in your household eat?" "During the worst month, how many times a day did children in your household eat?" "During a good month, how many times a day did adults in your household eat?" "During a good month, how many times a day did children in your household eat?" The distribution of these variables ranged from 1 meal per day in a bad month up to 4 meals per day in a good month. These questions were asked in the 2004 and 2009 rounds.

8) **Perceived Adequacy of Rain:** This variable is unique among the predictor variables. This variable was constructed from a set of five questions in the survey that serially ask respondents to rate the timing and adequacy of the rainy seasons. The five questions that make up this index were:

    a. "According to your plans, did the first rains come on time?"
    b. "Was there enough rain on your fields at the BEGINNING of the rainy season?"
    c. "Was there enough rain on your fields DURING the growing season?"
    d. "Did the rains STOP on time on your fields?"
    e. "Did it rain near the harvest time?"

The standard deviations for this scale were reviewed at each hierarchical level (regional, village, household, time). Results of the standard deviations indicate that there was high variability at the time and locational levels and almost zero variation at the household level, indicating good inter-rater (household) reliability (see Table 4.1). Thus, creating a scale for this variable seemed appropriate.

Table 4.1 Residual Standard Deviations at Hierarchy Levels for Perceived Rain Adequacy.

Variable	SD	95% CI
Perceived Rain Adequacy		
Region	.5202	[.2140, 1.265]
Village	.5815	[.4117, .8213]
Household	$1.5x10^{-10}$	[$6.5x10^{-10}$, $3.4x10^{-9}$]
Time	1.318	[1.295, 1.341]

Each item was dichotomized into a 0/1 response where 1 represents responses such as "the rains came on time" or "the amount of rain is just enough" and 0 represents responses such as "the rains came too early/late" or "there was too little/much rain." Worth noting, rains that came too late or were too much were also given a value of 0 because too much rain can be damaging to crops just as insufficient rain can.

The resulting index ranges from 0 (complete inadequacy of rain) to 5 (complete adequacy of rain). This variable was crucial to the analysis because the vast majority of the rural Ethiopian population depends on rain for their food, income, and subsistence (Cohen and Lemma, 2011 and Boko et al, 2007). Thus household perceptions of the timing, amount, and length of the rainy season, should associate with household food security (proxied by the number of food-short months) and with actual rainfall-data. These questions were asked in the 1994b, 1995, 1997, 2004, and 2009 rounds.

Table 4.2: Summary Description of Variables

Variable Name	Description/Construction
Number of Food-short Months: Outcome Variable	Average number of food-short months that households experience in the hunger-season by year. Reported for 1994a, 1994b, 2004, and 2009.
Land Area	Average total land area of all plots of land that households farm on. Reported for 1994a, 1995, 1997, 2004, and 2009.
Livestock Value	Average total value of livestock in 1000s of Birr that households own. Reported for 1994a, 1997, 1999, 2004, and 2009.
Forced to Sell Livestock to Buy Food	Yes/No report of whether households were forced to sell livestock to buy food. Reported for 2004.
Any Irrigation on Land	Yes/No report of whether households had any irrigation on any of their land. Reported for 1999, 2004, and 2009.
Household Storing Cereals, Seed, Etc.	Yes/No report of whether households were storing any cereals, seed, etc. Reported for, 1994b, 1999, 2004, and 2009.
Public Works Participation	Yes/No report of whether anyone in the household participated in a public works program, and yes/no report for whether the household received any free-food distribution. Reported for 2004.
Number of Meals Eaten Per Day	Average number of meals consumed by adults and children in good and bad food-months, encompasses 4 discrete variables. Reported for 2004 and 2009.
Perceived Adequacy of Rain	Index variable, constructed with five discrete variables, dichotomized into: 1 = appropriate (or adequate amounts/timing of rains) and 0 = inappropriate (inadequate amounts/timing of rains). Index value 0 – 5, represents sum of all 0/1 responses. 0 = complete inadequacy of rain, 1 = complete adequacy of rain. Reported for 1994b, 1995, 1997, 2004, and 2009.

4.2.3. Data management

All bivariate and multivariate hypothesis tests of household-level food security utilized the above variables. To utilize these data, important data-management steps were taken. The raw data came in seven separate data files, which were cleaned, checked for duplicates which were eliminated, and consolidated into one master file from which all analyses were conducted.

Given attrition at the household level and subsequent replacement with similar households, the replacement households were kept in the serial cross-sectional and longitudinal analyses.

Attempts were made to understand and address non-response and missing responses. The vast majority of variables had low-rates of non-response (less than 5%) for most of the years they were available with exception of the variables: Number of food-short months with 9% non-response, irrigation presence in 1999 with 15% non-response, total land area in 1995, with 9% non-response, number of meals eaten adults/children good/bad months in 2004 and 2005 with approximately 25-28% and 37-40% non-response respectively, and overall adequacy of rainfall in 1994b with 49% non-response, which improves dramatically every subsequent year thereafter.

Table 4.3: Non-Response Rates and Missing Response Rounds for Select Variables

Variable	Non-response Rate	Missing Response Rounds
Number of food-short months	Maximum 9% (2009)	1995, 1997, 1999
Presence of Irrigation	Maximum 15% (1999)	1994a, 1994b, 1995, 1999
Total Land Area	Maximum 9% (1995)	1994b, 1999
Household storing any cereal, etc	0% all years	n/a
Number of meals/day	Range 24-43%	1994a, 1994b, 1995, 1997, 1999
Livestock Value	0% non-rsponse	1994b, 1995
Forced to sell livestock	<5%	Only asked 2004
Rainfall Adequacy (5 questions)	Maximum 49% (1994b)	1994a, 1999
Public Works/Food Distribution	< 1%	Only asked in 2004

Most often, missing data were the result of questions not being included during that round of the survey resulting in data that are missing completely at random (MCAR). For the dependent variable, number of food-short months, and nearly all independent variables, multiple imputation with chained equations (hereinafter: MICE) was used. MICE is the process of replacing missing data with plausible random values that are drawn from the conditional distribution of the observed data. Regression models are fit for each variable that are conditional on all the other variables (Raghunatha et al, 2001; Young and Johnson, 2010). This is done in an iterative process for each variable in each round that has missing cases.

To carry out MICE it was therefore necessary to understand how the variables were related to each other in order to generate proper estimates of the missing data and to complete the data sets. Multiple imputation does not add bias to the analysis, and can in fact correct or reduce bias where the data are missing completely at random (not asked) or missing at random (due to some independent characteristic of the household not related to the outcome). Where data are missing not at random (non-response) or are missing due to some characteristic of the household that is related to the outcome, multiple imputation methods do not introduce additional bias. However, multiple imputation is not able to correct the bias that already exists in the data Graham, 2008).

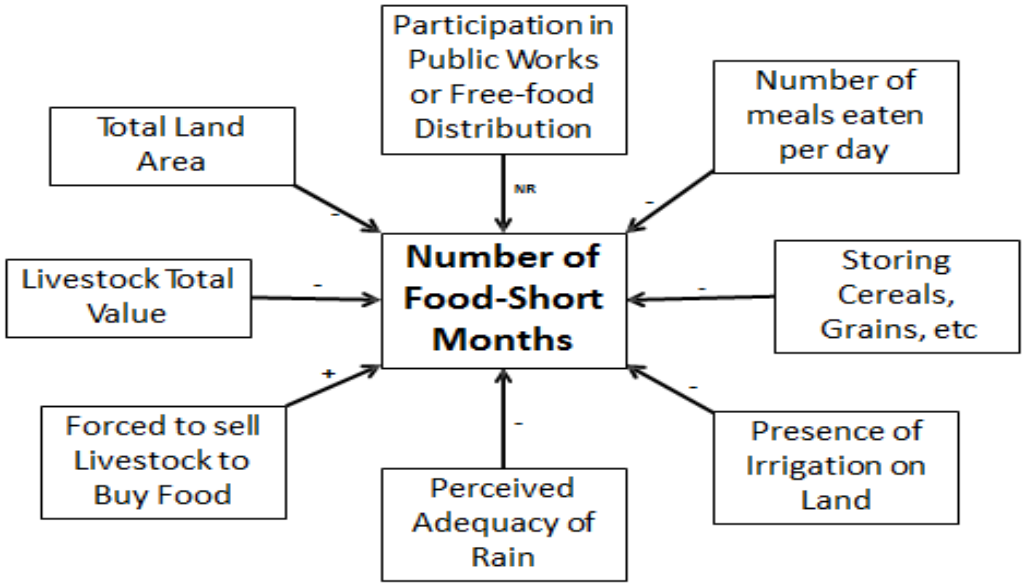
There was an exception where single imputation was used for the variables, "number of meals eaten in good and bad months, by adults and children." For these variables, the missing data were completely at random, not asked in all rounds, but the observed values for 2004 and 2009 were quite similar. The results from chapter 3 on the number of meals eaten by adults and children, in good and bad months, also corroborated the values observed in the ERHS data set. Thus single-imputation, "carrying forward the last-observed value" or in this case carrying back the average of the last two values was applied. This was felt to be acceptable due to the similarities in the observed values and the relative generality of the questions.

Once all missing data were imputed, the full multivariate analysis was run on each of the imputed data sets. The results of each analysis were then combined using "Rubin's Rules" to calculate a single set of results, which are reported in this paper. The benefit of using MICE is that the final model better reflects the true correlations among the variables, takes uncertainty into account, and reflects, more accurately, the true correlations among the variables in the analysis (*ibid*).

4.2.4. Hypotheses and Analytical Model

Descriptive statistics were computed for demographic characteristics, the predictor variables, and the outcome variable, number of food-short months (see Tables 4.4 and 4.5). After the descriptive statistics and imputations were completed, bivariate analyses were conducted using STATA 12.1 statistical software (Stata Corp, College Station, Texas). Bivariate analyses were based on hypotheses about the presumed relationships between each predictor and the outcome variable, number of food-short months (see Figure 4.4 and text).

Figure 4.4: Bivariate Hypotheses [14]



a) **Land area v. number of food-short months**. Hypothesis: Households with more land will have fewer food-short months, a negative relationship. Households with more land should be able to grow more crops and therefore have fewer months of food-shortage.

b) **Total value of all livestock v. number of food-short months.** Hypothesis: Households

[14] Note: NR in the diagram = no relationship between the two variables.

with greater total livestock value will have fewer food-short months, a negative relationship. Households that own more livestock should be able to purchase more food post-sale than households that have lower values of livestock or own no livestock at all.

c) **Forced to sell livestock to buy food v. number of food-short months.** Hypothesis: Households that are forced to sell livestock will have more food-short months on average, a positive relationship. The causal direction of this relationship is actually reversed such that households that experience more food-short months may be forced to cope by selling livestock to buy food.

d) **Perceived Adequacy of Rain v. number of food-short months.** Hypothesis: Households that perceive higher levels of rain adequacy will have fewer food-short months, a negative relationship. Since over 80 percent of Ethiopians depend on rainfall for their harvests, households that have the most adequate rainfall should reliably have the highest crop-yields as compared to households that have inadequate rain (too much/too little, or rain that comes too early/too late), and thus, fewer food-short months.

e) **Any irrigation is present on land v. number of food-short months.** Hypothesis: Households that have any irrigation present on their land will have fewer food-short months, a negative relationship. Irrigation is a water resource, and should in theory fill the water gaps for households where rain is inadequate.

f) **Household storing cereals v. number of food-short months.** Hypothesis: Households that are storing cereals will have fewer food-short months on average, a negative relationship. In theory, households that experience food-short months should be able to cope by consuming or selling their stored crops or food, thereby reducing the overall number of food-short months they experience.

g) **Public works participation or free-food distribution in the past year v. number of food-short months.** Hypothesis: There will be no difference in the average number of food-short months between households that have and have not participated in public works or received free-food distribution in the past year, there is no relationship. This hypothesis is based on the literature review (Chapter 1) and results in Chapters 2 and 3 that safety-net programs do not provide the types of assets or assistance that households want or need, and that the coverage is extremely low.

h) **Number of meals eaten per day v. number of food-short months.** Hypothesis: Households where adults and children are eating more meals per day in good or bad months have experienced fewer food-short months, a negative relationship. Again, the causal direction of this relationship is reversed, such that households that are experiencing fewer food-short months should in theory be consuming more meals per day.

The hierarchical linear model (hereinafter HLM) used to test bivariate relationships was:

$$\mathbf{M_{ijkt} = \beta_0 + \beta X_{ijkt} + u_i + v_{ij} + w_{ijk} + e_{ijkt},} \text{ where}$$

i indexes regions, j indexes villages, k indexes households, and t indexes survey rounds (1994a through 2009).

M = the number of food-short months

β_0 = the intercept, the number of food-short months when the predictor variable is = 0.

β = the change in the number of food-short months experienced for each 1-unit increase in the predictor variable, or the presence of the variable in a yes/no binomial response.

X_{ijkt} = the household-level predictor variable of interest.

u_i = a random effect characterizing time-invariant aspects (observable and unobserved characteristics) of region i.

v_{ij} = a random effect characterizing time-invariant aspects of village j.

w_{ijk} = a random effect characterizing time-invariant aspects of household k.

e_{ijkt} = the residual error term

Tables 4.4 and 4.5 below provide the descriptive statistics of the sample demographic characteristics and variables used in the bivariate analyses. HLM was conducted on the outcome variable (number of food-short months) and on the rainfall-adequacy index-variable to assess the amount of variation in responses nested at the household, village, region, and longitudinal levels (Goldstein, 1999). For these variables to exhibit good inter-rater reliability, they had to show substantial variation over time and place, and minimal variation across households, variation that was close to zero (refer back to Table 4.1, and ahead to Table 4.6). The variance components for these two variables confirmed that there was significant agreement at the household level and provides evidence of inter-rater reliability. The larger proportion of variation at the village or regional level indicate that geography and location within Ethiopia significantly influence the value of the response, which may be used as a proxy measure of rainfall and climate-influences. Finally, the high proportion of variation across time indicates that perceived rainfall adequacy fluctuates or changes over time, similarly pointing to climate-, weather-, or rain-related changes over time.

Table 4.7 provides the coefficients and strength of relationship for the predictor variables in the bivariate HLMs. Bivariate models explore the extent to which only one variable explains the outcome, number of food-short months, and thus provides biased estimates of the effect. For more accurate estimates, all variables were tested simultaneously in a multivariate HLM to identify how all predictors independently influence or confound the number of food-short

months that households experience.

The multivariate HLM used for this study was:

$$M_{ijkt} = \beta_0 + \beta_1 X_1 + \ldots + \beta_n X_n + u_i + v_{ij} + w_{ijk} + e_{ijkt,} \text{ where}$$

i indexes regions, j indexes villages, k indexes households, and t indexes survey rounds (time)

M_{ijkt} = the number of food-short months for an individual observation.

β_{0j} = the intercept of the outcome variable when all predictor variables are equal to 0.

β_n = the change in the number of food-short months for each 1-unit increase in the predictor variable, holding all other modeled variables constant.

X_n = the household- (or other-) level predictor variable of interest.

u_i = random effect at the regioin level

v_{ij} = random effect at the village level

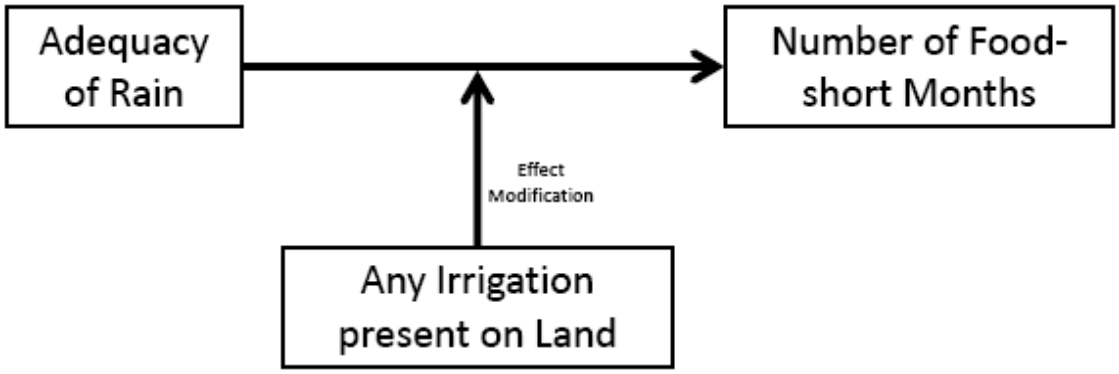
w_{ijk} = random effect at the household level

$e_{ijkt,}$ = the residual error term.

Table 4.6 provides the estimates for all variables in the multivariate HLM.

Finally, given my expectation that the presence of irrigation, a technological input, modifies the effect of rainfall adequacy, I tested an interaction between these two variables (see Figure 4.5). An interaction between rainfall adequacy and irrigation supports the hypothesis that having irrigation further decreases the number of food-short months households experience. Table 4.7 includes time-trend and interaction effects for the above multivariate HLM.

Figure 4.5: Interaction (Effect Modification) Model of Irrigation on Adequacy of Rain



4.3 Results

4.3.1 Descriptive Statistics – Characteristics of the sample

See Tables 4.4 and 4.5 for descriptive statistics of demographics and variables used in this analysis. Overall households from the Amhara, Oromia, and SNNP regions make up nearly 90% of the sample in all years with the Tigray region making up the remaining 10% of the sample. Sample distributions are approximately consistent across all waves of data and align with census population distributions in Ethiopia (CIA World FactBook, 2013). The distributions of households from each village (woreda) similarly are consistent approximately across all waves of data collection.

Household size significantly decreases over time ($p < .0005$) while educational attainment for both household-heads and their spouses significantly increases over time ($p < .0005$). As expected from a panel study, age increases over time. The proportion of households that store cereals is constant over time through 2004 ($p = .261$). In 2009 however, there is a significant increase in the proportion of households that stored cereals ($p < .0005$). According the Central Statistics Agency of Ethiopia (2011), rainfall levels have become increasingly labile

in the last 20+ years, and 2007, 2008, and 2009 represented years where some areas of Ethiopia had significantly less than average rainfall. Other areas, primarily the highlands of Ethiopia that covers part of Amhara, Oromia, and Amhara, experienced more rain than average, and households were better able to store crops from boon harvests. Given the frequency of drought-induced famines in Ethiopia, households store crops when able (*ibid*). The proportion of households with any irrigation on their land significantly increased between 1999 and 2004 ($p < .0005$) but remains constant between 2004 and 2009 ($p = .689$), data that are also concordant with Central Statistics Agency data (*ibid*).

The average value of animals significantly differs from year to year ($p < .0005$) with large upswings in 2009. This is also consistent with livestock price data obtained from the Central Statistics Agency (CSA, 2010). Perceptions of rain adequacy vary by year, with 83 percent of the variation occurring at the time level. Perceptions of rainfall adequacy for some villages appear to be relatively consistent with available data on actual rainfall levels, for other villages; there is a less clear trend (*ibid*).

Average land area by household does not vary between 1994 and 1995 ($p = .6694$), is significantly different between 1995 and 1997 ($p = .011$), between 1997 and 2004 ($p = .0007$), and between 2004 and 2009 ($p = .0005$). Average land area does not differ between 1995 and 2004 ($p = .786$), nor between 1997 and 2009 ($p = 1.000$). The fact that this variable is so dynamic indicates that household land areas change over time. This change may represent the division of land among households due to marriage or the pledging of land to other households in years of economic hardship, a common practice in Ethiopia where households are unable to sell or buy land.

The number of crops stored by households varies over time. The number of meals consumed in good and bad months by adults and children does not significantly change between 2004 and 2009. This lack of change is not too surprising as the question obtains a general sense of how many meals adults and children consume in good- or bad-food months, rather than for a specific day or month. Worth mentioning, 2003-04 and 2008-09 had lower than average rainfall over all of Ethiopia, 91 and 110mm less rainfall respectively, than the long-term national average. That these two seasons had similar, lower-than average rainfall supports agreement in the number of meals consumed for good and bad months, for adults and children between 2004 and 2009 rounds. Finally, the number of food short months that households report differs significantly over time ($p < .0005$) though the number reported in 1994 and 2004 do not differ ($p = .393$).

Table 4.4: Descriptive Statistics of Demographics by Round

	1994a	1994b	1995	1997	1999	2004	2009	Total
DEMOGRAPHICS	**n=1,485**	**n=1,481**	**n=1,509**	**n=1,461**	**n=1,706**	**n=1,375**	**n=1,577**	**n=10,594**
Region (%)								
Amhara	32.4	32.3	30.0	31.7	27.3	31.4	26.6	30.1
Oromia	27.4	27.4	27.8	28.2	36.8	26.8	37.5	30.5
SNNP	30.0	30.0	29.4	30.0	27.1	31.0	26.5	29.1
Tigray	10.2	10.2	9.6	10.1	8.8	10.8	9.4	9.8
Household Size								
(Mean ± SD)	6.0 ± 3.0	¥	¥	¥	7.1 ± 3.3	4.6 ± 2.3	4.6 ± 2.3	5.7 ± 3.0
Age (Mean ± SD)								
Head of household (HH)	46.4 ± 16.3	¥	¥	¥	49.3 ± 15.4	50.5 ± 15.1	52.9 ± 14.9	49.8 ± 15.7
Spouse of HH	35.3 ± 12.5	¥	¥	¥	38.9 ± 12.4	40.1 ± 11.7	41.9 ± 11.5	38.8 ± 12.3
Educ. Attainment								
(Mean ± SD)								
Head of household (HH)	1.3 ± 2.4	¥	¥	¥	¥	3.7 ± 6.1	5.4 ± 6.9	3.5 ± 5.8
Spouse of HH	0.7 ± 2.0	¥	¥	¥	¥	2.7 ± 5.6	4.0 ± 6.5	2.4 ± 5.1

¥Question not asked these rounds

Table 4.5: Descriptive Statistics of Key Variables by Round

KEY VARIABLES	1994a	1994b	1995	1997	1999	2004	2009	Total
	n=1,485	n=1,481	n=1,509	n=1,461	n=1,706	n=1,375	n=1,577	n=10,594
Forced to Sell Livestock for food (%)								
Yes	¥	¥	¥	¥	¥	38.2	¥	5.0
No	¥	¥	¥	¥	¥	57.2	¥	7.4
Missing	100.0	100.0	100.0	100.0	100.0	4.7	100.0	87.6
Household Storing cereal/seed (%)								
Yes	¥	64.4	¥	¥	61.6	61.5	80.2	38.8
No	¥	35.5	¥	¥	37.0	36.2	19.2	18.5
Missing	100.0	0.2	100.0	100.0	1.5	2.3	0.6	42.7
Participation in Public Works in past 12 months (%)								
Yes	¥	¥	¥	¥	¥	32.4	¥	4.2
No	¥	¥	¥	¥	¥	67.2	¥	8.7
Missing	100.0	100.0	100.0	100.0	100.0	0.4	100.0	87.1
Household Received Free-Food Distribution (%)								
Yes	¥	¥	¥	¥	¥	24.7	¥	3.2
No	¥	¥	¥	¥	¥	74.7	¥	9.7
Missing	100.0	100.0	100.0	100.0	100.0	0.7	100.0	87.1
Irrigation on any land (%)								
Yes	¥	¥	¥	¥	4.0	22.0	22.3	6.8
No	¥	¥	¥	¥	80.7	77.0	75.3	34.2
Missing	100.0	100.0	100.0	100.0	15.3	1.0	2.4	59.0
Value of animals (1000s of Birr)	**n=1,485**	**n=1,481**	**n=1,509**	**n=1,461**	**n=1,706**	**n=1,375**	**n=1,577**	**n=10,594**
(mean ± SD)	1.21± 3.76	¥	¥	1.96 ± 2.78	1.68 ± 1.95	2.28 ± 2.83	6.63 ± 8.72	2.78 ± 5.13

Perceived Rain Adequacy (%)	**n=1,485**	**n=1,481**	**n=1,509**	**n=1,461**	**n=1,706**	**n=1,375**	**n=1,577**	**n=10,594**
Complete Inadequacy	¥	6.4	9.0	10.3	¥	10.4	12.6	6.8
Very Inadequate	¥	10.9	12.5	13.6	¥	12.5	12.6	8.7
Somewhat Inadequate	¥	9.9	19.4	25.3	¥	13.0	14.7	11.5
Somewhat adequate	¥	9.6	20.3	36.9	¥	15.8	18.5	14.1
Very adequate	¥	10.7	24.5	6.0	¥	33.0	27.7	14.2
Complete Adequacy	¥	3.7	5.6	0.0	¥	11.6	12.6	4.7
Missing	100.0	48.8	8.9	7.8	100.0	3.9	1.4	40.0
Average Land area per household (hectare)	**n=1,400**	**n=0**	**n=1,371**	**n=1,420**	**n=0**	**n=1,363**	**n=1,574**	**n=7,128**
(mean ± SD)	4.1 ± 50.7	¥	4.9 ± 51.8	1.4 ± 2.6	¥	5.4 ± 44.2	1.4 ± 10.0	3.4 ± 37.7
Number of crops stored by household	**n=928**	**n=1,478**	**n=1,216**	**n=1,412**	**n=1,681**	**n=0**	**n=0**	**n=6,715**
(mean ± SD)	2.3 ± 1.5	1.2 ± 1.3	2.0 ± 1.7	0.2 ± 0.6	1.3 ± 1.3	¥	¥	1.3 ± 1.5
Number of meals consumed/day	**n=0**	**n=0**	**n=0**	**n=0**	**n=0**	**n=1,041-982**	**n=990-889**	**n=2031-1881**
(mean ± SD)								
Good month adults	¥	¥	¥	¥	¥	2.96 ± 0.47	3.05 ± 1.13	3.00 ± 0.86
Worst month adults	¥	¥	¥	¥	¥	2.0 ± 0.67	2.07 ± 0.55	2.04 ± 0.61
Good month children	¥	¥	¥	¥	¥	3.38 ± 0.74	3.57 ± 0.72	3.47 ± 0.74
Worst month children	¥	¥	¥	¥	¥	2.47 ± 0.75	2.60 ± 0.67	2.53 ± 0.71
Average Number of food-short months	**n=1,476**	**n=1,472**	**n=0**	**n=0**	**n=0**	**n=1,345**	**n=1,431**	**n=5,724**
(mean ± SD)	2.51 ± 0.57	2.69 ± 0.50	¥	¥	¥	2.46 ± 2.17	3.01 ± 3.03	2.71 ± 1.89

¥Question not asked these rounds.

Table 4.6 provides estimates of the variation observed at the household, village, region, and time levels for the outcome variable (number of food-short months).

Table 4.6 Residual Standard Deviations at Hierarchy Levels for Number of food-short months.

Variable	SD	95% CI
No. of food-short months		
Region	.4010	[.1372, 1.173]
Village	.6676	[.4705, .9472]
Household	$5.3x10^{-10}$	[$1.8x10^{-10}$, $1.6x10^{-9}$]
Time	1.774	[1.742, 1.807]

Similar to what was found in Table 4.1, which showed the residual standard deviations for the rainfall-adequacy index, nearly zero of the variation is found between households, and the vast majority (84%) of the variation is found over time or from longitudinal differences. As before, this indicates good inter-rater reliability at the household level in the number of food-short months experienced. These two variables point to time and place as likely influencing how food secure a household will be.

4.3.2 Bivariate Analyses

See Table 4.7 for the strengths of the bivariate associations between the outcome variable (number of food-short months) and each independent predictor variable. When each variable equals zero, households experience 2.8 months of food-shortage each year on average. Six variables: Total livestock value, perceived rain-adequacy, household storage of crops, number of meals consumed by adults and children in worst months, and any irrigation present on household land, were significantly and negatively associated with the number of food-short months.

Total livestock value was significantly and negatively associated with the number of food-short months ($p < 0.0005$). For each additional 1,000 Birr value of livestock households

own, the number of food-short months on average decreases by 0.052 months. Thus, owning more livestock is associated with a reduction in food-short months. This relationship supports the hypothesis stated above in section 4.2.4.

Perceived rain adequacy was significantly and negatively associated with number of food-short months ($p < 0.0005$). For each one-unit increase in the perceived rain adequacy scale, the number of food-short months on average decreases by 0.288 months. Thus, households that perceive rainfall to be the most adequate, a value of 5 on the rain-adequacy index, on average experience approximately 1.5 fewer months of food-shortage than households that perceive rainfall to be least adequate, a value of 0 on the rain-adequacy index. This relationship supports the hypothesis stated above.

Households that stored cereals are expected to experience 0.746 fewer months of food-shortage on average than households that did not store cereals ($p < .0005$). This significant and negative association similarly supports the hypothesis proposed above.

The number of meals eaten per day by adults and children in the worst months was significantly and negatively associated with the number of food-short months. Each additional meal that adults ate in the worst month was associated with 0.253 fewer months of food-shortage on average ($p < .01$). Similarly, each additional meal that children ate in the worst month was associated with 0.216 fewer months of food-shortage on average ($p < .01$). The parameter estimates indicate that the number of meals children eat have more influence on the number of food-short months than the number of meals adults eat. This supports the notion that adults try to protect their children's nutritional status during food-shortage (FAO/WHO, 1992h). This relationship partially corroborates the hypothesis stated in section 4.2.4 since the number of

meals eaten in good months was not associated with the number of food-short months households experienced (see Table 4.7)

Having irrigation on any plots was significantly and negatively associated with the number of food-short months households experienced. Households that have irrigation are expected to have 0.420 fewer months of food-shortage than households that do not have irrigation ($p < .01$). This association supports the hypothesis stated above.

Variables that were significantly and positively associated with the number of food-short months included "forced to sell livestock" and public works participation. Households that were forced to sell livestock on average experienced 0.358 more food-short months than households that were not forced to sell livestock ($p < .01$). The observed relationship between food-short months and sale of livestock supports the hypothesis stated above.

Similarly, households that participated in public works programs on average experienced 0.333 more months of food-shortage than households not participating in public works programs ($p < .05$). The causal direction of these relationships are likely reversed, however, such that households experiencing more food-short months sell livestock and/or are targeted by public works programs to cope with the food shortages. It is also possible that households participating in public works are poorer and more likely to participate in the program, but also are more likely to have food-short months. That there is an observed relationship between these variables fails to support my hypothesis above, that there would be no-relationship.

Variables that were not significantly related to the number of food-short months households experienced included household land area, number of crops stored, number of meals consumed by adults or children in good months, and whether the household received any free-food distribution. The lack of relationship observed between land area and the number of food-

short months fails to support my hypothesis above. However, household land areas were small almost entirely across the board with exception of a few outliers on the high end, so differences may not be observed.

The number of crops stored is highly correlated with whether households store crops. The number of crops stored by households varies little, with most households storing no more than one or two crops. Additionally, the number of food-short months that households experience did not decrease, on average, with the storage of more crops. Thus, the number of crops stored by households does not provide information in addition to whether households store any crops. Therefore, it was not surprising to find no relationship between the number of crops stored and the number of food-short months although there was a negative relationship in the dichotomous variable.

The number of meals consumed by adults and children in good-food months was not associated with the number of food-short months. This lack of relationship may be because the number of meals consumed in good-food months represents the number of meals households eat when they do not have food-shortage. This lack of relationship partially differs from my hypothesis above.

Finally, whether households received free-food distribution was not associated with the number of food-short months. This may be because so few households received food-distribution, or may be related to the ineffectiveness of the Ethiopian Productive Safety-net Program as described in Chapter 1. This lack of relationship partially supports my hypothesis above, that there will be no relationship between the number of food-short months and public works participation where these variables proxy safety-net program use (MoARD, 2010).

Table 4.7 Bivariate Relationships between Hierarchical Predictor Variables and Number of Food-Short Months

Variable	Definition (Unit)	N of HH‖	Observations per HH	β	95% CI
Household Land Area	Land area in hectares (ha)	1,733	2.4	-.00058	[-.0022,.00098]
Value of Livestock	Total value of all animals owned by household, in 1000's of Birr	2,761	2.4	-.0490****	[-.0602, -.0378]
Number of crops stored	Distinct number of crops that household is storing	1,477	1.6	.0117	[-.0028, .0263]
Number of meals eaten					
By adults-good month	Distinct number of meals eaten per day	1,346	1.5	-.0244	[-.1341, .0853]
By children-good month	Distinct number of meals eaten per day	1,292	1.5	.0334	[-.1033, .1701]
By adults-worst month	Distinct number of meals eaten per day	1,343	1.5	-.2532**	[-.4164, -.0901]
By children-worst month	Distinct number of meals eaten per day	1,283	1.5	-.2162**	[-.3647, -.0678]
Perceived Rain Adequacy	Index (0-5) of perceived rain adequacy, 5 = most adequate rain	1,655	2.1	-.2884****	[-.3410, -.2358]
Presence of Irrigation	Yes/No variable, if the household has irrigation available	1,335	1.0	-.4202**	[-.7275, -.1129]
Household storing crops	Yes/No variable, if the household is storing crops	1,760	2.9	-.7463****	[-.8671, -.6255]
Forced to sell livestock	Yes/no, if the household is forced to sell livestock to buy food	1,282	1.0	.3580**	[.1240, .5919]
Pub. Works Participation	Yes/no, if the household participated in public works in the past year	1,342	1.0	.3329*	[.2875, 1.6422]
Free-food distribution	Yes/no variable, if the household received free-food distribution	1,340	1.0	.0570	[-.2224, .3364]

*p < .05, **p < .01, ***p < .001, ****p < .0005, ‖ HH abbrev for household

4.3.3 Multivariate Linear Analysis Results

Table 4.8 shows the multivariate relationships between the outcome and predictor variables simultaneously. Worth noting, when all predictor variables hold a value equal to zero in the year 1994 (such that households do not have irrigation, perceive completely inadequate rain, have zero hectares of land, own zero Birr of livestock, do not sell livestock, do not participate in public works, and do not receive free-food), households are expected to experience approximately three months (2.978) of food-shortage.

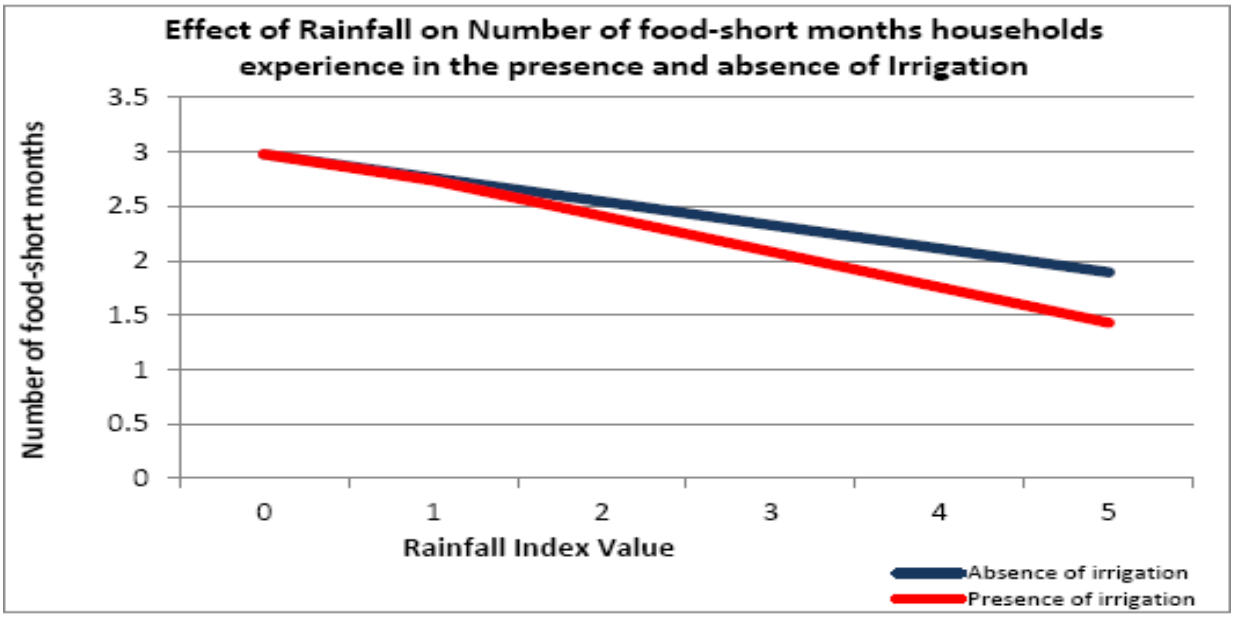
Three variables were significantly and negatively associated with the number of food-short months. These variables were: The value of livestock, perceived rain adequacy, and the interaction between perceived rain adequacy and household-irrigation presence. Total livestock value was significantly and negatively associated with the number of food-short months, such that for each additional 1,000 Birr value of livestock owned, the number of food-short months on average decreases by .066 months adjusting for all other variables in the model ($p < .0005$). This relationship supports the hypothesis stated in section 4.2.4 and is congruent with the estimate in the bivariate relationship above.

Perceived rain adequacy was significantly and negatively associated with the number of food-short months ($p < .0005$). For each one-unit increase in the perceived rain adequacy scale, the number of food-short months on average decreases by 0.217 months adjusting for all other variables in the model. Households that perceived rainfall to be the most adequate, a value of 5 on the rain-adequacy index, on average experienced approximately 1.1 fewer months of food-shortage than those households that perceived rainfall to be the least adequate, a value of 0 on the rain-adequacy index. This relationship supports the hypothesis stated above, is similarly

congruent to the estimate in the bivariate relationship above, and more accurately reflects the true relationship.

The interaction between perceived rain adequacy and irrigation presence indicates that for households that have irrigation, each one-unit increase in the perceived rain-adequacy index decreases the number of food-short months experienced by approximately one-third of a month (.217 + .110 = .327) adjusting for all other variables in the model. Another way to state this is that households that have irrigation and completely adequate rainfall (index value = 5) experience approximately 1.63 fewer months of food-shortage than households without irrigation and completely inadequate rainfall (index value = 0). Similarly, households that have irrigation and completely adequate rainfall (index value = 5) will experience approximately one-half (.551) fewer months of food-shortage than households without irrigation but completely adequate rainfall, the distance between the red and blue lines at rainfall index-value = 5 (see Figure 4.6).

Figure 4.6: Impact of Irrigation-Rainfall Interaction on Number of Food-Short Months:



Based on these results, irrigation is important. However, the fact that the lines intersect at completely inadequate rain (index = 0) indicates that irrigation is closely intertwined with water resources, including rivers, underground aquifers, and rainfall. Therefore, the absence of rainfall inhibits the ability to successfully use irrigation since irrigation is derived from rain-water or other rain-dependent sources.

Variables that were significantly and positively associated with the number of food-short months households experienced included "time," "forced to sell livestock," and household storage of crops. The "time" trend variable is a representation of the change in the number of food-short months households experienced on average each subsequent year adjusting for all other modeled variables. Here, households on average experienced 0.04 additional months of food-shortage each year after 1994 such that in 2009, households experienced an additional 0.647 (two-thirds) months of food-shortage as compared to 1994 adjusting for all other variables. This is a serious and important phenomenon, that every 100 years households are expected to experience an additional 4.3 months of food-shortage, to be discussed in greater detail in the discussion and implication sections.

Households that were forced to sell livestock on average experienced 0.2802 more food-short months than households that were not forced to sell livestock ($p < .01$) adjusting for all other variables. This observed relationship is congruent with the relationship observed in the bivariate analysis, as well as with the hypothesis stated in section 4.2.4 above. The causal direction of this relationship again, is likely reversed such that households experiencing more food-short months sell livestock as a way to cope with food-shortage.

Households that stored crops experienced on average 0.216 additional food-short months than households that did not store crops ($p < .05$) adjusting for all other variables. This

relationship differs in direction from that observed in the bivariate relationship and also departs from the hypothesis stated above which may be a function of confounding or some other unknown or unobserved relationship between crop storage and food security.

Variables that were not significantly related to the number of food-short months households experienced included household land area, public-works participation, and free-food distribution. The lack of relationship between household land area and the number of food-short months coincides with that observed in the bivariate analysis, and again, does not support my hypothesis above. This may again be related to the fact that household land areas are small across the board with exception of a few high-value outliers. However, as before, it may be that household land moderates the ability for households to cope with food-shortage.

Finally, public-works participation and free-food distribution have no relationship with the number of food-short months. The lack of relationship among these variables supports my hypothesis above, and may be an indicator of the failure of safety-net programs to really improve household food-security status as has been indicated in my two other chapters, and by other authors including Slater et al (2006).

Table 4.8 Multivariate Linear Analysis between Hierarchical Predictor Variables and Number of Food-Short Months

N of region	4
N of Village	29
N of Household	1,881

Variable	Definition (Unit)	β	95% CI
Time	Years, starting with 1994 as baseline year.	.0431****	[.0325, .0538]
Irrigation	Yes/No variable, if the household has irrigation available	.0855	[-.2386, .4095]
Perceived Rain Adequacy	Index (0-5) of perceived rain adequacy, 5 = most adequate rain	-.2167****	[-.2716, -.1619]
Irrig*Perc'd Rain Adequacy	Interaction between irrigation and rain adequacy perception	-.1102*	[-.2092, -.01126]
Household Land Area	Land area in hectares (ha)	-.000044	[-.0013, .0012]
Household storing crops	Yes/No variable, if the household is storing crops	.2161*	[.1766, .2088]
Value of Livestock	Total value of all animals owned by household, in 1000's of Birr	-.0658****	[-.0846, -.0470]
Forced to sell livestock	Yes/no, if the household is forced to sell livestock to buy food	.2802**	[.0931, .4673]
Public Works Participation	Yes/no, if the household participated in public works in the past year	.2588[a]	[-.0375, .5551]
Free-food distribution	Yes/no variable, if the household received free-food distribution	-.1351	[-.4034, .1332]
Constant	Number of food-short months in 1994 when all other variables = 0 (ie. No irrigation, 0 on the rain-adequacy index, 0 Ha land, 0 Birr of livestock value, No sale of livestock, no participation in public works, no free-food distribution)	2.978**	[1.259, 4.698]

Overall F-statistic: 10.14, p < .0005

*p < .05, **p < .01, ***p < .001, ****p < .0005, [a] = .086

Number of meals eaten in good/bad months by adults/children co-linear with predictor variable, removed from analysis.

4.4 Discussion and Implications

Discussion: Key findings of this study are that household assets, safety-net programs, and coping strategies do not influence food-security status. In fact, the only predictors of food-security status identified from this study were rainfall, time, and space characteristics.

More specifically, rainfall adequacy, time, and space in combination, as identified by the HLM, appear to proxy weather and climate characteristics. These variables account for the vast majority of variation in and are the pervasive predictors of household food-security status. This assertion directly supports those made by the IPCC (2007), NOAA (2011), and Cardona et al (2012) related to climate change and global food production. However, it is the finding that household assets, safety-net programs, and coping-strategies do not have an effect on household food-security status that counters some of the prevailing literature and makes this study unique.

A number of authors indicate that livelihood assets, coping strategies, and safety-net programs protect households against food-insecurity, and fill in asset-gaps to counter the negative effects of climate change (WFP and FAO, 2009; DFID, 1999; Chambers and Conway, 1992; and Demeke et al, 2011). However, this study refutes those claims by demonstrating the reverse, that household assets including land area, livestock value, and the number of crops stored do not influence food-security status. These results are likely because the amount of land that households farm is small and vulnerable, households own small amounts of livestock, so the magnitude of its effect is nearly negligible, and it simply may not make much difference how many crops households have stored. Moreover, this study supports the argument that the PSNP has no effect on household food-security status (Slater et al, 2006). Thus, macro-level time, space, and rainfall appear to be the key determinants of household food-security status identified from this study (see Tables 4.9 and 4.10 for summary charts of the literature and conclusions).

Table 4.9 Summary Chart of the Literature, Conclusions, and Importance of This Study

Researcher (year)	Major findings
IPCC (2007)	Climate change/variability impact productivity of agricultural, forestry, and fisheries systems and livelihoods of rural farmers dependent on them. Vulnerable livelihoods depend on climate and weather lacking adaptive capacity to recover. The extent to which populations are affected is temporally and spatially dependent.
NOAA (2011)	Anthropogenic climate change impacts growth, yield, development, health of local and global ecosystems, and the foods they provide to individuals and populations. Climate variation will decrease crop yields by 50% and farming incomes below the long-term median. SSA experiences decreased precipitation/increased drought, decreased food supply and increased likelihood of malnutrition.
Easterling (2007)	Technical adaptation strategies including irrigation are more expensive than most rural farming households can afford pushing food-systems beyond what is recoverable. Soil erosion, salinization, overgrazing, and over-extraction of ground water further damage land.
World Bank (2011)	Ethiopians engage in rain-fed agriculture with few/no technological inputs, earn $0.50 per day, and have constant threats to livelihood- and food security.
Cardona et al (2012)	Ethiopian livelihoods depend on climate and weather; lack adaptive capacity to recover, and are vulnerable to climate extremes which disrupt land productivity, household coping strategy use and adaptations, increasing the risk of negative health, nutritional, and livelihood outcomes. Low access and availability of social safety-nets, buffers, land-tenure, and liabilities additionally increase vulnerability to hunger and food security.
FAO (2002)	Climate impacts the four dimensions of food security by affecting production (**availability**), cost (**access**), production + cost (**stability**), and health (**utilization**).
WFP & FAO (2009)	Safety-net programs fill certain social and economic gaps, prevent the emergency sale of assets, livelihood loss, and improve/smooth over food consumption. PSNP replaces emergency food aid with predictable resource framework, and cash-transfers. The PSNP provides support as seed, fertilizer, food-supplementation, cash-vouchers, and other consumables such as clothing or grain.

Slater et al (2006)	PSNP coverage is low, has limited budget, provides assistance 3mo/yr and to 10% of households. The program does not provide what recipients want (food and grain), as it represents more stable dietary intake. The PSNP has poor timing, and communication. There is dissonance in the program goal: to protect/promote rural assets/livelihoods as there is no long-term transition away from chronic food-insecurity.
DFID (1999), Chambers and Conway (1992).	Livelihood assets and coping strategies should protect households against the worst effects of food-insecurity.
Corbett (1988), WFP and CARE (2003).	Coping strategies are used by households to respond to adverse conditions: economic, social, or climate-related. Unfortunately, many coping-strategies reduce consumption (lower food-security status).
Demeke et al (2011)	Small-stock act as "insurance" that agricultural households liquidate when low or variable rainfalls increase risk for food-insecurity. Coping-strategy use is not always directly related to food intake/expenditure, and may be taken to address land-taxes, or future-harvests at the expense of food security.
Perch-Nielsen et al (2008)	Migration is a way to modify vulnerability to the negative effects of environmental events.
Afifi (2011)	Labor migration/mobility is for economic advancement.
DFID (1999)	Food security is a "livelihood outcome" that is affected by climate.
Qureshi et al (2013)	Climate change alters [macro-level] agricultural production, which impacts the global food-supply.

Table 4.10 Summary Conclusions of the Literature and Study

Conclusions	1) Climate change will impact the productivity of agricultural systems. (Macro-view) 2) Climate change will impact the livelihoods and food security of rural farmers who depend on the climate for their livelihood and food-needs. 3) Soil erosion, salinization, overgrazing, and other negative land-use procedures damage land. 4) Technical adaptation strategies are often expensive and out of reach for poor rural farmers, and therefore place adaptive strategies too far out of reach. 5) Climate impacts food security by impacting production and stability as well as access to food. 6) Safety-net programs are supposed to fill social/economic gaps and prevent livelihood loss. The PSNP however, does not provide what people want, and does not reach enough people. There is also dissonance with the program's stated goal, and its current actions. 7) Livelihood assets/coping strategies should protect households against food-insecurity. 8) Small-stock are able to be liquidated in the event of low-rainfall, but does not prevent food-insecurity. 9) Selling productive assets cannot prevent climate-change and its associated decrease in food-availability. Coping-strategies are taken once the insult is already experienced.
Importance of my study to the literature	1) Empirically demonstrates how rainfall adequacy impacts the food security of rural households in Ethiopia longitudinally and over time. 2) Indicates that few households have irrigation, a technical adaptation, but those that have irrigation have higher levels of food security adjusting for everything else. 3) Demonstrates that safety-net programs are having no impact on food-security status. 4) Indicates that coping-strategy use such as selling livestock do not improve security, and occur (likely) as a negative response to food-insecurity. 5) Selling productive assets/storing seeds cannot prevent the negative impact of climate change, and do not appear to help food-security status. 6) Demonstrates that the time/space impacts of climate (as stated above) are the real predictors of food security.

While few would argue with the near-obvious fact that climate change threatens global food security, food production, and water supplies described above (see Table 4.9), these phenomena are rarely studied at the household-level. This study demonstrates that time, location, and rainfall, factors exogenous to the household, do in fact impact food security at the household level, and that over time, households are experiencing declining levels of food security regardless of household assets. These findings are what set this study apart from others that look at either macro- or micro-level views of household food security in isolation.

Household-level food security, the number of food-short months, varies the most over time and then by location. Evidence from this study indicates that food-security status is dynamic, and that households move through better or worse food security status over time. Despite individual household-fluctuations in food-security status, over time, all households are experiencing nearly an additional half-month of food-shortage (0.43) every ten years. Moreover, where households are located influences their food-security status which is attributed primarily to changes in rainfall adequacy, a proxy for weather and location, and to other external and internal observed and unobserved factors that vary through time and by location.

As reported earlier, the inter-rater reliability for the rainfall-adequacy index is high indicating that the index, accurately measures perceptions of rainfall adequacy at the household level. Meanwhile, the high levels of variation in perceived rainfall adequacy at the village and regional levels indicate that there are aspects about each village or region, perhaps the elevation, the soil type, or the geography that influence how adequate the rainfall is and how it impacts the number of food-short months households experience, supporting the assertion again that location, time, rainfall, and effectively weather, or in the long-term, climate matters. Again, while this seems to be an obvious statement, when it comes to household-level food security, the

focus in the literature has primarily been on household-assets, that with sufficient assets, households can cope or buy their way out of food-shortage. This study demonstrates the opposite using the HLM to test how several variables influence the number of food-short months households experience both longitudinally over time, and by location.

That the vast majority of the variance of predictor variables came from time and place indicates that macro-level factors such as weather, environment, or political influences may be the most influential drivers of household food-security status, as opposed to micro- or individual-level characteristics, departing again from historical literature norms that look at household assets. It may be that the households in this study are homogenously poor and the models are unable to identify household-level asset-influences on food-security status. Conversely, it may be that these variables do not influence the number of food-short months households experience, or predict food-security status. It may be instead that household-level assets influence household resilience or how long it can cope with and respond to food-shortage, which would be consistent with current coping-strategies and livelihood-asset literature. However, resilience is an after-the-fact phenomenon and would not impact the number of food-short months experienced.

The fact that the direction and significance of public-works participation changes between the bivariate and multivariate models indicates that the confounding of the other variables in the multivariate model presents a more accurate picture of safety-net influence on food-security status. It may also be that similar to assets, the use or access to safety-net programs do not predict food-security status, but are instead a government-response once a certain threshold of food-shortage has been reached.

As reported above, while livestock value decreases the number of food-short months households experience, its overall contribution is extremely small (between .065 and .13 months)

since most households own between 1,000 and 2,000 Birr of livestock (~$53-$107). The need to sell livestock however, is related to a rather large increase in the number of food-short months that households experience, indicating that this micro-level coping strategy, sale of livestock or other animals, is taken once the food-shortage insult has already occurred, corroborating results from Chapters 2 and 3.

To reiterate, the models generated by this study assert that time, place, and rainfall levels are the most important predictors of household food-security status over time. The magnitude of this relationship indicates a large difference (more than 1 month) in the number of food-short months experienced by households that perceive complete rain adequacy versus complete rain inadequacy. Moreover, perceived rain-adequacy varies significantly over time and by location, while household asset levels had minimal influence, implying that geographical- and weather-related factors influence household food security more than the micro-level asset-level factors.

The one asset or technological input that appears to influence food-security status is irrigation. The interaction between rainfall and irrigation indicates that irrigation improves food-security status above rainfall alone with exception in the absence of rainfall. This indicates that irrigation is an important technological input that can help households improve their food-security status in the presence of adequate water resources. Unfortunately because few households in Ethiopia currently have irrigation, it is difficult to assess the full impact that irrigation may have on the food-security status of households (CSA, 2011). Additionally, due to irrigation's dependence on water resources, which itself can have negative unintended consequences and public health implications as water resources dry up, the ability or practicality of implementing this input on a wide-scale may be limited.

While the number of crops households stored made no difference to their food-security status, just the presence or absence of crops-stored did. In the bivariate model, households that stored crops had nearly one month less of food-shortage than households not storing crops. In the multivariate model, households that stored crops had about one-fifth more months of food-shortage than households not storing crops. The change in the direction of this relationship points to likely confounding with multiple variable influences, or that some other unknown or unobserved causal pathway exists, potentially that households that expect to have food-short months proactively store crops, though logically, one would expect that households that are storing crops should experience fewer food-short months.

Finally, free-food distribution and public-works participation had no observed impact on household food-security status. The concordance and non-significance of these two variables further lends support to the ineffectiveness of safety-net programs in Ethiopia, and represents the failure of another "asset" or "buffer" to improve food-security status.

Implications: While the National Oceanic and Atmospheric Administration (NOAA, 2011) and the Intergovernmental Panel on Climate Change (IPCC, 2007 and 2012) have modeled this relationship, to date, few studies have ascertained empirically the effects of climate change on household-level food-security status longitudinally. In fact, in a search of the "Ethiopian Rural Household Survey" and food security, only 135 studies exist. If I add the concept of climate change, only 30 studies exist, 16 of which were in the past 4 years. Moreover, the majority of these studies do analyze as many waves of the survey, do not look at fully-nested data but rather may only analyze time- and household-level variation, and do not use food security as the outcome with exception of the Demeke et al (2011) article, cited earlier in reference to this study. Therefore, this study contributes to climate-change and food-security

literature by demonstrating the impacts of time, location, and rainfall adequacy on household food-security status by way of the number of food-short months they experience.

The pervasive themes of this study are that where you live, how adequate the rainfall is, and other observed and unobserved macro-level changes over time influence food-security status. Households located in areas where there is inadequate rainfall experience the most food-short months while households in areas with adequate rainfall that also have irrigation have the fewest food-short months. These findings indicate that climate-factors such as rainfall are important, and may be the most important determinants of household food-security status. The findings of this study also indicate that most household assets and safety-net programs had no observed impact on household food-security status though, they may increase the ability of households to engage in and choose certain coping-strategies.

Worth underscoring is that over time, the number of food-short months is significantly increasing across the board such that every ten years households experience nearly an additional half-month of food-shortage. This phenomenon highlights the importance and necessity of developing and enacting policies and programs that halt or reverse the negative impacts of climate change, that change how safety-net programs work and what they provide, and that increase infrastructure and support for irrigation, water storage, and other water resource protections to reverse the declining food security trend. These findings point to deficiencies in current policies, programs, and governance and point to the need for better agriculture supports, risk-reduction and adaptation strategies, and possibly improved safety-net programs to modify the negative effects of future climate change and meet the needs of the populations they serve.

It is necessary that the government prioritize the welfare, health, and food security of its population. Given that this study corroborates the assertion that current safety-net programs are

ineffective, it is critical that the government meets with individuals from its agriculture-dependent population to understand their wants and needs from a safety-net program. Additionally, overall levels of education are low in Ethiopia. Yet the knowledge individuals have acquired from generations of farming the land makes them experts on understanding the types of infrastructure and technology they need, which may include irrigation and other reliable water resources, as demonstrated by this study.

Furthermore, climate- and crop-insurance may help farmers protect their food-security status in years with inadequate rains, poor harvests, or soil erosion. Insurance may also decrease the government's felt-need to provide ineffective food distribution or long-term food-aid, known depressors of household economy because of their ability to undermine the prices farmers can obtain for their own product (World Bank, 2010). There is a place for food distribution and food-aid in emergency or famine situations; however, it is critical that long-term prevention and risk-reduction programs and strategies be enacted.

Finally, programs that help farming households keep and obtain more livestock would be prudent. The data from this study indicate that owning more livestock significantly decreases the number of food-short months households experience, though the magnitude is small, and that selling livestock is related to more food-short months. Therefore, assisting households in retaining and obtaining more livestock could be an effective use of government-sponsored or funded programs.

Given that this study uncovers some of the variables that are associated with better or worse food-security status, the suggestions provided here scratch the surface. More research is needed, specifically in the field and with key stakeholders to more fully understand the policy and economic needs of this vulnerable population.

4.5 Delimitations, Limitations, and Strengths

Delimitations: The delimitations set for this study were chosen by the Principal Investigators of the Ethiopian Rural Household Survey, Dercon and Hoddinott (2011) and the International Food Policy Research Institute (IFPRI).

Limitations: There were a few limitations to this study. One includes attrition effects on the sample parameters. Approximately half of the initial sample was lost to attrition by the most recent-collected round (2009), so the longitudinal analysis and the accuracy of the estimates may have been affected (Rose, 2000). However, the fact that replacement households were demographically similar to those that left suggests the estimates obtained from the model are still reasonably accurate (Dercon and Hoddinott, 2011).

Missing data was another limitation of this study as described in detail in section 4.2.3. Data that were missing completely at random (MCAR) include questions that simply were not asked each round by design. Data that were missing at random (MAR) include responses that were missing due to some characteristic of the household that was not related to the study outcome (food security), or possibly due to respondent fatigue. Data that were missing not at random (MNAR) result possibly by household departure from the study, from embarrassment in answering a particular question, or due to some characteristic of the household that was related to the study outcome. MICE was used for all missing data. No bias was introduced for MCAR or MAR imputed data. Data that were MNAR already have bias at baseline, but do not introduce additional bias with imputation. It is a limitation unfortunately to know for sure which data are MAR and which are MNAR. Thus, a sufficient number of imputations were conducted with

overall agreement between the various imputed data-sets and so, led to stable estimates of the parameters of interest.

Generalizability was another limitation of this study. While the authors (Dercon and Hoddinott) aimed to cover a broad range of agro-climate and farming systems, and obtained sample characteristics that were similar to overall population characteristics, the sample still excludes large areas of the Ethiopian country. Moreover, all variables were based on respondent self-report, and may be subject to recall error or bias. However, the observed inter-rater reliability found among the variables indicates that household reports are likely accurate. Thus, interpretations of the results and perceptions gleaned from this study can be applied to rural Ethiopian households in the same geographic areas that were covered by the survey.

Another limitation is that only certain variables were looked at. There may be other important variables in the data that are associated with household food-security status that were omitted from the model. Moreover, all variables used in this study were measured at the household level, so it is possible that there are other village- or regional-variables that influence food-security status that were not explored.

The only exogenous rainfall and temperature data available from the Central Statistics Agency of Ethiopia covered two rounds of the survey only (2004 and 2009). Thus, it is difficult to corroborate or trend perceived rainfall adequacy to actual rainfall levels for all survey periods. Finally, another limitation was that the survey data were gathered at widely spaced intervals. The five-year span between survey rounds limited the ability to model possible short-term causal relationships between variables in one wave with similar variables in later waves, such that

short-term effects likely dissipated within that time frame. The best I can do is to trend the data and its associations over time.

Strengths: Strengths of this study included its longitudinal design and the ability to identify variable-trends through time. Another strength of the study was the large sample size and broad range of cropping- and eco-systems represented providing a larger, and somewhat more representative sample of Ethiopian rural households. Another strength is that the survey was conducted by a professional survey organization that is familiar with the area, has a stake in the population of concern, and has the resources and support to gather these vast amounts of data.

Another strength was the nested-nature of the data, which made assessing the contribution of variation at the household, village, regional, and time-levels possible. Additionally, the nested design made it possible to study data from a variety of locations over time, so that the findings were not limited to one small area at one snapshot of time. As such, new information was garnered from this study that not only contributes to the literature, but that can be used to make recommendations that hopefully improve the food-security status of this population into the future.

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Chapter 5: Summary, Conclusions, and Recommendations

5.1 Summary:

The three studies presented in this dissertation corroborate and add to the literature on climate-change, coping-strategy use, food security, and migration. The first two studies (Chapters 2 and 3) assessed household coping-strategy, food-security status, and perceptions of climate-change by asking interviewees how well the household's land met food needs for the year, the types of coping-strategies they engaged in, and how they perceived climate-parameters to be changing through time. The third study (Chapter 4) assessed how climate-change, proxied by rainfall-adequacy and location, and other household-factors, impacts food-security status over time.

All three studies examined household coping-strategy use, and perceptions of climate change through time. The first two studies addressed migration, why interviewees had already migrated, and why interviewees might migrate in the future. The third study examined climate impacts on food-security status over time. Below is a summary of the findings, followed by conclusions and overall recommendations.

The major findings of Chapter 2 were that interviewees migrated to Addis Ababa because they had insufficient tangible and intangible assets or because they had a desire to migrate for a better job or more money to improve their social or economic status. Primary reasons for low-asset levels were related to small land areas, small crop-yields, insufficient food and income, low levels of education, and high debts from fertilizer loans and land-taxes. Most migrants who perceived decreasing crop yields prior to migration used chemical fertilizer and also perceived changing rainfall levels and temperatures. Individuals who migrated out of volition more often reported having sufficient land and crop yields, sufficient food, and migrated to improve their

economic or social status. Only 25 percent of migrants reported access or eligibility to receive a safety-net program in their village. Most stated that the program was insufficient, and what it provided, undesired.

The major findings of Chapter 3 were that interviewees from rural villages were most worried about money, land, and food, and that their biggest needs were money, land, and animals. To cope with food- and asset-shortfalls or to pay for fertilizer and land-taxes, interviewees reported using four main coping strategies: 1) selling animals, 2) eating other foods, 3) changing the amount of food that is eaten, stretching foods, or skipping meals, and 4) selling other assets. The use of these strategies intensifies in years with less rainfall and decreased crop-yields. In good food months (plentiful food), adults and children ate three meals per day, but in bad food months (insufficient food), adults ate significantly fewer meals than their children. Adults from households with more members or the least amount of land ate the fewest meals, with the goal of protecting their children's food-intake.

While individuals overall perceived rainfall and crop-yields to vary with time, and temperatures to increase with time, 2011 and 2012 were reported as the worst years for crop-yields, coping-strategy use, and food-insecurity. There were no safety-net programs in the study villages, and only a handful of individuals reported their households had irrigation. Several individuals were aware of the need for and benefits of irrigation, infrastructure, and agricultural inputs, and desired them. Finally, the majority of individuals had someone in their household migrate in the past, for unspecified reasons. One-third believed they would need to migrate in the future for more money, good jobs, for education, or for land, reasons related to upward mobility.

The major findings of Chapter 4 were that households continuously move through various levels of food security over time and that the location of the household and climate-factors (rainfall adequacy) were the most important predictors of household food-security status. The presence of irrigation improved household food-security status above rainfall-adequacy alone indicating that while climate is an important predictor of food-security status, irrigation modifies the impact of climate and reverses the negative impacts of insufficient rainfall, to a point. Irrigation in the presence of complete rainfall insufficiency made no difference on food-security status, indicating that it may be difficult to have successful irrigation without adequate water resources. Over time, households are experiencing worse-levels of food-security. Finally, household assets, free-food distribution, and public-works participation appeared to make no significant difference in household food-security status.

In summary, household assets did not affect food-security status; but time, location, and rainfall adequacy did. Household assets may however impact the type and choice of coping-strategies households use as described in Chapters 2 and 3. This third study was important because it corroborates the findings of the first two studies and allows me to generalize the findings of the first two studies. All three studies demonstrate that climate not only impacts global food security as the literature has indicated, but also impacts household food-security, which few studies have empirically demonstrated. These studies also corroborate household coping strategy use as a way to cope with food-insecurity. These findings are the most significant contributions of this dissertation to the literature.

5.2 Conclusions and Recommendations:

These studies found climate and rainfall impacts on household food security. As climate-change evolves, rainfall will continue to influence household food security, particularly for rain-

fed dependent farmers that make up the majority of the Ethiopian population. Some households may benefit from climate-change, become more food-secure, and migrate by choice instead of by displacement as individuals desire upward mobility and better standards of living. Other households may become less food-secure due to negative effects of climate-change, increasing their use of coping-strategies. There is urgent need for social and economic action from the government of Ethiopia to reform policies and help farmers improve their food-security status.

Social and economic policy recommendations were made throughout this dissertation, including support for crop and livestock insurance, technological advancements including irrigation and infrastructure, and for households to increase their crop-storage capability and resilience. Other policy recommendations included discontinuing food aid post-emergency to prevent the decrease in prices farmers earn selling their products at market. Recommendations for training programs, irrigation, and water-storage infrastructure, as well as recommendations to improve the provisions and funding of the PSNP to increase household food-security in the long term, and to provide the desired and needed-types of assistance were made.

While the government of Ethiopia has greenhouse gas-mitigation policies and a safety-net program in place, it also needs to focus on other priorities such helping all individuals to become food-secure and to have adequate infrastructure and technology to reduce the negative impacts of climate-change. The government also needs to enact pro-poor policies that promote food security such as increasing household land areas, allows households to own land, and improves access to farming inputs. Based on the results of this research, some of these recommendations, if implemented, should assist the food-security status of the existing population and future generations.

Appendix A: Original Questionnaire for Addis Ababa Migration Study:

Demographic survey questions:

1. Age (<18, end interview).
2. Gender
3. Years of education received by:
    a. The individual migrant
    b. The migrant's parents?
4. Did you in-migrate to Addis Ababa? (No (born there), end interview)
    a. From where did you in-migrate?
        i. Is that where you were born?
    b. How long have you been in Addis Ababa?
        i. Where do you live now in Addis Ababa?
5. With whom do you live?
    a. How are they "related" to you? Family? Friends?
    b. Are you married?
        i. Do you live with your spouse?
    c. How many of migrated with you?
    d. How many are still at home?
        i. Who is still at home?
        ii. Do you send any remittances back?

Perceived reasons for Migration and choice of destination

6. Why did you leave your village or origin? (open-ended)
    Prompts as needed:
    a. What were the trends in agriculture yield/production prior to leaving?
    b. What were the temperature trends prior to leaving?
    c. What were the rainfall trends prior to leaving?
    d. Did local markets affect your decision to migrate? Prices? Etc?
        i. How did climate/weather affect commodity prices?
        ii. Did this affect whether or not you were going to migrate?

7. Why did you choose to in-migrate to Addis Ababa? (Open-ended) Prompts as needed:
    a. Did you know or have family in Addis Ababa?
    b. Were you looking to obtain better education?
    c. Were you looking to obtain better work?
        i. Type of work?
            1. agriculture/non-agriculture related and why?
    d. Was there a change in marital status that prompted the migration?
        i. If so, what was the change?
    e. Did you need Health care?
    f. Shortage of land? Change in land tenure?
        i. Does your family still own land?
        ii. Do they still farm on that land?

8. How was it decided that you would move as opposed to another family member? (open-ended) Prompts as needed:
    a. More able-bodied?
    b. More education?

Employment/Livelihood history and rural asset history

9. What was your livelihood/family's livelihood before migration? (open-ended).

10. What actions had to be taken in order to make migrating possible? (open-ended)
    Prompts as needed:
    a. Did assets have to be sold to make the migration possible?
    b. What was sold?

11. What assets did you/your family have prior to your migration? (open-ended)
    Prompts as needed:
    Natural assets:
    a. Land? How much?
    b. Livestock? How many heads?
    c. Poultry? How much?
    d. Wood, fiber, etc? how much?
    Social assets:
    e. number of individuals you could go to for assistance/money?
    Financial assets:
    f. amount of money saved?
    Etc.

Pre-migration v. post-migration assets:

12. How does your monthly wage differ pre-migration and post-migration (Birr)?
    a. What is your currently livelihood/employment?

13. How do you compare your living conditions now to before you moved?
    a. How were you expecting your living conditions to be before you moved?

14. How long were you planning to move away for and why?
    a. How long have you been away and why is this the same or different?

15. Did you migrate anywhere else before you migrated to Addis Ababa?
    a. Where and why?
    b. How long did you stay?
    c. Why did you eventually leave for Addis Ababa?
    d. Have you been back to your village of origin?
        i. Why or why not?
        ii. For how long? Why?

16. What is your current livelihood in Addis Ababa?

17. Do you own or rent? Do you have secure housing?

Social safety nets, PSNP, etc.

18. What types of programs exist in your village of origin that help with farm inputs and assist producers to increase their growth during lean time?

19. Describe how the PSNP works in your area?
    a. Were you eligible?

20. If programs existed, why did you migrate to Addis Ababa?

21. If your village did not have any programs, but had gotten them before your migration, how would that have affected your choice to migrate to Addis Ababa?

22. Did your village receive any food/assistance from the WFP or other emergency aid?
    a. In what form is it given?
    b. How did your village perceive this assistance?
    c. How did this affect your decision to migrate?
    d. How much food is for disaster relief v. as a program (for regular basis)?

Appendix B: Revised Interview Guide used in the Addis Ababa Migration Study:

1. Region of Addis where migrant was questioned?
2. Age of migrant?
3. Gender of migrant?
4. What is current livelihood of migrant?
5. How many years of education do you have?
6. Where did you migrate from?
    a. Region
    b. Town
7. How long have you lived in Addis? What year did you move?
    a. Where in Addis do you live?
    b. What month did you move to Addis?
8. Who do you live with?
9. Did you come alone? Who is still at home?
10. Why did you leave your village?
11. Why did you choose to come to Addis?
12. Why did you move and not one of your family members?
13. What was your family's livelihood before you migrated?
14. How much land did your family have?
15. What did you do to make migration possible?
    a. Did you have to sell anything?
16. Is there a difference in how much money you make now?
17. How long did you plan to stay away?
18. Does your family's land feed you all year?
    a. What crops do you grow?
    b. What time of year are they harvested?
19. Do you need more land to feed your family all year?
20. When you are not farming, what do you do in your village?
21. If you had more food and water, enough for the whole year, would you have moved to Addis?
22. If your family had enough food for the year or more with no worry, would you move back to your village?
23. Do you send money home to your family other than at holidays?
24. What types of safety-net programs existed in your village?
25. Were you eligible for a safety-net program?
26. What did it provide?
27. Would you have stayed if you had received assistance?
28. Did the amount of crop change from year to year?
29. How has weather changed?
30. Has it become wetter? How?
31. Has it become drier? How?
32. Has it become hotter? How?
33. Did fertilizer costs change?

Appendix C: Interview Guide used in Rural Village Study:

Questions for Nahom to ask in Rural Villages:

Demographics:
Region
Village
Gender
Age
Occupation
Years of schooling
Land-size
Type of land (highland, lowland, etc).

1) How long have you lived in this village (years)?
    a. Were you born here?
    b. If not, why did you come to this village?

Food Security:

2) Does your land feed your family throughout the year?
    a. How many people live in this household/family?

3) Does your land give you enough money or things throughout the year?
4) Does your land allow you to send your children to school?
    a. Do you want to send your children to school?

5) If you needed more land, would you be able to obtain it?
    a. How?

6) What crops do you grow?
7) What time of year are they harvested?
8) Do you need more land to feed your family?
    a. How much more?

9) Do you need more crops to feed your family?
    a. How many more?

10) Do you need more rain to feed your family?
    a. How many more months?
    b. Do you have irrigation?
    c. How far is your nearest water-source?
        i. (distance or time).
    d. What do you use this water for?

11) What else do you need to feed your family all year?

12) How many meals per day do you eat during a good harvest month?
13) How many meals per day do your children eat during a good harvest month?
14) How many meals per day do you eat during a bad harvest month?
15) How many meals per day do your children eat during a bad harvest month?

16) What do you/your family do when there is not enough food?
    a. Skip meals
    b. Stretch meals
    c. Eat other foods
    d. Sell animals
    e. Send children out to relatives
    f. Migrate/leave the village

17) How sure are you that you can obtain enough food in the next year? (scale: 1 = not sure, 10 = 100% sure).
    a. Why?

18) How sure are you that you can obtain enough food in the next 3 years? (scale: 1 = not sure, 10 = 100% sure).
    a. Why?

Liabilities

19) Do you use fertilizer?
    a. What type?

20) Where do you get the fertilizer? Government loan?
    a. Is it difficult for you to pay back your loan?
21) What do you do when you cannot pay it?
    a. Does this change how much you eat?

22) How much is your land-tax each year?
    a. Do you have trouble paying your land tax?

23) What do you do when you cannot pay it?
    a. Does this change how much you eat?

24) What is your biggest worry over?
    a. Food
    b. Land
    c. Money
    d. Tax

25) Has anyone in your family ever needed health-care for weight loss or diarrhea?
    a. What year?

Assets/buffers:

1) Are there safety-net programs in your village?
    a. If yes, what does it provide?

2) Are you able to access a safety-net program?
    a. Why or why not?

3) Would a safety-net program help you obtain more food? More money?
4) When you are not farming, what do you do in your village?
    a. Do you make money from this?
    b. Do your children go to school when not farming?

5) Have you ever had to sell animals or other assets?
    a. Why?
    b. What year?

Weather/climate

6) Has the amount of food/crop you can grow increased, decreased, changed from year to year?
    a. What was the worst year?

7) Has the amount of rain increased, decreased, changed from year to year?
    a. What was the worst year?

8) Has it gotten hotter, colder, changed from year to year?
    a. What was the worst year?

9) Has it gotten drier, wetter, changed from year to year?
    a. What was the worst year?

10) What did you do to feed your families during the worst years?
11) What are the most important things you need to have more food and to feed your family for a whole year?
    a. More land
    b. More fertilizer
    c. Cheaper fertilizer
    d. Less land tax
    e. Safety-net program
    f. More rain
    g. More labor
    h. More oxen
    i. more seeds
    j. better health
    k. more food.

Migration need:

1) Has anyone in your family ever migrated/left your village to go elsewhere?
2) Where did the/you go? How long are they away?
3) If you have ever migrated from your village: why?
    a. Not enough rain
    b. Not enough money
    c. Sick/illness
    d. Not enough food

4) Have you or your family member sent money or food while away?
5) If a family member, Have they returned home?
6) Do you think you will EVER need to migrate from your village?
    a. Why?
    b. Where would you go?
    c. What would gain from leaving?

7) If you had a safety-net program, would you leave?
8) Would you ever return to your village once you have left?
    a. Why?